SCIENTIFIC AMERICAN

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

Vol. XXVII.--No. 13. [NEW SERIES.] NEW YORK, SEPTEMBER 28, 1872. [$3 per Annum [IN ADVANCE.]

COMBINED REGULATOR AND ALARM.

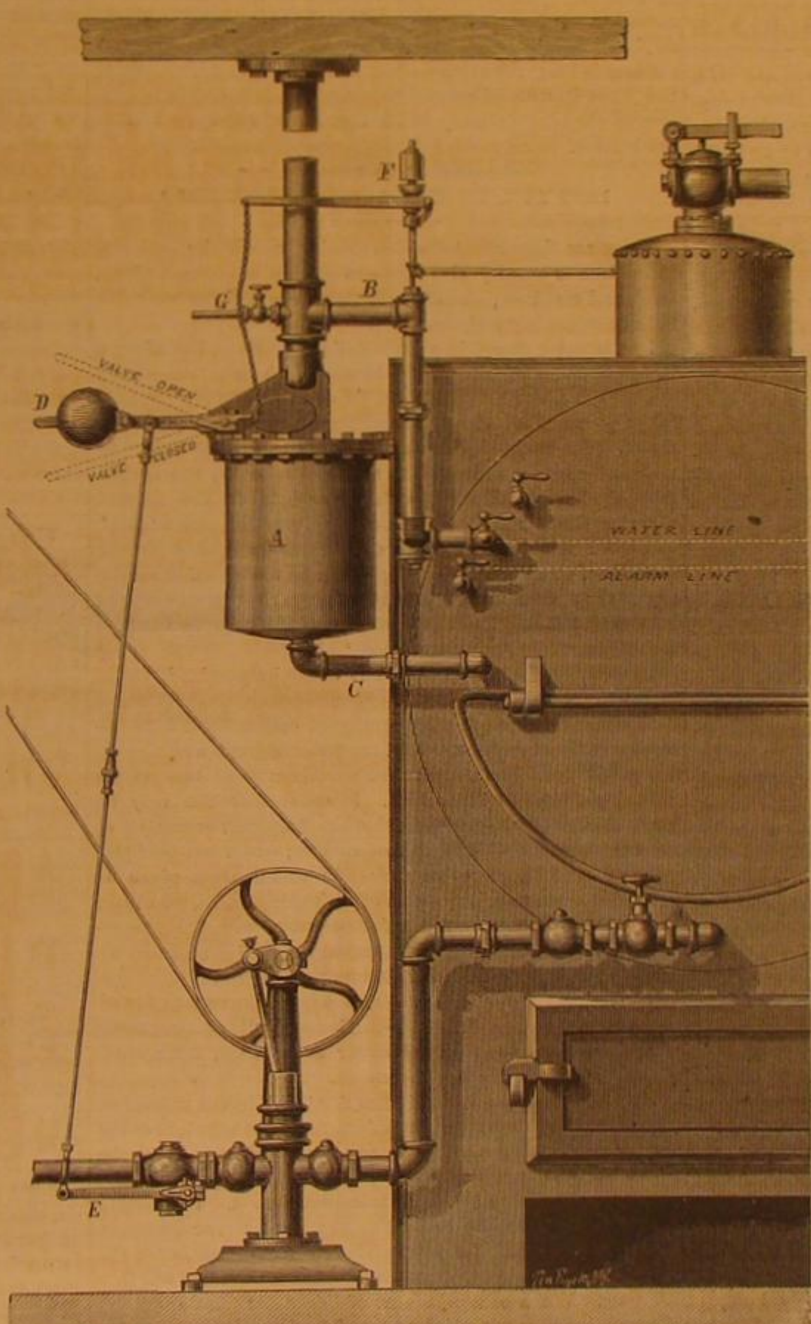
Competition in the different branches of manufacturing throughout the country has caused steam to be almost universally adopted for the motive power. A great deal has been accomplished in economizing the use of steam by the adoption of regulators, cut-offs, and other patent appliances, but there is great loss in the use of steam. No better field for inventors is now open than that for improvements in steam engines and boilers.

Thousands of boilers are being supplied with water only partially heated, while coal is being consumed and the heat exhausted in the atmosphere. And the irregularity with which some are supplied with feed water causes undue wear and unnecessary expense for fuel and repairs.

The machine now illustrated is designed to overcome some of the above difficulties by regulating the supply of water, feeding the boiler in quantities equal to the amount being evaporated. It is also constructed in such a manner that if, by any means, the source of supply to the boiler is stopped, a whistle will blow gradually and, as the water evaporates, the sound will increase until a loud alarm is given. It is the invention of R. Berryman, of Hartford, Conn., whose feed water heater was lately illustrated in these columns. For a sectional view of the machine now shown, we refer our readers to our issue of September 14th, where the same appliance is shown as a steam trap. We now represent it as applied to a steam boiler. The bottom of the cylinder, A, is set 6 inches below the feed or true water level, and the pipes, B and C, connect the interior of the machine with the interior of the boiler, B connecting the top of the cylinder to the feed line, while C is connected at any convenient point below the water line, and conducts the water back to the boiler at each change. In the casing, A, is a bucket which is suspended from one end of a lever; the other end has a square cast in it, which fits a corresponding square on the rock shaft, one end of which extends through a stuffing box. To this end the lever, D, is fastened by a dowel pin and a clamp. The lever, D, through its connecting rod, controls a valve in the steam pipe of a steam pump, or, as represented, the inlet valve of a plunger pump; it can also be used in all cases where the water pressure used to feed the boiler is greater than the requisite steam pressure.

Its operation is such that, when the boiler is supplied with water so as to cover the inlet of the pipe, B, on the feed water line (steam having been raised, and the air blown out through the lock on top of the casing, A), the casing will be at once filled with water. The bucket inside being thus submerged, the weight of water displaced by it will be given in power to the counterbalance on the lever, D, moving it down, thereby fully or partially closing the supply valve, which valve is adjusted by the right and left screws on the connecting rod. When the water in the boiler has evaporated to a level below the inlet of the pipe, B, on the feed line, steam enters, filling the upper part of the casing, A, and permitting the water above that line to flow back by gravity through the pipe, C, to the boiler. The water having thus resumed its level, the bucket falls to its former position, moving the counterbalance and lever, D. The latter rises, and the supply valve is again opened. Should the supply of water be stopped or so reduced that the water evaporates faster than it is supplied to the boiler (the water level being the same in both the cylinder, A, and the boiler), as the water evaporates the bucket falls with it until the short end of the lever, D, opens the alarm whistle by means of the connection. The connection can be lengthened or adjusted so that an alarm may be given at almost any desired point below the feed line. The gradual increase of whistle sound is such that ample time is given to avoid an alarm, provided water is supplied in proper quantity.

The hollow globe regulator, also an invention of R. Berryman, is favorably known and in general use. Yet we are informed by him it has been impracticable to get two separate movements of the same apparatus at different intervals of time, consequently it has been necessary to use two machines. The combined machine will work equally well on a number of boilers supplied by one pump, the connections of which will be more fully explained in our next issue. The great object of this appliance is to maintain water in a boiler at a uniform level. If a steam boiler be filled with water beyond its proper level, so that the steam space is reduced, and at this time the engine is using steam as fast as it can be generated, the result is, in many cases, water coming from the surface, impregnated with grit, is drawn in small quantity into the steam cylinder, the disastrous result of which, from cutting, is well known; and the deterioration of the inner surfaces of cylinders, of pistons, and the wear and corrosion of slide valves and slats are all promoted by the passage of water through the slide valves, even when no solid matter is carried over; therefore the importance of keeping only a proper quantity of water in the boiler cannot be overestimated. The Berryman Manufacturing Company, of Hartford, Conn., make a specialty of steam and its economical and safe appliance, and further information concerning their productions may be obtained of J. B. Davis & Co., agents, of the same city.



BERRYMAN'S COMBINED REGULATOR AND ALARM.

The Agassiz Expedition.---Discovery of Immense Glacier Beds in South America.

Professor Agassiz has nearly finished his famous voyage of deep sea explorations, the steamer Hassler with the scientific party having lately arrived at San Francisco. The full details of the voyage and of the discoveries made will be of much interest. Many thousands of new and valuable specimens of natural objects have been obtained and preserved.

In a recent letter to Professor Pierce of the Coast Survey, Professor Agassiz mentions the overland journey that he made in Chilli, from Conception northward to Santiago, the route travelled lying between the Andes and the high hills of the Pacific Coast. "There is," he says, "a broad valley between the Andes and the coast range, the valley of Chillan extending from the Gulf of Ancud or Port Montt to Santiago and farther north. This valley is a continuation, upon somewhat higher level, of the channels which, from the Strait of Magellan to Chiloe, separate the islands from the mainland, with the sole interruption of Tres Montes, which gives the clue to the whole, as we have here in miniature a valley between the Andes and the coast range. Now this great valley, extending for more than twenty-five degrees of latitude (1,300 miles) is a continuous glacier bottom, showing plainly *for* its whole length that the great southern ice sheet has been moving northwards in it. I could find nowhere any indication that glaciers descending from the Andes had crossed this valley and reached the shores of the Pacific.

An Attempt to Swim the English Channel.

The English sporting world has been greatly interested by a wager, of $5,000 against $150, that J. B. Johnson, the "hero of London Bridge and champion swimmer of the world," could not swim the English Channel, from Dover, England, to Calais shore, France, distance 19 miles. But owing to the strong tidal currents in the channel, the actual swimming distance was estimated at between forty and fifty miles.

Johnson is described as twenty four years of age, of medium hight, and one of the finest built men it is possible to see. He measures forty-five inches round the chest, and at will can inflate it to about five more; his muscular powers are also enormously developed. The terms of the bet did not allow of his coming out of the water, consequently, although his abilities as a swimmer might have enabled him to accomplish the distance, it was thought, and it afterwards proved, impossible to keep up the circulation of the blood for so long a period.

On the appointed day, August 23d, a large concourse of people assembled on the Admiralty pier, at Dover, to witness the departure of "the hero." For an hour or so, he entertained the audience by diving from the bow of a steamer and performing various aquatic feats; after which, in company with a party of friends, he embarked on the steamer Palmerston to begin his exploit of swimming across to France.

When some 200 yards from the pier, Johnson ascended to the paddle box, tremendous cheers greeting his appearance. He then dived, the time being 10:40 A. M., and striking out to sea with vigorous strokes, accomplished the first two miles in thirty minutes. The wind was moderate from east-north-east; a strong tide was also running, with a short chopping sea. At 11:20 he partook of port wine, and again at 11:30 refreshed himself. At 11:45 he approached the steamer and requested something to eat, asking whether he might come on board. Mr. Strange, seeing that in consequence of the strong tide, etc. his chance of reaching the French coast was quite hopeless, thought it advisable he should do so. When assisted on deck it was found that his legs, from the thighs downward, were numbed; the circulation of the blood seemed to have almost stopped—in fact, the cold had so thoroughly mastered the system that he was unable to raise a basin of beef tea to his lips.

THE practice of dentistry can hardly be included in the modern arts; for as early as 500 B. C., gold was used for filling teeth, and gold wire was employed to hold artificial teeth in position, and does not seem then to have been a new art. A fragment of the tenth of the Roman tables, 450 B. C. has reference to the burial of any gold with the dead except that bound around the teeth. Herodotus declares that the Egyptians had a knowledge of the diseases of the teeth and their treatment, 2,000 B. C. In Martial, Cassellus is mentioned as either filling or extracting teeth; but he specified that he would not polish false teeth with tooth powder. Lucian mentions an old maid that had but four teeth, and they were fastened in with gold. These facts cover a period of 600 years.

A NEW and profitable branch of business, it is said, has been invented and put into practice in Georgia. There is an enterprising man in Whitefield county who sprinkles salt on the railroad to allure cattle upon the track. The animals are killed by the trains, and the railroad company has to pay for them. The owner has the beef and hide for his profit.

AN iron church has lately been completed in Brooklyn, N. Y., having seats for 3,000 persons. It is said to be an elegant structure.

THE MANUFACTURE OF OLIVE OIL IN CALIFORNIA.

For a number of years past, the olive tree has been cultivated with varying success throughout the Southern States, and especially on the islands on the coast of Georgia and Florida and along the sea board of North Carolina. The quality of the product, however, not being the best, its manufacture has never assumed proportions of any magnitude, nor has it been able to compete with the oil imported from Europe.

A writer in the *Overland Monthly* publishes the information that the culture of the olive tree and the manufacture of oil from its fruit is gradually becoming a leading industry in California. The character of the climate, and the soil of the valley of Santa Barbara and of the foot hills of Santa Inez, for sixty miles along the coast, are adapted to the production of the finest varieties of oil. It is predicted that this portion of the State will eventually be numbered among the most celebrated oil districts of the world.

The olive is propagated almost entirely by cuttings taken from the sprouts and branches of mature trees at the time of pruning. The cuttings are generally from ten to fifteen inches long and from half an inch to three or four inches thick; the thickest are the best. These are placed in a perpendicular position in a bed of good soil, six, eight, or ten inches apart, their tops level with the surface. The earth is pressed closely around them, and their ends are slightly covered to protect them from the drying influence of the sun. Here they remain, throwing out leaves and branches, until April or May, when, with as little disturbance as possible of the roots, they are taken up and, after being trimmed to a single sprout, are set out in the orchard, in rows about twenty-five feet apart each way. The ground between the trees may be cultivated for several years, with little or no detriment to the young trees. When the olives are to be gathered, cloths are spread under the trees and the berries are pulled from their branches by hand and thrown upon the ground, or are beaten off with a long rod. If they are intended for making oil, they are carried to a dry room or loft and scattered upon the floor, or, where this is not convenient, a drying frame is made—consisting of broad shelves one above another, and sliding in and out as the drawers of a bureau—and the berries are spread upon the shelves. By this exposure to a dry, in-door atmosphere, the berries ripen further, their watery juices are evaporated, the oil is released and, when the skins have been broken, flows more readily under pressure. A slight mold may gather upon the berries during the few days that they remain here, but not sufficient to have an injurious effect upon the oil, or it may be prevented entirely by stirring the berries daily.

The process of extracting the oil, as practiced in Santa Barbara, is simple, even to mediæval rudeness. A large, broad stone wheel is held by an arm from a center post, and, by a horse attached to this arm, is made to traverse a circular bed of solid stone. The berries are thrown upon this stone bed, and are shoveled constantly in the line of the moving wheel until they are considerably macerated, but not thoroughly or until the stones are broken. This process finished, the pulp is wrapped in coarse cloths or gunny sacks, and placed under a rude, home-made screw or lever press. The oil and juices, as they ooze through the cloth or sacks, flow into a small tank, and, as they increase, are distributed into other vessels, from the surface of which the oil is afterwards skimmed. The oil flowing from this first pressure is that known as "virgin oil," and commands the highest price from connoisseurs of the table. Without further preparation the oil is now ready for use, except that, in order that any intrusive matter may be separated from the body of the oil and collected at the bottom of the oil cask or jar previous to bottling, it is set away for a time to rest. At the Mission of Santa Barbara, the oil is stored in huge antique pottery jars, that, ranged round the room, remind one of the celebrated scene of the jars in the story of "The Forty Thieves." The "second class oil" is the result of a second and more thorough crushing of the berries, in which even the stones are broken, and of a subsequent subjection of the pulp to the press. The berries are sometimes submitted even to a third process of crushing, and, previous to pressure, are brought to a boiling heat in huge copper kettles. The oil thus obtained is of an inferior quality, and is sold for use as a lubricator and also as an ingredient in the manufacture of castile and fancy toilet soaps, and for other purposes for which it is superior to animal oil. The residue of the berries is then returned to the orchard and scattered under the trees, and, possessing the qualities of a rich and rapid fertilizer, may be said to be yielded to us again revivified and luscious in the richer fruitage of succeeding years.

The tree, at five years of age, returns a slight recompense for care; and at seven an orchard should afford an average yield of about twenty gallons of berries to a tree. If there are seventy trees to an acre, there should be obtained from it one thousand four hundred gallons of berries. From twenty gallons of berries may be extracted three gallons of oil; and, if properly manufactured, olive oil will command $4 to $5 a gallon at wholesale. Thus, an average yield of olives, derived from an orchard covering one acre of land, will produce about $800 worth of oil. After deducting the entire cost of production and manufacture, a net profit may be anticipated of at least $2 per gallon; and thus, one acre, containing seventy trees, yielding an average of twenty gallons of berries, or the equivalent of three gallons of oil, each, will afford a surplus above all expenses of about $400 a year.

Olive culture is so simple that any one of ordinary intelligence may engage in it. The process of manufacturing the oil is an entirely different business, and belongs separate and apart from the cultivation of the olive. In time, it will not be expected, as now, that each grower shall be manufacturer also. As soon as the supply of olives in a neighborhood is sufficient to warrant the erection of suitable machinery for expressing the oil, every requisite for the purpose will be at hand. The olive grower's labors for the season will end with the deposit of his berries at the oil manufactory; and, according to the custom of the olive districts of Europe, one half the oil from his berries will subsequently be returned to him, ready for use and for market.

A large part of the oil sold in this country, and purporting to be olive oil of European manufacture, is the product of adulteration and imitation. It is generally manufactured in this country, and is composed principally of animal oil, though mustard seed oil and other inferior vegetable oils also form materials for its adulteration. Every housewife knows that olive oil purchased from the grocer, when exposed to a cold atmosphere, sometimes thickens and turns white or opaque in the lower part of the bottle; and every one familiar with the nature of olive oil knows that it retains its perfect transparency and uniform oily consistence under any temperature. Animal oil condenses under the influence of cold; but vegetable oil does not. This difference has been well noted on the shelves of stores where the genuine and the adulterated oil have been ranged for sale, side by side. The genuine oil glows clear beneath the glass in all weathers; the adulterated oil turns flaky with the cold, and the lard goes down with the fall of the winter's thermometer. It is an advantage, also, of the genuine "virgin oil," obtained by home manufacture, that it retains its perfect sweetness longer than any other oil. "Virgin oil," made at the Santa Barbara Mission four years ago, is to-day in possession of the nice delicacy of its first flavor when fresh from the berries.

IRON AS A MATERIAL OF CONSTRUCTION.*

There are three great divisions under which the material called iron is usually classified—malleable or wrought iron, steel, and cast iron; and of these there are endless varieties both as to quality and character.

Iron is never found in a chemically pure state, but always in combination with foreign substances, which it is the business of the manufacturer to get rid of as far as possible, as it is the presence of these impurities which deteriorates the metal. The ore, which is an oxide of iron, is first heated in a blast furnace with limestone and coal or coke, the carbon from the latter combining with the oxygen of the ore and allowing the molten metal to flow away, together with a "slag" composed of the earthy matters in the ore united with the limestone. The slag, being light, can be drawn off from the top of the molten metal, which is afterwards run out of the bottom of the furnace into furrows made in sand, and broken up into convenient lengths called "pigs."

Chemically pure iron, even if it could be obtained, would be much too soft for purposes of construction, and it is therefore necessary that a small quantity of carbon should be always combined with the metal to render it hard and strong; the proportion in which carbon combines with iron varies from ¼ per cent to 6 per cent. In order that iron may be malleable, or readily worked by the hammer, it must not contain more than ½ per cent of carbon; and from this proportion up to 2 per cent of carbon in combination gives us steel. If more than 2 per cent of carbon is present, we obtain cast iron, the brittleness of which increases with the proportion of carbon with which it is impregnated, 6 per cent being the highest that it is possible to combine with it.

The minerals silicon, sulphur, and phosphorus are found combined in greater or less proportion with all iron, and these impurities must be got rid of as far as possible, since their presence tends to weaken the metal.

Malleable iron is obtained from the "pig" by the process of "puddling," or exposing the molten metal to the action of the air, by which the greater part of the carbon is carried off, the metal being stirred until the above named impurities are got rid of, and a spongy character is imparted to it. The iron is then removed from the furnace to the squeezer, or hammer, by which the remainder of the slag is forced out, and the metal can then be placed between rollers and drawn out into flat bars. When bars or beams of large size are required, the puddled bars are piled up together, heated to a welding temperature, and passed several times through grooved rollers, the size of the groove diminishing each time until the required shape and size is obtained. By this means bars of any required section and length can be obtained.

CAST IRON.

Cast iron is obtained by merely remelting the pigs, and pouring the metal into sand molds made to any required form. The quality of the metal is improved by frequent meltings, which remove the impurities, and for good work a third melting should be used; the strength is also increased the longer it is kept in a state of fusion. It is desirable to mix the pigs from different ores, as well as those obtained from different meltings.

To obtain great hardness, the castings must be chilled or cooled rapidly, the surface metal which cools first being always harder and closer in texture than the interior, where the castings are of large size.

The tensile strength of cast iron, or its power to resist a direct strain applied to stretch it in the direction of its length, is small as compared with its crushing strength, as well as with that of malleable iron; 7 tuns being about the average force that will break a bar 1 in. square, although some bars, that had been carefully prepared and kept in a state of fusion for several hours, bore double this amount of strain It is in its resistance to crushing that the great value of cast iron as a building material lies; experiments upon a large number of cylinders, ¾ in. diameter and 1½ in. high, gave the crushing strength per square inch from 27 tuns to 54 tuns' or an average of 38 tuns, the specimens shortening from $\frac{1}{10}$ to $\frac{1}{20}$ of their length before crushing; the ultimate tensile strength was found to be about ⅙ of the crushing, the elongation being about $\frac{1}{500}$ of the length.

The transverse strength of cast iron beams is very variable, being greater in proportion in those of small size than in large castings. No sensible diminution of strength takes place in cast iron, if heated up to 600° Fahr., but beyond that temperature it gets rapidly weaker.

The ratio of the "working strength" of cast iron to its ultimate strength is as 1 to 3, or 1 to 4, for a stationary load, and 1 to 6 for a moving load, as in the case of a railway bridge. If the load is kept within the working limits, a beam of cast iron does not lose strength by a continuance, however long, or a repetition, however often, of the same load.

The average specific gravity of cast iron is 7·1, or it weighs 7,100 oz. or 443 lbs. per cubic foot. One cubic inch weighs ¼ lb, so that to find the weight in pounds of a casting, divide the number of cubic inches it contains by 4.

The great advantage of cast iron is that it can be made into any required shape; and when many copies of the same form are wanted, they can be supplied at a very moderate cost as compared with malleable iron. It has, however, the disadvantage of not being trustworthy, and is liable to unsoundness from unequal contraction in cooling, which causes some parts to be more dense than others; this can only be provided against by allowing an excess of strength in the castings. Its brittleness also unfits it for use where it would be subject to heavy concussions or sudden changes of load; this can, however, be obviated by a process of annealing, which produces

MALLEABLE CAST IRON.

The castings are first made in the usual way from soft and pure charcoal pig, and kept red hot for some days in powdered red hematite ore, by which most of the carbon is extracted, and the metal is converted into malleable iron; th expense, however, of this process prevents it from being use for any but small castings, of which a large number are required. Cast iron does not oxidize (rust) so readily as wrought iron when exposed to the weather, but the continued action of sea water is to convert it into a soft porous mass which readily crumbles to pieces.

WROUGHT IRON.

Wrought or malleable iron is the metal in its purest condition, and with the greatest proportion of carbon and other foreign matters removed in the process of manufacture When a wrought iron bar is broken by a tensile strain, applied in the direction of its length, it contracts in sectional area at some point before fracture, the amount of contraction depending on the quality of the metal, and being as much a 50 per cent in some specimens. The average resistance to fracture or tensile strength is about 25 tuns per square inch of original section, and no wrought iron ought ever to be allowed in a structure which will not stand at least 20 tun. per square inch.

When a compressive force is applied to wrought iron, it will stand about 9 tuns per square inch before any perceptible change takes place in the form, but beyond this it becomes distorted and yields like a lump of lead, its ultimate crushing strength being about 16 tuns per inch. The tensile strengt of rolled plates is 10 per cent less across the grain or direction of fiber than with it, and the ductility is about one half.

Wrought iron may be considered as perfectly elastic as long as the tensile strain does not exceed 10 tuns per square inch of section, the metal returning to its original shape and size when the strain is removed without any "set" or visible change of form; beyond this amount the extension becomes permanent, the limit of elasticity, which may safely be taken at about half the breaking weight, being passed. If a slight permanent set is produced when a load is first put on, this set will not be increased by any number of repetitions of that load, but each time the force is removed it will return to the form it assumed after the first loading, provided the limit of elasticity is not passed. For every tun of load per square inch up to 10 tuns, the extension is $\frac{1}{12500}$ of the length.

When wrought iron is subjected to a compressing strain, it is reduced $\frac{1}{10000}$ of its length for every tun per square inch up to 13 tuns, beyond which the amount of compression increases more rapidly; so that up to the limit within which this material ought to be strained in practice, whether in tension or compression, it may be assumed as perfectly elastic, the modulus being 10,000 tuns per square inch of section.

The toughness of wrought iron renders it useful for railways, machinery, armor defences, and wherever capability of resisting shocks and irregular strains is required; there is, however, great variety in the hardness of the metal, the soft irons being considered most valuable for withstanding heavy concussions or vibrations.

When a piece of wrought iron is broken suddenly, it generally presents a crystalline fracture, but if the force is applied gradually, the appearance is fibrous or silky; the fibers are, in fact, the crystals drawn out by the process of rolling or hammering. A crystalline fracture indicates hardness, while a fibrous fracture is a mark of softness and ductility; the finer and more uniform the crystals, the higher the quality of the metal. As might be expected from the process of manufacture, the specific gravity of wrought iron is higher than of cast, being usually taken at 7·68, a cubic foot weighing 480 lbs., and a plate 1 in. thick, 40 lbs. per foot super. A bar 1 in. square and 1 yard long weighs 10 lbs.; so that the

*Lectures at the Royal School of Naval Architecture. By William Pole, F.R.S.

weight of a lineal yard of any section of bar is found by multiplying the square inches in the section by ten.

It is generally found that large masses of forged iron do not possess the relative strength of smaller ones, from being irregular in texture. Rolling improves the toughness more than hammering does, the latter processes hardening it, but at the same time rendering it more brittle.

Wrought iron can be case-hardened by heating it for some days in contact with bone dust or other animal substance containing carbon; by this process the surface becomes converted into steel by the absorption of carbon.

If heat is applied to wrought iron, its strength is not affected as long as the temperature does not rise above 350° Fahr., but beyond that it begins to lose strength. When the temperature is reduced very low, the metal becomes less flexible and more brittle, so that its deflection under a given load is diminished, but at the same time its liability to fracture is increased.

The decay of iron arises from the joint action of air and water, the oxygen from which combines with the metal and forms a hydrated sesquioxide, called rust.

THE PNEUMATIC DESPATCH.

It is now nearly seven years since a pneumatic tube was first laid in the very heart of London, and its working proved to be perfectly successful. Notwithstanding this, the fact remains that the great public carriers—the railway companies—and the Post Office authorities have not yet availed themselves of the manifest advantages offered by this system for the rapid transmission of small parcels and mail bags. It is true that for some time the only available route was that from the North Western Railway at Euston square to the station of the Pneumatic Despatch Company in Holborn. It may have been that the value of the system was impaired by the southern termination of the tube being in a locality possessing but few advantages for those who were likely to be the principal users of the system. But the terminal point was never intended to be in Holborn, nor is it, inasmuch as a line of tube—long ago commenced—has recently been completed between the Holborn station and the General Post Office. The possible drawback to which we have referred, does not, therefore, now exist—if it ever did,—a clear route having been established between Euston square and St. Martin's le Grand. Descriptions of the pneumatic tube and the apparatus for working it were given by the press in November, 1865, when the first section was opened. It will be as well, however, now that the works have been finished, if we briefly refer to them again. This will be the more necessary, as the details have been slightly altered in one or two instances. The pneumatic tube is formed in two sections, with a station in Holborn. The first section—that between Euston and Holborn—is 3,080 yards in length, and is laid with easy gradients. The section between Holborn and the Post Office is 1,658 yards in length, and on it two gradients of 1 in 15 occur. [The total length is almost three miles.] The station at Holborn is placed at right angles to the direction of the tube, so that all through trains must reverse there. This is effected by allowing a train on its arrival to run from one tube up an incline, down which it quickly descends by gravity, and is turned on to the pair of rails leading to the other tube. This shunting is effected very rapidly, occupying only about half a minute. The tube is of the horse shoe section, the internal dimensions being 4 feet 6 inches vertically, and 4 feet horizontally. The pneumatic cars or trucks are 10 feet 4 inches long, and the ends present an outline conforming to that of the interior of the tube, the edges of the ends being bound in an elastic medium, so as to form pistons when in the tube. The cars weigh about one tun each.

The machinery by which the transit of the carriers is effected was designed and constructed by Messrs. James Watt & Co., and is placed in the rear of the Holborn station. It consists of an engine having a pair of 24 inch cylinders with 20 inch stroke. A fan 22 feet in diameter is geared at 2 to 1 with the engine, and is worked continuously, the alternate action of pressure and exhaustion being governed by valves. The ordinary working speed of the fan is 160 revolutions per minute, which gives a pressure of about 6 ounces per square inch. Trains are drawn by exhaustion from Euston square and the Post Office, and are propelled by pressure to those points. The doors of the tubes are arranged at Holborn and the Post Office on the principle of lock gates, being hinged vertically and hung in pairs.

Such is in general terms the machinery of the Pneumatic Despatch Company, the working of which was illustrated to a number of scientific gentlemen and others on Monday last. Among those present were the Duke of Buckingham and Chandos (Chairman), Mr. John Aird, Mr. G. S. Sidney (Directors of the Pneumatic Company), Mr. W. H. Barlow (Engineer to the Midland Railway Company), Mr. Winter (Engineer to the Post Office), Mr. Giraud, Mr. T. G. Margary (Secretary of the Pneumatic Company), Mr. S. de Wilde (representing Mr. L. Clarke, the Company's engineer), etc. The trials commenced by bringing a single car by exhaustion from the Post Office, the run being accomplished in 3½ minutes, a rather longer time than usual, but accounted for by the circumstance of the car having been over buffed, the pressure being relieved a little too soon. This car was then coupled to two others, and the three were started on their way to Euston, which point they reached under pressure in 6¼ minutes from the time of leaving Holborn. The train was next brought from Euston by exhaust, the time occupied being 5½ minutes. It was then run into the Post Office tube, and in 2½ minutes from the time of starting it had reached its destination. It was then sent on the return journey, which was accomplished in 3 minutes, as far as Holborn, and in 7 minutes more it had arrived at Euston. The time here was exceptionally long, but the pressure was rather low. Finally the train was brought back from Euston in 5½ minutes.

Experiments of such short duration as the foregoing, carried out, moreover, without any recent practice by the men in charge, can hardly be taken to represent the results of actual practical working. Some interesting facts, however, in connection with continuous working were established by Mr. W. H. Barlow, who in the early part of the present year instituted a series of careful experiments with the pneumatic tube, which lasted over several days, and showed the difference of power required to work the gradients of the Euston section of the tube as compared with the Post Office section. One feature proved by these experiments was, that whether the tube was closed at both ends or closed at one end and a car inserted and fixed at the other, or whether a train was moving or not, and again whether each tube was put in connection with the fan separately or both were put in connection with the fan at the same time, in all these cases there was—as might be expected—but little variation in the number of strokes required to maintain given pressures.

With regard to the actual weights moved, and speeds obtained, numerous experiments were made by Mr. Barlow on the section between Euston square and Holborn.

The remarkable feature of these experiments is that, with the same number of revolutions per minute of the engine, and the same pressure, a very large increase made in the load produced a comparatively small decrease in the speed.

By increasing the load from two to twelve tuns, the useful effect or weight passed through per minute was increased five times. In the last experiment, by increasing the load from two to twenty tuns, the useful effect was increased about seven and a half times; the pressure of steam and the work performed by the engine remained about the same, whether a weight of two tuns was passing through at 17·3 miles per hour, or twenty tuns at 13·15 miles per hour. The experiments made by Mr. Barlow upon the section of tube between Holborn and the Post Office showed that, notwithstanding the gradient of 1 in 15, the heaviest loads were those which produced the best commercial results.

The working expenses are estimated at £50 per week, working 12 hours per day, and the repairs at £500 per annum, an allowance which Mr. Barlow considers to be ample. He, moreover, observes that if sufficient traffic could be found to render it desirable, the carrying power of the apparatus could be greatly increased.

Seeing then that there exists in good working order a rapid and efficient means of transit between Euston square on the one hand, and the Post Office and the receiving houses of the principal carriers in London on the other, there can hardly be a doubt that these means will soon be utilized by those parties whom they would so clearly benefit. Useful as the system appears to be as at present arranged, it could be rendered infinitely more useful by a slight extension. It already has one of its *termini* at the North Western Railway, and we know of nothing to prevent its further extension eastwards to the Midland and Great Northern Railway stations. Such Such a step would appear to be most desirable, and we should think that the two last named companies would find it greatly to their interest to enter into working arrangements with the Pneumatic Despatch Company. This would afford a ready solution to the difficulty which the Company now experiences in obtaining sufficient traffic to start their line. Were such arrangements as we have suggested carried out, the additional length of tube would be forthwith constructed, and from what we have seen of the satisfactory nature of the working of the system, it would thereafter be rapidly extended in all directions under the metropolis and its suburbs.—*Engineering, Aug.* 23.

New Method of Telegraphing.

A patent recently granted to J. H. and J. W. Rogers, of Peekskill, N. Y., covers the following method of telegraphing:

The inventors provide a thin and narrow conducting tape or strip of metal, on which they emboss the message in the Morse characters, and this strip they draw through a transmitting instrument, which is so arranged that a metallic pen, or *stylus*, which is in communication with one pole of the battery, will only touch the upper surface of the characters, as the strip passes along through the machine. The under surface of the strip or tape is in communication with the other pole of the battery; consequently whenever the *stylus* comes in contact with an embossed character or signal, the electrical circuit is closed and a signal, corresponding to the embossed signal, is transmitted over the line wire, to the receiving instrument at the opposite end. The receiving instrument may be made on the plan of the Morse instrument, and is intended to be so arranged that it will indent or emboss the signals, as fast as received, upon a metallic strip like that used in first sending the message. Several advantages attend this method of telegraphing and recording. The transmission of messages once formed can be much more rapidly effected than heretofore.

The means for forming the raised letters on the conducting tape are, or may be, substantially the same as those now employed in printing telegraphic messages on the Morse system—that is to say, by the ordinary needle or recording pin of the register. The forming of the raised letters can consequently be effected at any suitable distance by the ordinary telegraphic appliances, and thus supply the place of repeaters. If, for example, in sending a message to California from New York, the wire beyond Chicago should be engaged, then (assuming the wire to be disengaged from New York to Chicago) the automatic repeater is of no use until the wire beyond Chicago can transmit its message; but the improved tape catches and holds the message at Chicago until the wire beyond may be used, and thus from fresh batteries repeats the messages from New York on to California at least ten times as rapidly as an automatic repeater could, leaving the wire from Chicago back to New York free for other messages to New York; which the ordinary automatic repeater cannot do, acting simultaneously, as it must, with the New York manipulations.

Again, to say nothing of the automatic repeaters, all the messages arriving at a central office—as, for example, the Western Union in New York—may be delivered there on the tape by each distant manipulation of other offices, instantaneously, and all these may be transmitted on to their destinations by turning a wheel, whereas now an expert must forward each message to which the wires beyond New York were not opened.

Japanese Fans.

In summer time the climate of Japan is generally moist, hot and oppressive, the air on the hottest days being not unfrequently stagnant as well; the consequence is that the use of the fan is universal, and in bamboo and Japanese paper are found materials most admirably adapted for the purpose of their manufacture. The artistic faculty of the Japanese embellishes their fans with designs that commend themselves by their exquisite fidelity to Nature; a few simple touches realize pictures which many a foreign artist could not approach; the Japanese are born draftsmen, and their sense of the contrast of colors intuitive; hence even the very commonest fans are generally very interesting to look at, and are almost never vulgar. The excellence of this branch of native manufacture, and the excessive cheapness of production, says the Japan *Herald*, are fast securing a foreign trade in them of no mean magnitude. Within the last year one commercial house shipped some three millions of them to America, and another firm is just shipping away, in one vessel, a million more to the same country, where it has become a common practice to deposit a fan in each sitting in churches and chapels, for the use of members of the congregation. There are some extensive factories at Yedo devoted to fan making, giving employment to hundreds of hands. The fans being wholly produced by manual labor, no machinery is employed.

A Tame Wasp.

At a recent meeting of the British Association, in Brighton, in the section of zoology and botany, Sir John Lubbock exhibited a tame wasp which had been in his possession for about three months, which he brought with him from the Pyrenees. The wasp was of a social kind, and he took it in its nest formed of twenty-seven cells, in which there were fifteen eggs, and had the wasp been allowed to remain there, by this time there would have been quite a little colony of wasps. None of the eggs, however, came to maturity, and the wasp had laid no eggs since it has been in his possession. The wasp was now quite tame, though at first it was rather too ready with its sting. It now ate sugar from his hand and allowed him to stroke it. The wasp had every appearance of health and happiness; and although it enjoyed an "outing" occasionally, it readily returned to its bottle, which it seemed to regard as a home. This was the first tame wasp kept by itself he had ever heard of.

Bullock's Blood as a Medicine.

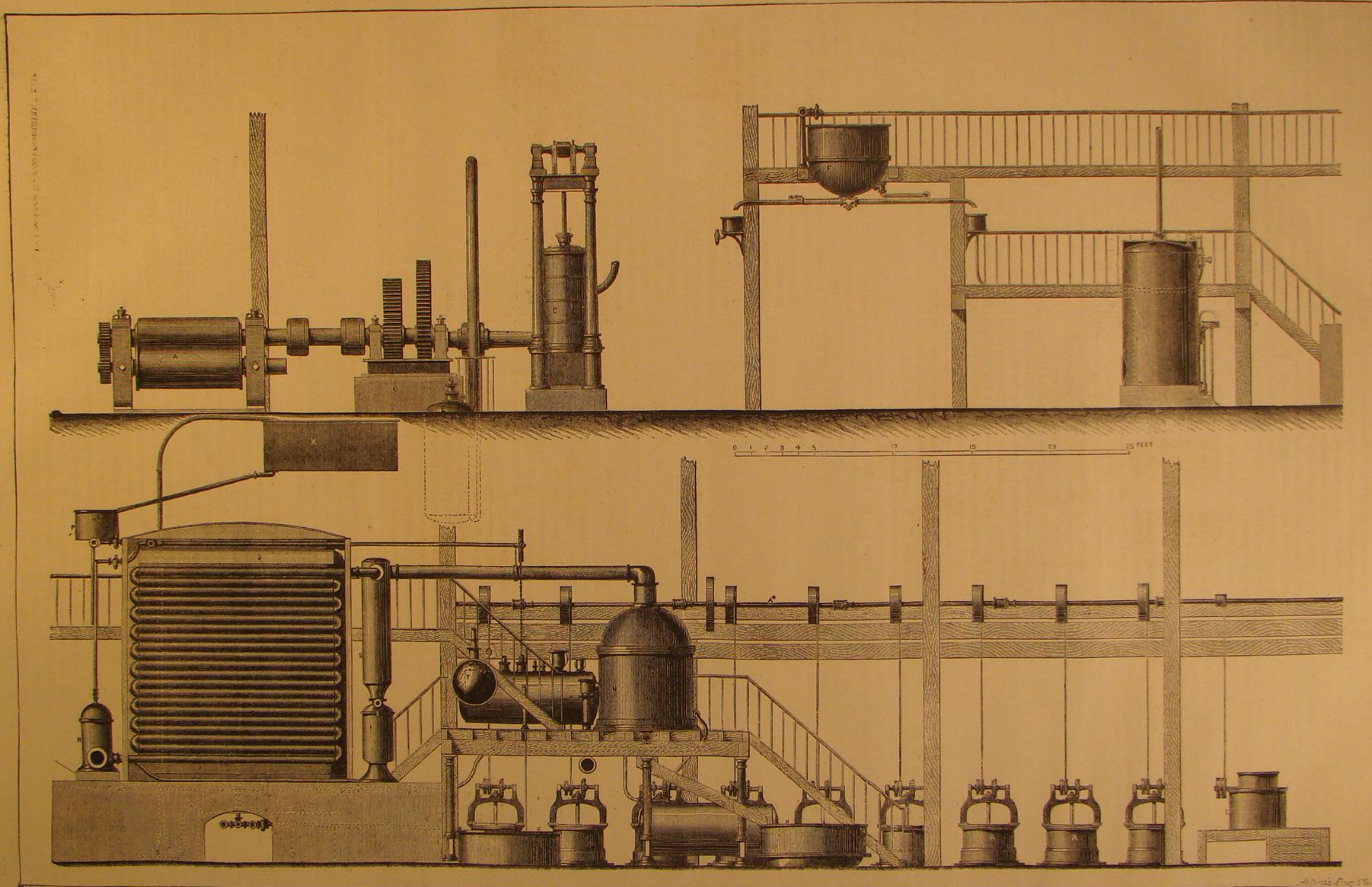
In the practice of medicine, as in other worldly matters, certain things are in fashion for a certain time. Bleeding and mercury have had their day; cod liver oil and chloral hydrate are already on the wane; alcohol and bullock's blood are now in vogue among the Parisians—the former for fevers and all inflammatory affections, and the latter for anæmia and pulmonary phthisis. It is said to be a curious sight in Paris to see the number of patients of both sexes and of all ranks and ages who flock to the slaughter house every morning to drink of the still fuming blood of the oxen slaughtered for the table. According to M. Boussingault, of all nutritive substances the blood of animals contains the greatest quantity of iron, and it is this which gives value to the new medicine.

Elevations in Colorado.—Collated by Professor C. Thomas, of the United States Geological Survey.

Names of Points.	Altitude above the sea. Feet.	Names of Points.	Altitude above the sea. Feet.
Mount Harvard (Whitney)	14,270	Jones's Pass	12,400
Gray's Peak	14,145	Argentine Pass	13,100
Mount Lincoln	14,123	Georgia Gulch Pass	11,487
Mount Yale	14,078	Ute Pass	11,200
Pike's Peak (Parry)	14,216	Vasquez Pass (estimated)	11,500
Long's Peak	14,056	Hot Springs (Idaho City)	7,060
Barry's Peak	13,133	Hot Springs (Middle Park)	7,725
Mount Flora	12,878	Soda Springs (near Pike's Peak)	6,315
Mount Wright (E. Berthoud's Pass)	11,800	Gold Hill	8,626
Cherry Creek Divide	7,573	Bergen's Ranch (Jefferson Co.)	7,752
Denver	5,317	Jefferson, South Park	9,842
Golden City	5,882	Tarryall	9,943
Mount Vernon	6,479	Foot Berthoud's Pass	9,325
Golden Gate	6,228	Osborn's Lake	8,821
Junction N. and S. Clear Creeks	6,466	Velie's Peak	13,456
Black Hawk	7,543	Mount Audubon	13,402
Central City	8,043	*Timber Line (Parry).*	
Missouri City	9,073	On Pike's Peak	12,000
Head Virginia Cañon	9,600	On Snowy Range	11,800
Idaho	7,149	On Mount Audubon	11,253
Georgetown	8,345	On Long's Peak	10,800
Berthoud Pass	10,938	On Wind River Mountains	10,169
Boulder Pass	11,670	On Gilbert's Peak (Uinta Mountains. Hayden's Survey)	11,100

FOREIGNERS IN JAPANESE EMPLOY.—From the *Nishi Shinjishi*, the Yedo newspaper printed in Japanese, we glean that the Public Works Department of that country employs 161 foreigners, at an aggregate cost of 29,621 dollars a month. They consist of French, 36 persons; English, 111; Swiss, 1; Chinese, 6; Manillese, 4; Indian, 1; and Americans, 2.

PLATING WITH NICKEL.—This may be effected by placing the object to be plated, whether of iron, steel, copper, bronze, zinc or lead, in a boiling neutral solution of zinc chloride containing a salt of nickel, and granulated zinc. If the zinc solution is acid, the coat of nickel is dull. A plating of cobalt may be made in the same manner.



THE CUBAN SUGAR MANUFACTURE.—MODERN MACHINERY.

THE CUBAN SUGAR MANUFACTURE--MODERN MACHINERY.

We this week lay before our readers a complete illustration of the mode of extracting the juice from the cane, and of the processes of boiling, purifying, and crushing it when crystallized. The plant portrayed in our engraving was erected by MM. Cail and Co., an eminent firm of mechanical engineers in Paris, at a cost of $160,000.

The first operation to which the cane is submitted is crushing in a mill, A; the mill has three rolls, each 6 feet 6¾ inches long by 2 feet 7½ inches diameter. These rolls are worked by a 30 horse beam engine, C, being connected thereto by the gearing in B. The engine runs at 26 revolutions per minute and the gear reduces the speed of the rolls to 2·6 revolutions per minute; so the rolls give a surface speed of 21·45 feet per minute. The juice from the crushed cane flows into a receiver or tank, and thence to a lifter, E, which consists of a wrought iron vessel into which the juice is admitted by a pipe. Through the top of the lifter, E, there passes an ascension pipe by which the juice is conveyed to the purifiers. The action of the lifter is as follows: When it is charged with juice and the cock of the pipe conveying the juice in is shut, steam is admitted which forces the juice up the ascension pipe by its pressure on the surface. When all the juice has passed up the pipe, a fresh supply is admitted and the forcing process repeated. In the arrangement now under consideration, the lifter is about three feet diameter and 7½ feet long, the ascension pipe being 3 3-8 inches in diameter.

There are six purifiers, one of which, marked F, is shown in the engraving. In these juice is mixed with the quantity of lime required to remove from it the carbonic acid it contains, which would, if suffered to remain, soon deprive the juice of its saccharine quality. About 3 per cent of lime is added to the juice, a portion being thrown into the juice while in the receiver or tank. The purifiers, F, are heated by steam coils containing steam of 60 lbs. on the square inch. These purifiers are 5 feet in diameter by 4 feet 7 inches deep, and they have hemispherical bottoms with supply and discharge pipes as shown.

After boiling, the next process is the filtering through animal charcoal, which material in the present instance is contained in 10 cylindrical vessels 3 feet 7 inches in diameter by 6 feet 11 inches high, each provided with two hand holes for removing the charcoal and refilling the cylinder. Into each cylinder a pipe having 3 branches leads, through which juice, sirup, and steam can be respectively admitted. A false perforated bottom is inserted in each filter through which the filtered juice flows to a pipe leading to the tank, V. The juice is lifted from this tank into the vessel marked X, by a lifter similar to that already described. Thence it flows to the vessel, P, which regulates the supply of juice to the evaporating condensers, R.

Each of the condensers, Q, is composed of two series of pipes, receiving in their interiors the steam from vacuum vessels. Each condenser consists of 21 tubes, 13 feet long by 6 inches diameter. After leaving the condensers, the juice is pumped into a vacuum vessel, N, in which the processes of evaporation and concentration are completed. A vacuum is maintained in the injection condensers, R, by a 25 horse power engine. Separators, S, are used to collect any water or juice that may pass out with the vapor.

The juice has now been reduced by evaporation to the state of sirup, and requires to be clarified. In the clarifiers, the juice is heated and the coloring matters are precipitated with blood. The sirup is then once again run into the closed filters already described, and is returned to the vacuum pans to be still further concentrated. After this, it is reheated, and passed to the molds wherein the crystallization takes place.

The crude crystallized sugar contains more or less molasses and matters which are not crystallizable, and to separate these it is broken up by the crushing mill, G, and then introduced into the centrifugal extractors, A. The molasses extracted by these centrifugal machines is collected in a tank. The centrifugal machines are driven by a 12 horse engine, which also gives motion to the mill, G. The line of shafting from this engine is run at 146 revolutions per minute, and from this the mill and centrifugal machines are driven at speeds of 58 and 1,208 revolutions per minute, respectively.

To manufacture the animal charcoal used in the filters, the bones, after carbonization, are ground in a crushing mill of any form, and made to pass a screen which separates the grains of the size necessary for obtaining a good filtration. The animal charcoal, after having been used in the filters, becomes charged with impurities, and as it is an expensive material, it is cleaned after each operation, and it is thus made to serve a large number of times. To clean it, it is washed in a suitable apparatus and is then revivified in the elliptical retorts of a furnace.

The plant we have described is capable of dealing with 100 tuns of canes in a day of twenty-four hours, the machinery being driven by engines of 150 horse power collectively. Taking the production of sugar at 8 per cent of the weight of the canes, we should thus have a production of 8 tuns of sugar per twenty-four hours, and as there are on an average 120 days in a season, the production per season would be about 960 tuns of crystallized sugar.

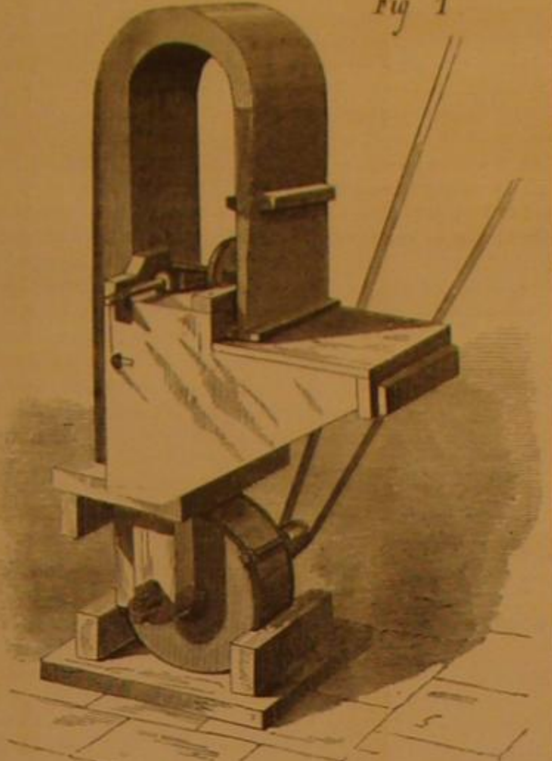
SOMEBODY says there should be a woman in every firm of architects to look after the closets. When you build your house, you may tell the contractor, until you are black in the face, "We will have a closet there." He will not put one there until he has seen madam, and ten to one, when he has seen her, the closet will go elsewhere, and double the number and twice the size be ordered

THE SAND BLAST PROCESS FOR CUTTING HARD SUBSTANCES, ENGRAVING ON GLASS, ETC.

Considerable interest was manifested, at last year's fair of the American Institute, in the Tilghman machine for engraving on glass, which was in practical operation.

We present herewith an engraving illustrative of the operation, copied from *The Science Record*. In this process a stream of sand is introduced into a rapid jet of steam or air so as to acquire a high velocity, and is then directed upon any hard or brittle substance so as to cut or wear away its surface.

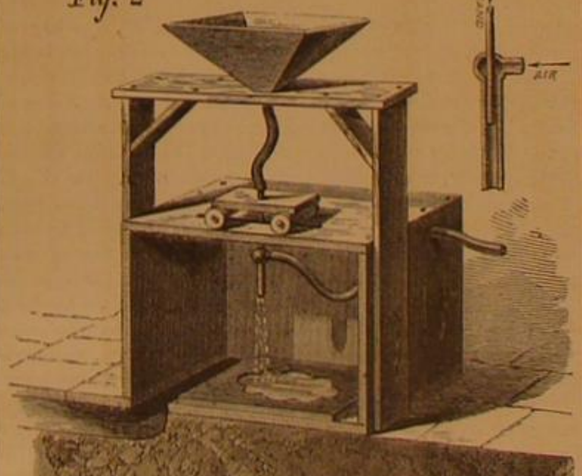
Fig 1



For ordinary rough work, such as cutting stone, where a considerable quantity of material is to be removed, a steam jet of from 60 to 120 lbs. pressure has generally been used as the propelling agent. The sand is introduced by a central tube $\frac{1}{5}$ inch bore, and the steam issues from an annular passage surrounding the sand tube, on the principle of the Giffard injector. The impetus of the steam then drives the sand through a steel tube $\frac{3}{8}$ inch bore and about 6 inches long, imparting velocity to it in the passage, and the sand finally strikes upon the stone, which is held about 1 inch distant when a deep narrow cut is desired, but may be 18 or 24 inches distant when a broad surface is to be operated on.

To produce ornaments or inscriptions on stone, either in relief or intaglio, a stencil of iron or caoutchouc is held or cemented to the stone, and the sand jet is moved with an even and steady motion over the whole surface, so that all the exposed parts may be cut to the same depth.

Fig. 2



The skill and time of the artist may be devoted exclusively to making the stencil; this being prepared, the most elaborate and intricate designs can be cut as rapidly as the most simple.

The durability of caoutchouc as compared with stone, under these circumstances, is remarkable. A stencil made of a sheet of vulcanized caoutchouc about $\frac{1}{16}$ inch thick, exposed to sand driven by 50 lbs. steam at 2 feet distance, has lasted, with scarcely perceptible wear, while 50 cuts were made in marble, each cut being about $\frac{1}{4}$ inch deep, or about $12\frac{1}{2}$ inches in all, or 200 times the thickness of the caoutchouc. With a supply of steam equal to about $1\frac{1}{2}$ horse power, at a pressure of about 100 lbs., the cutting effect per minute was about $1\frac{1}{4}$ inches of granite, or 4 cubic inches of marble, or 10 cubic inches of rather soft sandstone.

Sand driven by an air blast of the pressure of four inches of water will completely grind or depolish the surface of glass in ten seconds. If the glass is covered by a stencil of paper or lace, or by a design drawn in any tough elastic substance, such as half dried oil, paint, or gum, a picture will be engraved on the surface.

Photographic copies in bichromated gelatin, from delicate line engravings, have been thus faithfully reproduced on glass. In photographic pictures in gelatin, taken from Nature, the lights and shadows produce films of gelatin of different degrees of thickness. A carefully regulated sand blast will act upon the glass beneath these films more or less powerfully in proportion to the thickness of the films, and the half tones or gradations of light and shade are thus produced on the glass.

If we apply the sand blast to a cake of brittle pitch or resin on which a picture has been produced by photography in gelatin, or drawn by hand in oil or gum, the bare surface of the material may be cut away to any desired depth. The lines left in relief will be well supported, their base being broader than their top, and there being no under cutting, as is apt to occur in etching on metal with acid. An electrotype from this matrix can be printed from in an ordinary press. The sand blast has been applied to cutting types and ornaments in wood, cleaning metals from sand, scale, etc., and to a variety of other purposes.

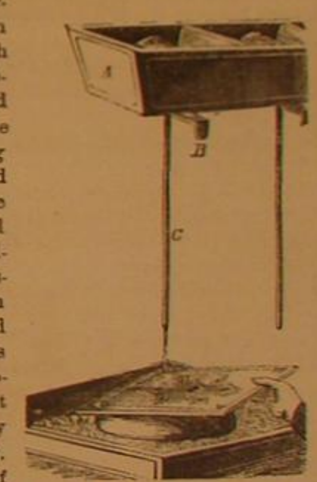
Various forms of apparatus may be used to execute the work. In our engraving, Fig. 1 shows a device for roughening sheet glass. The air blast is produced by the fan below, and the air rises through the curved tube, carrying the sand up with it, which is thrown into the air tube by an endless belt of scoops arranged in the lower part of the angular box. The sand is carried up by the air and brought over and down the front air tube, where it discharges with great force upon the surface of the glass, which is contained within the front box and is carried by a belt gradually forward under the sand blast. The sand falls from the glass into the lower part of the angular box, where it is scooped and thrown again into the air current.

Another form of apparatus for boring or engraving is shown in Fig. 2, and the sand is driven in this case by steam, on the principle of the Giffard injector. The sand descends through a tube from the hopper, and in its course the vertical sand pipe is joined by a lateral steam or air pipe, which gives a sudden impulse to the sand and drives it down upon the glass below with tremendous force. The sand tube is flexible, its extremity is carried on rollers, by which it may be moved back and forth to suit the requirements of the work.

MORSE'S IMPROVEMENT IN GLASS AND PLATE ENGRAVING.

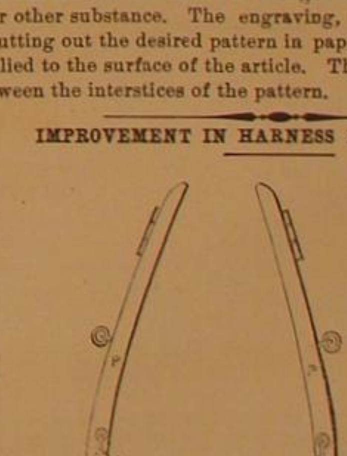
Subsequent to the patent of Mr. Tilghman, which bears date Oct. 11th, 1870, Geo. F. Morse, of New York, obtained a patent on a more simple contrivance for accomplishing similar results to the Tilghman process, which we also illustrate. The latter patent bears date November 21st, 1871.

The inventor provides a single box or hopper A, from which depends a small tube C, about eight feet long. No machinery whatever is used. A mixture of corundum and emery, in the form of powder, is placed in the hopper and allowed to descend through the tube, the flow being regulated by the slide B. The article to be engraved, which may be a silver cup, a watch case, a sheet of glass, a goblet, or other object, is held under the extremity of the tube, so that the engraving powder will fall upon it, and in a few minutes' time the most splendid ornamental designs are cut with marvelous exactitude and surprising beauty. We have seen engraved effects, produced by this process, upon glass and silverware, that altogether surpass anything that has ever been attempted by the most skilled hand labor.



As fast as the supply of engraving powder runs down through the tube, it is replaced in the hopper; and girls may do all the work. That portion of the articles that is not to be engraved is protected by paper or other substance. The engraving, therefore, is done by cutting out the desired pattern in paper, which is then applied to the surface of the article. The powder only acts between the interstices of the pattern.

IMPROVEMENT IN HARNESS BREAST STRAPS.



A simple improvement consists in making the strap, B, of metal, secured to the harness, P, by straps, A, as shown. This improvement is said to be decidedly superior to the common leather straps; but it must be more noisy.

NEW ANTIMONY BLUE.—This new, beautiful, and permanent color, unfortunately not applicable to lime, is very easily obtained by dissolving a portion of metallic antimony in *aqua regia*, filtering the solution through granulated glass, and adding a dilute solution of prussiate of potash, so long as there is any precipitate. This blue is scarcely to be distinguished from ultramarine, and supplies the flower makers with a corn blue not to be had before. Mixed with chrome yellow or zinc yellow (chromate of zinc), it yields a green color scarcely inferior to Schweinfurt green, which is much less poisonous than arsenic green. It works well with oil varnish, gum, glue, and starch.—*Polytechnisches Notizblatt.*

Correspondence.

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

Changing Pay Day.

To the Editor of the Scientific American:

By almost universal consent and usage, Saturday or Saturday night is the time when the greater bulk of working people are paid off. The custom, we believe, was imported from the European countries, where it has existed for an indefinite period. Lately, in certain sections of the Queen's dominions, the propriety of changing pay day from Saturday to Monday has been seriously discussed, and so far put to test as to conclusively prove the wisdom of the change.

The reasons specified were principally in the interest of the employed, who were habitually given to squandering on Sunday the wages in hand at the recurrence of the weekly holyday, thus perverting it into a mischievous holiday; but the result has also proved advantageous to the employers and to the community beyond, as will be shown.

First, as to the benefits to the employed: When they receive payment on Monday or Monday night, they have literally no time for carousal and debauching indulgences that would unfit them for the next day's work. Those with more self respect are not generally left with sufficient means, after providing for family expenses, to indulge in the numerous costly pleasures prepared in numberless blazing shop windows on Saturday nights, or which beckon in all directions on Sundays, in the form of excursions, sights, etc., which nearly always emptied the laborer's pocket of the small surplus that, if he were paid on Monday, would be more likely to get into savings bank, or, in some other form, provide for future comfort.

The good sense of reflecting people will approve this system and see, doubtless, what encouragement the change will indirectly be giving to the weak and wavering among our own population, that now find it so hard to deny themselves stimulants, finery, or foolish outlays by the score, when Sunday, with its leisure and opportunities for idleness, indulgence, and display is just at hand, and when the price of all they covet is just paid to them. The diversion of a large percentage of wages, now absolutely squandered on Sunday, might, by changing pay day, be at once secured to its proper and rightful appropriation, namely, the comfort of families that, under the present system, sooner or later come to want and beggary. I believe, further, that it would operate directly and disastrously upon liquor establishments and drinking places of every grade, for credit is not popular in such houses; the laborer is welcome there only when his money keeps him company.

Beyond these mere glances at the physical benefit to the employed and their now cheated families, and passing by the yet mightier moral effects herein involved, let us see what the employer and capitalist would gain by the change.

If labor is capital to a considerable extent, then a simple gain of reliable capital, in the shape of sober, rested workers, instead of sleepy, half drunk, enervated make believes, would be an item worth considering. The peace of mind following established confidence in the general sobriety and faithful appearance of the hands is an appreciable consideration, appealing to individual employers to try the change of pay day. The loss of time and the failure to meet contracts on account of the delinquencies of working men who despoil themselves over the Sabbath appeal to the credit of manufacturers, head mechanics, and all grades of employers to devise a new system alike beneficial to themselves, their patrons, and their employees.

I have the utmost faith that a simple measure that will "stand to reason," as this does, and that has been proved a success when tried, will arouse discussion in our own community, as well as elsewhere, and receive the practical approval of the parties most directly to be benefited.

Kingston, N. Y. M. M. S. F.

Japan as a Field for Employment.

To the Editor of the Scientific American:

Several letters from America and Europe have been directed to me by parties in search of employment. I can only say, very briefly, that this country is already overstocked with foreigners out of employment. I should advise no American to come to Japan, unless he has a position secured before he comes. A man can do well here if he comes to Japan having been appointed in America. It gives him *prestige* over those who are trying to get employment here. As you see by the appended note [printed elsewhere.—ED.], the English have the lion's share in the railroad undertakings, the Mint, the Lighthouse Department, the Navy, and in many other branches of enterprise. Yet the large majority of the unemployed foreigners here are English. In educational and agricultural matters the Americans take the lead, in military, the French, in medicine, hospitals, etc., the German.

In regard to men appointed to offices with high sounding names and large salaries, I am afraid many people will be disappointed concerning Japan. The Japanese simply want helpers and advisers. They propose to keep the "bossing," officering, and the power all in their own hands. Some disappointment and a little profanity has been indulged in by certain people who deceived themselves by supposing the flattering Japanese to mean all that their polite words said in America. All this "taking charge of," "being at the head of," "organizing," etc., is shear day dreaming. People from America and Europe must remember that "there were brave men before Hector;" and a few foreigners have been laboring in Japan for years, and with knowledge of the language, etc., have helped the Japanese to help themselves. Many who come here to "organize," etc., find that things are already organized as much as they can be under the circumstances, and that all that new comers can do is to wait quietly until perchance they gain the confidence of the Japanese, and even then all they advise is by no means adopted. Nearly every appointee comes here to "revolutionize" his department, but the Japanese don't want that. They want the foreigners to get into the traces, and pull just so fast as, and no faster than, their mighty enterprises can bear. Let it not be forgotten that this country is an emphatically poor country now, and that millions of its people are very ignorant, and that it has just emerged from feudalism; and that therefore the rulers of Japan must go slowly and cautiously. Above everything else, it is not wise to put their soil or their enterprises too much into foreign hands, and to prove that Japanese nature is human nature, they like to do it themselves, to play with their own toys, and to run their own machines. Therefore, if a man means real hard work, that takes off its coat, and is willing to run the risk of going hungry occasionally, and if he has patience enough to wait until an experience-taught people can trust him, and if he isn't a born brigadier general, and is willing to help without "taking charge" of everything, let him try Japan. If he expects that the Japanese people wish to make him a Secretary of State, or Minister of Education, or Postmaster General, etc., he had better stay at home, because the Japanese people like to be officers themselves, and are neither children nor weak minded. Neither exaggerating nor discouraging, I remain, Mr. Editor,

Yours very truly, W. E. G.

Yedo, July 19, 1872.

Ball Lightning.

To the Editor of the Scientific American:

In reference to J. H. P.'s letter upon lightnings, on page 148, let me say that in midsummer, several years since, there was an exhibition of this kind of lightning. I was at a farm house in northern Ohio; a black cloud hung over a wood, perhaps a hundred rods away and directly across the road in front of the house. Another cloud hung directly over or a little back of the house; both clouds appeared to be unusually near the earth. My position was on the "horse block" between the two clouds. Suddenly a ball of light, dazzlingly brilliant, rushed from the cloud over the wood, passing directly over my head, and disappeared with a loud report in the cloud over the house.

Under the impulse of the moment I ran into the road to get a better view of the destination of the ball; while others present ran into the house and locked the doors, so violent and so very near seemed the noise. J. H. P. may depend (and it can be proved satisfactorily) that the above is "testimony worthy of credit," as far as dazzled eyesight, backed by a cool head, can determine. C.

Cleveland, O.

The Remarkable Gas Well at Painesville, Ohio.

To the Editor of the Scientific American:

Having recently spent a few days at Painesville, Ohio, I visited the celebrated gas well of General J. S. Casement, located on the farm of the Hon. C. C. Jennings, about one mile from the city.

Our party, in charge of Mr. Daniel Casement, brother of the General, arrived at the place just as the lamps were being lighted, and were most cordially received by Mr. Jennings, to whom we made known the object of our visit. We were shown into the sitting room, and were soon seated around one of the fireplaces common to many primitive western homes. Before us was, to all appearances, a small wood fire. Upon inspection, however, our wood proved to be imitation logs, made of metal, and the fuel, gas. By the turning of a small stop cock at the side of the fireplace, our genial fire became a roaring flame, making it almost uncomfortable for us in the farthest part of the room. We next proceeded to the kitchen, where we found that all the cooking was done by the same agency, the gas being introduced into the range, and consumed through peculiarly constructed burners. These burners are arranged in six parallel lines, about one inch apart, and cover about two thirds of the fire plate. The form of the burners resembles the argand in construction. Passing from the old to the new house (which, by the way, though unfinished, is considered to be one of the most complete structures of the kind in the State and, we doubt not, in the West), we here found nearly all of the rooms arranged to be heated by steam and containing also fire places and firelogs. We now descended to the basement to inspect the furnace. The burners used here are the same as in the range, but greatly multiplied. The roaring of the flames under a full head of gas was awfully grand. After the fire was extinguished, the gas was again turned on, to show us the nature of the article. The smell resembles that of the most refined kerosene oil, yet it is not at all offensive. It has not yet been analyzed, therefore I am unable to state its constituent parts.

As to the origin of the well, Mr. Jennings informs us that he had long been convinced that gas was to be found, and that some two years since operations were commenced, but were abandoned on account of the flow of water. Soon after, the second attempt was made, upon higher ground, which proved successful. The first fifty feet were through light sand and gravelly soil, and at this depth the soapstone rock was reached. An eight inch pipe was then sunk, and boring through the rock commenced. At a further depth of six hundred and fifty feet, the vein was reached and the gas has continued to flow to the present time. No receiver or gasometer is used, but the gas is carried through a three inch pipe immediately to the house, some two hundred feet distant.

To give you some slight idea of the supply furnished, I will mention one fact. During the past winter, it was found necessary to keep large fires in the new house. There were thirteen of these, each consuming about the amount required for 150 of our common burners, and were continually burning night and day, without any apparent diminution.

A recent scientific test has shown that the pressure of the gas is 40 pounds to the square inch, and it is further estimated that there is a sufficient quantity to light the whole city of Cleveland.

There is one remarkable feature in connection with this, well deserving more than passing mention. While all the wells discovered have been more or less troubled with a flow of water, thus requiring pumping, Mr. Jennings states that, from the commencement to the close of the work, there has never been a drop of water in the well, and the engine used in drilling, and also designed for the purpose of pumping if required, has never been in operation since the well was completed.

I can assure your readers, if any of them find it convenient to visit the well, of a most hearty reception from Messrs. Jennings and Casement. They will find ample compensation for the trouble of a journey thither. M.

Sheet Lightning.

To the Editor of the Scientific American:

After carefully watching, for many years, what is called sheet lightning, I have never been able to make any distinction between it and so-called zigzag lightning. Sheet lightning is simply lightning at such great distance from us that we neither see its zigzag movements nor hear its thunders rolling. After sunset, should a thunder gust be on its march toward us, the first indications of it we see are its sheet lightning flashes and flickerings among the distant clouds. Bye and bye the blackening smoky looking clouds begin to loom up and travel toward us; then, shortly after, we hear the rolling sounds of distant but approaching thunder; and finally we hear the sharp alarming peals, and often see the zigzag movements of the fiery bolts, or electric charges, of the warring elements, flying from cloud to cloud.

Gloucester, N. J. JOHN HEPBURN.

[For the Scientific American.]

PORTABLE MEDICAL BATTERIES.

BY PROFESSOR GEORGE W. RAINS, OF THE MEDICAL COLLEGE OF GEORGIA.

The want of a small sized galvanic battery which can be easily carried about in the hand, and which at the same time is of sufficient power to fulfil all the requirements of the general practitioner, has long been felt; and it is continually growing more urgent, as the medical application of electricity becomes more extended. The apparatus now employed, whether it be that of Grove, Bunsen, Daniell, Smee, Siemens, Stöhrer or others, or their modifications as constructed in this country by Kidder, Drescher, Chester or the Galvano-Faradic Manufacturing Company of New York, has always the same inherent difficulty, when of sufficient power, of being too weighty and bulky to answer the requirements of easy portability, however excellent each may be for office use or laboratory purposes.

The Faradic instruments, for giving induced shocks by helices, have arrived at a high degree of excellence within the past few years, and may be considered as sufficiently answering all the requirements of portability and service, whether of the specialist or the general practitioner.

The principal difficulty heretofore existing in the construction of a small and sufficiently powerful galvanic battery has been in the well known law that quantity is proportional to the extent of active surface of each element, while intensity, energy, or power of penetrating and overcoming resistances is proportional to the number of elements employed. Thus it would appear that a battery of sufficient intensity to effectively pass its current through the human body must have many elements; and these must be of considerable size to give out the necessary quantity for all purposes of medical treatment.

So we have Siemens' modification of Daniell's battery for office and hospital use, composed of 60 glass jars from 5 to 6 inches in diameter by 7 or 8 inches high, containing the zinc and copper elements. Hence, from the apparent nature of the case, it has been assumed impracticable to construct a small battery, for portable use, having at the same time sufficient quantity and intensity.

This has been greatly to the detriment of the employment of the galvanic current, continuous or interrupted; for the larger number of cases for electric treatment require necessarily to be acted upon at the residences of the patients, and not at the office of the physician, where the necessary batteries are available. The high value of the galvanic current and its superiority to the Faradic in many cases are now well established, to say nothing of those instances where it is indispensable.

Such being the condition of things, the question arises as to the possibility of overcoming the apparent difficulties in the construction of a small, simple, readily portable battery for general medical use. Towards the solution of this problem I have devoted much time during the past year, and I will here state the principles which appear to evolve from my experiments.

First—That the electricity given out by any single element is composed of a number of rays or currents of different intensities.

Second—That a single element, even if of large size and in energetic action, has but a very small number of such rays or currents of the comparatively higher intensity.

Third—That only the rays or currents having the higher intensities pass through resistances.

Fourth—That an equal number of rays, or an equal amount of electricity, of sufficiently high intensity to be able to overcome a certain resistance, can be generated either by a large battery or by a smaller one having a greater number of elements.

Thus let it be assumed that, in a certain galvanic series, there are 100 rays or currents of different intensities given out by each element, of which only the ray of highest intensity, A, is able to pass through or overcome a given resistance; then only $\frac{1}{100}$ part of the total amount of electricity is available for such purpose. Let it also be assumed that there is another similar series composed of elements of one quarter the size of the former. Then, instead of the full amount, A, only one fourth of A, supplied by this new series, will be able to overcome the given resistance; but the series may be increased by such an addition of new elements that the next lower rays, B, C, and D, may be raised to a sufficient intensity to be able also to pass through the given resistance. Now each ray is assumed to be equal in quantity with any other ray, hence $\frac{1}{4}(A+B+C+D)=A$. Then the new series of smaller elements supplies exactly the same amount of electricity as the series of larger elements after passing through the resistance. The intensities, however, of A, B, and C, in the new series, have each been raised evidently above that of A in the first series; so the series of small elements has not only supplied an equal quantity of electricity under the conditions, but also electricity of higher tension than that of the series of larger elements.

It is known to physicists that the exact measure for the quantity (motive force) of galvanic electricity generated in any case is the amount of chemical action which takes place; and this may be represented by several methods, by the total amount of zinc dissolved, by the amount of water decomposed by the current, by the amounts of metals deposited from solutions, or by the deflection of the needle of the galvanometer, etc. Let us now apply this to the construction of a small galvanic battery, having a considerable number of small elements which shall give out, after passing the currents through a great resistance like that of the human body, the same amount or quantity of electricity as that supplied by a much larger battery having a less number of large elements.

Thus, for example, take 20 cells or elements of a medium sized Grove's battery in fair action, and pass as much of the general current through the body as can be endured without too much discomfort, by holding wetted metal electrodes in the hands and interposing the resistance of a short column or stratum of water in the circuit; interpose also a delicate galvanometer, and mark the number of degrees of permanent deflection of the needle, which will settle, we will suppose, at 40°. Repeat the experiment, retaining the same conditions carefully, with the 32 cells of a modified Stöhrer's battery supplied by the Galvano-Farad'c Manufacturing Company; the needle will settle also at about 40°. Perform the same experiment under the same conditions with the small portable battery presently to be described; the needle will again be deflected permanently to 40°. In each one of the foregoing cases, after passing the constant current through the body, cause it to pass into water slightly acidulated, by means of two platinum wires (electrodes) passed through a cork and immersed to the same extent in each trial; collect the evolved gases in a quill glass tube drawn out to a capillarily closed extremity; the volume of the gases will be found the same in each experiment. Perform similar experiments with the three batteries by passing the respective currents through about one half inch stratum of rain water without passing through the body; the comparative results will remain substantially the same. If, in the above cases, the currents be passed through albumen (white of egg) or freshly drawn blood, the amount of coagulation will be found about the same for each battery.

From the above experiments, it may be fairly inferred that the three batteries evolved the same amount of galvanic motive force; hence either might be substituted for the other in medical use, since in all such applications of electricity the current must pass through some portion of the human body, thus encountering great resistance.

The total amount of zinc surfaces (both surfaces included) exposed to the action of the exciting liquids in each of the three batteries may be approximatively stated to be 1,000 square inches in the Grove, 200 square inches in the Stöhrer, and 49 square inches in the small battery, the number of cells being 20, 31, and 49, respectively.

Thus it would appear that a small portable battery has been constructed just as effective for all medical purposes as those of the largest size usually employed, indeed one which not only gives out an electro-motive force of equal quantity but of superior intensity.

I am convinced that the large Siemens battery of 60 glass jars is no exception to the above conclusion, although I have only been partially able to make a comparison for the want of a proper battery. In this, the action of the exciting liquid is comparatively feeble, the distance between the zinc and copper plates being some three, four, or more inches; while in the portable battery in question, the exciting liquid acts energetically, and the distance between the opposed zinc and platinum plates is but 3-16 of an inch. The electro motive force of any galvanic arrangement is a function, not only of the size and number of the plates, of the kinds of metal opposed and of their distances apart, but also of the energy of action of the exciting liquid.

The office and hospital batteries, however, will probably never be replaced by any portable apparatus, however equal or even superior it may be in power, for the simple reason that the zincs and liquid will require much more frequent renewal in the latter; for equal amounts of motive force, equal amounts of zinc must be dissolved and liquid consumed.

The specialist and general practitioner will necessarily require both kinds of batteries; but in any case where but a single battery is employed by a physician, the portable one would appear to have much the advantage. This one, having 49 elements actively excited, has such high intensity that it answers admirably for giving the interrupted current, which hence is able to penetrate to the deepest muscles and tissues; and the battery is, moreover, useful to supply the constant current.

A more particular description of this battery, as constructed by myself and used daily for the past ten months, will now be given. The metal strips used are zinc and platinum as before stated; but carbon could be employed in place of the latter, if the cells be made somewhat larger. The zincs are 2½ inches long, ⅛ inch broad and ⅛ inch thick; the platinum strips are 2 inches long, ¾ inch broad (crimped to one half inch) and of thin foil; both metals are immersed to a depth of 1½ to 1¾ inches when in full action, which is rarely required, generally from ¼ to ½ inch immersion being all that is necessary.

The strips of zinc and platinum are united by copper strips in the shape of the letter U inverted, the platinum being soldered to one extremity, and the other being so made as to lap partially around the end of the zinc which is retained in place by the spring in the copper laps. These copper strips are ⅛ inch broad, and 1¾ inches long, made in the form of the letter T before being bent, the top of the T forming the laps to retain the zinc. The zinc and platinum strips, being thus united, are respectively passed through corresponding rectangular holes made in a square piece of hard rubber (wood might answer), 6¼ inches in dimensions by ⅜ inch thick; this plate has a rod in its center by which the whole is readily raised or lowered, so as to give the proper immersion, into a square trough of hard rubber forming 49 separate cells; these cells are ¾ inch square inside, and 2¼ inches deep. Thus the battery, with the metal strips immersed, occupies a space only 6¼ inches square by 2¾ inches deep. For service, however, the whole is enclosed in a thin box 6½ inches square inside by the same hight, open at both ends and slipping easily down over and enclosing the trough, to which it is attached by pins. There is a stiff strip of hard rubber (or metal) loosely placed across the upper part of the box, having a hole in its center; through this, the rod sustaining the hard rubber plate with the attached metals passes, moving freely up and down, and held by a set screw at any required depth of immersion of the zinc and platinum couples. The zinc strips are readily replaced from the top of the rubber plate by simply pushing out, downwards, the worn out one by means of the new one which takes its place; the zincs, being well amalgamated, form a perfect connection with the copper strips without the aid of a screw. The platinum strips of course never require renewal, and are never disturbed after once being placed in position. The exciting liquid is the same as that used in Stöhrer's battery, being a solution of bichromate of potash in dilute sulphuric acid. To fill the trough with liquid, the pins are removed and the box lifted clear from it; then, the trough being placed in a dish, the liquid is poured over it in a large stream, filling all the cells at once, the excess passing over into the dish. The trough is then raised up on one side to a considerable angle to permit a portion of the liquid to flow out from the cells; and being wiped with a cloth, it is placed on a table and the box containing the metal strips is slipped over it, and the battery is ready for use; no more time is taken than would be required to fill a single large cell. This facility in replacing the worn out zincs and renewing the excited liquid is indispensable for the practical working of small batteries; otherwise they are soon thrown aside, from giving too much trouble when frequently used. In a daily use of this battery for one half hour for interrupted current, the zincs have lasted two months and the liquid over two weeks without renewal. It is important that the liquid should not fill the cells, so as to wet their top surfaces when the couples are fully immersed, and that there should be no cracks in the cell partitions; otherwise the high intensity will establish currents along such conducting channels to the great loss of power and waste of materials; for the same reason, the hard rubber plate must not be wetted, which can only happen from carelessness.

By a simple arrangement, any number of cells from 1 to 49 can be brought into action; a pole changer and current interrupter being added makes the battery complete. The entire weight of the battery is about the same as that of a good Faradic instrument, such for example as No. 4 of the Galvano-Faradic Company's manufacture; and it is equally as portable.

In case zinc of the required thickness cannot be had for the strips, they are readily made from the common thin sheet zinc, by cutting slips ½ an inch broad and 12 inches long and doubling up the two ends compactly so as to form a total of six thicknesses; such strips when amalgamated become a solid mass. The trough might be made of vulcanized rubber, gutta percha, or even, for a temporary purpose, of thin wood or pasteboard dipped into melted paraffin, getting a coating of the latter of about 1-16 of an inch around the walls of each cell.

Grove's battery of 20 cells is referred to as a unit of comparison on account of its well known power, being sufficient probably for all medical purposes; Stöhrer's modified battery of 32 cells, as perhaps the best, taken all in all, for office use that has ever been constructed.

ON the morning of the 12th June, a large aerolite fell in the province of Musashi, during a violent storm. The stone sunk some five feet into a paddy field; where it fell, it has the appearance of having been red hot. It is to be removed, says the Yedo *Herald* to one of the Yedo exhibitions.

A New Telegraph Line between England and New York.

The success attending Atlantic telegraphy has made people express wishes for more cables and reduced tariffs—the latter being so high as to be somewhat exclusive,—and to enable the public to send messages at a less rate, the Great Western Telegraph Company was projected for the purpose of laying, during the course of next year, a cable from England to New York *viâ* Bermuda. This endeavor so far succeeded that the public took the matter up, and a contract was signed with Hooper's Telegraph Works for the manufacture and the laying of the cables, which are now in course of construction.

The following particulars are given in *Engineering:* The proposed route for the cable is entirely new. The cable will start from a convenient point at the Land's End to the island of Bermuda, and from thence to New York. From Bermuda, a cable will in the course of time be laid to St. Thomas to connect with the network of West Indian cables, and there are subsequent intentions of connecting Bermuda with the coast of South America, which route is stated to possess the great advantages of connecting Brazil both with England and with New York by direct lines. The distances are as follows: Land's End to Bermuda, 3,225 knots; Bermuda to New York, 762; total, 4,953.

In the existing Atlantic cables, the insulating medium is that of the well known and generally used material, gutta-percha. In the present instance, however, the directors have decided to employ india rubber in that form known as Hooper's material, as the insulator for their cable. Hooper's core has of late years been largely adopted, as for instance, for the Persian Gulf cable, the various English cables belonging to the Great Northern company, and more recently the China and Japan extensions. The success of the present cable, being the longest stretch of cable yet attempted, will prove of material moment in the great question of gutta percha *versus* india rubber.

Conductor.—The conductor consists of a strand of seven tinned wires of annealed copper of the best quality and manufacture, and the resistance of a nautical mile will not exceed 4·3 ohms at the standard temperature of 75° Fahr.; this represents a conductivity of 92½ per cent of pure copper. The copper strand will weigh for this section 300 lbs. per knot.

Dielectric.—The conductor will be insulated with Hooper's material to the weight 250 lbs. per knot. This may be briefly stated to be pure rubber next the wire, a separating medium then coatings of vulcanized rubber, and finally a jacket, the whole process being peculiar, but representing finally a compact insulated core.

The insulated conductor, or core, is protected with a serving of india rubber felt, and subsequently with a serving of jute yarn, in quantity according to the requirement of the various types of cable.

The manufacture of this cable progresses steadily. Sir William Thompson and Professor Fleeming Jenkin are electricians and engineers to the company.

Statistics of the Iron Industry.

The ninth census gives the following information relative to the iron industry of the United States, for the year ending June, 1870:

Pig iron, 386 establishments, 574 blast furnaces (with a daily capacity of 8,357 tuns melted metal) employing 27,554 hands, producing 2,052,821 tuns of pig, of the value of $69,640,498.

Bloomary forges, 82, employing 2,902 hands, producing 110,808 tuns of blooms, of the value of $2,765,623.

Founderies, 2,653, employing 51,297 hands, and producing to the value of $99,837,218.

Forges, 103, employing 3,561 hands, and producing to the value of $8,147,669.

Establishments producing bar, rod and railroad iron, nail, plate, etc., 309, employing 44,643 hands, and producing to the value of $120,301,158.

Condensing Liquid Steel.

At the Austrian Steel Works, of Neuburg, Styria, Chevalier Stummer, of Trauenfels, has carried out a large series of experiments in order to weld the interior particles of cast steel to each other as strongly as possible, and to prevent the honeycomb, which is an accumulation of fine pores, filled with elastic gases which are inclosed in the cooling metal. The principal result of these experiments is that it is quite possible, by exposing the semi-fluid metal to great pressure, to unite all the pores within a very limited space in the center of the steel block. This fact is of the utmost importance in the manufacture of heavy steel ordnance, which is intended to bear the strain of very great charges, as in that case it is just the central part of the barrel which is bored out and the perfectly sound part of it left to form the wall of the gun. Thus a pressure of from 6 to 9 tuns on the square inch will be sufficient to compress a red hot steel ingot before its solidification, and give it an even structure throughout the whole mass, while the impact even of a very heavy steam hammer, like Krupp's 50 tun hammer, is principally spent on the outer part of the block, and the result will be the absorption of the power before it reaches the center, and the exterior of the mass will be elongated and cause the tearing asunder of the central part. Only very heavy hammers or rams will effectually overcome the *vis inertiæ* which a very heavy casting opposes to them.

MESSRS. J. A. SAKES & CO., of New York city, have made a contract to furnish to the United States Navy two hundred thousand pounds of pickles for seventeen thousand five hundred dollars.

COFFEE HULLING AND POLISHING MACHINE.

We this week put before our readers a further invention by Mr. José Guardiola, of Chocolá, Guatemala. It consists in a machine for hulling and polishing coffee, rice, etc., and its pr incipal feature is an improved construction of the polishing faces of the rotary stones or other articles between which t he coffee, etc., is placed to be operated on.

Fig. 1

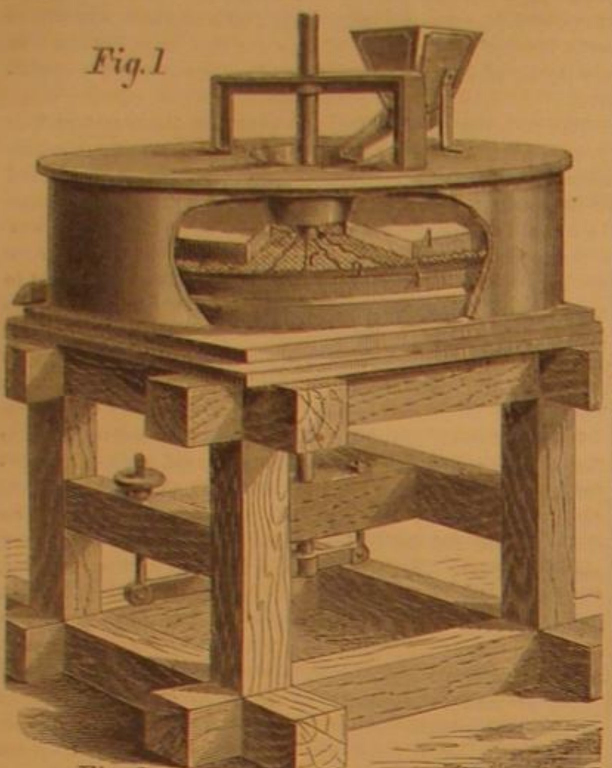
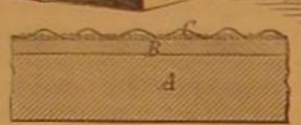


Fig. 2



It will be seen from Fig. 1, which represents the machine with part of the cover and one of the stones broken away to show the interior parts, that it is similar in construction to an ordinary grain mill. At A are the two polishing or hulling stones in blocks. The polisher, A, is shown also in Fig. 2' which is a detail section of the same.

B is a covering of india rubber applied to the polisher, and C is a wire cloth which is stretched over it. The darker lines seen on the face of A, in both figures, represent thicker wire, which forms lines of rounded projections diverging from the center so as to increase the roughness of the polishing surface.

Stones thus prepared are much better for the purpose than the rigid surfaces heretofore employed, with which the chief difficulty was to prevent the grains breaking while being subjected to the necessary degree of friction. The rounded surfaces of the wire facing are sufficiently hard to remove the pellicles and polish the surface of the grain operated on; but by means of the elastic cushion, B, they yield enough to prevent all injury to the grain.

Instead of rubber, a cushion may be made of matting or other elastic material. It may, in some cases, only be necessary to have one of the stones prepared as described, and the face of the other may be roughened or grooved in the usual manner.

Patented through the Scientific American Patent Agency, July 30, 1872. For further information address José Guardiola, care of Ribon & Muñoz, 63 Pine street, New York, or care of J. C. Merrill & Co., 204 California street, San Francisco, Cal.

Rock Ice that never Melts.

The following yarn, which will do very well for a hot weather romance, is produced by a Tennessee paper, and is supposed to refer to Linden, Perry county, in that State:

"Some ten days since, T. M. Brasher, our late representative from this county, Major J. L. Webb, our excellent sheriff, and J. P. Wilson, our efficient tax collector, were together at Major Webb's, and for recreation took a walk in and around his farm, when coming to the hills on the south of Major Webb's place, they approached the mouth of a cave in the side of a hill, from which, in wet weather, a stream of water usually flowed. Feeling very warm, they concluded to enter the cave to cool off a little, and upon entering were surprised at the unusual coldness that pervaded the cavern.

"Thinking there must be something in the dark recesses of the cavern to produce such unusual coldness in the atmosphere, they concluded to penetrate still further to see if they could not clear up the mystery. Procuring lights, they entered the cave and, after proceeding some seventy-five feet, upon turning an angle they beheld, to their astonishment, the whole interior of the cave festooned with the most beautiful stalagmites the eye of man ever beheld. Holding up their lights, they gazed upon the beautiful sight with pleased astonishment, and upon a nearer approach they found the stalagmites to resemble the hardest, clearest ice, and cold as the touch of the Ice King himself. Becoming by this time chilled through with the coldness of the place, each of the gentlemen broke off a lump of this strange wonder, and started to return. Before reaching the mouth of the cavern, their hands were so chilled they could scarcely hold the strange substance, and upon reaching the outer air they laid it down upon the ground, thinking it would soon acquire the temperature of the atmosphere. Arriving at the house, they placed the crystals on a table and waited patiently to see if it would melt or even turn warmer. After waiting some half hour and finding that it still retained its former coldness, one of the party suggested that they should try it in a pitcher of water, which was soon declared equal to the best ice water. At dinner they tried it in milk, and it soon made Mrs. Webb's excellent buttermilk as cold almost as ice itself. It produced the same effect upon butter as ice, and still retained its original frigidity. A number of persons have since visited this wonderful cave and carried off portions of this rock, which they are using for all the purposes of ice, and it sustains no diminution in bulk or loss in coldness. Strange and improbable as all this may seem, it can be certified to by numbers of our best citizens. Dr. Black is using it in his practice. Mr. Thomas French and Colonel Waggoner, hotel keepers in Linden, used it in their hotels during court week, to the astonishment of their guests. Specimens will be sent to our State geologist for analyzation."

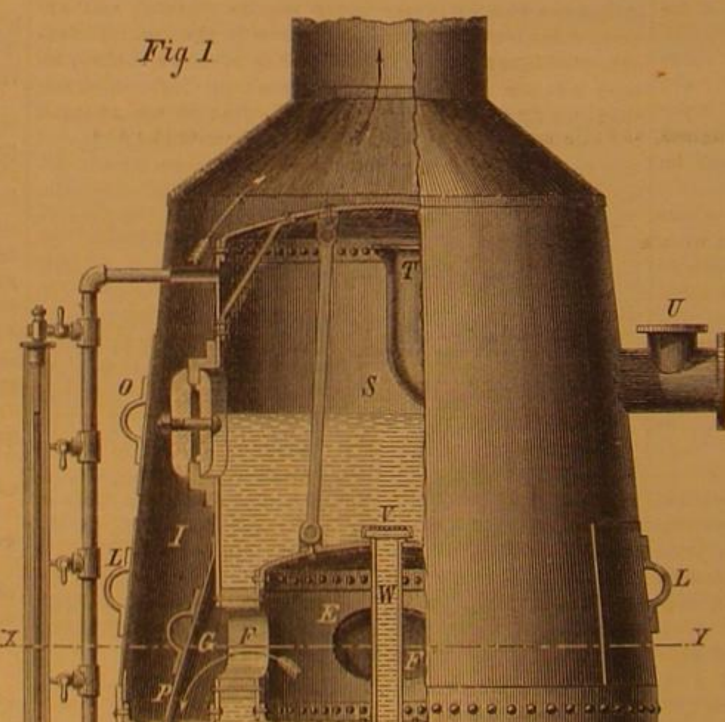
IMPROVED STEAM BOILER.

The improved steam boiler represented in the accompanying engravings is designed with especial view to the utilization of every available portion of heat through large grate and steam surfaces, freedom from danger of accident, economy of fuel, and facility for repairs. Though at first appearance somewhat complex, its interior arrangement needs but a short examination to render the manner, in which the inventor claims to have secured the above mentioned desiderata, easily comprehended.

The boiler is of the upright tubular type, embracing the special improvements hereafter described. Its chief peculiarity lies in an enlargement or belt around the waist or middle portion, which is inclosed with, and forms a part of, the boiler shell, and which, in combination with the provision for returning gases, contributes greatly to the efficiency of the invention.

Fig. 1 is a side elevation showing, on the right hand, the outside of the casing, and on the left, the same broken away, presenting a perpendicular section of the interior arrangements. Fig. 2 is a horizontal section of the boiler through X Y. In Fig. 1, A is the grate, B the fire chamber, and C and C' the surrounding interior and exterior shells. The

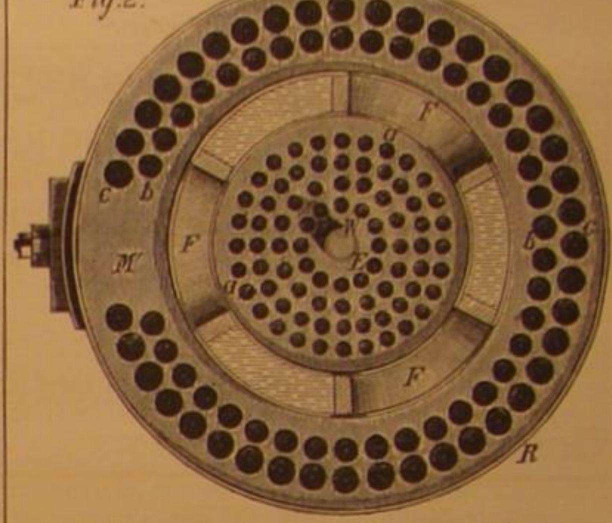
Fig 1



products of combustion following the direction of the arrows in the engraving, arising from B, first pass through the fire tubes, *a a a a*, into the mixing chamber, E. From this receptacle, the gases have their exit through the large openings, F F F, and after having imparted a portion of their heat in the ordinary manner, are retained by the conical casing, P, which incloses the space, G. They are consequently compelled to descend through the fire tubes, *b*, into an annular chamber, H, which is inclosed in a conical casing, Q. Thence the gases rise through the exterior circle of fire tubes, *c*, pass into the large space, I, and finally are discharged through the chimney at the apex, the object of forcing them through this circuitous course being to gain the full benefit of every particle of heat. The particular enlargement above referred to consists of the space between the annular tube sheets, M_1 M_2, and the outer casing, R, in which are the circles of tubes, *b* and *c*.

A special point of advantage to which attention is directed, is the arrangement of the water spaces. A central chamber, W, will be noticed, extending above the crown sheets as far as the mixing chamber, E. At this point, it is reduced in size to a tube, W, which terminates at the bottom of the steam drum, S—its open upper end being surrounded by a perforated cover, V, which prevents a too violent upward motion of the current generated in the lower chamber. In connection with the other water spaces which lie between the systems of tubes, surround the fire chamber, occupy the interior of the

Fig. 2.



surrounding casings of the mixing chamber, and finally cover the lower portion of the steam drum, this central chamber adds greatly to the already large separating surface, so that steam may be rapidly disengaged without carrying up water into the steam pipes.

For easy access to all parts of this boiler, for repairs, ample provision has been made. By removing the covering at Q the tubes, *b* and *c*, may be readily cleaned, the refuse falling out at H, by its own weight. The opening of the door at L permits entrance to the space, I, after which, the door, P, being displaced, access may be had to the chamber, G. Through the opening, O, the interior of the steam drum may be reached. At U is the steam pipe, its inner end, T, opening upwards in order to prevent its becoming obstructed through priming of the boiler. To the left of the illustration is the appliance for the test cocks and glass water gage, which, it is claimed, prevents these appendages from being choked or otherwise rendered inoperative. Its form is plainly shown and needs no special explanation.

The efficiency of this boiler has been amply tested, and, judging from the testimonials before us, with uniformly successful results. Steam, it is stated, has been obtained in the larger boilers in thirty minutes, and in the smaller ones in eighteen minutes—a fact due both to the large steam surface before described and to the liberal size of the grate, which, it will be noticed, is of much larger area than could be afforded if the lower portion of the boiler were made on a cylindrical instead of on a conical form. As regards economy, its consumption of fuel is claimed not to exceed two and a half pounds of coal per horse power per hour.

From the interior arrangement of this boiler, its safety from danger of explosion will be apparent to every mechanic. Ample steam space is afforded, which may be increased by making the steam drum of any required hight. The outside covering forms a jacket which confines the heated gases around the interior steam generator, so that every available portion of heat contained in the escaping gases is utilized. In proof of how thoroughly this is done, it is stated that the exterior shell never becomes sufficiently heated to blister the paint with which it is coated; and we are informed of a case where a thirty horse power boiler has been used for two years and a half, and yet no deterioration of its outside paintwork is visible.

This invention is now in use in the Metacomet Mills of Fall River, Mass., in the Valley Worsted Mills, in Providence, R. I., on board the steamboat Plymouth Rock, and in many large manufactories throughout the country. Letters for further information should be addressed to the inventor, Mr. Daniel Flynn, Fall River Iron Works, Fall River, Mass. The patent bears date Nov. 15, 1870.

Nickel Plating by the Battery.—Professor Böttger mentions a curious fact that patents have recently been taken out for nickel plating by a process discovered and published by him thirty years ago. He reprints his own article on that subject, published as early as 1843, in Erdmann's *Journal für prakt. Chemie*, vol. 30, page 267.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK

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

VOL. XXVII., No. 13. [NEW SERIES.] *Twenty-seventh Year.*

NEW YORK, SATURDAY, SEPTEMBER 28, 1872.

Contents:

(Illustrated articles are marked with an asterisk.)

BINARY VAPOR ENGINES.

There are few experienced engineers who have not noted the fact that nearly every recent advance in engineering practice is due to the finally successful introduction of some device which had long been known, and whose success at last has been attained through the persistence and ingenuity of an inventor who has fortunately hit upon some minor yet essential improvement in detail, or whose business capacity and opportunities have placed him in advance of his fellows.

Twenty-five years ago a French inventor, M. Prospère Vincent du Trembley, brought into notice what is now known as the "binary vapor engine," or the "combined vapor engine." He constructed a number of these engines, and published a work describing their peculiarities and their operation.*

In this class of engines, one cylinder has its piston impelled by steam, usually, and the fluid, having done its work there, is exhausted into another part of the apparatus where it is allowed to communicate its unutilized heat to some liquid volatile at a lower temperature; and the vapor of this second liquid, by its expansion in a second cylinder, yields additional useful work. Ether, chloroform, and carbon bisulphide, or, as the latter is popularly termed, bisulphide of carbon, have all been tried without permanent success. Du Trembly used the vapor of ether.

Could an absolutely perfect binary vapor engine be constructed, its performance would exhibit precisely the same economy of fuel as would a perfect steam engine working between the same limits of temperature. There is, therefore, no purely scientific reason for anticipating economical advantage from this form of prime mover. There are, however, some practical considerations which would, at least, make it appear possible that the introduction of this form of engine may ultimately occur as a consequence of a superiority in economy over even the best of modern engines. It is evident that a wasteful steam engine may be converted into an economical binary engine in which a large amount of the heat, formerly wasted, may be successfully utilized; and, in all non-condensing steam engines, some considerable proportion of the heat of the exhaust steam may be saved by such a change. Could the additional engine be constructed and operated at a moderate expense, it seems very certain that the binary plan would, in very many cases, be certainly advisable. Even with the best of condensing steam engines, it is by no means certain that the heat abstracted in the condenser might not be more economically removed and made useful by a fluid whose vapor has a higher tension than that of water at the same temperature.

It may possibly be yet learned that, upon the whole, the leakage of air into the condenser is a more serious evil, and that the power absorbed by the air pump and the use of condensing water in such large quantities may be more objectionable than the leakage outwards of minute quantities of vapor and the other difficulties attending the use of a really well designed and carefully constructed binary engine doing similar work. There remains much to be done in the way of experimental investigation before the subject can be treated of fully and intelligently, and we are hoping that valuable information may be derived from experiments in progress with the bisulphide of carbon engine of Mr. Ellis (of which we gave an illustrated description in the SCIENTIFIC AMERICAN of January 13, 1872), and from independent research. Mechanical difficulties have hitherto prevented the success of this form of engine, but it cannot be pronounced unlikely that coming inventors may make the system commercially valuable. Tight joints and good packing will do much toward making it a success, if success be possible, and a method of producing the volatile fluid at smaller cost is hardly less essential.

Both of these requisites are said to have been attained by Mr. Ellis, who also claims, in the Boston *Daily Advertiser*, to be able to get an indicated horse power with the consumption of 1·6 pounds of coal per hour, an extraordinary performance if the statement be correct.

A steam engine of large size, if non-condensing, is considered to do exceedingly good work when consuming less than three pounds of coal per horse power per hour; the best marine compound condensing engines require about two pounds, and, although Professor Rankine reports the British ship Thetis to have consumed but one pound of fuel per horse power per hour, there are reasons for doubting the accuracy of the data quoted by him. If Mr. Ellis' little engines have approached the figure stated, they have done better than any steam engine of the same size has yet.

It is to be hoped that the new engine may be thoroughly tested and reported upon by known experts and recognized authorities, and that we may be given statements of power developed, fuel consumed, loss of bisulphide by leakage during a period of considerable length, together with a statement of actual costs in dollars and cents.

The public are greatly interested in every promising project for economizing fuel in the production of power, and every professional engineer will be anxious to learn whether the binary vapor engine has at last proved itself capable of superseding the steam engine where the latter is really well designed, properly constructed and skillfully managed.

* "*Manuel du conducteur des machines a vapeur combinees ou machines binaires;*" Lyons, 1850.

ANOTHER GREAT ENGINEERING WORK.

A contract has lately been signed between the directors of the St. Gothard Railway, Switzerland, and M. L. Favre, of Geneva, for the boring of a new railway tunnel through the Alps, which promises to surpass anything of the kind yet attempted. The length of the tunnel will be a little more than nine miles. Cost $10,000,000. The work is to be finished within eight years; and if sooner finished the contractor is to receive $1,000 a day for each day in advance of the contract time. If the completion of the work is from any cause delayed beyond the contract time, $1,000 a day are to be forfeited. If the delay reaches beyond six months, the forfeit is then to be increased to $2,000 a day. The contracter deposits $1,600,000 as security for the faithful performance of the work. If the delay exceeds the contract time beyond one year, the contract is to be broken and the company take possession of the security money. The contractor is an eminent civil engineer, and a man of rare abilities. He was formerly a journeyman carpenter in Paris.

FAST CANAL STEAMING.

Mr. Simon Stevens, President of the Tehuantepec Railway Company, has written a letter to the Canal Commission of the State of New York, in which he gives some useful information in respect to steam transportation on canals. He thinks that the only way to obtain speed and economy, by the use of steam power on the Erie Canal, is to line the banks with stone, in order to prevent damage by wash, which he says can be done for $2,000 per mile; the canal would then be rendered available for steamboats of suitable dimensions, running at the fastest speeds.

He instances the success of the Caledonian Canal in Scotland which, in 1838, was lined with stone throughout, and says that the system "is brought to such perfection that steamers drawing seventeen feet of water ply daily through the canal at an average speed of from seven to eleven miles an hour without injuring its banks. The same system is perfectly feasible for the Erie Canal, and, if adopted, would enable the ordinary towboats, similar to those in the New York harbor and elsewhere, to be used with perfect safety and economy at a speed of from four to six miles per hour.

After the inner slopes of the banks of the Caledonian Canal had been thoroughly pitched with rough, irregular quarried stones, the annual expense of dredging the bottom of its channel was materially reduced. That canal is 110 feet wide at the top, 50 feet at the bottom, and 21 feet deep. The Suez Canal was made 320 feet wide at top, 60 feet at bottom, and 26 feet deep. Nearly the entire amount of dredging in the Suez Canal is required, not because of the drifting sands, as heretofore supposed, but because the washings of its banks are constantly filling its channel."

THE CAUSES OF EXTRAORDINARY CONDITIONS OF WEATHER.

Nothing is easier than to invent an apparently very scientific cause for any natural event, and this is the simple reason why so many people indulge in this kind of mental exercise. When the winter is severe in the Eastern States of the Union, we hear of a change in our climate by a change in the direction of the Gulf Stream; when the summer is a little hotter than usual, we hear of great discoveries having been made, with the spectroscope, in the sun, where immense masses of burning magnesium have been seen; when we have a rainy season, it is due to an extraordinarily great number of sun spots; when we have a dry season, it is that the sun is free from spots, or it is advised that we may produce rain by firing many guns or setting the woods on fire. And notwithstanding that these reasonings are always afterwards annihilated by facts, people will go on in the same way to argue on points on which their information is necessarily very limited, and editors will publish all kinds of crude notions, which appear especially welcome to the daily papers, for the simple reason that they fill up the columns with a topic in which every one is more or less interested, namely, the weather.

The idea of a change in the direction of the Gulf Stream is pretty well exploded at the present date; while that of the great heat of the sun during this summer ought at once to have been set at rest by the reports from New Zealand; as the telegraph informed us that at the same time the winter there, which falls in July and August, was of extraordinary severity, so that heavy wagon loads crossed the frozen rivers which has seldom, if ever, been the case in other winters. That large island is surrounded by currents from a kind of Pacific Gulf Stream, which make its winter climate ordinarily equal to that of Florida, notwithstanding it is at about the same latitude as New York, 40°. If now, the sun were so much hotter than usual, it would have been also hotter in New Zealand, where it shines during our night, and the winter there would then have been unusually warm, in place of unusually severe. People, in giving reasons for peculiarities of the weather, should first ask if that peculiar feature has been observed over the whole globe, as in that case only could it be ascribed to so general a cause as the sun. It was the same when, in the summer of 1870, a great deal of rain fell, and while this was being ascribed here to the prevalence of sun spots, making the sun less hot and the weather cold, we received the following telegraphic report from England: "A panic prevails among the farmers by the continued dry weather." When, the year before, the weather was exceedingly dry out west, and it was asserted that a great fire in the woods would produce rain, a great fire took place shortly afterwards without any such result.

In regard to the influence of sun spots, it should be kept in view that, the heat of the sun being the cause of all evaporation and therefore of all rain, an increase in that heat will increase the evaporation and consequently the rain, and a decrease must do the reverse; so that, if it be supposed that the sun is so covered with spots that half its heat is taken away, half its evaporating power would be lost, and when only half as much water goes up as vapor, only half as much can come down as rain. Thus sun spots, so far from increasing rain, tend to diminish it.

If we look intelligently about us, and make use of the reports reaching us from all sides by means of the telegraph and the newspaper, we find out that the weather is constantly different in different localities. Everybody knows of course that it is always cold at the poles, and hot at the equator; everybody ought to comprehend that it cannot possibly rain everywhere at the same moment, and also that it is improbable that the sky is ever clear over the whole earth at the same time; that, on the contrary it is always cloudy or ever perhaps always raining somewhere, or a thunderstorm is going on in some locality or other. And further, if one locality has much rain for a time, it is at the expense of some other locality which is deprived of its usual allowance. In short, we must come to the conclusion that on our earth's surface there is always every possible kind of weather prevailing somewhere. Consequently nothing is easier than predicting the weather, for any given day or hour, if only care is taken not to mention the place where the predicted weather is to prevail, as it is sure to prevail somewhere.

In regard to the high temperature prevailing during several days in July and August, it must be kept in view that local circumstances, such as direction of wind, barometric pressure of atmosphere, hygrometric condition of the same, when acting in the same direction, are amply sufficient to raise an ordinary summer temperature a few degrees, so as to produce an uncomfortable condition of the atmosphere. Such an explanation is more satisfactory than the far fetched attempts at explanation by assumed solar disturbances, which could not affect alone New York city with a few hundred miles around without having effect on the rest of the globe.

THE GOVERNMENT EXAMINATION OF BREECH LOADING ARMS.

The Board of Army Officers, ordered by the government to examine into the various inventions in breech loading small arms, convened at the army head quarters in New York on the 4th ultimo. As the important duty of selecting a weapon for the equipment of the entire army devolves upon the officers detailed for this service, their investigations will be conducted with the utmost thoroughness and impartiality. For the information of all interested in the small arms industry, the following is published:

OFFICE OF THE BOARD ON BREECH LOADING SMALL ARMS,
4th STORY ARMY BUILDING, COR. HOUSTON AND
GREENE STS., N. Y., September 4, 1872.

Notice is hereby given to all persons who desire to submit samples, or to appear in person before this Board, that it is now in session at the above-named place.

All written communications will be addressed to the Recorder of the Board, and samples of arms will be received at the Board rooms between the hours of 10 and 3 daily, until further notice.

HENRY METCALFE, Second Lieutenant, Ordnance Recorder.

We learn from the *Army and Navy Journal* that a petition is being circulated among inventors, requesting the Board to hold its sessions and trials on the grounds of the National Rifle Association at Creedmoor, which, from the practical advantages presented by the change of site, will probably be granted.

A large entry of inventions is anticipated. The Board, desiring to show every liberality, will receive arms not as yet completed, but in course of construction up to the last day of trial. This gives at least five weeks' additional time for the completion of models.

WHO IS DR. VANDER WEYDE?

During the past few weeks, an esteemed correspondent, J. W. Nystrom, Esq., C. E., of Philadelphia, has furnished to our readers several interesting communications, some of which have been answered and criticised by another of our valued correspondents, Dr. P. H. Vander Weyde, of this city. From the tenor of the following letter it would seem that our Philadelphia correspondent is a little suspicious of the respectability of his antagonist. But we can assure him that, in Dr. Vander Weyde, he has a foeman worthy of his lance.

To the Editor of the Scientific American:

Sir :—Will you be kind enough to inform me, through the Scientific American, if Mr. P. H. Vander Weyde, of New York, has a doctor's diploma, and if so, from which college he has received that title? And what kind of a doctor is he?

The answer to these questions will greatly oblige yours very respectfully, John W. Nystrom.
1010 Spruce street, Philadelphia, Pa., Sept. 7, 1872.

We would inform our correspondent that Dr. Vander Weyde is a physician of the strictest orthodox sect; that he is an honored graduate of the New York University Medical College, of which John W. Draper, LL.D., is President; that he holds the regular diploma of that institution; that he enjoys the fellowship and esteem of many of our leading physicians and prominent men of science; that he is a native of Holland, where he received a university education; took the degree of Doctor of Philosophy in 1840; was the editor of a scientific periodical; in 1845, at Amsterdam, he received the honorary prize, consisting of the gold medal of the Society of Sciences for his essays upon natural philosophy.

Dr. Vander Weyde is now a citizen of the United States. From 1859 to 1864, he was Professor of Physics, Higher Mathematics and Mechanics at Cooper Institute in this city. During nearly the same period, he was also Professor of Chemistry in the New York Medical College. From 1864 to 1866, he was Professor of Industrial Science in Gerard College, Philadelphia, Pa. His contributions to the scientific literature of the day have been very extensive, and are widely known.

These are only a few of the items of Dr. Vander Weyde's public record. But they are sufficient, we trust, to satisfy the enquiries of our correspondent, and remove from his mind any adverse prejudices that he may have formed concerning the qualifications of the distinguished gentleman whose public standing he has questioned.

CHEMICAL MEANS OF PREVENTING SCALE IN BOILERS.

In a recent number, we treated of the means acting mechanically to prevent the formation of deposits in boilers. In the present article, we propose to consider the efficiency of various chemicals, proposed from time to time for the same purpose.

Among the alleged remedies, the first to be considered are those which effect a decomposition of the gypsum (sulphate of lime) and convert it into insoluble but pulverulent carbonate of lime. The cheapest substance of this kind, and the one which would first suggest itself, is carbonate of soda, first proposed by Kuhlmann and recently again by Fresenius. We shall see that some authorities have affirmed that this substance may itself be detrimental; that a large surplus may corrode soldered joints or dissolve putty, if any be used. On the other hand, others maintain that they had used carbonate of soda for years with decided benefit and without detecting any such damage to the joints of the boiler. In all cases, it will be proper to regulate the addition of this material in such a manner that it will just suffice to decompose the sulphate of lime in the feed water.

Fresenius has recommended a ready method for ascertaining the quantity. To a measured volume of the feed water, a solution of carbonate of soda of known strength is added, until no further turbidity takes place. When the white precipitate has deposited itself, some lime water is added to a sample of the clear liquor; if it becomes very turbid, too much soda has been added; and the contrary is the case if, in the clear liquid, a further addition of carbonate of soda produces cloudiness. But if the liquor remains clear, or if it gets only slightly cloudy, the right quantity has been employed. From the proportions used in these tests, the quantity necessary to be added to the feed water may readily be calculated.

Soda is employed in various manners. Runge recommended boiler tenders to draw off the clear water from the deposit, which would be unnecessary labor; for if particular precaution be necessary that the required amount of soda be not exceeded, the mixture may be made in the feed water heaters or in another vessel, before being pumped into the boiler. The ordinary way of procedure consists in putting in the boiler sufficient soda to last some time. It is evident that, in such a case, it must be considerably in excess in the beginning, and that it will be used up in time. In such instances, it is possible that the boiler is injured by the surplus of carbonate of soda, and some writers maintain that the cause is to be attributed to cyanide of potassium, from which commercial carbonate of soda is rarely free. Kuhlmann recommends the use of two or three tenths of a pound of soda per horse power per month. It is evident that this proportion can only be an approximation, from the fact that the conditions vary according to the construction of the boiler, the tension of the steam, the duration of a day's work, and, primarily, to the nature of the water. The sulphate of lime is converted into carbonate of lime (and so loses all its adhesiveness) when boiled with a solution of potash or soda; these two substances may also serve for the cleaning of incrustated boilers. And we must here remark that those in favor of the use of soda declare that such boilers as become leaky only remained tight in consequence of the scale which incrusted therein. In case the scale should not be completely dissolved by soda, dilute muriatic acid may afterwards be tried, the employment of which would be ineffective if soda were not used beforehand; but this remedy should only be resorted to in case of the utmost necessity and in simply constructed boilers. Due precaution should also be taken that the acid be completely washed out.

With regard to the substitution of caustic potash or soda for the respective carbonates, the result remains the same, and it is not clear to the writer, why the more expensive caustic alkalies are to be preferred to the cheaper carbonates. Muriatic acid and chloride of barium, in mixture, are only to be employed with great caution. By the addition of the latter, sulphate of baryta is produced from the gypsum of the water, as well as from the other sulphates. Respecting the muriatic acid, it is added for the purpose of dissolving the carbonate of lime; and it is stated that it is preferable to use the clear water only, although sulphate of baryta does not form any cohesive and adhesive deposit. The danger of using muriatic acid need scarcely be pointed out.

Carbonate of ammonia plays a part corresponding to that of the fixed carbonated alkalies; it precipitates the solution of the bicarbonate of lime, as well as that of the sulphate of lime, and forms sulphate of ammonia with the latter. Since a part of the carbonate of ammonia volatilizes always with the steam, one must not use the steam for purposes wherein the volatile alkali could be hurtful, as for instance, in steaming cotton tissues printed with topical colors, or for heating dyers' vats, etc. The other ammonia salts, such as sal ammoniac and the acetate and nitrate of ammonia, act quite differently. This becomes obvious when we consider the part which sal ammoniac plays. O. Smith observed that one equivalent of freshly precipitated carbonate of lime, when boiled with one equivalent of sal ammoniac, forms chloride of calcium, and that carbonate of ammonia passes off from the boiling liquid. Gypsum and carbonate of lime in presence of sal ammoniac are converted into chloride of calcium, carbonate of lime and sulphate of ammonia. Elsner was of opinion that sal ammoniac fulfils every reasonable requirement, and he considers one part sufficient for 1,200 parts of spring water. There is no doubt that sal ammoniac renders good service in dissolving scale, but it must not be overlooked, however, that all ammonia salts corrode stop cocks and other parts of the boiler made of brass.

Regarding substances containing tannin, they act by producing tannate of lime, a substance of slimy consistency which deposits itself without adhering to the walls of the boiler. Among them we enumerate extract of oak bark, gall nuts, tan bark, catechu, etc. Elsner found the wild growing tormentilla root very suitable. Cavé patented the suspending of oak blocks (from four to six pounds per month per horse power), and Roard recommends mahogany sawdust in the proportion of eighteen quarts for a ten horse boiler for every three months. Some of these materials possess also a mechanical action, about which we spoke in our previous article.

THE MARRIAGE OF FATHER HYACINTHE.

In the month of July, 1867, by the favor of a United States senator who was returning from abroad, we received a small package containing three corsets, accompanied by a letter dated at Paris, written in a clear and business style, directing us to take immediate steps to secure a patent on the article in the United States. "And can you," says the writer, "recommend to me a good, smart, honest Christian lawyer, a saint, to attend to all my affairs relating to my invention?"

In a subsequent letter concerning her patent business, she commences: "I beg you will not allow this letter to leave your left hand till your right hand answers it." And again she writes, from the Alps: "Here I am among the eternal snows, clouds, rocks, monks, and dogs of St. Bernard." During the pending of the application before the Patent Office, we received a number of letters from our fair client, all of which bear evidence of the writer's genius and superior business qualifications. In the patent records for September 8, 1868, may be found the name of Emilie J. Meriman, patentee of an improved corset. It is to this lady that Father Hyacinthe, the eloquent and gifted Frenchman and Catholic clergyman, was married the other day in London. The new wife of the reverend father is very beautiful, and is gifted with rare talents.

This marriage will not, we presume, be promotive of a reconciliation between Father Hyacinthe and his former religious order, and we therefore indulge the hope that it may influence him to seek in this, the native land of his bride, a new and happy home. He would be cordially welcomed here, and as a citizen of the United States would enjoy the most extensive opportunities for usefulness.

PATENT OFFICE ITEMS.

The Commissioner of Patents has granted an extension of the patent of Theodore Heermane, of Illinois, for coffee roaster, and of Harlow H. Thayer, of Boston, Mass., for journal boxes, and has refused an extension to Clayton Lippincott, administrator of Sherburne C. Blodgett, deceased, of New Jersey, for sewing machine.

Lewis W. Haupt, C. E., Assistant Examiner in the class of Civil Engineering and Architecture, has resigned his position to accept the chair of Assistant Professor of Civil and Mechanical Engineering and Mathematics at the University of Pennsylvania.

The receipts of the Patent Office during the month of August last were $57,217.75.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BITUMINOUS COAL AND IRON MANUFACTURE.

Professor E. B. Andrews, State Geologist of Ohio, read before the Association, at its recent meeting at Dubuque, an interesting paper on coal. He states that, so far as his observation extends, a coal seam has never been accumulated on high grounds, or ground above water level; and such formations could not take place, because it would be impracticable to establish the conditions of accumulation on the side of a hill. Hence it is impossible in the nature of things that two distinct seams of coal could ever coalesce, since their subsidences must take place in parallel lines. To suppose otherwise would involve a very unequal subsidence over very limited area, amounting, indeed, to a convulsion of Nature, which is almost incredible. For example, Professor Andrews has yet to see two seams of coal 50 to 100 feet apart in one place come together in another within a distance of a mile or a few miles so as to make one seam, though the contrary has often been asserted by other explorers. The apparent exception to this is in cases where a small local basin of coal has been formed and subsequently filled in with clay sediments, and after that a new coal seam has been established, like a lid to the basin, and continuous with its edges.

Referring to the solidification of coal, which is generally considered an exceedingly slow process, Professor Andrews states that it is comparatively rapid. Thus it appears that where a gully has been torn out of a coal seam by a rapid current of water, the small boulders, washed by it over the covering stratum of sand a few feet above, are complete coal, having an angular fracture, some being still sharp on the edges and some being slightly water worn. These boulders in turn have again been covered by subsequent depositions and are found at considerable depths, near the base of the coal measures.

There are three leading varieties of bituminous coal; the ordinary resinous or caking coal, the splint, and the cannel coal. These pass into each other by almost imperceptible gradations. The resinous coal seems to be the normal condition which the buried vegetation first assumes, and splint and cannel are modified forms, the cannel coal having lost all trace of structure, and containing no organized forms except stigmaria, which are very abundant. The ash of coals is the original inorganic matter of vegetation, often increased by sedimentary matter in the marsh during the formation of the coal. The lowest percentage of ash observed by Professor Andrews in Ohio coals is 0·77 per cent. Sulphur is found in all coals, being a part of the original organic compounds, now combined in part with iron, as iron pyrites—sulphuret of iron,—though not necessarily so combined, as Professor Wormley has abundantly shown in his chemical examination of the Ohio survey. Sometimes the sulphur is so exclusively combined with the more bituminous element of the coal as to pass off entirely with the gases in the operation of coking, leaving the coke almost as pure as charcoal. Coals of this kind are specially adapted to the blast furnace, the sulphur passing off in the top of the stack without detriment to the iron. Coal for the blast furnace, if used in the raw state, must be a dry burning coal, so as not to expand in coking and thus choke the furnace. The coke of the dry burning coals has a tendency to be less firm than that made from the more bituminous or coking varieties, and consequently will not so well sustain in the blast furnace the weight of the superincumbent materials of the charge. The coke made from the softer coals, like the Newcastle of England and the Connellsville of Pennsylvania, has a hard, cinder-like formation, enabling it to bear the burden of furnaces of great hight, those of England sometimes exceeding 100 feet. As a practical matter, it is absolutely necessary that iron masters should adapt their furnaces to the peculiar physical properties of the coke produced by the coals they are using. A high furnace with a weak, tender fuel must necessarily meet with disastrous results, unless, by simple mechanical contrivances, the vertical pressure of the burden can be relieved and the coke at the bottom of the furnace allowed to rest lightly and not under heavy weight; thus securing the most intense and perfect combination of the carbon at the base of the furnace. Such contrivances are by no means impracticable.

TEMPERATURE OF THE POLAR REGIONS.

Professor Wheildon, of Concord, Mass., advances, in opposition to what is known as the Gulf Stream theory, an atmospheric theory to account for ameliorations of climate and an open sea in the polar regions. The accounts of arctic voyages, it is stated, show sudden rises of temperature when nothing but an unlimited extent of ice is near. These changes, it is considered, could not have been consequences of proximity of open water, which, at best, would be of 29° temperature. The theory of Professor Wheildon is that open water, melting ice, rain after snow, and other phenomena of the sort in arctic regions, are not caused by winds warmed by an open sea, but by a circulation of air in which warm winds descend from upper atmospheres; being a circulation by which winds heated at the equator reach the poles.

INSECTS SHAPED TO THE NEEDS OF FLOWERS.

The flowers of the Yucca plant are peculiarly constructed so that it is impossible for the pollen to reach the stigma, it being glutinous and expelled from the anthers before the blossoms open. It has been therefore the opinion that the plants must needs rely on some artificial agency for fertilization. Professor C. V. Riley, of St. Louis, has lately discovered that the work is done by a small white moth which he calls *pronuba Yuccasella*, and which forms the type of a new genus. It is most anomalous from the fact that the female only has the basal joint of the maxillary palpus wonderfully modified into a long prehensile spined tentacle. With this tentacle she collects the pollen and thrusts it into the stigmatic tube, and after having thus fertilized the flowers she consigns a few eggs to the young fruit, the seeds of which her larvæ feed upon. The Yucca is the only entomophilous plant known which absolutely depends for fertilization on a single species of insect, and that insect is remarkably modified for the purpose. The plant and its fructifier are inseparable under natural conditions, and the latter occurs throughout the native home of the former. In the more northern portions of the United States, and in Europe, where our Yuccas have been introduced and are cultivated for their showy blossoms, the insect does not exist, and consequently the Yuccas never produce seed there. The larva of the *pronuba* eats through the Yucca capsule in which it fed, enters the ground and hibernates there in an oval silken cocoon. In this stage the insect may easily be sent by mail from one part of the world to another, and our transatlantic florists may, by introducing it, soon have the satisfaction of seeing their American Yuccas produce seed without any personal effort on their part.

JEWELS IN THE UNITED STATES.

It is stated that the chief discoveries of rubies and sapphires in this country have been made in Macon and Cherokee counties, North Carolina, where the mining of corundum is carried on to a great extent. A ruby has been found of the weight of a pound. A crystal of ruby and sapphire corundum, weighing 315 pounds, has been sold for $350. These specimens are all found in beds of chrysolite which extend into Georgia, a distance of 100 miles; that is, corundum is found only in chrysolite. Professor Carr has recently seen one of these crystals which had partially become tourmaline —at least one half of it having become metamorphosed into that stone.

Professor I. Lawrence Smith, of Louisville, Ky., having made the subject a specialty, declares his belief that the so-called diamonds discovered in this country were not diamonds, but that they are colorless sapphires which, if properly cut, are nearly if not quite as brilliant. They will scratch every other mineral, except the diamond itself.

This is doubtless the whole fact in relation to the mooted diamond discoveries of Arizona, as the telegram, recently published in the daily papers, regarding the buying of rough diamonds in London by American purchasers is, in all probability, a mere sensational supposition.

ANOTHER LADY SCIENTIST.

Place aux dames! Miss J. Swain, in the late convention at Dubuque, read an excellent paper on "Why we differ, or the law of variety," treating her subject with remarkable taste and ability. The fair philosopher discussed the material aspect of humanity, how each individual consisted of a little more or less hydrogen, oxygen, nitrogen, carbon, sodium, sulphur, and phosphorus respectively, and judged that differences in the proportion of these ingredients, if carefully ascertained, might lead to a knowledge of the law of variety in individuals.

CURIOSITIES OF VIBRATION.

Professor Lovering, on vibration, mentions the following curious instances: When the first suspension bridge was building in England, a fiddler offered to fiddle it away. Striking one note after another, he eventually hit its vibrating note, or fundamental tone, and threw it into such extraordinary vibrations that the bridge builders had to beg him to desist. Only recently a bridge went down under the tread of infantry in France who had not broken step, and 300 were drowned. An experiment is often referred to of a tumbler or a small glass vessel being broken by the frequent repetition of some particular note by the human voice. It is said, and may be true, that certain German tavern keepers increase their custom by the occasional performance of this feat. In the Talmud there is a curious question raised as to what would be the damages if a domestic vessel were broken by a noise made by an animal, such as a barking dog.

[Special Correspondence of the Scientific American.]

LETTER FROM PROFESSOR R. H. THURSTON.

The machinery used in copper mining.—Homeward journeying from the Lake Superior region.—The new city of Chicago.—General character of the new buildings.—The water machinery.—The North Chicago Rolling Mills.—Manufacture of Bessemer steel.—Description of the process.

NIAGARA FALLS, August, 1872.

In presence of this most sublime of *all* earthly scenes, one feels very little like writing of such vulgar concerns as those which must form the subject of this letter; but as we found, in copies of the SCIENTIFIC AMERICAN that we obtained in the little mining towns recently visited, the commencement of the series, it will probably be expected that others follow uninterruptedly.

COPPER MINING MACHINERY.

When writing from Negaunee, I had intended, had space permitted, to describe the machinery in use in the mining regions visited.

There is usually but little machinery about a mine, whatever its character or location. The ore is raised through vertical shafts in iron buckets, and through inclined shafts in *skips*, as the miners call them, peculiarly shaped wagons having small wheels which run upon a tramway laid upon the lower side of the shaft. The skips are also made of iron. The hoisting rope is usually of iron wire of from seven eighths to one and a half inches diameter, according to circumstances, the smaller size being sufficient for inclined shafts and light loads, and the larger being required where heavy loads are raised through vertical shafts. The rope is led through a series of heavy blocks, or over a set of larger pulleys, to the engine house, where it is wound upon a drum of from thirty to forty-eight inches in diameter. In one case, where a one and a half inch rope was used, the drum was eight feet in diameter. A small quick-running engine is generally used to drive the drum when hoisting, and a brake controls the latter when the engine is thrown out of gear and the bucket is lowered. The strap brake is used with the best winding machinery, and the compression is effected by a right and left handed screw, whose connection with the strap is made by means of nuts secured to the strap ends.

At the Jackson mine, near Negaunee, the compression is obtained by a very neat and immensely powerful combination of levers and screw, designed by Captain Merry, the superintendent of the mine. At this place, the winding apparatus was driven very satisfactorily by a 40 horse power Root engine and boiler, built in New York.

At the Champion iron mine, the winding machinery is well made and highly finished. It does excellent work, and is considered by many to be the finest in that section. It was built in Detroit, and I very much regret that the name of the firm of whom it was purchased has escaped from my memoranda. I think, however, it is from the Michigan Iron Works of Messrs. Hodge & Christie. At a number of places we found the very neat and effective stone breaker of Messrs. Blake, of New Haven, an admirable machine.

HOMEWARD JOURNEYING.

From Negaunee we came by rail to Escanaba, thence by steamer through Green Bay to Menominee, and, there taking the train again, reached Chicago in just twenty-four hours from Negaunee.

NEW CHICAGO.

We remained at Chicago long enough to inspect the burned district with some care, to visit the water works, and to spend a half day with Mr. Forsythe, the superintendent of the Bessemer plant of the North Chicago Rolling Mills.

The resurrection of Chicago after the great calamity is something marvelous. Rebuilding commenced before the fire was extinguished, and has gone on unceasingly since. The results of such wonderful enterprise and energy are now seen in the rebuilding of perhaps one half of the business portion of the South side. The new buildings are generally substantial, neat, and convenient, and many are noble structures, uniting, in an unusual degree, architectural beauty with strength and excellence of workmanship. The new Chicago will be far superior to the old Chicago which it replaces, and ultimately it may be that the great fire will be considered, upon the whole, as having been a benefit to the city, notwithstanding the terrible suffering that came upon the citizens of this portion of Chicago as its consequence.

THE CHICAGO WATER MACHINERY.

The pumping machinery of the Chicago water works is located directly in the midst of the burned district, but fortunately remains uninjured. Four large steam engines are at work supplying the city with water, which is drawn from the lake through a tunnel extending far out into the lake, and which is of itself a noticeable piece of engineering. Besides the four pumping engines actually in use, two new engines of great power are in process of erection, and another tunnel is proposed. The new engines were built by the Fort Pitt Foundery, and are very similar to those of the St. Louis water works. We noticed here the Winter cut off on the old engines, the only application of that device to pumping engines that has come under our observation. The new engines have a modified Sickles cut off, and the bucket and plunger pump. They are fine looking machines, and should do good work.

CHICAGO ROLLING MILLS AND IRON WORKS.

The North Chicago Rolling Mills are situated in the suburbs of Chicago, and are extensive works. By the courtesy of Mr. Potter, the president, and the kind attention of Mr. Forsythe, we were enabled to make a very thorough inspection of the plant.

There are two large blast furnaces running here, smelting a variety of ores and making Bessemer pig metal. These furnaces are 17 feet in diameter and 66 feet high; the blast, at a pressure of 3½ pounds per square inch, is heated to a temperature of, probably, 800° Fah. before entering the tweers; the fuel is a mixture of coal and coke. The product amounts to about 600 tuns per week. In the rolling mills about 45,000 tuns of iron rails are made per year—enough to lay nearly 500 miles of track. There is nothing peculiar in the processes in use here.

BESSEMER STEEL WORKS AND PROCESS.

The Bessemer steel plant consists of two five tun converters and their accessories, and is placed in a building by itself. Here selected pig iron, from Lake Superior ores principally, is melted in cupola furnaces, and thence flows, at the proper time, in a glowing stream into the converter, the vessel in which its conversion into steel takes place. Air is then forced, by powerful blowing engines, into the bottom of the vessel, and rises, in hundreds of minute streams of bubbles, through the liquid metal, burning out its carbon and silicon, leaving it almost pure iron, and at so elevated a temperature that it is more fluid than at first. An alloy of iron and manganese rich in carbon, is next added, and in such quantity that the amount of carbon entering the mass is just sufficient to convert it into the desired quality of steel. The manganese assists by neutralizing the deleterious effect of any sulphur that may be present, and by preventing ebullition of the metal when poured into the molds. The process is one of the most beautiful applications of scientific principles to useful purposes that has ever been made. The operation presents to the spectator one of the most imposing sights that can be witnessed in any branch of manufacturing industry, and the ingenuity displayed in every detail of engineering connected with it is no less remarkable. This most interesting and immensely important branch of modern industry is patented by, and owes its successful introduction very greatly to, a most persistent and ingenious British inventor, Henry Bessemer; but, as might be anticipated, American enterprise and inventive talent have done much towards increasing the reliability and effectiveness of the process. An American, Kelly, was working upon the problem contemporaneously with Bessemer, and met with some success even in advance of him, and the efficiency of the apparatus is largely due to our fellow countryman, A. L. Holley, who has brought up the number of charges worked off per day by a pair of converters to, in some cases, as many as there are hours in the day. Some of the transatlantic Bessemer steel works are producing, even now, but eight or ten charges per day.

R. H. T.

The Great Suspension Bridge between New York and Brooklyn.

Work on the East River bridge is progressing rapidly. The caisson on the New York side is now completed, and the superstructure or tower has reached the hight of twenty-four feet above high water, eight hundred cubic yards of masonry being laid every week. There are about fifty men employed on the structure, and they are under the personal supervision of four engineers, headed by Colonel Roebling. Mr. Martin, one of his assistants, has the present control of the work. Everything possible is done by steam. The stone comes from Maine, and is stored at Red Hook, Long Island immediately opposite Governor's Island. A scow plies between the structure and the island every day. From the scow, the stone is lifted by steam to the dock, where, at a certain point, two tracks come together. The stone is placed on two cars and conveyed to the structure, to the top of which it is raised and placed in its proper position by means of steam derricks. Then the spaces are filled up with concrete composed of cement, sand, and gravel. Even this is mixed by machinery. A revolving shaft is used to perform this operation, which is found to be much more thorough and economical than it could possibly be if done by hand. After this structure is completed, the next step will probably be the building of anchorages on the New York and Brooklyn sides. These will each be 800 feet inland from the towers, the New York one at the corner of Water and Dover streets, and the Brooklyn anchorage at the corner of James and Mercein streets.

The American Institute Fair.

It seems to be an impossibility for the managers of any exhibition to get into proper order before the opening day, and the managers of the American Institute are always more or less behind-hand with their arrangements. The machinery is still in a very incomplete condition, and any attempt to give the public an idea of the merits of the show would be lost labor. As the building in which the fair is held is now the property of the Institute, and the managers have had possession of it for some months past, there is no excuse for the want of punctuality.

As soon as the display is sufficiently complete to allow of judgment being passed upon the exhibition, we shall give our usual full account of such improvements and new appliances as it contains.

A Singular Explosion.

Workmen were lately employed to clean out the grease and paint from the inside of the steam cylinder of one of the large ferry boats of the New Jersey Central Railway Company, opposite this city. For this purpose the piston had been duly removed and three men went down into the cylinder, which is 11 feet deep and 50 inches in diameter, taking with them a pail of benzine, which liquid they used in softening the grease. Suddenly a small snake like streak of flame started from under the hands of the man nearest the benzine pail, and the next instant an explosion occurred, and scattered the burning fluid over the persons of the men.

Martin Sweeney was terribly burnt about the face and neck, and was taken to the hospital. Charles Maloy and John Hays were also severely burned on the face, neck, and arms.

FROM the official testimony given by the chief engineer of the steamer Metis, it appears that the recent foundering of that unfortunate vessel in Long Island Sound was due to the flimsy construction of the partitions in the hull of the vessel. The ship had four separate compartments. By a collision with a schooner, a leak into one of the compartments was made, and the rising of the water therein broke through the adjoining partition and filled the vessel. Had the partition been of proper strength, the steamer would have floated.

GEORGE P. ROWELL & CO, advertising agents, received twenty seven thousand dollars in advance yesterday, for inserting a four line advertisement one year in all American weeklies. The advertisers are Geo. Stinson & Co., fine art publishers, Portland, Maine.

THE fair of the Maryland Institute for the Promotion of the Mechanic Arts will open on October 1, and continue till October 31.

BRIGADIER-GENERAL SYLVANUS THAYER, of the United States Corps of Military Engineers, died Sept. 7th, at Braintree, Mass., aged 87. He had been fifty years in the public service.

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.—PITCH OF A PROPELLER.—Will you please explain the meaning of the term "pitch" used in describing a screw propeller?—J. D. E.

2.—SAPONIFICATION OF LINSEED OIL.—What will cause linseed oil to turn to soap after absorption by a piece of woolen goods?—J. D. E.

3.—REDUCING VALVE.—If I wish to drive my engine with a pressure of 50 lbs. on the square inch, the gage on my boiler showing 100 lbs. on the inch, can I do so by using an intermediate boiler and a reducing valve? What is a reducing valve?—A. H.

4.—BRICK BURNING QUERIES.—How shall I remedy a kiln of brick in which the fires have been allowed to go out during the burning, leaving the bricks too soft? If I take down, soak in water, reset and burn over, can anything be put in the water to improve the quality of the brick?—S.

5.—SAW MILL HANDS.—Please tell me why it is next to impossible to find a man who thoroughly understands the management of a circular saw mill? Such is the case in this State (Tenn.) Is it because a saw is harder to run than any other tool?—G. V. V.

6.—MECHANICAL DRAWING.—What is required of a young man in addition to a thorough knowledge of mechanical drawing, to fit him for a position as draftsman in a first class machine shop? Is a practical education in the principles and construction of machinery, or a course in mechanical engineering, essential?—S. J. L.

7.—ATTRACTION.—Two leaden spheres, each one foot in diameter, are placed with their centers four feet apart. What is the force with which they attract each other? What is the force that unites two pith balls, when floating near each other upon the surface of water?—A. F. M.

8.—REVOLUTION OF THE EARTH.—Would the earth's velocity upon its axis be increased by moving matter from the equator to the poles?—A. F. M.

9.—RADIATION OF HEAT.—Does the radiation of heat depend upon air, and would heat radiate in a room or vessel from which the air was exhausted? If air be essential in the case of heating a house, would not the register supply sufficient air to the air chamber and so dispense with a draft through the chamber? The particular question is: Can I heat a house by a furnace with the air draft closed?—H. P.

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.

TARNISH ON BRASS.—To A. P.—We have given many directions for cleaning polished brass. See pages 281, 298, 314, and 329, of volume XXV. of the SCIENTIFIC AMERICAN.

CEMENTING RUBBER TO SHEET IRON.—D. P. W. should try either or both of the methods described on page 42 of volume XXV. and page 42 of volume XXVI. of the SCIENTIFIC AMERICAN. If he paints his sheet iron with a thick metallic paint, he can fasten his rubber on with glue or any cement he chooses.

POWER OF ENGINE.—By a slip of the pen, there is an error in my answer, on page 170, to this query. The horse power, theoretically, is 1·856, which is subject to variation as I mentioned.—D. B., of N. Y.

ELIMINATION OF MERCURY.—To I. H. M., query 9, page 138.—Place the tin amalgam in a retort, and distil at a low red heat, conducting the mercury into a receiver of water. If the quantity to be operated upon is small, you may use a hard glass retort.—E. H. H., of Mass.

CEMENT FOR MEERSCHAUM.—To E. S. T., query 10, page 138.—Dissolve carbonate of magnesia in strong hydrochloric acid till saturated. With this solution, make a paste by adding fresh calcined magnesia, and rapidly use the cement so formed for building up the fractured pipe. If a piece is to be cemented in, moisten each edge with the solution, apply a little of the thin cement, and bring the pieces into correct apposition. In an hour or less it will have hardened sufficiently to clean off, and the pipe will be quite serviceable.—E. H. H., of Mass.

DRILLING HOLES IN GLASS.—To W. V. B., query 11, page 138.—Use chrome steel for drills, and make the points very obtuse angled. Use a slow motion, with firm and moderate pressure. Moisten continually with a saturated solution of camphor in turpentine.—E. H. H., of Mass.

BOILING OIL.—To V. L., query 12, page 138.—Steam can be used for the purpose, but to obtain the necessary heat, a very high pressure would be required, and would be attended with no advantage over coal where ordinary care is observed.—E. H. H., of Mass.

INDIA RUBBER FOR STEAM JOINTS.—To N. L., query 13, page 138.—India rubber washers exposed to the heat of steam pressure at four pounds and upwards will soon become hard and brittle, but if the joint has been carefully made at first, this will not affect its integrity.—E. H. H., of Mass.

NITRO-GLYCERIN.—To P. G. S., query 20, page 138.—Take nitrate of potash in powder 1 part, sulphuric acid 3¼ parts. Mix thoroughly, and cool to zero, then pour off the strong fuming nitric acid, draining thoroughly the mass of sulphate of potash left behind. To this acid and four fifths of a part of glycerin very gradually, taking care to maintain the whole at as near zero as possible. In an hour's time add a considerable quantity of water; the nitro-glycerin will separate and fall to the bottom. Wash it thoroughly with fresh water, and whatever else you do, be careful in all your manipulations with this powerful agent.—E. H. H., of Mass.

CEMENT TO RESIST WATER AND ALCOHOL.—To F. S., query 24, page 31.—You do not say what material is to be cemented. The peeling off depends on an affinity between the cement and the object it is placed on, and what will answer in some cases will not in others.—E. H. H., of Mass.

DRILLING HOLES IN GLASS.—To W. V. B., query 11, page 138.—Holes can be drilled in glass by the use of turpentine constantly applied to the drill.—C. O. L., of Pa.

Recent American and Foreign Patents.

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

PLOW.—Charles C. Lewis, Gainesville, Ala.—This invention has for its object to furnish an improved wooden mold board plow. The upper forked end of the standard is attached to the middle part of the plow beam, and the forward branch of the former supports the plow share. The land side is attached by its forward end to the share, to the outer part of which is fastened a brace, which, passing through the lower end of the standard, is secured to the land side. The space at the land side of the plow is closed by a metallic plate. The foot of a solid wooden mold board is fitted and secured in the cavity of the share, by which it is claimed the device is rendered light, cheap, and suitable for furrowing or for use in light soil.

GRAIN CEILING FOR VESSELS.—Constantin Lazarevitch, New York city.—When grain is shipped in bulk from one port to another, and especially to European ports, it is necessary to ceil the part of the vessel which contains such cargo to protect it from dampness. Such ceiling is required by the insurance companies. Boards are therefore placed between the bottom of the vessel and the grain, thus making a second bottom with boards, which overlap each other in that part of the hold. These boards are firmly nailed down to the bottom of the vessel, which renders it impossible to remove them without splitting, breaking, and effectually destroying them. This lumber, consisting of many thousand feet, is consequently sold for fire wood after the grain has been discharged. The object in this invention is to so put in and secure this ceiling that the lumber or boards of which it is composed shall not be injured, but may be removed intact and sold as perfect lumber, thus effecting a very material saving to ship owners, while reducing the cost of freight. The invention therefore consists in securing the ceiling with hooks, which do not penetrate or injure the lumber.

WINDLASS.—Melancton Bryant, Northport, N. Y.—This invention consists of the attachment of the pawl lever for turning the drum of a windlass or winch to the ratchet wheel or disk by a kind of yoke or frame, embracing both sides of the wheel, and confined upon it by sectional annular flanges fitting in annular grooves in the disk, and sliding around the disks in said grooves, for raising the pawl, but binding therein when the pawl is forced against the teeth, and moving with the disk when the latter is turned. When the pawl lever has the end of its short arm pivoted at the axis of the drum, it is capable of being worked much faster than the detachable bar arrangement, wherein two or more hand bars are placed in radial mortises arranged at intervals around the drum.

MUSIC STAND.—Lewis V. Brown, Salisbury, N. C.—This invention relates to an improved music stand whose rack can be extended for large or contracted for smaller sheets of music. The invention consists in making the rack proper on the principle of lazy tongs, or jointed rods, and in combining it with a bar or plate at the back, whereby it is locked in its expanded position. When the stand is not in use it is folded together and can be packed into a narrow space.

FANNING MILL.—James M. Kendall and James Peel, Madelia, Minn.—This invention consists of a simple and efficient arrangement of the shaking shoe and a revolving screen, whereby the grain is first subjected to the blast in the shoe, and then passed through the screen, which is revolved by gearing connected with the fan driving shaft, the said screen being protected from the blast of the fan by a hood. It also comprises a novel arrangement for shaking the shoe, whereby a horizontal and a vertical motion are imparted to the shoe. The shoe is constructed with perforated sides.

SAND-PAPERING MACHINE.—Orra I. Foster, Salem, N. H.—This invention consists of an arrangement of the fan blower for carrying the dust away, the fan blades being applied to a prolongation of the sand paper cylinder or its shaft instead of to the hood of the machine, as heretofore.

CULTIVATOR.—Totten Poling, Guthrie, Iowa.—This invention relates to an improved iron cultivator, which shall be so constructed that it may conform to irregularities in the surface of the ground, and may be readily adjusted to run deeper or shallower in the ground, as may be desired. Suitable appliances enable one of the plows to rise above or drop below the level of the other, thus adapting the cultivator to work upon an uneven surface, and enabling one of the plows to be raised to pass an obstruction without disturbing the other. This construction also forms an arch or rise in the connecting bar so that the cultivator may cultivate both sides of a row of plants at the same time without injuring or breaking the plants. The plow beams may be moved farther apart or closer together, as may be desired, their rear ends having a free lateral but no vertical movement. The plowman, while guiding the plows, walks at the side of the row of plants being cultivated. Bars bent downward and curved rearward to rest upon the ground serve as drag bars to support the plows away from the ground when passing from place to place.

CARRIAGE WHEEL HUB.—Jesse B. Bauman, Shepherdstown, Pa.—This invention relates to an improvement in carriage wheel hubs, the construction of which is such that the spokes, tire and felloe can be readily and easily tightened by means of movable collars, when it is necessary to take the dish out of the wheel.

CARRIAGE WHEEL.—Samuel R. Bryant, Waterford, Pa.—This invention relates to the mode of locking the spokes by means of grooves and wedges, and the mode of fitting the spokes and pipe box together. To lock together the spoke tenons so that lateral movement of one upon the other shall be prevented, longitudinal grooves in their contiguous surfaces are formed, and to prevent longitudinal movement of the spokes one upon another, transverse perforations may be formed to receive locking pins of any suitable material.

WAGON BRAKE.—Joseph Pavey and Marshall Martin, Walla Walla, Washington Territory.—This invention relates to improvement in a class of wagon brakes, wherein the brake bar is suspended below the reach of the wagon. This brake can be used with or without the wagon box, by reason of the employment of the bar for suspending the brake bar when the box is removed, and the attachment of the supports for the brake levers and to the axle.

APPARATUS FOR DRYING FLOCK OR VELVET PAPER.—Theodore A. Blanchard, New York city.—Flock paper after being flocked has heretofore been dried by looping or festooning the paper over poles, which were usually arranged so that they could be moved closer together or further apart, as circumstances required. This mode of drying the paper, though allowing the air to circulate freely about the paper, always permanently creased or marked it where it passed over the poles. This invention consists in supporting the paper in a horizontal or nearly horizontal position during the drying operation upon drying frames prepared for the purpose.

IMPROVED MANUFACTURE OF BITARTRATE OF POTASSA.—Gustave Bourgade, Jersey City, N. J.—The object of this invention is to simplify the means of producing cream of tartar or bitartrate of potash, so that the same may be economically manufactured in large quantities. The apparatus consists of a double jacket steam kettle, made of copper or equivalent material, with its lower part hollow, for the admission of steam. In the bottom of the kettle is a discharge pipe, having a valve and covered with a filter. The inventor fills the kettle with water, and, when it is boiling by the heat of steam admitted into the jacket, adds a quantity of crude argols, well ground, which are left to boil until perfectly dissolved. In order to prevent the formation of tartrate of lime, he adds a quantity of diluted sulphuric or muriatic acid. Bone black is then poured in and the mixture left to boil. After dissolution, a quantity of prime American clay well dissolved in water is added; after which the preparation is allowed to flow into crystallizing tanks.

METHOD OF MAKING BLANKS FOR PLOW ATTACHMENTS.—Orren A. Anthony, Mayfield, N. Y.—This invention consists in a method of making a blank for an attachment for plows of a single plate of steel, which is fitted on to the worn out point of a plow and secured by rivets or bolts through the share and colter.

RAILROAD TANK VALVE.—Charles W. Chappell, Watertown, Wis.—This invention has for its object to furnish an improved device for operating a railroad water tank valve, enabling the valve to be conveniently opened, whatever may be the weight of the water pressing upon the valve. This is effected by means of a lever attached to the valve stem being raised by the revolution of an eccentric on the end of a shaft which enters the side of the tank. This shaft is rotated from the outside by means of a hand wheel.

SCROLL SAWING MACHINE.—David R. Williams, Sr., Paris, Ky.—This invention relates to an improved mode of combining guide rods and a bearing plate with a saw cross head, so that the cross head will not have the friction of the bearing plate, except when pressed against it by the work; and it also consists in providing a clamp, which holds the saw, with an adjustable pin that will afford a rest thereto when the width is lessened by wear or sharpening.

CORN PLANTER.—George G. J. Millar, Lockbourne, Ohio.—This invention has for its object to furnish an improved corn planter which may be adjusted to plant the rows of hills at any desired distance apart, and to drop any desired number of kernels to a hill. The dropping cylinders are so placed as to receive the seed from the hoppers and discharge it upon the ground, and are attached to the outer ends of a rod or shaft which is made in parts sliding upon each other, so that its length may be extended or contracted as the machine is adjusted to plant the rows of hills wider apart or closer together. By means of suitable appliances the driver can operate the dropping cylinders and drop the seed with his foot or by hand. The driver's seat is adjustably supported from the platform, so that it may be moved back or forward, to enable the driver to balance the machine with his weight, thus relieving the horses' necks. Other mechanism allows the planter to be raised from the ground for convenience in turning or passing from place to place. The machine may be adjusted to plant the seeds at any desired depth in the ground. The covering plates are secured by a single bolt, so that they may be set back or forward, according to the amount of soil desired to be drawn over the seed. Cutters are provided, designed to cut off any stalks or other rubbish that may be upon the ground, and which might affect the proper operation of the plows.

FENCE.—William T. Willie, Independence, Texas.—It is economically important to the farmer that the rails composing the fence he removes, and for which he substitutes another, should be fully utilized on the spot. Hence the inventor purposes setting the posts diagonally across the fence alternately, in opposite directions, which brings the lower or base portions of every successive pair of posts much nearer each other than they would otherwise be. This renders it practicable to utilize the short rails for the bottom and longer rails for the top portion of the panel.

WASH BOILER.—Wilson C. Berger, Bethel, Pa.—This invention consists of a secondary or false bottom, adapted to fit inside that of the sheet metal boiler snugly, with the legs to hold it about three inches above the permanent bottom, which said false bottom has three parallel rows of holes, through it vertically, said rows being in the direction of its long axis; and over the middle row a long narrow space is inclosed by two perforated plates, rising as high as the top of the boiler, and joined together at the top and ends, so that water heated in the space below the false bottom will be forced up in the said inclosed space, and out through the perforated sides among the clothes, and down to the heating space again, through the outside row of holes in the false bottom, so as to act upon the clothes very efficiently.

KNIFE SHARPENER.—Jonathan Quipp, Buffalo, N. Y.—This invention furnishes convenient means for sharpening knives; and it consists simply in an emery roller, supported on a suitable frame, with a journal or pivot at each end. Stands or ears are attached to the bed plate, through which the journals of the roller pass. The roller is made of wood or of any suitable material, and is covered with emery or equivalent material, the same as emery wheels; or it may be made of a composition of emery or sand and other material. The sharpener may be placed upon the dining table, and is intended to take the place of the ordinary steel sharpener.

BEE HIVE.—Amos R. Moulton, Fall Branch, Tenn.—This invention relates to an improvement in bee hives which shall be of such a construction as to enable every portion of the same to be opened or unfolded with the greatest facility for the purpose of inspection, removal of honey and refuse matter, etc.

CAR COUPLING.—James Broadley, of Bradford, Eng.—The mechanical arrangements comprising this invention consist of a sliding shaft or bar, working in suitable bearings secured to the ends of the carriage or vehicle at a position somewhat above the usual coupling chain arrangement, which can be left attached to the carriage or vehicle, and can be made use of when two carriages are to be coupled, one of which is not provided with the coupling arrangement. This sliding shaft or bar has a bolt connected thereto, which bolt is made to work in an orifice provided for it in the sides of a socket or guides secured to the carriage or vehicle. A slotted link is also secured to the carriage of vehicle, to which it is attached by a joint, so that it may be lifted up out of the way and secured by a catch on the sliding shaft when a carriage or vehicle unprovided with these arrangements is to coupled in the ordinary way. The coupling slotted link is, when two carriages or vehicles are brought together for coupling, down in its ordinary position, and is inserted in the sockets or guides above mentioned by simply bringing the two carriages or vehicles together, and then the sliding shaft can be actuated so as to couple the carriages by handling its end from the side of the carriage without going between the carriages, and the uncoupling can be effected by a similar though reverse action. If thought desirable, lever arrangements might, it is obvious, be adopted, to enable the guard or attendant to work these arrangements without getting down from his place.

SAFETY SWITCH FASTENING.—William B. Sloan and Edward H. Sweetser, Hamburg, Iowa.—The invention consists in a railroad switch fastening, constructed with spring jaws which clamp the annular recess of a bolt passed therethrough and require to be separated by a key before the bolt can be removed.

FOLDING PAIL.—Ransom Sabin, Benona, Mich.—This invention consists in a combined water pail or bucket and feed bag, formed of a waterproof flexible cloth or rubber cylindrical body, and a sheet metal bottom. It is capable of use in drawing water from a well, may be set over a flame, can be folded flat so as to be placed under carriage cushions or otherwise conveniently packed away, and is withal very light as well as strong, durable and cheap.

LATHES FOR TURNING BENT STICKS.—Thomas Ott, of South Green Township, Pa., assignor to himself and Nathan Houck, of same place.—This invention has for its object to produce a simple apparatus for turning the hooks at the ends of umbrella sticks and other bent sticks; and consists in an annular chuck carrying a cutter at its narrow inner edge, and hollowed at the faces to be as thin as possible along the inner edge. An annular chuck or block made of wood or metal is slotted out to receive a knife whose cutting edge projects beyond the inner periphery of the chuck. The knife is preferably slotted, to be adjustable as its edge wears. The faces of the annular chuck are hollowed to make it as thin as possible in the middle. Being thin in the middle, the chuck permits the stick to be held at such varying angles as to allow its entire bent portion to be turned to uniform thickness.

LAMP HEATER FOR NURSERY FLASK.—Seymour Hughes, of Jersey city N. J.—This invention relates to a new apparatus for heating the contents of nursery flasks and similar vessels; and consists in the use of a portable water heater containing a lamp, flues, and a platform for the support of the flask. The latter can be placed within the heated water to have its contents gradually and gently warmed without exposing the flask to injury or wasting heat. The invention also consists in providing the flue of the water heater with a transparent section so that it may also serve as a lamp. This is a very neat and useful invention, one of the small kind adapted for general use which usually produce to the patentee quick sales at good profits.

HARROW.—Horatio N. Swift, Matteawan, N. Y.—Heretofore the connection between the sections of the well known flexible harrow has been made by means of round rings through the three eyes, which approach each other, but it has been found that the sections, when connected by a ring in this manner, were liable to catch and cramp in turning the harrow, and cause much trouble in releasing and straightening out the same. To remedy this difficulty, instead of the round ring, a triangular connecting link is employed composed of a single piece of metal, but with a separate ring for each eye. By this means the eyes of the sections are separated, so that in turning or twisting the harrow will not cramp, but assume its natural position without aid from the driver. These triangular links are used only for the interior connections, the outer angles of the sections being connected by common links and chains.

LAND ROLLER.—Halloway W. Mathews, Frenchtown, N. J.—The invention consists in providing a roller frame with four pendent bearings, each vertically slotted, and all the corresponding parts of said slots being in the same horizontal plane, so that the journals of each end of a roll can freely play up and down, and so that the weight of frame and driver will, when on a level, be equally distributed over the several journals, but will be concentrated upon any clod over which either end of either roll may pass.

[OFFICIAL.]

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DESIGNS PATENTED.

6,089.—CAMPAIGN SHIRT.—A. Blumann, New York city.
6,090.—OTTOMAN.—C. J. Conradt, Baltimore, Md.
6,091 and 6,092.—CARPETS.—A. M. King, Kidderminster, England.
6,093.—SHAWL.—M. Landenberger, Philadelphia, Pa.
6,094.—CARPET.—J. Powell, Kidderminster, England.
6,095.—MUFF COVERING, ETC.—R. M. Seidis, New York city.

TRADE MARKS REGISTERED.

969.—SPOOL THREAD.—Clark Thread Company, Newark, N. J.
970.—POMATUM.—P. Davis & Son, Montreal, Canada.
971.—DRUGS, ETC.—J. Faber, New York city.
972.—MOLASSES.—A. Thomson & Company, New Orleans, La.
973.—SIRUP.—A. Thamson & Company, New Orleans, La.
974.—MOLASSES.—A. Thomson & Company, New Orleans, La.
975.—FANCY GOODS.—Weil & Woodleaf, San Francisco, Cal.

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:

22,185.—PRESERVATION OF FLESH FOR FOOD.—N. B. Marsh. Nov. 13, 1872.
22,197.—HOOP SKIRT.—S. Peaberdy. Nov. 13, 1872.
22,674.—TRUSS SPRING.—J. W. Riggs. Jan. 2, 1873.

EXTENSIONS GRANTED.

21,233.—CARPET SWEEPER.—H. B. Herrick.
21,306.—HILLSIDE PLOW.—H. S. Akins.
21,311.—SECURING PLANE IRONS TO STOCKS.—L. Bailey.
21,324.—SUN SHADE.—A. G. Davis.
21,329.—SENDING AND RECEIVING TELEGRAPH MESSAGES.—M. G. Farmer.
21,352.—RAILROAD CAR SEAT.—C. M. Mann.
21,367.—STRAW CARRIER.—F. W. Robinson.
21,372.—FARE BOX.—J. B. Slawson.
21,381.—BRACELET.—F. M. Sweet.

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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.

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

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

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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By the terms of the new patent law of Canada (taking effect September 1st, 1872) patents are to be granted in Canada to American citizens on the most favorable terms.

The patent may be taken out either for five years (government fee $20), or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with Munn & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish pamphlets of instruction free.

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FOREIGN PATENTS—A HINT TO PATENTEES.

It is generally much better to apply for foreign patents simultaneously with the application in the United States. If this cannot be conveniently done, as little time as possible should be lost after the patent is issued, as the laws in some foreign countries allow patents to any who first make the application, and in this way many inventors are deprived of valid patents for their own inventions. It should also be borne in mind that a patent is issued in England to the first *introducer*, without regard to the rights of the *real* inventor; therefore, it is important that all applications should be entrusted to responsible agents in this country, who can assure parties that their valuable inventions will not be misappropriated. The population of Great Britain is 31,000,000; of France, 40,000,000; Belgium, 5,000,000; Austria 38,000,000; Prussia, 25,000,000; German Confederation, 40,000,000; Canada 4,000,000: and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency.

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Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From August 24 to August 29, 1872, inclusive.

BLAST REGULATOR.—C. B. Knowles, J. E. Saunders, Nashville, Tenn.
FIRE ARM.—J. J. Byers, Delta, N. Y.
MACHINE FOR CUTTING TEXTILE MATERIALS.—A. Warth, Stapleton, N.Y. W. F. Tobbins, New York city.
MACHINE FOR MAKING SCREW TAPS.—A. and A. E. Goddard, Essex, Conn.
OXYDIZING METALS.—T. S. Harrison (of Philadelphia, Pa.), London, Eng.
PAINT FOR SHIPS' BOTTOMS.—J. H. Bloodgood, New York city.
PERAMBULATOR.—J. B. Wightman, Brooklyn, N. Y.
PLUGS FOR BOILER TUBES.—R. A. Copeland, New York city.
PRINTING MACHINERY.—R. M. Hoe, New York city.
SEWING MACHINE.—I. W. Hoyer, Philadelphia, Pa.
SEWING MACHINE.—T. S. Harrison (of Philadelphia, Pa.), London, England.
STEAM AND WATER GAGE.—C. H. Hall, New York city.
TYPE SETTING MACHINE.—S. D. Sperry, Hartford, Conn.
VESSELS FOR ACIDS.—C. Morfit (of Baltimore, Md.), London, England.
WASHING ORES, ETC.—W. Rickard, Monitor, Cal.

NEW BOOKS AND PUBLICATIONS.

THE FLOWER GARDEN.

A new magazine, handsomely printed, devoted to floral matters, has just been commenced by C. L. Allen & Co., 76 Fulton Street, Brooklyn, N. Y. Price $1 a year. The first number is before us, and contains a great amount of information on flowers, floral gardening, and the habits and treatment of plants, which we have not before seen. The publishers are practical gardeners, and do an extensive business as seedsmen; but they devote especial attention to raising and dealing in bulbs. All the new and best varieties of gladiolus, lilies, tulips, hyacinths, crocuses, etc., are produced by them, and information concerning the new varieties of all this class of flowers is contained in the new magazine, which renders it very instructive to a great and increasing number of persons interested in bulb growing.

SCIENTIFIC AMERICAN

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

Vol. XXVII.--No. 14.] NEW SERIES.] | NEW YORK, OCTOBER 5, 1872. | [$3 per Annum [IN ADVANCE.]

Cod Fishing in Alaska.

A correspondent of the Alaska *Herald*, published at San Francisco, writes from the Shumagin Islands the following particulars. The Shumagins are a group of small islands situated near the 55th parallel, half way out on the peninsula of Alaska. They are among the possessions ceded to the United States by Russia.

There has been a great deal of rough weather along the Shumagin Islands during the summer. The strong south and southeasterly winds are the most severe here, and often prevent the fleet from carrying on operations. The storms brought by these winds are not infrequent, and compel vessels to leave their anchorage for sea. The atmosphere is thick with fogs and the rains are constant and heavy during these winds. The sun is seldom seen, and for the past three months has appeared only twice. You may rest assured that when we do see "the divine light of heaven," as the poets have it, the heart goes out in thanks for the small favor granted. A good sun bath is a luxury we do not often indulge in and which can only be properly appreciated by people in our situation.

Speaking of the winds, it is a strange fact that what we call the south winds are the the coldest and chilliest that we endure. These are the winds that bring us our severest storms, foggiest weather, and heaviest rains. In other countries, the south winds bring calm, warm, and beautiful weather. There must be a wind whirlpool, somewhere along the Aleutian coast, which changes the current of the air and the temperature of the climate. Perhaps, as the lovers of science advance this way, they may be able to discover the causes which make our south winds feel as if they came right from the north pole. In this as in a thousand other matters of great scientific interest, Alaska offers an inviting field of observation.

The few Americans on the islands are not, however, so much interested in science as they are in codfish. In catching the latter and making it marketable, their time, during the fishing season, is pretty well occupied. From daylight until dark—and daylight and darkness are considerably mixed here—the hands are engaged in catching and salting.

Codfish are taken by men in small boats, who go to the fishing grounds and bait for their harvest of the sea. They fish with lines, and use what are known as eleven and twelve inch hooks. Halibut and cuttle fish are the best bait. A good fisherman, if he is lucky, will haul up 400 codfish in a day, and this is considered a splendid catch; to procure 300 on an average every day is very satisfactory. Having brought the catch on board, the fish are immediately salted, packed away, and are not again touched until the cargo lands at its destination.

White men make better fishermen than the Aleuts, although the latter, when they are trained, do very well.

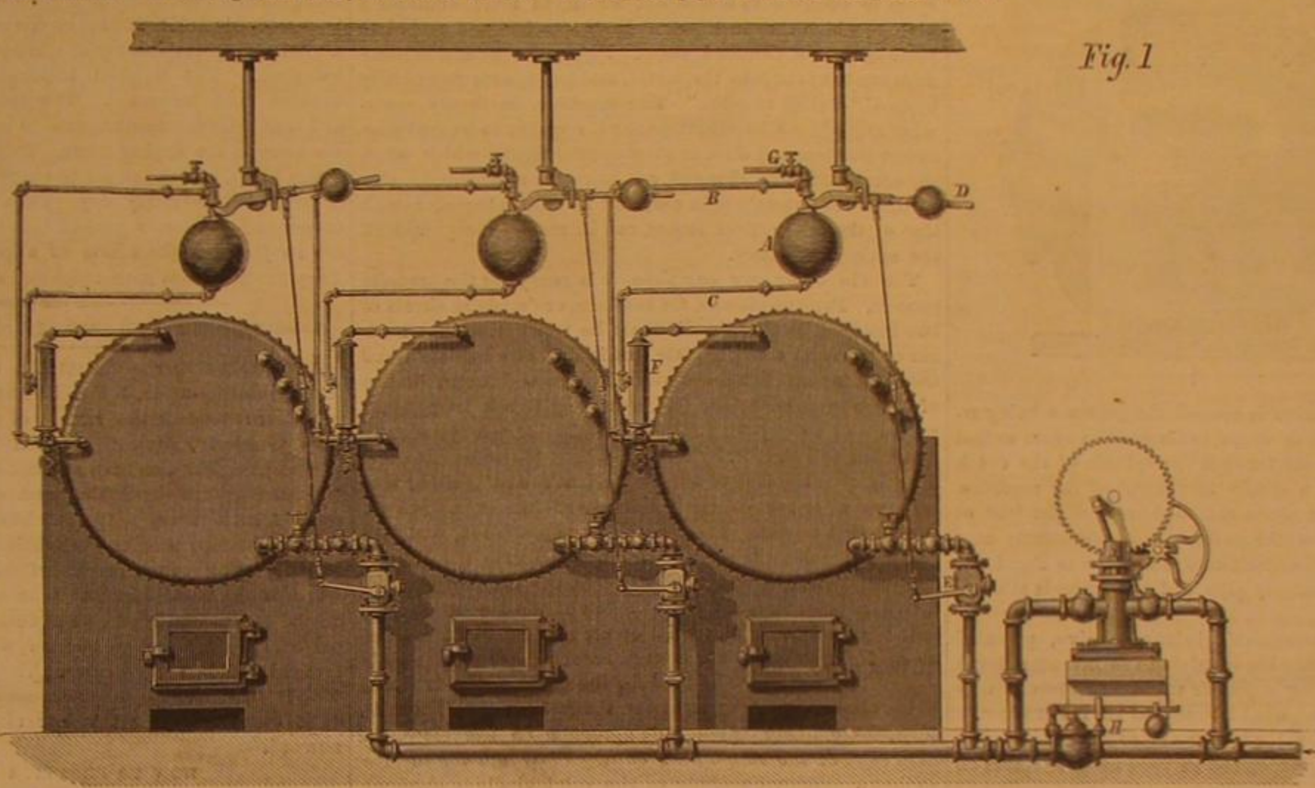
It may seem to your readers that life on this coast cannot be very enjoyable; and yet the white men here appear to be as happy as they could hope to be anywhere in the world. You hear very little growling or complaining. Our wants are few, and we scarcely know what care is.

THE use of red light in photography has been found to hasten impressions and increase their sharpness. A diaphragm of thin translucent reddened paper in place of the ordinary metallic diaphragm in the camera has been tried with great success.

IMPROVED FEED REGULATOR FOR BOILERS.

The construction of this machine is based on the principle of gravity acting upon a counterpoised hollow sphere, A, the varying weight of which, together with that of its contents and the counterpoise, is made to operate a lever. The sphere may contain water, water and steam, or steam alone. Fig. 1 shows an illustration of three regulators attached to a similar number of boilers. The flexible pipes, B and C, are made at

Fig. 1



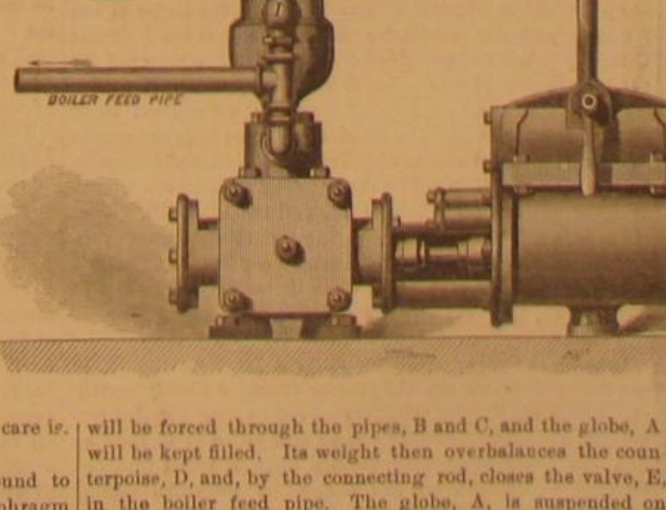
BERRYMAN'S PATENT FEED REGULATOR FOR BOILERS.

least six feet long on the horizontal part, and connect the interior of the globes, A, to the interior of the boiler by their connections with the columns, F. The end of the pipe, B, is connected with the proper water level in the boiler, and the pipe, C, called the discharge pipe, is connected at any convenient point below the water level. If the air in the globe, A, is expelled through the air cock, G, and there is sufficient water in the boiler to cover the inlet of the pipe, B, on the water line (steam having been generated in the boilers), water will be forced through the pipes, B and C, and the globe, A will be kept filled. Its weight then overbalances the counterpoise, D, and, by the connecting rod, closes the valve, E, in the boiler feed pipe. The globe, A, is suspended on knife edge bearings, similar to a scale beam; and as soon as the water in the boiler has evaporated so that steam can enter the inlet of the pipe, B, an equilibrium is at once formed, and the water in the globe, A, flows back by gravity, to a level with that in the boiler, through the discharge pipe, C. The weight, D, now overbalances the empty or partially empty globe, A, and falls again, opening the valve in the feed pipe.

The inventor states that this device is now attached to hundreds of boilers, so regulating the feed that a variation of not more than one quarter of an inch occurs in the water level.

Illustrated in Fig. 1 is a plunger pump, shown with the supply and discharge pipes connected together, to admit of constant motion. Should the valves all be closed in the feed pipe, the relief valve, H, opens and the water circulates back from the discharge to the supply pipe until some one of the feed valves opens. This is one manner of attaching this device when more than one boiler is used. The construction of this regulator admits of its being used only as a regulator. In our last issue a very simple method was shown by which one apparatus performs the double duty of regulating and giving an alarm if by any means the water supply to the boilers is stopped. The danger attendant on connecting glass gages and gage cocks by small pipes, leading out from the tube sheets through the cast iron fronts of tubular boilers, owing to the intense heat acting on these small pipes, is obviated by the use of the column, F. Unless the usual gages are slowly and carefully opened, engineers are often deceived, as steam is shown when there is plenty of water, while there exists the possibility also of their being closed by deposits. The column, F, is attached to the boiler by a one and a quarter inch steam and one inch water pipe, to the front of which a glass gage may be attached with advantage. The inventor states that the use of the column prevents the fluctuations witnessed in the glass gage, as well as supplying clear water to the gage from below the surface, which generally is loaded with more or less scum. Should any enter, however, it may be readily blown out at the bottom of the column.

Fig. 2.



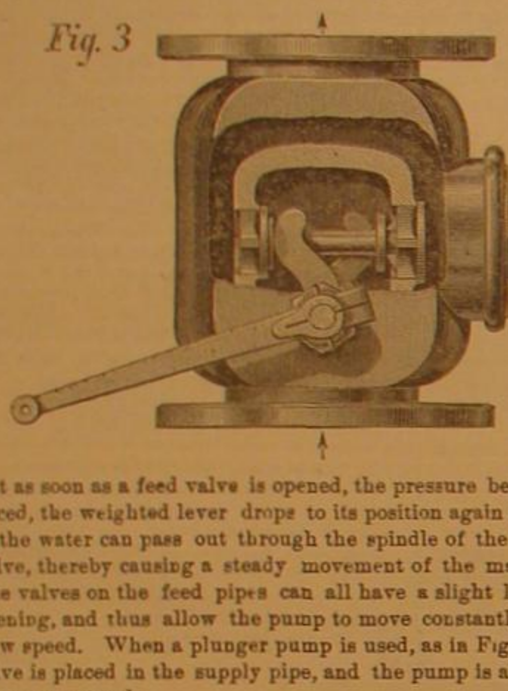
The inventor also states that this manner of attaching a column with pipes of different areas is important, and preferable in all kinds of steam boilers. The column and regulators may be attached to any part of the boiler most convenient for getting a direct motion to the valve, which is operated by the regulator. The latter, in most cases, is conveniently suspended by a flange and a piece of steam pipe from a ceiling or wall, as shown in the engraving. This invention was patented in January, 1871.

Fig. 2 shows another device by which the loss of power, usually consumed in pumping against a weighted valve, as shown in Fig. 1, is avoided. The connections of this machine are simple and economical of power, and it is intended to reduce the wear of pumps used on marine engines, for which it is more especially designed. The construction of it is such that the power derived from the pump may be used either to open or close a valve, as required.

The device is constructed by bolting together two metal disks, with a flexible diaphragm between them. In the center of the diaphragm is a spindle securely fastened, one end of which acts as a guide, the other end extending out through a stuffing box and supporting the lever upon which the weight hangs, the arrangement being somewhat similar to that of a safety valve. The under side of the flexible disk has com munication with the discharge pipe of the pump, through a connecting pipe, in which is placed a check valve, I, opening in towards the disk. In the spindle of this check valve, a small hole is drilled for the purpose of getting a gradual motion when opening the valve in the steam pipe of a pump, to which it is attached as shown, and is used in feeding a number of boilers regulated by either of the patent regulators. The top side of the disk is connected by a pipe, in which is formed a siphon, leading either from the steam or water space of any one of the boilers, to obtain the same pressure on both sides of the disk. The pressure in the discharge pipe of the pump against the under side of the diaphragm being greater than that in the boilers, the weight and lever are raised.

The operation is as follows: Should all the regulator or feed valves and the feed pipes of the boilers become closed, an increased pressure will at once be thrown on the under side of the flexible disk, and the valve J, in the steam pipe of the pump will be closed, and will remain so as long as the valve remains closed in the feed pipe of the boiler, or as long as the pressure is maintained in the discharge pipe of the pump.

Fig. 3



But as soon as a feed valve is opened, the pressure being reduced, the weighted lever drops to its position again as fast as the water can pass out through the spindle of the check valve, thereby causing a steady movement of the machine. The valves on the feed pipes can all have a slight lead or opening, and thus allow the pump to move constantly at a slow speed. When a plunger pump is used, as in Fig. 1, the valve is placed in the supply pipe, and the pump is allowed to run constantly.

Fig. 3 represents Berryman's balanced valve, patented April 9, 1872. In working his regulator, the inventor found much difficulty in getting a proper valve. In the one now shown in Fig. 3, is found what is essential for his purpose.

The balanced poppet valve in this device has added to it a simple improvement by which the valve is made to rotate on its seat at each time of its opening, causing a constant and equal wear on all parts of the valve and seat. The fork inside has one prong slightly longer than the other, so that at opening, the bearing is on one side of the valve, which tends to rotate it each time it opens. The fork works between two collars or shoulders which allow the valve to move freely; and the inventor states that its construction is such that, having one hundred pounds pressure on the face of one and back of the other valve, it can be opened or closed with a power of less than five pounds on a three inch valve.

For further information concerning all these improvements, address J. B. Davis & Co., sole agents for the Berryman Manufacturing Company, Hartford, Conn.

"GREENBACKS" AND POSTAGE STAMPS.

NUMBER I.

The visitor to Peter Cooper's noble charity, the Cooper Union, in this city, will find that while he is permitted to ramble, unobstructed, around the greater part of the immense building, his entrance to the fourth and to portions of the third stories will be barred by heavy iron gates backed by massive doors, and that his requests for admission to this mysterious quarter will be refused unless he be armed with certain necessary passports. His curiosity, doubtless thus aroused, will be augmented by learning that within those walls, thus secluded from the outer world, comparatively valueless sheets of white paper are changed into millions of dollars, as well as into the stamps which carry his written thoughts throughout the world. In short, the rooms are the workshops of the National Bank Note Company, the corporation that supplies the majority of the money and the postage stamps used, not only in the United States, but in many of the States of Europe, in all of the South American countries, and even in China and Japan.

If the reader will follow us through the processes below described, we will endeavor now to explain how this modern alchemy, which transmutes not baser metals but paper into the equivalent of gold, is carried on. We shall trace the manufacture of postage stamps and greenbacks, in the beginning together, as the various steps are essentially the same, noting, however, afterwards the special points of difference.

The general portion of the work, that is, all the decoration not directly bearing upon the special use for which the note, stamp, bond, bill, warrant, or whatever it may be, is intended, such as border, corner ornamentation, etc., is ready at hand. It has already been drawn and engraved in a manner which will be described further on, and impressions have been taken on paper, so that it is only necessary to cut the latter neatly out and paste them upon a sheet of the required form in their proper places. Then the lettering, vignettes, etc., are carefully drawn, and finally the entire design, which is really nothing more than a patchwork, is finished and submitted. If approved by the Government or party ordering, it is returned with special written instructions as to the details of manufacture. It is then placed in the hands of the workmen, and at this stage we begin our tracing of the process through which it passes to completion.

The first proceeding is making the die. A plate of soft, highly polished steel is selected, and upon it is sketched the design, or, perhaps, such portions of the latter as are of the same color, if more than one tint is to be used in printing. Of course a separate die is needed for every shade used. This is then carefully engraved; the labor is most elaborate and the skill of the operatives wonderful. Steel plate engraving is so generally understood that we need enter into no special description of how it is done; but we simply note the fact that it is the reverse of wood engraving, that is to say, the lines which take the ink are cut into the plate instead of being raised above its surface. The engraver is limited to such parts of the work as can be done by hand; other portions, such as the scrolls and elaborate tracery, are necessarily done entirely by machinery. The principal apparatus used is a complicated piece of mechanism, which we have not space to describe in detail, but which, in brief, actuates a plate to which the steel for the die is attached and caused to press against a diamond point. Perfectly true and delicate lines are thus cut into the metal, making figures technically termed "cycloid rosettes." The machine, in theory, somewhat resembles a kaleidoscope, as it requires to be set by accurate pointers and dials to some special figure, which, when the combination is changed, can never be reproduced. One of these instruments is in use, and its work, together with that of the geometrical lathes, can be readily recognized on the national currency.

The die being now complete, it is ready for the transfer process. Postage stamps, for instance, are made in sheets of two hundred, so that the die must be transferred that number of times on a single plate. It is first case hardened and then put, face up, in a press which is made with a combination of levers actuated by the foot, so as to give the tremendous pressure of twenty-one tuns on a single line. A cylinder or "roll" of soft steel is, by careful gaging, placed so as to rest directly over the face of the die, and, at the same time, is so arranged as to revolve easily along its surface even when under the full weight. The pressure is then applied, with the result of forcing the soft steel of the roll into the lines of the engraving, so that when complete, the periphery of the cylinder shows an exact reproduction of the face of the die, only the lines sunk on the latter are now raised on the former. Next, this cylinder is case hardened. Then the plate—soft steel again—to be used for the final printing is placed in the above mentioned press and the roll arranged above it. Now, the cylinder leaves its impression on the plate, the hard steel of the raised lines cutting deep into the surface, so that a precise duplicate of the original die is obtained. This is repeated for as many times as there are to be repetitions of the stamp or note on the single plate, which is then ready for use. Here we leave it and turn our attention to another part of the manufacture.

The ink for printing is also made on the spot. In a large room are ten or a dozen paint mills, which are busily grinding the colors and oil together. Two large ones are filled with green ink, suggestive of liquid greenbacks, another, with vermilion, while others are making blue, red, and other tinted inks. Nothing but the finest color and the best boiled linseed oil is here used. We now pass to the paper room, where the paper is received directly from the Government, cut in sheets of the required form. The fractional currency and larger notes are made of a peculiar material containing colored fibers, manufactured at Glen Mills, near Philadelphia. The paper for postage stamps is made by the Bank Note Company, of the best linen. It is of short fiber, very fine, and extremely strong. The sheets on which currency is to be printed are counted as soon as received, and the result telegraphed to Washington for verification. Some idea of the accuracy required may be gathered from the fact that, for every sheet unaccounted for, the company has to pay in cash the full value of what *might* have been printed on it; that is to say, if a sheet intended for four $1,000 notes is missing, $4,000 must be returned. The paper varies in size according to the purpose for which it is designed. Thus the sheet for 10 cent fractional currency is 7¾ by 16¾ inches, and so on up for the larger denominations. All the paper is not received perfectly blank, for the reason that the National Company prints but one side of each bill. The material for the 15 cent and 25 cent notes is supplied with the backs already finished—the work being done by the American Bank Note Company; while, *vice versâ*, the 10 cent bills are sent to the last mentioned corporation from the National Company in a similar condition. The sheets being counted are placed in heaps, marked off in sets of 100 and 1,000. When issued for printing, the workman receiving them has to present an order signed by the superintendent. They are then charged against him in his pass book, when he carries them away to be damped, this being done by simply wrapping them in wet cloths.

Leaving the paper room, we enter a large apartment, in the center of which are 116 presses arranged closely together. These are simply cylinders moved by long handled levers, and are each attended by three men and a girl. Here we find our plate again, now resting upon a small iron box warmed underneath by gas flames. A workman rapidly covers it with ink with a plate printer's roller and passes it to another operative at his side, who wipes the plate over with a soft cotton cloth, and then polishes with the palm of his hand covered with whiting, thus removing the ink from its surface but not from the engraved lines, which remain filled. This done, the plate is placed, face up, in the press. The girl stands ready with a sheet of damped paper which she carefully lays upon the plate. The pressman turns the levers, the cylinder revolves, the plate passes under it, and the paper is removed bearing a perfect impression. It might be naturally imagined that the workmen engaged in this portion of the manufacture would often succumb to the temptation of furtively running a sheet of ordinary paper through the press, and thus possessing themselves of, say, 200 ninety cent stamps in a moment's time. But such a proceeding is practically impossible. Apart from the constant vigilance of the superintendents, the presses are placed so close together that the men can overlook each other's every action. One of the strongest safeguards is the *esprit de corps* among the workmen themselves. So sensitive are they that they recently insisted upon the discharge of one of their number who, merely to try his press, ran a sheet of common brown paper through it.

As soon as a printer has completed the work assigned to him, he hands it, made up in "books" of 100 impressions, each sheet inclosed between two others of brown paper, to a clerk. He is then credited with his delivery, spoiled sheets being counted the same as perfect ones, so that if his return is correct his debit account on his passbook, which is kept in a totally different apartment and by other employees, is thus balanced. The finished impressions are now carefully counted and inspected. The spoiled ones are removed and sent to Government agents to be burnt, while the others are hung in the drying room. This apartment is heated by steam pipes, and the paper is suspended by wires, for a day or two, until perfectly dry. Then the brown paper is removed and the sheets, packed between leaves of press board, are subjected to the action of a powerful hydraulic press. They are then once more inspected and counted.

SCIENTIFIC AND PRACTICAL INFORMATION.

An esteemed correspondent, Mr. R. B. Forbes, of Boston, Mass., informs us that Mr. Herman Hirsch, whose screw propeller is used on the vessels of the Transatlantic Steamship Company, plying between New York and Havre (France), and has also been adopted by the British Admiralty, has recently discovered the form of least resistance in vessels. Almost every ship that has been built hitherto has been an attempt to solve the problem, and it has seemed that only by trying every possible form could it be ascertained which is the best. Mr. Hirsch is confident that he has succeeded by a scientific process in determining the theoretically perfect lines for a ship, and he will soon lay his plans before shipbuilders and owners. The scientific world will look with interest for the development of the system, especially as it comes from an inventor already successful and renowned.

HOW TO PRESERVE VINEGAR.

Our correspondent "Expert" writes as follows: "This article being the product of three well known chemical fermentative processes, known as the vinous or spirituous, acetous, and putrefactive: into each of which dilute saccharine or starchy solutions pass with great rapidity, under favorable circumstances, it is not exactly correct to attribute the latter process to the "mother" which is formed on good vinegar exposed to the air.

Vinegar makers should never keep their product in open vats or tanks. It ought to be passed from one generator to another till it is strong enough for a fluid ounce to saturate from 33 to 35 grains of crystalized bicarbonate of potassa, when it ought immediately to be run into casks or barrels, in the warm vinegar house kept at a temperature of 85° to 90°; and after filling the casks up to the bung, it should be sealed up tight and covered with a tin cap.

To prevent vinegar from running into the putrefactive fermentation, it is commercial usage to add one ounce of sulphuric acid to 100 gallons. This should not be added until the article possesses the required acetous strength, and is intended to destroy any putrefactive spores which may be present. British standard vinegar is said to have one part of dilute sulphuric acid in every 1,000 parts of vinegar, and this proportion is not regarded as an adulteration or injury in any way.

In general, the presence of mother in the vinegar is not considered objectionable. On the contrary, in domestic use its formation is promoted by using sheets of brown paper, etc. It is the "vinegar plant," about which so much was said, a few years ago, in the papers. Depending, for its existence, on the presence of oxygen, nothing is easier than to prevent its formation by carefully excluding the air.

The presence of mucilaginous matter so affects the specific gravity of the article that no test, by any scale, will prove or show its strength. The only proper method is occasionally to saturate a portion with potassa, using litmus paper to ascertain the degree of saturation."

A FISH SAVINGS' BANK.

There is, in Siberia, a district where the chief wealth and means of subsistence of the people consist of dried salmon; and to obviate the evils arising from an occasional dearth of food, the Russian government has established a savings' bank, with a capital of 300,000 fish. In this institution, every male inhabitant is compelled to deposit one tenth of all the fish he catches so long as the takes are up to the average; but if the yield fails, the contributors are entitled to withdraw their deposits.

ALL three of the Atlantic telegraph cables are now in perfect working order. We hope that the icebergs will not trouble them this winter.

Explosions in Flour Mills.

Most of our readers, no doubt, will remember the destruction by fire of a large flour mill near Glasgow on the 9th of July last. The fire was caused by an explosion which originated in the exhaust and, traveling through the various conduits of the mill like fire damp in a mine, set fire to the woodwork. The occurrence caused some sensation at the time, not because explosions of the kind were previously unknown—for the high rates of insurance help to show that this was not the case—but because in this instance the attention of the comparatively uninformed public was attracted by the unusual gravity of the accident. A searching investigation into the circumstances which probably led to the explosion at the Tradeston Flour Mills has been made on behalf of the fire insurance offices by Professor Macquorn Rankine and Dr. Stevenson Macadam. We understand that, after having examined witnesses and documents relating to the history of fires and explosions of a like nature, they have reported that the primary cause of the explosion was the accidental stoppage of the feed of one of the pair of stones, which led to their becoming heated and striking fire. The fire thus generated inflamed the finely divided dust which was diffused through the air in the exhaust conduits and then passed on to the exhaust box. This sudden ignition or flashing of the extremely inflammable dust diffused through the air would produce a very high temperature in the gaseous products of the combustion, and this would necessarily be accompanied by a great and sudden increase in pressure and bulk, constituting in fact an explosion. The first effect of this explosion would be to burst the exhaust box and allow the diffusion of dust and flame throughout the mill. A second explosion was the consequence, and the mill was reduced to ruins and the woodwork fired. They further believe that the stores or granaries were set on fire partly by the flame and fire from the mill traveling along the gang ways, and partly from the fall of burning materials through the skylights. No explosive or other foreign material was used in the manufacture of the flour, and the steam boilers were found uninjured. No blame has been traced to the proprietors of the mill, or to anyone in their employment.

Direct experiments were instituted by Professor Rankine and Dr. Macadam with the view to ascertaining the inflammability and explosiveness of this mixture of air and dust. They have also calculated that, when the theoretical proportions best suited to produce an explosion are exactly realized, the pressure of the resulting gaseous products, if confined in a limited space, suddenly becomes equal to about eight times that of the atmosphere. It is probable that, in this instance, these theoretical conditions may not have been exactly reached, but still it is certain that a very great destructive pressure was produced. Now the question naturally arises, what precautions should be taken to guard against such accidents in future, or at all events to mitigate their destructive effects. The problem does not seem a very difficult one. The danger does not lie in the grinding process proper, but in the plans for storing up the dangerous flour dust. So long as the grinding operations are carried on in the simple manner pursued in small mills, where the stones are merely boarded in and where there is no exhaust, there can only be a limited amount of dust to inflame. But it is otherwise when the exhaust is employed and the fine dust is drawn up into an exhaust box. There the flame drawn up from the stones must inevitably lead to a more serious explosion, and where many pairs of stones are connected with the same exhaust the danger is enormously increased. It is accordingly recommended that all receptacles in which the dust is collected shall be lightly constructed and placed outside the buildings, in order that any explosion which might occur in them should free itself at once and not be induced to travel back into the mill. The word "receptacle" is understood to include exhaust boxes, stive rooms, smut rooms, and exhaust fans. The report also contains a suggestion that the well known principle of extinguishing a flame by causing it to pass a large cooling surface might be adopted, that in fact the dust should be made to pass through a number of metal tubes instead of through the exhaust trunk. It is, however, pointed out that cold surfaces are also apt to cause a condensation upon them of moisture in the air, and consequently the tube system would perhaps be open to the disadvantage of being liable to become clogged by pasty depositions. Naked lights should not be used in a dusty atmosphere, and all gas jets should be protected with gauze. Finally, as the emission of highly heated particles from the stones is rendered more probable by the entry of nails and pieces of iron with the grain, it is strongly advised that the use of magnets to collect these metallic intruders should be made universal.

It appears that these accidents are of very frequent occurrence, and their number has increased since the introduction of the exhaust. The fact, however, appears to be little known to the general public, and though mentioned in French and German treatises on flour mills, does not, as far as we can ascertain, appear in the standard English works on the subject.—*Engineer.*

Work on the New York City Docks.

We recently gave a full page illustration of the proposed new piers and bulkheads in the city of New York. The present state of the work is that the preparation of the foundations for the new stone piers along the North and East Rivers is being rapidly pushed forward, and at Pier No. 1, on the North River, the stone is already being laid. When it was first determined to replace the old wooden piles with pillars of "enduring granite," it was also deemed advisable to ascertain the depth at which a permanent rock foundation existed, and, under the supervision of General McClellan, a drilling machine, similar to that used in oil boring, was set to work among the upper piers of the North River, the mode of operation being the driving of a six inch iron tube through the strata at the river bottom until a permanent foundation was reached. The boring was begun at the foot of Fifty-seventh street, and continued along the bulkhead line about every 300 yards to Whitehall and along the East River, the distance between the borings being here decreased to 200 yards. The progress of the work has developed many interesting facts concerning the strata of the river bed, which, in most cases, has been found to consist of gravel and petrified wood nearest the surface, then gray sand, coarse gravel, bright red clay, and great quantities of minute sea shells, boulders of two feet in thickness being often met with above the desired mica slate rock, which is found at depths varying from 60 to 200 feet below high water. At the foot of Thirteenth street, the mica was not reached until the tube had sunk 206 feet. In many instances, quicksands have been reached beneath what had been originally supposed to be safe foundation. While penetrating the strata at the foot of Canal street, the old beach level was struck at a depth of 56 feet, and the tube passed through the trunk of a tree which, from the specimen obtained, seemed to be in a good state of preservation, the bark being yet perfect. At Third street, a stream of clear, fresh water was struck, the fluid bubbling up through the tube at the rate of 50 gallons per minute; and another boring in the vicinity revealed another spring, equally fresh and sending out 30 gallons to the minute. The depth of the foundations of mica rock being determined, iron shod piles are driven down and their tops sawn off near the surface, so as to form a resting place for the granite blocks. The pillars—three to each pier—will be unusually massive in construction and lozenge-shaped so as to offer no resistance to the tide. A frame work of iron will be rested on these supports, the whole being covered with a flooring of wood, similar to that in use on the old piers.

Decisions by the Commissioner of Patents.

APPEAL FROM THE BOARD OF EXAMINERS IN CHIEF—DIES FOR FORMING WRENCH HEADS.

L. Chapman vs. Candee and Taylor. Interference.

LEGGETT, *Commissioner:*

Priority of invention may be established by showing either that an applicant was the first to conceive the idea of an invention and the mode of putting it into practice, and used reasonable diligence in adapting and perfecting it, or that he was the first to actually perfect and reduce the invention to practice.

Where an applicant has actually completed an invention, but has not tested its utility for want of machinery to operate it, while procuring such machinery he is to be considered as exercising due diligence in adapting and perfecting his invention.

If the date of filing an application be relied upon as proof of date of invention, it must also be relied upon as proving the invention belonging to the applicant, and this may be disproved by testimony introduced in rebuttal.

Application of Geo. H. Sellers for patent for Rolled Hollow Hexagonal Column.

In determining the patentability of an article the process by which it is made is immaterial; the article is to be considered independently of the process and upon its own merits as to novelty.

An "article of manufacture" is a device complete in itself for some special use, and not to be applied to general purposes, like pipes or tubes.

LEGGETT, *Commissioner:*

This appeal is upon the application as rejected by the Board.

The claim is as follows:

As a new article of manufacture, a hollow column of uniform thickness, hexagonal on both its interior and exterior, and rolled out from a solid or welded pile or billet of iron or steel with a hexagonal opening through it, substantially as described and represented.

It appears, from the wording of this claim and from applicant's argument, that he understands that the fact that his tube is rolled out materially aids to confer upon it patentable novelty. In this he is entirely in error. The process by which an article is constructed is a matter altogether distinct from the article itself, so far as the question of the patentability of the article is concerned. The process may be patentable and the article not, and *vice versâ*, or both may be patentable. But each must be regarded independent of the other, and upon its own merits as to its novelty. The fact that applicant's "column" is produced by rolling may then be left out of consideration altogether. The question is: Is applicant's hexagonal "column," or tube, new, without regard to his process of making it? I regard it as fairly anticipated by the English patents cited, Nos. 9 of 1854, and 102 of 1862. The former is circular within, but that is an immaterial matter. The form of the space within the interior of a hollow tube can be and is commonly made in all machine shops where such articles are produced, of any shape desired, whether circular, triangular, octagonal, hexagonal, or square, and a pipe of one form of interior might as well be claimed as another because made by a particular process. Besides, a pipe, tube, or "column," of whatever form or by whatever process constructed, is not an article of manufacture in contemplation of the patent law. An article of manufacture is a device complete in itself, for some special use, and not to be applied to general purposes like pipes or tubes. This point has been heretofore fully discussed. (See Commissioner's Decisions, 1869, p. 74, C. H. Ackerson; and 1870, p. 59, W. R. Blanchard; and p. 123, L. E. Truesdell.) Nor does the fact that applicant employs the word "column" in his claim aid him at all. He does not produce and has not shown a column in any other sense than that a tube or pipe may be regarded as a column. The Examiner's strictures upon the application of this term to this mere hexagonal tube were entirely proper. A column, in a technical sense as known to mechanics, is a very different thing, and he was quite right in refusing to be blinded to the nature of the device before him because it was—whether for the purpose of misleading him, or not—called by a wrong name.

Again—granting that the exact form of applicant's tube is not shown by the references—the mere change of form of a tube, or the mere production of a tube of a particular shape externally and internally, does not constitute invention. In a broad sense, such as is contemplated by the legal requisites of novelty to distinguish a patentable device, there is no advantage in this particular form of tube to give it the importance of invention. It is not stronger, or better, or cheaper of production than a round tube except merely in form; and in whatever particular situations tubes hexagonal in form may be desired, mechanics readily make them. Applicant's invention is not in his "column," but, if anywhere, in his process, or machine, or perhaps in both. To grant him a patent covering hexagonal tubes would be a violation of the letter and spirit of the law.

The decision of the Board of Examiners-in-Chief is affirmed.

Application of Henry Waterman for extension of Patent No. 21,286, and reissued No. 1,874, for Tempering Wire.

LEGGETT, *Commissioner:*

The claim is as follows:

The process, substantially, such as herein described, of hardening steel wire, or other thin steel, of any desired length, which process consists in drawing the wire continually, while under tension, through the heating medium, and thence through the hardening liquid.

The process previously employed was to wind the wire in a flat coil, in the form of a volute, tie it with small wire, and, after heating to the proper degree, to plunge it into the hardening liquid. This process limited the length of the wire to be hardened, did not always harden it equally, and sometimes caused it to "crinkle." Applicant's process cured all these defects, and at the same time greatly reduced the expense of hardening, according to the evidence, to at least one fourth the former cost. Besides, it produced a wire capable of many uses to which wire, as before prepared, was not adapted, thus presenting every element of a meritorious invention. Through applicant's efforts, which are shown to have been reasonably diligent, it soon went into extensive if not exclusive use, and has earned him, at a moderate charge for royalty, the net sum of $65,916.76. The Examiner reports the invention to have been novel when patented, and the testimony, of witnesses familiar with it and the business connected with it, with regard to its value and importance to the public amply shows, by estimates from reasonable data, that probably not less than a million dollars have actually been saved and gained for the public by it. Although no testimony has been filed in opposition to the grant of the extension, counsel appeared at the hearing and cited the English patent of Wm. Smith, No. 1,614 of 1855, in bar. I do not regard this patent as in any measure covering applicant's invention. It is for a materially different process of treating wire, for an altogether different purpose, namely, to soften and not to harden it, so that it may be afterward drawn. But whether it covers the invention under consideration or not is immaterial, because applicant establishes his date of invention as prior to the date of the English patent. This patent was sealed January 15, 1856, and it is proved that applicant completed his invention in 1855.

The only question as to the propriety of granting this extension is as to whether the applicant has not already been adequately remunerated. $65,000 is a large reward, but there is no definite standard of adequacy. Considering the important character of the invention, the advance it made in the art to which it appertains, the diligence of the inventor in introducing it, and its great saving to the public, I am constrained to grant the extension.

Decisions of the Courts.---United States Circuit Court, District of Massachusetts.

BROWN *vs.* WHITTEMORE *et al.*

This was a suit in equity, brought by Alzirus Brown, a territorial assignee, against Jonathan R. Whittemore, John R. Whittemore, Benjamin Belcher, and John W. Belcher, in the district of Massachusetts, for an alleged infringement of letters patent for an improvement in hay rakes, granted to George Whitcomb October 5, 1858, and reissued in two divisions June 16, 1868.

The case came on for final hearing before Justices Clifford and Lowell.

Verdict for complainant.

What is a Bustle?

"The bustle referred to is substantially a hoop-skirt of a diminished size." This is the definition of Judge Blatchford, as given in the recent trial, Young *vs.* Lippman, United States Circuit Court, Southern District of New York.

This was a suit in equity, brought by Alexander R. Young against Philip Lippman and Clara Seligman for the alleged infringement of letters patent for an improvement in springs for hoop-skirts, granted to Thomas B. De Forest and Thomas S. Gilbert, February 18, 1868, the infringement complained of consisting in the manufacture and sale of the article of wearing apparel known as a bustle.

The case came up before Judge Blatchford on a motion for a provisional injunction.

The claim is in these words: A skirt-hoop, formed by inclosing one or more wires within a covering, which not only envelopes and protects the wire, but forms an edge, A, or connection, B, substantially as and for the purposes specified.

The allegation of infringement in the bill is that the defendants are making and selling springs for hoop-skirts precisely the same as those described in the plaintiff's patent. The evidence of infringement is that the defendants have sold an article of dress called a bustle, containing hoop-skirt wire made substantially in the manner described in the patent, and that the defendant Lippman has been vending such hoop-skirt wire.

The making and selling of the bustle are not denied, and a specimen is produced which contains wire hoops made in the manner described in the patent. Each hoop in it is a skirt-hoop formed by inclosing two wires within a covering which not only envelopes and protects the wires but forms a connection between them, substantially as and for the purposes set forth in the specification of the plaintiff's patent.

There can be no doubt that the claim of the patent is for such a skirt-hoop as is described, as an article of manufacture, a skirt-hoop capable of use in making what is known as a hoop skirt. The bustle referred to is substantially a hoop-skirt of a diminished size.

Injunction granted.

E. N. Dickerson, for complainant. J. B. Staples, for defendant.

COAL is now being imported into England from Belgium. It can be shipped from Ghent and delivered at Grimsby for nearly one dollar a tun less than the current prices in England. This is due to the recent advance in the price of English coals, which, it is believed, cannot be much longer maintained.

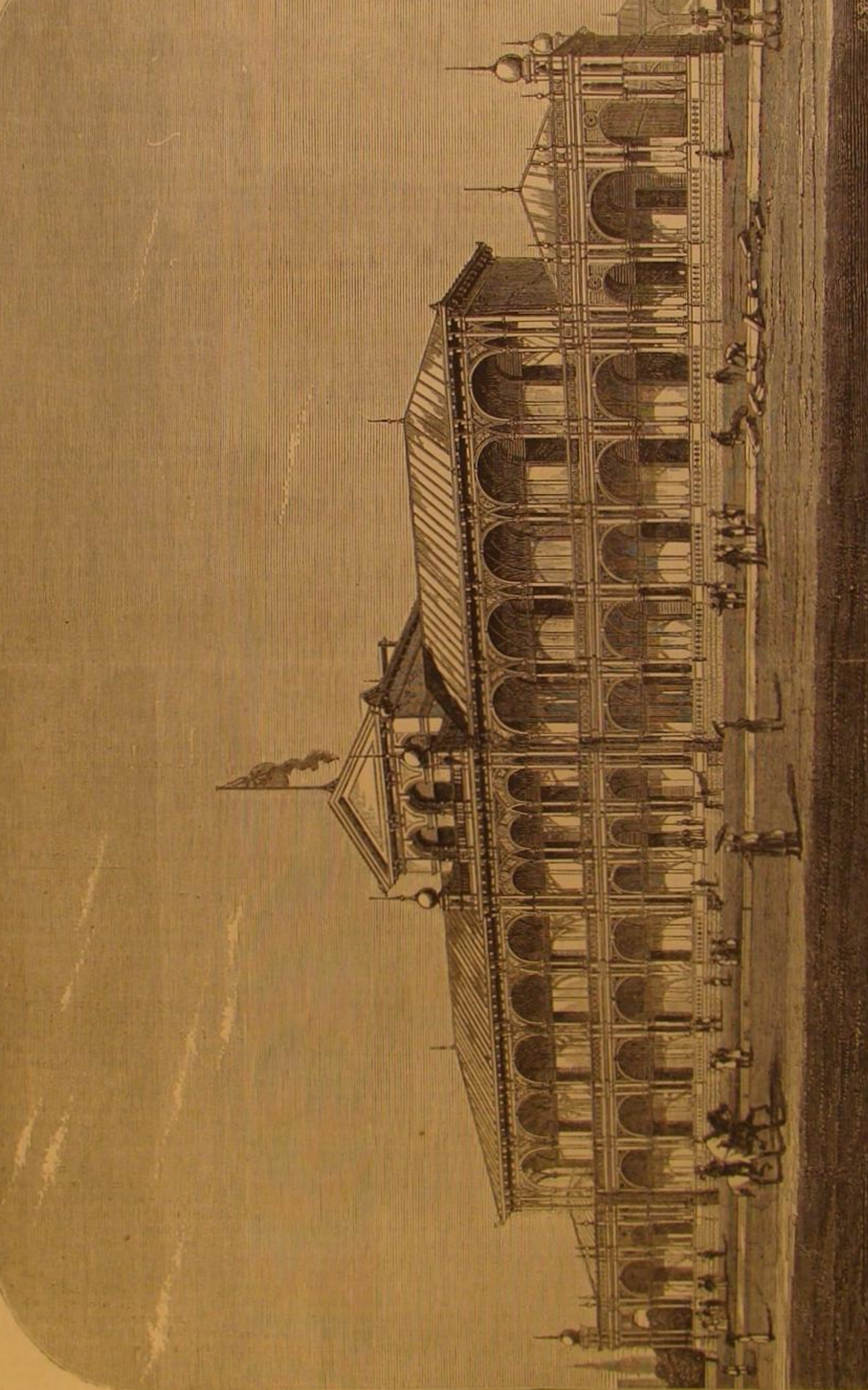
SAILORS' HOME, BOMBAY, INDIA.

On the occasion of a visit of the Duke of Edinburgh to Bombay, it was determined to commemorate the event by the erection of some permanent work of public utility; and the happy idea was suggested that nothing would so appropriately celebrate the visit of the Sailor Prince as the foundation of a new Sailor's Home, plans of which had already been prepared, the existing building having been found entirely inadequate to meet the constantly increasing requirements of the port. The foundation stone was accordingly laid by his Royal Highness, in the presence of Sir Seymour Fitzgerald, the Governor of Bombay, and a large concourse of natives and foreigners of distinction.

Eager to satisfy their appreciation of so auspicious an event as the visit of a royal prince of England, some of the native princes subscribed largely to the funds; the Guicowar of Baroda alone contributed the munificent sum of twenty thousand pounds.

We give a general view of the proposed new Sailors' Home, as designed for the site originally given by Government, which possesses a frontage towards the sea of 300 feet, with a western aspect. The central block and south wing comprise complete accommodation for 126 seamen: the north wing is devoted entirely to officers' quarters; and the master's residence is placed in the attic story, in the center of the building. The kitchen department is placed in the northeast; and the lavatories and earth closets for seamen in the southeast angle of the site, communicating respectively with the main building by means of covered corridors. Wide verandahs encircle the whole edifice to the west and south, and smaller ones at the back. These it is proposed to construct entirely of iron, which would be made in England and sent to Bombay, ready to fix. The floors throughout are to be constructed with rolled iron joists and cement concrete. The windows are, in all cases, to have double casements, the one glazed and the other Venetian. The roofs are designed to be constructed throughout of iron, covered with Italian zinc, laid on solid boarding; and special precautions have been taken to secure thorough ventilation, and to provide against discomfort (particularly in the dormitories, which occupy the whole of the upper story) from the great heat of the climate. It should be stated that the plans have been so arranged that, by the addition of either one or two stories to the north and south wings, the amount of accommodation might easily be doubled.

Mr. J. Macvicar Anderson, of London, England, is the architect.



SAILORS' HOME, BOMBAY, INDIA.

Mechanical Pigeons.

Pigeon shooting from the traps has of late years become one of the standard sports with lovers of the trigger, and the announcement that a shoot is to take place is sure to call together a crowd. While many attend to witness the trials of speed, many others equally enthusiastic over fine shooting remain away on the ground of cruelty, deeming such shoots a wanton destruction of poor harmless birds. Many devices have from time to time been originated looking to the furnishing of something to take the place of live birds. While some have failed entirely and others being unreliable in their workings, our sportsmen have generally given all the go by and had recourse to the live birds. Though Yankee ingenuity is equal to almost anything, it has been the lot of England to produce a device which in its workings seems to be the desideratum desired, a specimen of which we were shown on Saturday by a gentleman of this city, who recently sent to England and obtained it. The invention consists of a neat brass locomotive whistle shaped trap, fixed by a ground fork to the earth, which, by spring action, gives flight to a steel-winged bird, the motion of which through the air is wonderfully natural and bird-like. The "Gyro" bird flies distances ranging from thirty to one hundred yards. The "Gyro," in its flight, exhibits innumerable vagaries, going off with the steady flight of a pigeon, resting on the wing like a hawk, or darting swiftly forward in a straight line like a snipe, thus affording the very best practice for the education of the hand and eye of the shooter. It can be despatched by means of a ball and socket joint to the trap, in any desired direction, and it is asserted it is far more difficult to hit the "Gyro" than a live bird.—*Syracuse* [*N. Y.*] *Journal.*

The mechanical description above given is rather mixed. The *Journal* will have to try it again.

Telegraphic Items.

The new Society of Tel graph Engineers, in England, have commenced the publication of a journal, in which the progress of telegraphy as a science and as an art will be duly recorded. The first number contains a paper on "Automatic Telegraphs," by Mr. R. S. Culley, who thinks that, without the automatic apparatus, it would be impossible to supply the information required by newspapers all over the kingdom. "From the central station in London as many as 400,000 words are transmitted in a single night, and through five or six stations simultaneously, whereby it happens that the quantity of matter telegraphed is equal to a thousand columns of the London *Times*. All this is accomplished while one half of the world are asleep. The rate of transmission varies: To Aberdeen, it is 60 words a minute; to Sunderland, 90; while to Manchester, Liverpool, and Cardiff, it is 120. The messages are punched in strips or ribbons of paper, and these can be multiplied to any extent when pressure of newspaper work requires. The punching of the strips is greatly facilitated by the use of a pneumatic apparatus, in which the levers are struck by pistons actuated by compressed air. Three keys, like those of a pianoforte, open the valves, and the touch is so light that three or four ribbons can be perforated at the rate of forty words a minute, by a female clerk."

It would appear from the foregoing that our English telegraphers have not yet acquired the art of sending telegraph messages in the quickest and most economical manner, and they have something yet to learn. The aggregate number of words transmitted at the central office of the Western Union Telegraph Company, in this city, exceeds that of the London central station, but no "punched strip" or automatic machines are employed in the New York office. Experience shows that the interposition of the punched strip, the punching machine, and the girl to do the punching, are an unnecessary complication in the sending of a telegraph message. First class operators can send messages more economically and quickly by the usual instruments than is possible by the above "automatic" plan. The rates of speed mentioned above, we believe, are equaled, if not exceeded, at the Western Union Telegraph office here.

In the working of the telegraph, some curious facts have been observed. A message sent through land lines and an under-sea cable travels quicker to the place which has the long land line than to the shorter. From Amsterdam to London, a signal is transmitted at greater speed than in the reverse direction; the reason being, that on the English side there is a wire of 130 miles, then a cable of 120, and on the Dutch side a wire of 20 miles. This difference, however, can be rectified by a scientific contrivance.

Another fact arrived at by observation is that, on wires stretched east and west, the speed is decreased every day about noon. The cause, we are informed, is not clearly understood; but it is supposed to be due to the diurnal variation in earth currents.

WIRE ROPE TOWAGE ON THE DANUBE.

We have, in other numbers of the SCIENTIFIC AMERICAN, described the Belgian plan of towing canal boats by a wire rope submerged in the canal, and have also described the same plan as now used on a portion of the Erie canal in this State. The fact that the system is now being extended on the Erie canal will lend additional interest to the following description of the performances of a new boat now used on the Danube, for which, with the engraving, we are indebted to *Engineering*.

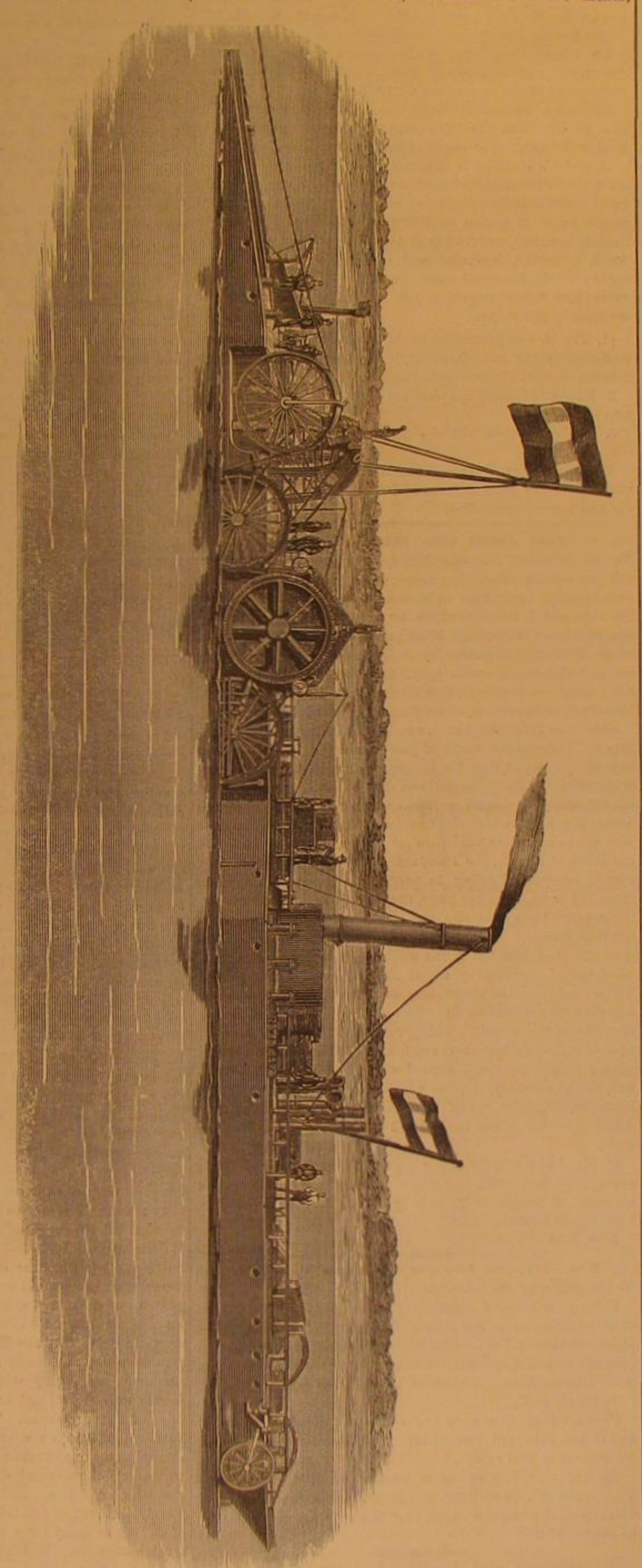
The Nyitha, shown in our engraving, is a flat bottomed iron vessel of 138 feet length, beam, 24½ feet, and depth of hold, 7½ feet. It is provided with two false keels, and has a large rudder at the bow as well as at the stern, each rudder being separately governed by a wheel placed near the center of the boat.

As on most rivers with rapid currents, it is intended to use the wire rope on the Danube only for towing up stream. The tug is therefore provided with twin screws of 4 feet 2 inches diameter, worked by two separate vertical engines, placed near the bow and supplied with steam by the same boilers, which also work the clip-drum machinery.

The diameter of the clip drum is 10 feet 6 inches. One revolution of the engine corresponds to an advance of the boat by slow speed gear of 4 1 feet, by quick speed gear of 7 5 feet.

The clip drum is keyed to the outside end of the main shaft; it therefore overhangs the larboard side of the boat, its horizontal center line being about 1 foot above deck. The clips are set to work a 1¼ inch wire rope. Two press pulleys can be made to touch the rope, somewhat above the horizontal center line, of which the hind one at least is required to give to the last clips of the drum the necessary initial bite, whenever the back rope gets unusually slack.

WIRE ROPE TOWAGE ON THE DANUBE.



For the purpose of leading the rope from the bottom of the river over the clip drum, and permitting it to sink down again into the water, there are three large guide pulleys employed, each having the same diameter as the clip drum itself, namely, 10 feet 6 inches. The first pulley over which the rope passes runs *loose* on a stud fixed to a wrought iron bracket, which is provided with two nearly vertical steel pivots. These pivots are held in corresponding bearings, firmly connected with the ship's side. Thus the pulley is able to swing about, very much like a door swinging on its hinges, and will place itself readily in the direction indicated by the wire rope. It will be understood now why the deck near the bow of the ship slopes down towards the water, thus permitting the wire rope to pass over it at any angle without hindrance. To allow for the swinging of the pulley towards the ship, a segment had to be cut out of the ship's side, but this segment is entirely above the water line, and therefore of little importance.

The second pulley, which the rope touches along the underside of its periphery, turns on a stud fixed in the side of the vessel. It is so placed that the center line of the pivots of the swinging pulley above described is tangential to both pulleys, so that the rope runs perfectly correct from one pulley to the other, whatever the position of the movable one may be.

From this pulley the rope runs over the clip drum, touching the upper half of its periphery, after which it passes over to the third and last guide sheave. This again is a swinging pulley, with perfectly vertical pivots, its bottom edge reaching below the keels of the vessel. Thus the back rope is allowed to fall to the ground at any angle it may assume towards the center line of the ship. Here also a segment had to be taken out of the regular side of the vessel, to permit the pulley to swing inwards if required.

Throughout its passage through the pulleys, the rope is everywhere carefully guarded against getting out of the grooves when slack. These guards had to be so arranged that they can readily be removed and replaced whenever the rope has to be taken off or put on again.

The total displacement of the boat, when ready for service, amounts to about 200 tuns; the draft is 3 feet 9 inches, the immersed midsection 74 square feet. Besides the machinery weighing 42 tuns, boilers weighing 32 tuns, and coal bunkers holding 10 tuns, it contains nothing but the usual accommodations for captain, engineers, and crew, and the necessary fittings and contrivances for attaching barges, etc.

A variety of experiments have been made with this vessel, and among them a train of eight loaded barges was towed with the following results, assuming an engine which burns three pounds of coal per indicated horse power, the steam gages indicating a pressure of from 66 to 75 lbs., and the permissible boiler pressure being 80 lbs.:

Total displacement	2,753	tuns
Useful load in eight barges	2,023	"
Total immersed midsection	784	sq. ft.
Length of course	13·3	miles
Time of running	4 h. 34 m.	
Speed against land	2·91	miles
Speed of current	2·83	"
Speed against current	5·74	"
Indicated horse power	107	
Real horse power, in wire rope	80	
Strain in rope	10,312	lbs
" per tun displacement	4	"
" " square foot of cross section	13·1	"
Total coal consumed	1,467	"
Coal consumed per mile	110	"
" " " " and tun of displacement	0·037	"
Coal consumed per mile and tun of useful load	0·054	"

The above results would be greatly modified, when the system is applied to canal navigation proper. In this case there would generally be no current against the boats, and the speed of the train would, under any ordinary circumstances, scarcely be permitted to exceed *four* miles an hour; in fact, three miles an hour would be considerably in excess of the average speed at present practicable on ordinary canals.

For such a speed, a train of three boats would produce a strain in the rope of about

$$\frac{3^2}{7{\cdot}728^2} \times 7485 = 1127 \text{ lbs.}$$

The speed being three miles per hour, or 264 feet per minute, we would require $\frac{1127\ 264}{33000} = 9{\cdot}016$ horse power, corresponding to 12 indicated horse power.

The useful load moved would be 752 tuns, and as the engine in the tug could easily give off, as shown by the trials, 11 times the power thus required, it could move at the given rate 11×752 or 8272 tuns, equivalent to forty-one 200 tun boats. Of course it would, for practical reasons, be out of the question to employ such enormous trains. Smaller engines and tugs would be employed instead. A tug, for instance, with an engine giving off 27 to 30 indicated horse power (equivalent to a nominal 10 horse power engine) would tow 3×752 tuns $= 2256$ tuns of useful load in, say, eleven 200 tun boats at the rate of three miles an hour. The coal consumed for this smaller class of engine may be assumed to be four pounds per indicated horse power per hour. Thus the whole coal consumption of the engine per hour would be $4 \times 27 = 108$ pounds, or per mile, 36 pounds, and per mile and tun moved, $\frac{36}{2256} = 0{\cdot}016$ lb.

This figure will, no doubt, be modified by the proportion of the cross section of the canal and the boats, which, as a rule, is much more favorable on open rivers. On the other side the tug employed will have a comparatively smaller immersed midsection and total displacement, and will, therefore, require less power to move itself than the larger river tug on which the above calculations are based.

AMERICAN genius stands preëminent in the perfection of mechanical appliances to supersede manual work. Perfect invention to this end is, indeed, the offspring of necessity in the United States, where scarcity of hand labor has forced forward, to an almost inconceivable degree, human ingenuity. In this special branch of invention, there can be no dispute that the Yankee can give the world long odds and beat him. In England, where labor has been always abundant, and until of late, cheap, the genius of invention has trodden rather the higher than the humbler path, has tended rather to achieve great ends than to effect simple purposes, has given mechanical handicraft less attention and devoted itself to great physical revolutions. In America, it is far different; there is scarcely an industry too humble, a labor too mechanical or common to escape the attention of the inventor, who, with an almost infinite ingenuity, sets himself to work to combine all the known mechanical movements and to invent new ones, until the sleight of the hand of the operator is imitated to the life, and the dead metal is endued with life and power with which flesh and blood cannot compete.—*Engineering*.

THE mixing iron scraps, filings, or drilling chips from machine shops, in the soil about the roots of pear trees, is becoming general with some of our best fruit growers. The health and productiveness of the trees are greatly promoted thereby. Pieces of iron hoop, old scythes, and other useless bits of iron have long been used by the most successful growers.

TO convert French currency, stated in francs, into U. S. currency, divide the number of francs by 5. To convert English currency, stated in pounds, multiply the number of pounds by 5. The above methods, although not exact, will be found approximately correct. Thus 10,000,000 of francs equals about $2,000,000, and £2,000,000 equals about $10,000,000.

THE St. Louis *Republican* states that a prominent citizen Mr. George Osgood, died recently at New Salem, Mo., from lead poisoning, occasioned by the use of water drawn through a new lead pipe about two years ago. This poison first showed itself at the tips of the fingers, gradually working into his arms and neck, thence into his heart, resulting in his death.

AN industrial exposition is announced in Brooklyn, N. Y., to open on September 30 and close on October 22. With a population of 500,000, and numerous and important manufactures, Brooklyn ought to support an annual fair of this kind

Correspondence.

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

Force of Falling Bodies.

To the Editor of the Scientific American:

A close examination of the supposed contradiction between Dr. Vander Weyde and a former correspondent, Mr. Nystrom (pages 164 and 131), on the subject of the force of falling bodies will show that both agree as far as the principle is concerned, and that their only distinction lies in their choice of words.

Mr. John W. Nystrom gives formulæ based on the principle that the force, F, of the weight, W, falling through the distance, h, is: $F = W \times h$, and that this force is used up in driving the nail through the distance, d. His opponent says that the force ought to be measured by the *vis viva*, expressed in the formula $v^2 \times m$. A slight transformation of the first formula will show, however, that there prevails no contradiction whatsoever. If a body falls through the hight, h, its velocity is expressed by $v =$ the square root of $2gh$ or $v^2 = 2gh$ where g means the acceleration by gravitation. Instead of h in the first formula,

$\frac{v^2}{2g}$ can be substituted. We have then $\frac{W \times v^2}{2g}$,

and as the weight of a body divided by the acceleration of gravitation is the mass, m, of the same, the formula has now the appearance: $F = \frac{1}{2} \times v^2 \times m$, which proves conclusively that Mr. Nystrom measured the force by the *vis viva*, $v^2 \times m$, but used different words, such words as can be better understood by the workman.

Dr. Vander Weyde says further: "Where gravitation increases or decreases, and with it the velocity of the falling body, the force of the blow will increase or decrease as the square of the gravitation, while the weight of the body will only increase or decrease in the simple ratio of the gravitation." The velocity will increase or decrease in the same ratio as the gravitation only if the body is allowed to fall for the same length of time; and as, in order to attain this purpose, the hight of the fall has to be changed in the same ratio as the gravitation, not only the weight, W, but also the hight, h, in Mr. Nystrom's formulæ have to be increased or decreased, and the result will prove to increase or decrease as the square of the gravitation. If, though, Dr. Vander Weyde wishes the hight of the fall to be unaltered, he would be entirely wrong in maintaining his assertion that the velocity of a body (by falling through a given hight) increases as the gravitation does. The known formula $v =$ the square root of $2gh$ shows that the velocity in this case increases only with the square root of the gravitation, because the time of the fall will be no more the same. Therefore the *vis viva*, $v^2 \times m$, in this case, increases only in the simple ratio as the gravitation, and Mr. Nystrom's formulæ do not contradict this.

These formulæ, though, are only correct as long as the resistance, against the falling body during the moment of the blow, is constant, and the distance, d, can be measured. In many cases the blow is taken up by the elasticity of the striking bodies, causing the falling body to rebound, or is used up for change of form or by friction and transformed into heat. In most of these cases the resistance, R, is varying very much during the time of the blow, and the distance, d, cannot be measured, often being very small. Therefore the force of the blow, that is, the pressure between the striking bodies cannot be determined by calculation, and is in many cases much greater than might be expected, especially if the striking bodies are hard and elastic, as is the case in striking an anvil with a hammer.

All the instances given by the latter correspondent have no bearing on the formula, for the door through which the pistol ball has been fired, without apparently being moved, had certainly to stand the pressure which crushed the fibers of the wood, but this pressure lasted too short a time to effect a motion of the whole door. HUGO BILGRAM.

Philadelphia, Pa.

Force of Falling Bodies.

We print the following *literatim:*

To the Editor of the Scientific American:

It is not convenient for me to answer Dr. Vander Weyde's squable on force of falling bodies, which bear evidence of gift of the gab, $v \times m$ and $v^2 \times m$, vis-viva, according to circumstances. JOHN W. NYSTROM.

Philadelphia, Pa.

An Aching Inventor.

To the Editor of the Scientific American:

I am aching to relieve myself of two or three ideas which properly belong to the public, and I take this means of so doing. Among the thousand and one ways of propelling canal boats which have been proposed, I have not seen the following very simple plan, namely: To connect the motive power with two paddle wheels without paddles, said wheels adjustable perpendicularly so that they may rest upon the bottom in from seven to twelve feet water. Let the wheels consist of hub and spokes without felloes or tires, and of sufficient weight to take a good hold on the mud. The only side swells would be those caused by the boat itself, as that caused by the wheels would be almost nothing, and what little mud was stirred up would be an advantage, as serving to deepen the channel.

What is the use of employing heavy traction engines on expensive roads at one side of the canal, when there is a good hard bottom, only seven feet below the boat, on which to take hold? The wheels need not take up more than three inches on each side of the boat, and would not interfere with its steering qualities, so that boats could pass without obstructions or delays.

My next improvement is to construct a sewing machine with a double pointed shuttle, the machine running either backwards or forwards, and the feed works operating either way. The advantage would be that the machine could not be run "backwards," either way being right; it would do away with complicated mechanism for reversing the feed, and allow of sewing back and forth without turning the work; and in beginning or finishing a piece of work, two or three stitches could be taken first in the opposite direction, and the motion then reversed, in order to fasten the thread.

Not having the time or means for experimenting on these plans, I turn them over to the readers of the SCIENTIFIC AMERICAN, and merely beg them, when they have realized fortunes on them, to give me a fair share.

And now my last concerns you more particularly. Why can we not have the SCIENTIFIC AMERICAN published on double the number of pages of just half the size?

Appleton's Journal is allowed on all sides to be the most attractive of American publications, and in my mind the great merit is in its convenient and handsome size. By the single paper it makes no difference, but when bound, how neat, convenient, and handy is the *Journal*, and how awkward, ungainly, lop-sided, and un-get-at-able is the larger sized paper! As we all want our numbers bound for preservation and future reference, you can judge what an interest we have in the subject. VOYAGEUR.

[1. The idea of propelling canal boats by spoke wheels, as proposed by our correspondent, is very old. It is objectionable on account of the varying depths of the water.

2. Expensive roads are not required for the use of traction engines.

3. Double pointed shuttles for sewing machines are very old, and in use.

4. The majority of the readers of the SCIENTIFIC AMERICAN regard the present form of its pages as the most suitable and convenient.—EDS.

Fast Small Side Wheel Steamers.

To the Editor of the Scientific American:

Your correspondent, Mr. Lynn, on page 130 in your issue of August 31, invites an opinion as to the probable speed of his side wheel boat, of which he gives the data at 70 feet length, 15 feet beam, draft 16 inches without load, with two engines, 18 inches diameter by 3 feet stroke, 120 pounds of steam "with engines wide open," and wheels 12 feet in diameter. At 20 inches draft, this gives about 18 square feet of immersed cross section, and a displacement of about 25 tuns.

This is an interesting case, as giving an excellent opportunity to illustrate the waste of power in urging a short vessel beyond the speed due its length, as taught by the experiments made by Scott Russell and others. According to these experiments, her length corresponds to a speed of about ten miles per hour, which she could accomplish in the common way at the usual expenditure of power. Disregarding the condition of length, the standard formulæ would make her speed, everything being in proper proportion and order, from 19½ to 20 miles per hour, the wheels making 60 revolutions with 21 per cent slip, the steam being cut off at three quarters stroke. There would be too much strain upon engine and boat, and too much waste of steam, with "engines wide open," developing about 192 indicated horse power. The useful thrust of the engines would be about 2,150 pounds, allowing 60 per cent useful effect of the engine and 20 per cent slip of the wheels. This gives over 119 pounds for each square foot of middle cross section. With such a power and proper length the speed named would not be extraordinary, but, on the contrary, it gives a rather low coefficient. When, however, length is taken into consideration, the usual formulæ give her speed at about 13·4 knots, or 15½ miles, per hour.

If Mr. Lynn will favor the public, through your valuable paper, with the result, the question as to how the drawback of want of length may, to a great extent, be overcome, might then be discussed. R. CREUZBAUR.

New York city.

The Meteoric Shower in North Carolina.

To the Editor of the Scientific American:

From your issue of August 31, I learn that the shower of meteors expected on the 10th of that month "did not make its appearance in the locality of New York." In this section (eastern North Carolina) an immense number of meteors were seen between the hours of 10 and 12 at night.

Roxobel, N. C. J. E. T.

[We are glad to receive the report of our correspondent, and if any others of our readers made similar observations, we hope they will report.

Careful observations by a number of different persons were made at Yale College, and they report an increased fall of meteors, during the night, over the number ordinarily to be seen.—EDS.

Heating and Cooling our Dwellings.

To the Editor of the Scientific American:

In your issue of September 14, W. C. D. reproaches present civilization with supineness in not having supplied a means of cooling and ventilating our dwellings, and significantly points out a means of doing so, by forcing external air by hydraulic power through ice packings. The refrigeration he proposes might prove more fatal than if his charge of external air were freighted with contagion. Summer air treated thus would more rapidly chill the body than the direct application of a "cold easterly storm."

The thermometer in the room in which I write stands at 90°; if this room were closed, and such a refrigeration as W. C. D. proposes were applied, carrying the mercury down to 75°, a "dew point" would be reached, in which temperature a man who had been through the heat and toil of the day would sleep at the risk of his health or his life. If the air surrounding the body, under 98° and over 80°, be rapidly or sufficiently displaced, the body will take care of itself. A hydraulic fan will do this. R. H. A.

Baltimore, Md.

The Metis Disaster.

To the Editor of the Scientific American:

On reading the first accounts of the disaster of the steamer Metis, it occurred to me that there ought to be a law in the United States, requiring every steamer (or at least those which carry passengers) to be divided, below the water line, into compartments, so that one of them being broken into and filled with water would not sink the vessel. If the unfortunate Metis had been constructed in this way, the 70 lives lost on August 30 might all have been saved; and a few hundred dollars spent in repairs would render the Metis seaworthy again. I believe most, if not all, of the large ocean steamers are constructed with bulkheads; why not have all the small passenger boats constructed in the same way, since their safety is of equal importance with that of the large ones?

A friend of mine, Mr. Hanes, made a suggestion that, since a part of the upper deck of the Metis floated, why not make all steamers for carrying passengers with the deck so constructed that it could be readily detached when the lower and heavier part of the vessel sank away from it, and so constructed, also, that, when thus detached, it would float and really become a life boat, keeping the passengers above water until they could land or go aboard some other vessel? This, it seems to me, would not be difficult to do. Either of these means, or any other which promised the greatest safety to travelers, would be readily adopted if those who go into the enterprise were as anxious about the safety of their passengers as they are about making dollars.

In a country like ours, where there is not only a growing civilization but a rapidly increasing population, the increase of travel must be very great; and this being the case, every device which can in any degree add to the public safety ought to be adopted without waiting for an immense sacrifice of life to compel the community to demand these safeguards. W. WICKERSHAM.

Boston, Mass.

Car Coupling Dangers.

To the Editor of the Scientific American:

I noticed, in the SCIENTIFIC AMERICAN of September 21, a communication with regard to the danger of coupling cars, together with an article on the same subject in which the opinions of those familiar with the matter are invited. Your correspondent blames brakemen for taking unnecessary risks in order to save themselves a little trouble by not getting on the platforms of cars to do the coupling. Evidently he is not well informed on this particular point of the subject on which he writes. As a brakeman myself, I speak knowingly in saying that I myself would (and I have never seen any one but who would do likewise) gladly avail myself of any opportunity to save the risks encountered in coupling; and getting on the platform is a very little trouble to take, I am sure. But, as I shall show, this is not always practicable by any means. On the Erie railroad, as well as on some others, the passenger cars all have self-acting couplers, and the old fashioned drawheads, with links and pins, are only in use on freight and coal cars, where there are no platforms, and consequently the brakeman has necessarily to encounter all the risks that your correspondent enumerates. Some engineers seem to have no regard whatever for the safety of those engaged in coupling, and take no pains at all to move the cars so slowly as to give the person who does the coupling time to couple up and get out from between the cars and to avoid having to run two or three yards with the cars before they slack sufficiently to let him out; and the coupler hereby runs the great risk of stumbling and losing his life, as all is done so quickly that he has no time to pick his steps. I fully agree with your denunciation of wrought iron drawheads with their small mouths. Why such things should be gotten up passes my comprehension; for certainly they are no cheaper than cast iron ones, and I doubt if they are any more durable. On the Erie railroad, however, the wrought iron ones are not nearly so common as the cast iron, which are made with very wide mouths so that a coupling need hardly ever be missed on account of the link striking the edge of the drawhead. This, however, is but a slight advantage, and in no wise lessens the dangers of coupling. Cannot some one invent an apparatus for coupling which will combine cheapness and durability with safety in operation, and which can be applied to both freight and passenger cars? Surely an invention of this kind, which would have the effect of saving so many lives every year, ought to claim more attention than many which have for their only merit the saving of a little labor. No matter if it should be a little more difficult to operate; give us something whereby our limbs and our lives are not continually risked. Such an invention would be looked upon as a genuine blessing by every,

BRAKEMAN

Rochester, N. Y., September, 1872.

NEW EXPLOSIVE MIXTURE.—M. Violette has made the observation that by fusing together a mixture of the nitrate and acetate of soda, a white, hard mass is obtained, which, when heated to 350° C. (662° F.) explodes with violence. By plunging into the liquid mixture a lighted body, an explosion instantly follows.

[Special Correspondence of the Scientific American.]

LETTER FROM PROFESSOR R. H. THURSTON.—LAST LETTER OF THE SERIES.

General view of Chicago.—The University of Michigan.—A glance at Detroit.—The Niagara suspension bridge.—The great falls of Niagara.—Their estimated value for commercial purposes.—General impressions of the journey.—The wonderful engineering and industrial progress of our country.—Its extraordinary natural advantages.

HOBOKEN, N. J., August 25th, 1872.

Chicago, although possessing in the aggregate many manufactories of various kinds, is rather a commercial than a manufacturing city; and our visit to the rolling mill described in the preceding letter was almost the only one made in the Garden City. We learned, incidentally, that the harbor has a depth of 14 feet in places, making it an excellent haven, and it has been very greatly improved by liberal outlays in engineering during some years past. Its harbor, the many radiating lines of railroad which together place the city in communication, by land or water, with every section of the country, its central location and the wonderful activity of its people have made Chicago remarkable for its rapid growth in wealth and population, and have already placed it among the most important of American cities. Since 1840 its population has increased, from less than 5,000, to about 300,000 in 1870.

We left Chicago on the morning express train of the Michigan Central, and, satisfying ourselves that the company had been enterprising and intelligent enough to provide the train with the Westinghouse brake and that other valuable improvement, the Miller platform, we spent the hours, with greater satisfaction than usual, in the enjoyment of the continually changing scenery of the pleasant and productive country through which we rode.

THE UNIVERSITY OF MICHIGAN.

We stopped, at evening, at Ann Arbor, where we had an opportunity to visit the grounds of the great University of Michigan, which, under the able administration of our old friend and teacher, President Angell, and his able corps of professors, is becoming a giant among our universities. The town is very pleasantly situated, the colleges are finely located, and the 1,300 or 1,400 students of the University should be able to find much pleasure as well as excellent instruction here. Professor DeVolson Wood has recently left the chair of Engineering to accept that of Mathematics and Mechanics in the Stevens Institute of Technology. This great loss to the University will, however, be at once repaired, and we may anticipate the uninterrupted prosperity of that noble institution.

A GLANCE AT DETROIT.

En route again, next day, we had an opportunity to glance at Detroit, the "City of the Straits." One of the oldest of our northern frontier towns, it has only within a comparatively short period exhibited the real western rapidity of growth. It has now a population of over eighty thousand, and its splendid situation, upon the beautiful strait uniting the upper lakes with Lake Erie, has given it a large and lucrative trade with other lake ports and has, as well, made it the seat of considerable manufacturing. Crossing the strait we passed over British soil, on the Great Western Railroad, in cars of standard gage drawn by a broad gage locomotive, and, late in the evening, crossed the Niagara river on Roebling's great suspension bridge, one of the noblest works of that great engineer. As the train slowly passed over, nothing was visible, by the faint starlight, but the seemingly slender cords sustaining it above the abyss; but the sound of the rushing of the waters along their deep narrow channel, two hundred and fifty feet below, came up through the gloom with impressive distinctness and, mingling with the still more impressive thunder of the distant falls, produced in the mind the conviction that we were in the unseen presence of Nature's sublimest objects.

THE NIAGARA SUSPENSION BRIDGE.

The Niagara suspension bridge is now about 25 years old and has been even recently pronounced the "grandest and most distinguishing achievement of art" in the world. Although of less span than the Cincinnati bridge, it is a stronger and heavier structure. Its span is 822 feet; its roadway is 245 feet above the water; its towers are 78 and 88 feet high; its cables are 4 in number and of 10 inches diameter. There are 4,000 miles of wire in the cables and stays, and the total weight of the bridge is something over 1,600,000 pounds. It has a factor of safety of about 6. Its cost was $500,000.

THE CATARACT OF NIAGARA.

This bridge is two miles below the falls. Another suspension bridge of much greater span, but calculated only for a single roadway carriage bridge, has recently been erected a very short distance below the falls and from this a splendid view of the cataract is obtained. Standing here, the day after our arrival, seemingly suspended over the tremendous gorge by a few slender threads, Mrs. Sigourney's lines came into the mind with a new and previously unrecognized meaning:

"Flow on forever, in thy glorious robe
Of terror and of beauty; God hath set
His rainbow on thy forehead, and the cloud
Mantles around thy feet, and He doth give
Thy voice of thunder power to speak of Him
Eternally; bidding the lip of man
Keep silence, and upon thy rocky altar
Pour incense of awe-struck praise.

All of the water flowing into Lake Ontario from the upper lakes, the drainage of a half million square miles of territory, here precipitates itself into a gulf one hundred and sixty feet in depth. Nearly 20,000,000 of cubic feet of water pass over the precipice per minute, and the amount of energy developed in its fall is almost two thousand times as great as the power expended in the propulsion of one of the great steamers of our transatlantic lines. Were all of this inconceivably great power usefully applied, its annual value to the country would be something like five hundred millions of dollars, and would pay the national debt in five years. A hundred thousand years this wonderful water power has been uninterruptedly in existence. Human skill and intelligence have now succeeded in making an insignificant commencement in the work of substituting utility for natural sublimity; it would be a wonderful yet unpleasing triumph of mind over matter were some future day to see that work completed. Who shall, however, pronounce it impossible?

There are many subjects of interest that I should like to touch upon in this last letter of a rather lengthy series, but neither time nor the space available in the crowded columns of the SCIENTIFIC AMERICAN allows of their consideration.

GREAT ENGINEERING AND INDUSTRIAL PROGRESS.

Our hurried journey and hasty observations of the more striking phase of western and northwestern engineering has, however, filled a note book with information too purely technical for publication here, as well as with much that would interest others than professional engineers. Engineering, in the districts visited, is frequently very rough; but it is yet effective, and no intelligent engineer will wholly condemn it. It cannot be doubted that, had it been attempted to erect none but the most substantial structures and to build none but highly finished machinery, a serious check would have been placed upon the development of the country; and, with the demand for capital far in excess of the supply, an immense amount of important work would have remained undone. Now, capital is flowing westward with greater freedom, and we find, as a natural consequence of the fact and of the rapid creation of wealth in the more completely settled States, that noble bridges, good roads, well equipped rail roads and systematically worked mines are becoming the rule rather than the exception. We were everywhere surprised, in travelling on the more recently constructed railroads, to find such heavy traffic, both freight and passenger, as ought in most cases to make them paying property already. It is one of the most convincing of all proofs of the marvelously rapid yet healthy growth of the States of the Mississippi Valley. We were pleased to see, here and there, evidence that the cultivation of forest trees had received some attention. The rapid denudation of the forest covered lands of the less settled portions of the country makes the cultivation of trees in the fully settled States a matter of vital importance to the nation. Well considered legislation upon the subject has been already too long deferred.

OUR WONDERFUL MINERAL RESOURCES.

Another thought which comes to mind after a mental retrospect of this pleasant tour, and prompted also, in some degree, by a glance at the neat land office map of our mineral lands which hangs upon the wall, is that our country is wonderfully blessed with an abundance of all the essentials of prosperity in manufactures and of rapid advance in civilization. In every direction we find immense and readily worked deposits of coal, iron, copper, lead and other useful minerals; while, in some otherwise unattractive territory, are distributed veins of ores of the noble metals which attract population and induce the early settlement of the less readily accessible portions of the country.

With such splendid opportunities for progress in manufactures as no nation ever yet possessed, and with, at the same time, such an extent of fertile soil as can nowhere else be found accompanying mineral wealth, it requires only intelligent and conscientious legislation and habits of industry and frugality in our people to build up such a civilization as the world never yet saw, and one of which no living man can yet probably form more than a faint conception.

R. H. T.

Black Wood Varnish.

It cannot be denied that the fine, black, shining color of ebony pleases the eye; hence on this account, as well as from the love of imitation, it has long been attempted to imitate this foreign wood. The result is, after numerous experiments, that not only this color, but its individual properties, can be so closely imitated that ebony is no longer in such great demand, on account of its high price.

According to J. C. Ackermann's trade circular, there are two kinds of black varnish: 1. The ordinary black varnish for different kinds of wood; 2. The black ebony varnish for certain native woods which approach nearest to ebony in hardness and weight. The ordinary black wood varnish is obtained by boiling together blue Brazil wood, powdered gall apples and alum, in rain or river water, until it becomes black. This liquid is then filtered through a fine organzine, and the objects painted with a new brush before the decoction has cooled, and this is repeated until the wood appears of a fine black color. It is then coated with the following varnish: a mixture of iron filings, vitriol and vinegar is heated (without boiling) and left a few days to settle.

If the wood is black enough, yet for the sake of durability, it must be coated with a solution of alum and nitric acid, mixed with a little verdigris; then a decoction of gall apples and logwood dyes are used to give it a deep black. A decoction may be made of brown Brazil wood with alum in rain water, without gall apples; the wood is left standing in it for some days in a moderately warm place, and to it merely iron filings in strong vinegar are added, and both are boiled with the wood over a gentle fire. For this purpose soft pear wood is chosen, which is preferable to all others for black varnishing.

THE FINE BLACK EBONY VARNISH.

Apple, pear and hazlewood are recommended in preference for this; especially when these kinds of wood have no projecting veins, they may be successfully coated with black varnish, and are then most complete imitations of the natural ebony. For this varnish: 1¼ ozs. of gall apples, 3½ ozs. of rasped logwood, 1½ ozs. of vitriol, and 1¼ ozs. of distilled verdigris are boiled together with water in a well glazed pot, the decoction filtered while it is warm, and the wood coated with repeated hot layers of it.

For a second coating a mixture of 3½ ozs. of pure iron filings, dissolved in ¾ of a litre of strong wine vinegar, is warmed, and when cool the wood already blackened is coated two or three times with it, allowing each coat to dry between.

For articles which are to be thoroughly saturated, a mixture of 1½ ozs. of sal ammoniac with a sufficient quantity of steel filings is to be placed in a suitable vessel, strong vinegar poured upon it, and left for fourteen days in a gently heated oven.

A strong lye is now put into a good pot, to which is added coarsely bruised gall apples and blue Brazil shavings, and exposed for the same time as the *former* to the gentle heat of an oven, which will then yield a good varnish.

The pear wood articles are now laid in the first named varnish, boiled for a few hours, and left in for three days longer; they are then placed in the second varnish and treated as in the first. If the articles are not then thoroughly saturated, they may be once more placed in the first bath and then in the second.—*Oberlausitzer Gewerbeblatt.*

The White Grub.

There is a certain spot on our lawn which is infested with this pest, to its great injury. The grubs have completely severed the grass roots, so that the turf loses its color and may be rolled up like a sheep skin, disclosing quarts of the larvæ. The robins have found out the peculiarities of this spot, and I have often amused myself by watching their operations and observing the manner in which they feed, morning and evening, on the shiny fat worms. Frequently two or three dozen birds at a time may be seen stalking over the spot, occasionally turning their heads to one side as if listening intently, then suddenly plunging their beaks into the turf and tearing away like mad until they drag forth the grubs, which they then eagerly devour. The robin does not, however, appear to be well adapted to this kind of work. The turf being rather tough, he does not always succeed, pull as stoutly as he may. If he fails, he deliberately turns aside and tries another spot. The crow, with his strong, sharp pointed dibble, is much better fitted to be successful in this business of grub catching. When we see him sauntering about in the pastures or meadows in his leisurely way, we must be sure not to disturb him, for he is doing the farmer good service. It is pleasant to know that the robin does some good. He is such a gluttonous fruit eater that, were it not for this propensity to catch insects, we should regard his presence as an unmitigated misfortune, despite the sentimental fondness for 'robin redbreast' inculcated in our childhood.—*H. T., in the Oneida Circular.*

The Recent Strike in London.

The combined strike and lock-out, which has thrown the metropolitan building trades into confusion for the last twelve weeks, has terminated unsatisfactorily; so says the *Building News*. Influenced by the general rise of prices and the increased demand for labor in the country, the London carpenters, joiners, and masons demanded more wages and shorter hours; and, as a matter of course, these demands were stoutly, and not in the politest way, resisted by the masters. Hence the strike and lock out which, at one time, threatened to be one of the most robustly contested struggles on record. The men demanded ninepence an hour, and nine hours' work per day. At first all the building trades joined in the demand, and at one time there were between 10,000 and 12,000 men on strike in London. The masons, however, were the first to give way. They made, on their own account, without consultation or understanding with the amalgamated trades, arrangements with their employers on a modified basis of action. From that moment the strike phalanx was broken, and the prospects of a successful issue on the part of the men narrowed.

Transferring Pencil Drawings on Paper to Other Paper.

Any kind of reasonably fine paper, either thick or thin, serves to receive the copy. Simply lay it upon the drawing board, then upon the face of the drawing paper lay the transfer paper, and upon the top of the lot lay the drawing, pencil marks upwards, fasten the whole three sheets together and to the board by four drawing pins, one at each corner, then proceed to run over the pencil marks with a fine but dull pointed instrument. Use for the purpose a stocking darning needle with a handle and the point ground off; run over the marks in the same way as with a transparent slate. If the drawing is not too thick and the carbon paper is good, a good copy may be obtained, with care and practice. Copies are also taken by first perforating the picture with small holes along the marked lines with a needle, then afterwards laying it on the face of another sheet of paper, and rubbing it over with powdered black lead; the black lead goes through the holes and leaves a dotted outline beneath. A pencil is afterwards run over the marks, and a fair copy is produced, which can be quickly multiplied.

COLORATION OF WOOD FOR VENEERING.—To make the color penetrate the wood thoroughly, it is necessary to soak the woods for 24 hours in a solution of caustic soda, and finally boil them for half an hour; on being washed and dipped in the color bath for 24 hours, they take the color all through.

IMPROVED COTTON PRESS.

In this cotton press, the follower is moved from bottom upwards, forcing the cotton into the upper part of the machine, by the action of hand power applied through the ingenious combination of mechanical devices below described.

The engraving shows a perspective view of the apparatus with the follower at its lowest position. A is the press case. Hinged thereto on either side, and opening from the top downward, are two doors, B, one of which is represented as open and raised, and the other as shut. A cover, D, closes the top of the press case. This opens upward on the pivots, E, and is moved by the hand levers, F F. When shut it is firmly fastened by the bar, G, the extremities of which are held in the metal links, H, attached to the beams, I. J is the follower, constructed as shown, attached to which, on either side of the press, are the notched bars, K, which are confined in suitable guides, L L. The cotton being placed in position, the lower doors, B, and the cover, D, closed, the bars and, at the same time, the follower, are raised by means of the levers, M. These are pivoted to supports, N, and to their short arms are attached links, O, which, passing over the bars, engage in their notches, thus lifting them, when the outer ends of the levers are forced down. P shows one of the holding pawls, which retain the bars when the links go back to engage a lower notch after lifting the bars to the hight of their range. Also attached to each end of the follower are ropes, Q, which, passing over pulley, R, on the supports, N, serve to lower the follower readily when the press is to be filled, the links, O, and the pawls, P, being lifted out of the notches.

There is an absence of complication of parts about this press which renders it both economical in first cost and easy of repair. Its effectiveness in pressing, which depends upon the increased power gained by its mechanical arrangement, may be readily determined by simple calculation based upon the length of the lever arms and the amount of force to be applied thereto, friction being considered. The arrangement of ropes and pulleys for lowering the follower is a novel improvement, and the general mode of raising the latter by the notched bar and lever is claimed to be specially advantageous.

The top cover, on which the greatest strain is brought to bear, is fastened in the firmest manner by the transfer bar and links, so that if the machine be properly constructed of strong material there is no possibility of its giving way. It may be noted, as an interesting point regarding this device, that it is the invention of Gus. Falkner, formerly a slave, but now a free citizen in North Carolina—although, we may add, it is by no means the first patent granted to a colored man.

Patented through the Scientific American Patent Agency, April 30, 1872. For further particulars regarding rights, licenses, etc., address Col. W. J. Green, Box 610, Baltimore, Md.

IMPROVED HOSE COUPLING.

The invention illustrated herewith is designed to provide a means of readily and securely coupling hose without having recourse to the ordinary and disadvantageous method of screwing the two parts together. Fig. 1 is a perspective

Fig. 1.

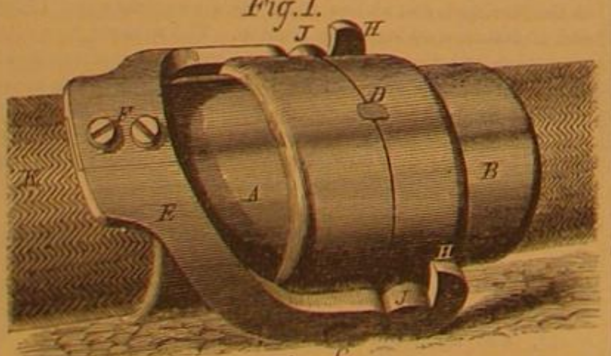
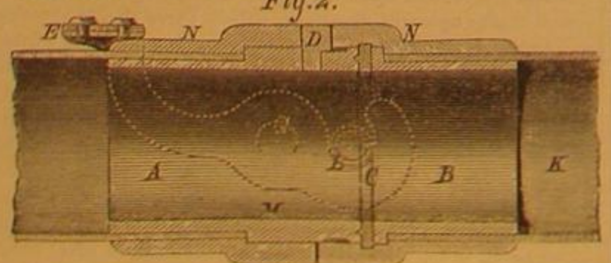


Fig. 2.

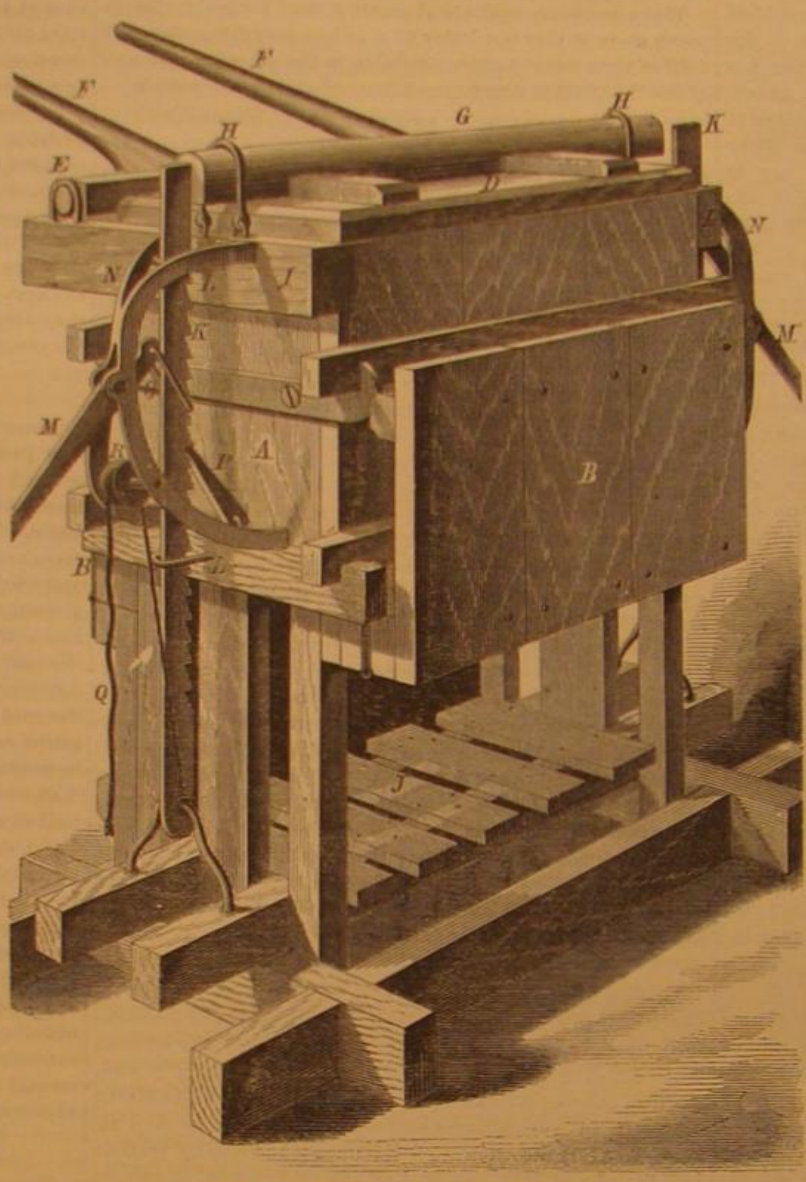


view of the coupling fastened, and Fig. 2 shows a vertical section of the same. It will be seen that the device is constructed in two portions—that on the left, A, being the male, and that on the right, B, the female part. In order to render the joint perfectly water-tight, a packing ring of india rubber, C, Fig. 2, is confined in a groove on the female part, while, entering a recess on the same portion, a guide, D, on the male part, retains the coupling in proper relative position.

The mode of fastening is at once simple and effective. E is a steel or iron double cam hook lever made in the form of a stirrup, in two pieces, which are halved together as shown and joined by screws at the point, F. Its fulcrum pins are represented at G, on the male part of the coupling, while the cam hooks, H, in which the short ends of the lever terminate, engage the fastening pins, J, on the female portion.

Friction rings on these fastening pins, shown by the dotted lines at L, Fig. 2, render the separate parts easily joined. The hose, K, is confined by means of the interior rings, M, and the shoulders, N, in the ordinary manner.

The mode of operating this device is to bring the two parts together, bearing down the male portion with one hand and



FALKNER'S COTTON PRESS.

moving the lever so as to cause it to hook on the fastening pins with the other. In view of the simplicity of this invention, it is hardly necessary to recapitulate advantages which are clearly apparent. The rapidity with which the joining of the sections can be effected at times when every moment is of value, and the non-liability of its working parts to get out of order, render the device especially adapted for the purpose for which it is designed, and well worthy of the examination of members of fire departments or others having frequent occasion to use extended lengths of hose.

Patented through the Scientific American Patent Agency, August 13, 1872. Further information may be obtained by addressing Mr. J. W. Magill, Little Falls, N. Y.

Polishing and Painting Floors.

Dissolve three ounces of potash and four drams of catechu in four pounds of boiling water, in an earthen pot. When these ingredients are dissolved, add two pounds of water and boil again, stirring in four ounces and a half of yellow wax with a wooden rod. Continue boiling until all the lumps of wax disappear. Let cool, and add three pounds more of water. In this condition, it is ready for use. By boiling the wax and potash together, a soluble wax soap is formed, so that a floor waxed with this preparation may be swept, but cannot be washed with water, for that would dissolve off the soluble wax soap. For this reason an oil paint is preferable to wax polish, the only advantage being that it dries quickly while other paints require a long time, during which the room cannot be used.

For painting floors, says the *Building News*, the mineral paints are exclusively used. Paints which contain white lead are too soft, and wear off very easily. If a floor painted with oil colors wears off unreasonably fast, it is sure proof that the paint contained white lead. This generally happens because such colors cover better and are more easily applied. Even the use of varnish boiled with litharge is to be avoided, and one boiled with borate of manganese preferred. As a rule, it should have two coats, but the greatest care should be taken that the first be perfectly dry before the second is put on. After the floor has been painted, in order to give it a polish and make the surface more permanent it is coated with what is called "floor lac" which may be made thus: Dissolve one ounce of shellac in a quarter pound of 80 per cent spirits, and add to the solution one dram of camphor, and strain out the lees in a linen cloth. This lac is used after the paint is dry, and gives more tenacity to the surface. A fresh coat of lac may be applied from time to time as it wears off, and you have always a fine polished surface which can be washed.

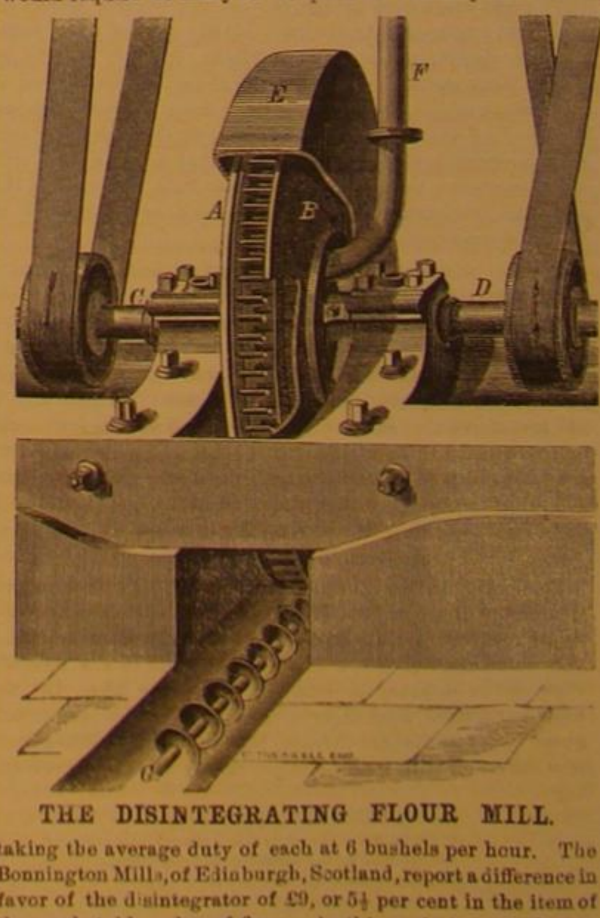
THE DISINTEGRATING OR CENTRIFUGAL FLOUR MILL.

Mr. Thomas Carr, of Bristol, England, is the inventor of the disintegrating mill, heretofore referred to in the SCIENTIFIC AMERICAN, which is stated to have been applied in practice with success for various purposes. Percussive instead of grinding force is employed, and the most novel use of the apparatus is the manufacture of flour from wheat. We are indebted to Leffel's *Mechanical News* for the main points of the following description. Our engraving gives a general view of a seven-foot disintegrating flour mill, various portions being represented as broken away in order to show the interior arrangement of the working parts. A and B are circular metal disks, which rotate in contrary directions upon the shafts, C and D, which are situated in the same line. On the inner surfaces of these disks are concentric rings of projections, called beaters, the rings on one disk intervening alternately with those on the opposite disk and moving in a contrary direction. Several concentric rings of beaters may be thus made to operate conjointly.

The revolving beaters are inclosed in a casing, E. The grain is delivered down the fixed shoot F, through the orifice in the outer casing, into the innermost cage, from which it is instantly projected by centrifugal action through the machine and delivered, in a shower radiating from every portion of the circumference, into the outer casing, in the form of a meal similar to that thrown out by the ordinary millstones; to this state the grain is reduced almost instantaneously by being dashed to the right and left alternately by the bars of each of the successive cages revolving in opposite directions at a very high rate of speed. As it falls to the bottom of the casing, the meal is continually removed by the ordinary rotating screw, G, used in flour mills; it is then passed through the usual bolting machines to separate the bran, and subsequently through silk dressing machines to separate the fine flour from the semolina. The latter is then winnowed by an exhaust current of air in a machine for that purpose, so as to free it from all finely powdered bran, and is afterwards ground between millstones, of which three or four pairs are kept for the purpose; the flour resulting from it is added to the fine flour produced at the outset by the disintegrating flour mill, and to insure perfect intermixture, the two are then passed through the silk dressing machines together.

The machine is driven at a speed of about 400 revolutions per minute; and the outermost ring being 6 feet 10 inches diameter, the last beaters have a velocity of 140 feet per second, or about 100 miles per hour.

Foreign substances which would prove of great injury to millstones are readily thrown out by the centrifugal force in this machine. The work accomplished by a machine of this description, of 6 feet in diameter, is stated to amount to 160 bushels of wheat per hour, which would require as many as 27 pairs of ordinary millstones,



THE DISINTEGRATING FLOUR MILL.

taking the average duty of each at 6 bushels per hour. The Bonnington Mills, of Edinburgh, Scotland, report a difference in favor of the disintegrator of £9, or 5½ per cent in the item of the marketable value of flour. As this grain is equivalent to an extra profit of £16 on each 100 quarters of wheat (a sack being 280, and a quarter 496 lbs.), and the rate of produce being 20 quarters per hour, no inconsiderable gain is effected. The repairs, it is stated, on one of these mills, working 22 hours per day for twelve months, were practically nothing.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK

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

TERMS.

One copy, one year	$3 00
One copy, six months	1 50
CLUB RATES { Ten copies, one year, each $2 50	25 00
CLUB RATES { Over ten copies, same rate, each	2 50

TO BE HAD AT ALL THE NEWS DEPOTS.

VOL. XXVII., No. 14. [NEW SERIES.] *Twenty-seventh Year.*

NEW YORK, SATURDAY, OCTOBER 5, 1872.

Contents:

(Illustrated articles are marked with an asterisk.)

THE LATEST DISCOVERIES IN THE NATURE OF THE SUN.

Frankland has recently made the important discovery that when a flame of hydrogen gas burns in oxygen under high pressure, it becomes very luminous, and gives in the spectroscope a continuous spectrum without lines, the same as is the case with incandescent solid or fluid bodies. This induced Muellner to examine with the spectroscope the electric spark when it passes, not through highly rarefied, but through condensed, gases. He found that the hydrogen spectrum becomes continuous when the gas is highly condensed in the tube, and when it is raised to a very high temperature by means of the spark of a Rhumkorff coil, intensified by the use of a Leyden jar.

If the spark, which this apparatus produces with the Leyden jar, is passed through a tube in which the hydrogen gas is highly rarefied, the three characteristic narrow lines, the red, blue and violet, show themselves well defined; when the rarefication is diminished so as to obtain a density equivalent to the mercurial pressure of one inch, the blue and violet lines become broader, while the space between D and F becomes feebly luminous. The rest of the spectrum remains, however, like a dark background.

By increasing the pressure of the gas, the two lines mentioned expand more and more, so that at last they appear as a luminous ground; at the same time the red line begins, at a pressure of 14 inches of the mercurial column to appear as a broad red band, which is no longer separated by a dark space from the continuous orange color of the background; but the space between is luminous.

At higher pressures, the luminosity of the continuous spectrum increases everywhere, so that, at a pressure of 40 inches, it is all illuminated between the extreme hydrogen lines, like a spectrum of a white hot solid body; but the light is somewhat differently distributed. At 60 inches mercurial pressure, the whole spectrum becomes indeed dazzling, and then the following curious and interesting phenomenon appears: The inside of the glass tube begins to volatilize and shows the line of the sodium vapor as a beautiful double dark line. It is thus seen that, for the production of the dark lines of Frauenhofer, the light of a glowing solid or liquid body is not indispensable.

In consequence of all this, Zoellner comes to the conclusion that the visible solar surface is formed by that layer of its hydrogen atmosphere in which, by increased pressure, the spectrum has become continuous; and that the glowing fluid surface of the solar globe lays below this bright luminous envelope of hydrogen. If we now consider the sun spots as local, slag-like, cooling products, floating on the glowing liquid surface and the *penumbra* as condensation clouds which surround the shores of the slag islands to a certain hight, then the centers of the sun spots must necessarily appear deeper than the visible solar surface, and the phenomenon so minutely observed and described by Wilson is explained in the most natural manner. The depth of the dark solar spots below the luminous surface has been determined, by different observations, to be on an average about 8 seconds of a degree; as this is nearly the 225th part of the apparent solar diameter of 30 minutes, it is also the 225th part of the 800,000 miles of the actual solar diameter, which gives nearly 2,600 miles for the depth, which thus is about equal to the diameter of our moon.

Among the characteristic forms of the protuberances, there are many which compel the observer to the conclusion that enormous and powerful eruptions of glowing hydrogen are taking place. Zoellner has often seen such protuberances project to a hight of 3 minutes of a degree, the tenth part of the solar diameter, 80,000 miles high in the time of 10 minutes. The enormous masses of hydrogen thus suddenly let loose into space, originate, according to this observer, in local accumulations, which form under the liquid surface, and which at last, by their increasing tension, break through the latter in the way that volcanic eruptions break through the solid earth's crust.

On the theory of the conservation of forces, Zoellner has calculated the temperature equivalent to the eruption of such a mass (as is observed in the protuberances), with the velocity and the distances measured. Without going into the mathematical details of his calculation, we will only communicate the results. They are that the temperature of the condensed gas under the liquid crust is 80,000° Fah. higher than the temperature of the solar surface above the crust. Further, it is easy to find that the velocity of the masses escaping, in 10 minutes to a hight of 80,000 miles, is 133 miles per second, a velocity 20 times greater than that required, on our earth's surface, to be imparted to a body in order to cause it never to return when thrown upward.

Basing his speculation on the mechanical theory of heat, Zoellner finds the mean temperature of the solar surface to be 40,000° Fah., which is so high that iron must exist in the solar atmosphere as gas, and all chemical affinities between different substances must be totally suspended, which, in modern science, is called the condition of dissociation.

The temperature of the inner mass of the sun is therefore about 120,000° Fah.

Zoellner further calculates that, as the pressure on those places where the hydrogen spectrum begins to be continuous is about one quarter of the atmospheric pressure, the pressure of the solar atmosphere on the whole area of its liquid surface must be 134,000 terrestrial atmospheres. But on the inner space whence the protuberances escape, the pressure is 4,070,000 atmospheres; which is so enormous a pressure that, notwithstanding the high temperature prevalent there, the permanent gases, even hydrogen, can exist in a fluid condition alone.

This view of the solar constitution is the only one which agrees with the actual density or specific gravity of the mass of the sun, as determined by astronomy.

A WORKING MAN'S CITY.

An English paper states that on August 3, the first stone of a workman's city was laid with appropriate ceremonies at Wandsworth, England. This city, laid out in lots for 1,200 dwellings, is situated on the Shaftesbury Park estate, and is to be built by the Artisans', Laborers', and General Dwellings Company, established in 1867. The object of the association is particularly to enable workmen to become owners of their dwellings in the course of a stated number of years, by the payment of a small additional rent. The Shaftesbury Park estate contains about forty acres, and is situated near London, on the line of the railroad to Dover, by which road facilities for traveling to and from the metropolis will be afforded. The houses are to be thoroughly drained, and economically but substantially built. Ample school accommodations are to be provided, and a hall for lectures and public meetings is to be built. A coöperative store is to be established, and public houses are to be prohibited. The well known philanthropist, the Earl of Shaftesbury, has taken a great interest in this enterprise, and laid the first stone of the buildings.

We regard the above as an excellent movement, and we wish that something of the kind, on a still larger scale, might be inaugurated here, for the benefit of the poorer class of working men in this city. Their domestic situation is indeed deplorable. Living daily from hand to mouth, their earnings are absorbed by the payment of high prices for poor food, bad clothing and wretched apartments. The very first requisite for their improvement is the provision of good homes,—which they will never provide for themselves. Somebody must do it for them.

The good and the charitable, those who are blessed with a superabundance of this world's luxuries, others who have time to spare and willing hearts to help, might, we think, unite under one effective organization, having for its especial object the erection of suburban cottages, for the purpose here indicated.

It would be practicable for such a society to obtain charitable contributions for the purchase of lands on some of the steamboat or railway lines, accessible to New York, to grade, drain, and erect hundreds of cottages, to be let to working people, under proper sanitary regulations, at rentals merely equivalent to the cost of repairs or maintenance. School houses, reading rooms, and other needful appliances would of course be included in the plan. The operations of such a society might even be extended to the supply of the tenants with food, clothing and fuel at wholesale prices.

NEW CANAL THROUGH FLORIDA.

By authority of the Assembly of the State of Florida, a corporation has been formed with a capital of nine hundred dollars, to be increased to twenty millions of dollars if necessary, for the purpose of constructing a canal and improving the navigation of certain rivers, thus forming a new route for the shipment of goods, by water, from the Atlantic to the Gulf of Mexico. The canal will extend from the St. John's river, through Lake Kerr and the Ocklawaha river to Silver Spring, which is the summit, and where an abundant supply of water exists, thence westerly twenty-four miles to Blue Spring, thence nine miles to Fort Clinch on the Withlacoochee, and down this river, nine miles, to the Gulf. Total, fifty-two miles. It is stated that any required depth of water can be obtained, the lockage will be small, and the expense of construction very moderate. Silver Spring and Blue Spring are the outlets of two subterranean rivers and their supply of water is very constant. Silver Spring is stated to yield a flow of 628,320 cubic feet per minute, which is more than sufficient to supply a canal large enough to accommodate ocean steamers of the largest size.

SCIENCE IN COURT.

A trial for murder has lately been concluded at Carlisle, Pa., during which some very remarkable incidents, connected with the scientific attainments of the witnesses, were developed. The prisoner, Paul Schoeppe, M.D., an intelligent, highly educated physician, thirty years of age, a graduate of the university of Berlin, had, in 1868, established himself in practice at Carlisle, where his father had previously settled, and was there the clergyman of the Lutheran Church.

Dr. Schoeppe soon acquired the confidence and esteem of the community, and among others made the acquaintance of a maiden lady, Miss Steinecke, seventy years of age. Mutual admiration resulted in an engagement of marriage; the lady made a will, bequeathing her fortune of fifty thousand dollars to the doctor. They were shortly to be married, intending to leave at once for Europe to avoid the annoyance of the gossips. But their plans were frustrated by the sudden death of the lady, who was taken ill and died within twenty-four hours, attended by Schoeppe and another physician named Herman. No suspicion of death from any other than natural causes appears to have been harbored by anybody until some time afterward, when the relatives of the deceased filed, for probate, an old will by which the property of the deceased was to come to them. Dr. Schoeppe now presented a more recent will, made in his favor by Miss Steinecke, and demanded the property. The relatives thereupon raised the cry of murder by poison against him, the newspapers hounded them on, his neighbors were filled with suspicion, and the unfortunate man was arrested, indicted, tried, found guilty and sentenced to be hung. This was in December, 1869. On this trial two experts, Dr. J. S. Conrad and Professor Wm. E. A. Aiken, both of the Baltimore Infirmary, were the chief witnesses against the Doctor, and they testified that they had made careful medical and chemical *post mortem* examinations of the body of the deceased, and found prussic acid present in the stomach, and were satisfied that death had resulted from the administration of that poison. Dr. Herman also testified that, in his opinion, the symptoms shown during the illness of the lady were those resulting from poison.

The criminating evidence, though satisfactory enough to the judge and jury, was considered worthless by intelligent scientific men, the Doctor protested his innocence, and the strongest efforts were made for his reprieve. But his townsmen were firmly prejudiced against him, and there was a popular clamor for his execution. Two days before the appointed time for the execution, however, the Doctor's friends succeeded in obtaining a reprieve from the Governor, and subsequently a new trial was ordered, which has just taken place, resulting in the triumphant acquittal of the prisoner. On this second trial the three original witnesses, Conrad, Aiken, and Herman, were again brought forward, but this time they were subjected to a straightforward cross examination, during which they were compelled to give to the Court the most particular details of their alleged *post mortem* examinations, and were closely questioned as to the state of their actual knowledge in regard to the nature and action of poisons upon the human system, the symptoms of its presence and the proper methods of its detection. It clearly appeared from these questionings that the three witnesses were, confessedly, a trio of ignoramuses, not posted in the sciences pertaining to their own professions, and unqualified to give to a jury any reliable information in regard to the subjects they were so solemnly called upon to testify.

For example, Dr. Conrad testified that he had made a careful *post mortem* examination of all the important organs of the body of the deceased, such as the brain, heart, liver, and stomach, which he pronounced healthy. But, on cross examination, he said that *he had not examined any of these organs under the microscope.*

He stated that he found the heart healthy, but he had not examined it under the microscope, and was not apparently aware of the important fact, testified to by Professor Wood for the defence, that it is impossible for the best pathologist to decide that the walls of the heart are healthy unless a microscopic examination is made. Granular degeneration has been found by means of the microscope to exist, when to the unassisted eye, the heart looked perfectly healthy. Professor Wood also showed that some of the most common causes of sudden death are to be found in the kidneys and spinal cord; but these organs Dr. Conrad had failed to examine.

In regard to the brain, Dr. Conrad had also failed to make any careful examination, because he did not notice how much blood ran out of it when it was opened, and therefore could not tell whether there had been any congestion.

It was shown for the defence, on the highest medical authorities, that almost any disease of the brain substance may be hidden, without causing any notable symptoms, and the subject be suddenly stricken down with stupor and unconsciousness, without convulsions, gradually deepening into death—which were the symptoms of the deceased. It was also shown that softening of the brain or change in the small vessels can only be ascertained with absolute certainty by microscopic examination, which had been wholly neglected by the witnesses for the prosecution.

The testimony of Professor Aiken for the prosecution, in reference to the finding of prussic acid in the stomach of the deceased, was a lamentable confession of his chemical ignorance and careless manipulation. On his direct examination he testified, positively, that he had found prussic acid actually present in the stomach of the deceased; but on being cross-questioned and required to give the details of such finding, he admitted that he did not actually extract any of the prussic acid at all; but what he did was to mix a solution of potash, sulphate of iron, and muriatic acid with some of the juices distilled from the stomach of the deceased; these solutions, he said, when mixed with anything containing prussic acid, give a blue color; and as he obtained this color, he was satisfied that prussic acid was present. "All I did," he swears, "was to satisfy myself that a blue color resulted, and that satisfied me that prussic acid was there." He then made a vapor test and got a red color, which confirmed his previous test, he thought; finally admitting that he obtained only the merest trace of color in both tests. The nitrate of silver test, which is admitted by intelligent chemists to be the best test of all for prussic acid, was not used by Aiken.

It was shown for the defence, by the testimony of Professor John J. Reese, LL.D., of the University of Pennsylvania, that the saliva, which would naturally flow into the stomach of the deceased, was capable of producing the same results that Aiken had alleged that he found, and it further appeared that the colors had probably been introduced into the liquids by Aiken himself, by careless manipulation, and did not result from the presence of prussic acid. Dr. Reese further showed that in a chemical analysis, in such a case, it is the duty of the chemist to be so thorough, so complete, so exhaustive, as to leave no test untried. He further showed that Aiken had completely failed in this, and pointed out his errors in the processes of distillation, in which all the recognized tests for the presence of prussic acid had been omitted. The most overwhelming medical evidence was also presented for the defence, showing that the prosecuting witnesses were not properly informed as to the symptoms produced by poisons upon the human system. Finally it was conclusively proven that the symptoms exhibited by the deceased were those occasioned by natural causes, namely, the contraction of the kidneys, resulting in the injection of uric acid into the blood, which produced serous apoplexy or congestion of the brain—of which the patient died. The evidence for the prosecution was completely broken down, and the prisoner was acquitted by the jury, and is now free.

The Chief Justice remarked that he considered the evidence against the Doctor so feeble that, had it been presented to him on the hearing for binding over to answer the charge, he could not see how he could have done so, further remarking that he "believed that it was God's providence which alone had saved the Court and former jury from committing a great wrong."

The Doctor has renewed his application for the probate of the will, and it is to be hoped he will receive the fifty thousand dollars bequeathed to him. It will be a poor recompense for the terrible ordeal through which he has passed, for the three long years of imprisonment that he has suffered, and for the loss of his business, reputation and property.

Some of our cotemporaries, we observe, in commenting upon the evidence in this singular case, express the opinion that scientific knowledge is, after all, of little practical value; for it appears that experts are always to be found who are ready to contradict each other in testifying upon a given statement of facts. But this, we think, is an erroneous deduction. An intelligent cross-examination will invariably demonstrate whether the expert is really a man of knowledge and science, or only an ignorant pretender. If the latter, his contradictions will have no weight, will perplex no intelligent mind. The importance and value of thorough scientific training, and its utility in the detection of professional fraud, ignorance, and humbuggery, has, in our opinion, seldom been more strikingly exhibited than on this remarkable trial.

THE FAIR OF THE AMERICAN INSTITUTE.

The same delay in forwarding and arranging goods for exhibition, which has rendered the first two weeks of all previous Fairs of the American Institute periods of disorder and confusion, seems to have been the case in the exhibition of this year. In spite of the increased demand for space and the consequent crowding that must later ensue, exhibitors manifest the same inexcusable tardiness, so that we scarcely hope to see the Fair well under way, with all its departments complete, much before the time allowed for its duration shall have half expired. Although we miss several articles and processes of manufacture that formed prominent points of interest in the exhibition of last year, others have filled their places; so that, in general popularity, there is every reason for the present exposition to equal if not excel its predecessors. The interior of the building, late the Empire Skating Rink but now the property of the American Institute, has been renovated and redecorated. No additions to its already large area of floor space have been made, although the mode of arranging the articles in the separate departments is somewhat altered. The general decorations consist of the time-honored red, white and blue draperies, national flags, etc., and the scenic effort of doubtful excellence on the large arch at the further end of the hall. The roof of the building has been painted in appropriate colors, which is a decided improvement over the bare woodwork of former times. The usual Matthews soda water fountain occupies a central position in the hall, and is surmounted by a colossal female figure. The latter, we hope to see speedily removed. In our opinion it has no artistic merit; it is rough and apparently unfinished, while its false or rather want of proportions show a lack of knowledge of anatomy on the part of the modeler which the immense size of the statue renders still more glaring. While t is possible to obtain in this country the works of such sculptors as Powers, Palmer and scores of others of equal or less note, there is no necessity for forcing into prominence any such caricature on the plastic art. Illumination at night is effected by means of the new oxyhydrogen gas which, carried through the building, gives an admirable light.

In recording our notes jotted down during several visits to the exhibition, we shall, according to our usual practice, begin with the department of machinery, mentioning whatever it contains of novelty and interest, and then proceed through the other divisions in regular succession. Professor R. H. Thurston, of the Stevens Institute, Hoboken, N. J., the author of the excellent series of letters ended in this number of our journal, is the chairman of the Committee of Managers in charge of the machinery. He is ably seconded in the executive portion of his duties by Mr. R. H. Buel, the superintendent of the department, through whose efforts the arrangement of this part of the Fair has been conducted with unusual vigor. Of

STEAM BOILERS,

but three are in position. The small Root safety boiler, on the right hand side of the entrance to the boiler room, is the one used in the previous exhibition. Facing it, is a larger boiler of the same pattern, of 200 horse power. A Phleger non-explosive boiler is also in place, supplying steam. In this generator, there is a constant circulation due to the position of the water tubes, some of which are under the fire, while the internal arrangements are such that dry steam is always afforded. The

STEAM ENGINES

are not so numerous as they were last year. An admirably built 80 horse power Wright horizontal engine occupies the most prominent place and supplies the power to other machinery by means of two 3 inch triangular belts. The latter form a new and effective mode of transmitting power, and are claimed to possess many points of superiority over the flat belt. The best oak tanned leather is used, made, for the above mentioned size of belt, of 5 ply with long laps. For belts of smaller dimensions, 3 or 4 ply leather is substituted. The pair referred to, as used at the Fair, are claimed to equal in every respect the 20 inch single belt of last year. On the opposite side of the passage way from the Wright machine is a 50 horse power horizontal engine, from the Newburgh Steam Engine Works of Messrs. Whitehill, Smith & Co., of Newburgh, N. Y., which is fitted with an adjustable cut-off worked by eccentrics and a Shive's governor, which will be described hereafter.

The Yale Iron Works exhibit a 10 horse power vertical engine which, if we may judge from its noiseless and equable motion, is excellently constructed. The Erie City Iron Works present a 15 horse power horizontal engine, remarkable for its compactness of form. The steam and water pressure engine of Messrs. King & Mulock, of Middletown, N. Y., is a recent invention of very simple construction, having but a single valve. As its name indicates, it can be run by either water or steam pressure, and, it is claimed, at a very low cost. The well known Baxter engine, manufactured by the Colt Arms Company, of Hartford, Conn., is displayed in its various sizes. It attracts a curious crowd, and is the recipient of well merited praise from all quarters. Other excellent portable engines are those from the Ames Iron Works. The larger sizes are especially adapted for use in saw mills. Two machines are exhibited of ten and three horse power respectively.

PROFESSOR R. H. THURSTON'S LETTERS.

The last of the interesting series of letters written by Professor Thurston for the SCIENTIFIC AMERICAN, during his recent western tour, will be found in another column. We much regret the necessity which brings this correspondence to a close, for it has been full of interest to our readers, furnishing them with the latest information concerning the improved processes now in vogue in metallurgy, as practiced at the leading establishments, with observations relating to the situation of the mineral supplies upon which many of the metallurgic industries of our country depend. Our correspondent has arrived at his home in Hoboken, N. J., and resumed his accustomed duties as Professor of Mechanical Engineering in the Stevens Institute.

PATENT OFFICE ITEMS.

Assistant Commissioner of Patents J. M. Thacher, after several weeks' absence, has returned to his post, and will administer the duties of the Commissioner while the latter is away in the West, whither he has gone in the interest of the Government.

Competitive examinations which have recently taken place at the Patent Office have resulted in the following appointments and promotions: Major Z. F. Wilber, lately first assistant examiner in-chief of the class of Mills, Glass, and Clay, has been promoted to be principal examiner in the same class, to fill the vacancy made by the resignation of T. C. Folger; F. L. Freeman, W. Osgood, L. N. E. Cooke, and J. B. Darnall are appointed second class clerks in the examining corps.

Professor H. H. Bates, examiner, has taken charge of the class of Civil Engineering.

CAR COUPLING DANGERS.

The suggestions heretofore made by us on this subject have called forth a variety of communications from correspondents, some of which we shall publish. One of these, signed "Brakeman," will be found in our present number. It is the production of a brakeman now working on the Erie railway, and is a model of excellence. The clear intelligent manner in which the subject is discussed is very creditable to the writer. Communications of this kind, from practical men, we highly value.

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.—EXTRACTING SILVER FROM WASTE PRODUCTS.—I have a quantity of chloride of silver, containing also cream of tartar and common salt. How can I convert this into pure silver, or into the nitrate?—J. H. P.

2.—BLEACHING SHELLAC.—I am using shellac varnish for varnishing my negatives, but it gives them a color which I do not like. How can I remove the color, or bleach the shellac?—L. Q. B.

3.—DISSOLVING SHELLAC.—Is there any process by which shellac can be dissolved in water? Is there any way in which more than the usual amount may be dissolved in alcohol?—L. Q. B.

4.—PAINTING TIN ROOFS.—What paint is best for tin roofs? What time of the year is best to put it on? Should the old paint be removed before the new is applied? How long ought the best paint to last on a tin roof?—L. M.

5.—FREAKS OF BOILERS.—On August 16, 1871, we began to use a second hand boiler; in a few weeks, it began to leak, and the iron showed fine cracks. We had a patch put in, and it gave out in a few days. Then we put in a new sheet; it lasted a few days, bulged badly, and sprang a leak. Then we put in a new boiler, made of the same iron as the sheet put on the old boiler, and fired up at 6 o'clock A. M. At 3 P. M. two sheets bulged; we put in two new ones, and ten hours afterwards these were as bad. We then put in three new sheets; these ran for a few days and then gave out. A boiler inspector says that it was the fault of the fireman; can this be so?—G. & B.

6.—BURNING GAS.—I have an ordinary gas fixture burning 5 feet of gas per hour, and if I attach, by a piece of rubber tubing, an argand burner, I get more light. Can I possibly burn more gas per hour than I did before the argand was attached? It has been asserted that the argand greatly increases the draft and has the same effect as though the pressure was increased in the street mains. On the other hand, it is claimed that no more than 5 feet of gas can come through a 5 foot burner. How is it? Argand burners would be more frequently used but for the impression that they are very much more expensive.—M.

7.—HYDROGEN LAMP.—Your description of the hydrogen lamp will not, I fear, satisfy expectation. It requires refilling too often, and sulphuric acid is difficult to procure in country places. The commercial acid sold in the shops is valueless, as it acts but very feebly on zinc. I therefore propose, as a substitute for the hydrogen lamp, a battery and a platinum wire (if practicable) and I would like to ask if a platinum wire heated to whiteness by a battery will ignite an alcohol or kerosene lamp? What kind of battery would be most suitable and least expensive for this purpose?—J. H. P.

8.—EXHAUST STEAM IN A STEAM JACKET.—Some engine builders surround their cylinders with a chamber through which the exhaust steam is passed, imagining that such jacketing affords protection against loss of heat from the cylinder. I have long suspected that this was a mistake, and that the exhaust steam would carry away more heat than would be radiated from the naked cylinder, even in cold weather; but I am not in possession of any data from which I can estimate the extent of such loss, if any. Can you or any of your readers give me or refer me to any? Some builders take special pains to avoid all contact between the exhaust steam and the shell of the cylinder, while others, among whom are some prominent eastern builders, seem to be indifferent in the matter.—J. W. T.

9.—DIAMONDS IN NEW MEXICO AND ARIZONA.—Reports come to us daily of the discovery of diamonds in these territories, and as but little is known about them, will some one please give us information? 1st. What are the origin and formation of diamonds? 2nd. In what localities are they mostly found, high, low, or level, among rocks or gravel? 3rd. What is the best manner of determining or testing which are true diamonds in the rough? 4th. How is the value ascertained? 5th. What is the best manner of locating or taking up claims, as there seems to be no law relative to locating diamond mines in the United States? A large party of miners will go this fall from Elizabethtown, New Mexico, and they know but little of the mode of diamond mining or hunting, although they are well versed in regard to minerals in general.—H. M. P.

10.—BOILER SCALE.—I am running a boiler, 36½ feet long, 4½ feet diameter, with five flues, three of 11 inches, and two of 14 inches. The flues prevent my cleaning it from the inside. There is a hand hole at each end of the boiler, likewise a man hole. The boiler in question has been running three months, the water used is brackish, and has a muddy appearance. In cleaning our well, we get nothing but white sand. The scale or deposit in the boiler is nearly three thirty-seconds of an inch in thickness. I have tried the much talked of anti-incrustators, but without effect. I have also tried potatoes; I put in half a bushel, but perhaps that was not enough. A couple of weeks since, I took out several pieces of this deposit; one piece I put into pure, another in diluted, sulphuric acid. After standing 6 hours they remained undissolved. I had thought before this trial that the scale was lime and salt, but find now that it is nothing but white sand along with a small quantity of clay. I have tried to settle the water, but after standing a couple of weeks, it presents the same muddy appearance; but no matter how cloudy it is, if the rain beats into the tank for but one hour, it will, in a few hours, be so clear that the bottom of the tank can be seen. Now what acts so magically upon this water? Is it not the ammonia in the rain water? If so, cannot I settle it by using ammonia or alum? and how much is necessary for a 60 barrel tank? We removed a locomotive boiler about three months since; the deposit on the sides of the fire box was one fourth inch thick. I wish to find something to suit my case. Every day the boiler gives more trouble in raising steam, and I know the time will come when it will be almost impossible to keep up steam. I know there are many others in a like situation, and if you could give us any advice it would be thankfully received.—E.

11.—CEMENTED FLOORS.—A few months ago I cemented the bottom of my cellar, which had always been dry, clean, and noted for keeping every thing put into it in a satisfactory condition. Now it is all changed. Moisture gathers and remains on the cemented bottom, the whole cellar is damp, moldy, and unwholesome, and nothing will keep. The ventilation is the same as before the bottom was cemented, namely, by windows. It has been suggested that I cement the side walls, which are of limestone laid in ordinary mortar, to keep out the moisture which perhaps was formerly absorbed by the earth floor or bottom. What do you think will be the proper remedy?—J. C. W.

12.—CONSTRUCTION OF LIFE BOATS.—Concerning the necessary points essential in constructing a life boat, let me ask, as nearly all the accidents occur upon steamship routes, or routes frequently travelled: If passengers can only be kept safely afloat until a passing boat picks them up, is it necessarily essential that a mode of propulsion be attached to a boat? Judging from the difficulty of keeping a life boat headed to windward, will a life boat left to follow its own motion lie lengthways in the trough of the waves, and only assume another position when guided by the rudder? Could not a lifeboat, upon a plan allowing the necessary amount of provisions and water, means of signaling, etc., easily launched, capable of riding the waves in the severest storm without fear of capsizing or swamping until succor comes to the passengers from passing boats, be built? I am at present engaged on the plans of a life boat possessing these merits, and I desire to hear some opinions on the subject before completing them.—L. S. F.

13.—RHEOSTAT.—I wish to construct a rheostat or resistance indicator to be used in connection with a galvanometer for testing telegraph lines. Will some one who has a good one please describe it so that any good mechanic can construct one like it? I wish to know what alloys are generally used for the resistances, and in what form. Is it a very fine wire, insulated with cotton or silk, and wound in a coil with the resistances measured off and a switch between each so as to make the combination? What length of wire of some particular number and composition has 10 ohms resistance? I cannot find any details in any text book to which I have referred.—S. C. D.

14.—DISSOLVING GLASS.—Will some of your readers give directions for dissolving glass so that it can be used with a paint brush, and tell me how it should be done so as to retain its original gloss? Can coloring matter be used with it?—D. R.

15.—EXTERMINATING SNAILS.—What is the best methed of destroying and preventing snails in wells?—J. A. D.

16.—WATERPROOFING LEATHER.—How can I make thin calf skin leather waterproof?—F. C.

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.

CAR FARE BOXES.—C. H. R.'s suggested improvement is already in use.

PACKING AND BLACK POLISH.—E. should consult our advertising columns.

D. F. McE.—We are indebted to this correspondent for a very fine insect specimen. He desires to know what it is. Answer: It is the *dynastes tityrus* of entomologists, one of the largest beetles within the United States. It belongs to the same family as the sacred *scarabæus* of the old Egyptians.

C. W. P., of Dakota, writes: Enclosed please find a number of different kinds of rock, found near Sioux Falls, Dakota Territory. Please inform me if they are of any value. Answer: The specimens are quartz, except the yellow one, which is chalcedony; neither is of any value.

J. N., of Texas, writes: Will you please inform me what kind of ore is the enclosed? We have an abundance of it in our neighborhood. Answer: It is the red hematite ore of iron, which often occurs in concentric layers. It is a very rich ore.

H. A. S., of Me., writes: Please find a solid substance enclosed which a lady found in an egg. I presume it is a piece of coagulated albumen, but I cannot imagine how a portion of the albumen should become coagulated in a fresh raw egg. Can you? Answer: The specimens are condensed portions of the yoke, not "coagulated albumen." We have a similar example on a larger scale in our possession. They consist mainly of globules of oil.

G. W. G., of Ill., writes: Enclosed you will find a mineral specimen found on a relative's farm near Galena. I request you to inform me what it is. It is found in a meadow (lowland) with a spring close by; what quantity there is, I cannot tell. We have had a bucketful tried in the stove and it seems to burn well, but I am at a loss to say what it is. Answer: It is asphaltum, resembling the celebrated deposits in New Brunswick and Trinidad. If abundant, it is valuable.

R. & T., of Georgia, write: We here hand you a sample of what we term, for want of a better name, a mineral polish in its crude state. We have tested it as a polish upon steel, brass, etc., with results highly satisfactory to us. We have burned it, and find that it stands the strongest fire test we can apply without being affected in the least. Answer: The specimen consists mainly of quartz in a finely comminuted state. It differs from tripoli in not being of animal origin. It has probably resulted from disintegration of some granitic rock. It is softer than emery, but for many purposes it would make an excellent polish.

J. L. S. says: On page 160 of your current volume, in an article on writing fluids, you mention the use of chromate of potash (not bichromate). I am a maker of ink, and I want to make an experiment, and I can find no druggist who has or knows of the chromate of potash. Can you tell me where it can be had? Answer: Chromate of potash is a very common substance, and can generally be had of all dealers in drugs and dyestuffs. You can make the chromate by adding potash to the bichromate.

MOUNTING MAPS.—To J. B., of Mo.—In pasting cloth to maps, take common muslin, cut it to size, lay it on a smooth, clean board, and sponge it with water till it lies quite smooth on the board. Paste the map and lay it on the muslin, then rub carefully with a clean cloth till all the air bubbles and wrinkles are gone. Leave it on the board till quite dry, when it will almost fall off and be perfectly smooth.—F. H. W., of Mass.

COMBUSTION OF COAL.—J. S. J. asks how many cubic feet of atmospheric air are required to produce perfect combustion of one pound of coal, bituminous or anthracite? How many feet of air are usually passed, in ordinary practice, through the fire box of a locomotive or stationary engine, for each pound of coal consumed? Answer: 150 cubic feet of air are required for the perfect combustion of one pound of bituminous coal and 80 per cent more air for one pound of anthracite. Perhaps some of our locomotive friends will tell us how much air is generally passed through the fire box of a locomotive.

VERMIN IN DRIED FRUIT.—M. S., query 23, page 138, should put the fruit in a pan and set it over a kettle of boiling water until it is hot enough to kill any insect that may be in it. Then keep the fruit in a thick muslin or paper rack carefully tied or pasted that the worms may be kept out; but it will retain its taste longer if it is put in an airtight jar.—E. E. S., of O.

VARIATION OF THE POLE STAR.—L. H., query 3, page 106, is informed that the present distance of the pole star from the zenith of the pole is one degree thirty minutes.—H. W. G., of Mich.

CUTTING GLASS.—To J. W. A., query 18, page 153.—Cut from the edges of your glass a number of lines to the edge of your circle, taking care not to cross it. Tap gently with a knife or key, and the outer glass will come away in pieces as divided by the lines. Do not cut twice in a place, and do not try to cut both sides.—J. W. P., of N. J.

WATER VERMIN.—To A. H. R., query 19, page 138.—Go to the nearest river or pond, and with a small net (a piece of old mosquito bar will do) collect a dozen or more of the small fishes known as minnows and put them in your cistern, and, in a short time, you will have clear water, the wiggle tails and reddish colored bugs or lice being gobbled up by the fishes.—M. O'R., of Texas.

PAPIER MACHÉ.—W. P. F. will find the information he seeks on page 16, current volume of the SCIENTIFIC AMERICAN.—F. S. B., of Me.

STAINS ON BLACK MARBLE.—To S. M. T., query 1, page 153.—Wash with a damp sponge; when dry, touch each spot with a solution of shellac in alcohol colored with a little fine lampblack, and continue to do so until the spots are hidden. Then rub lightly with soft cotton slightly moistened with alcohol until you have a fine polish.—E. H. H., of Mass.

NITRO-GLYCERIN.—To O. I. K., query 9, page 153.—Nitro-glycerin cannot be exploded by a common safety fuse.—E. H. H., of Mass.

BISULPHIDE OF CARBON.—To W. H. P., query 14, page 153.—This liquid can be used with safety for the purpose mentioned. It is made by distilling sulphur over red hot charcoal. It can be got from any manufacturing chemist.—E. H. H., of Mass.

SPECIFIC GRAVITY.—To J. P., query 15, page 153.—A body will weigh the same at the equator as at the poles, and specific gravity is the same without reference to latitude.—E. H. H., of Mass.

FLEAS.—I would suggest to T. J. W., query 6, page 153, one method of getting fleas out of the house. Work on the principle of the old adage that the hair of the dog will cure the bite. Our dog carried them away by being allowed to remain in the house through the night. I wash him thoroughly with strong soapsuds, then allow him to remain in during the night. The flea has a great affection for the dog, and consequently in the morning I find him well stocked, and I again take him out for another scrub. This continues to be the case as long as there is a supply of insects.—T. R. J., of Pa.

DETECTION OF SULPHURIC ACID IN VINEGAR.—Vinegars of commerce are frequently sharpened by the addition of sulphuric acid and pungent spices, which can be easily detected by evaporating a half gill in a saucer placed over boiling water. As it boils down, add a little honey. If the grape sugar it contains turns black, it is proof of the presence of sulphuric acid. As the last of the liquid evaporates, the odor of cayenne pepper, etc. (if there be any) can be readily distinguished.—G. H. C., of R. I.

PRESERVING THE EYESIGHT.—To J. H. D., query 18, page 138.—The decay of sight by age is simply a flattening of the eyeball; if you can restore it to its original form, you may dispense with spectacles. I am now near fifty-two years of age, and when I was about forty-five, I found my eyes would get fatigued by reading. I thought I should have to buy spectacles, but just then I saw an article in the *Herald of Health*, "How to restore and preserve the eyesight." The method is this: You shut your eyes, and press the eyeball with the finger and thumb from the outside corner of the eye towards the nose; the finger and thumb must go round the eyeball above and below about five minutes daily. I generally do it before I go to sleep as I lie in bed, because I shall not have to use my eyes again before morning. If you press from the nose outward it will do injury, as that way is for shortsighted people. I have never used spectacles and never expect to; this is written without them by the light of a kerosene lamp.—J. W. P., of N. J.

Communications Received.

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

Car-Coupling Dangers.—By C. F. R.

Science and Theology.—By P. D. V.

The improved construction and propulsion of Lifeboats.—By L. S. F.

A Comparison of the Meetings of Religious and Scientific bodies—being a reply to an editorial article in the SCIENTIFIC AMERICAN, on the American Association of Science.—By E. S.

Horse-railroads without rails.—By R. B.

The Polar Sea and its cause.—By J. H. F.

An endless chain of vacuum air cylinders, operating within a water column.—By J. W. S.

Science and Theology.—By M. F. F.

The Day of Rest.—By J. T. N.

On the need of further Legislation relative to the construction of Sea-going vessels.—By W. W.

The late Edward Marcus Chaffee.—By A. R. T.

Force of Falling Bodies.—By G. M. T.

Sulphuric acid in Vinegar.—By R. H.

Old and New Inventions.—By J. H.

Theology and Science.—By G. N.

The need of better mechanism for Cider making.—By E. H

On Animal Heat and Disease.—By A. B. M.

Car-coupling Dangers.—By G. F. W.

Car-coupling Dangers.—By C. S.

Theology and Science.—By J. E. E.

The causes and dangers of Kerosene-lamp Explosions.—By C. M. H.

Life preserving Garments.—By S. H. S.

Cheap Microscopes.—By C. S.

Milk sickness.—Its cause and cure.—By O. S. M.

The frozen well at Brandon.—By C. S.

Recent American and Foreign Patents.

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

SASH HOLDER.—Abraham Perron, of Stevens' Point, Wis.—This invention relates to a new and useful improvement in the mode of supporting and locking window sashes; and consists in a catch made to oscillate by means of a lever, so as to engage with the sash and hold it in any position.

APPARATUS FOR FEEDING THE CHARGE TO METALLURGIC FURNACES.—Giles Edwards, of Tannehill, Ala.—This invention consists in a feeding tube having a charging chamber with a valve at top and another at bottom to graduate readily the amount of fuel and its mixture with the ore, and thus to give the smelter entire control of the quantity and quality of the ascending gases.

BOLT CUTTER.—William F. Strong, of Charleston, S. C.—This invention consists of a peculiar arrangement of the stock, scroll plate, and cap of a chuck for holding and adjusting screw cutting dies or tap holding jaws, whereby provision is made for the application of a scale, adjustable stop bolt, and a stud pin for arresting the dies as they close upon the bolt at any predetermined point, for bolts of any sizes.

WELL TUBE.—Roswell R. Rouse, of Indianapolis, Ind.—This invention consists in making the tubes of cast or malleable cast iron with projecting ribs and perforated, and in soldering over its perforated sides wire gauze of the desired grade, so that, when the perforations are sufficiently large, the change from coarser to finer gauze, or *vice versa*, will fit the tube to serve as strainer in all manner of material.

WHIFFLETREE.—Jacob M. Isenberg, Huntingdon, Pa., assignor to himself and S. H. Isenberg, same place.—This invention consists of a peculiar arrangement of devices with sliding catch bolts on the whiffletree for engaging and holding the traces, whereby the traces may be detached and the horse let go by the pulling of a cord or strap.

Tool for Belt Riveting.—Mortimer D. Lawrence, Flintville, Wis.—This invention has for its object to furnish an improved combination tool for use in belt riveting, consisting of handles pivoted to each other, and provided with a cutter, claw, punch, and head.

Water Pressure Check Valve.—Thomas Bailey, New York city.—The fact that water is practically a non-compressible and non-elastic fluid is overlooked by plumbers, and no means are provided to prevent the sudden shocks to which water pipes are subjected when stop cocks are instantly closed and the momentum of a column of water is suddenly checked. This invention is designed to remedy this difficulty, and it consists in a valve in combination with an air chamber. When any stop cock connected with the water pipe is closed suddenly, and the momentum of the flowing water instantly arrested, the pipe will receive no shock nor be in danger of bursting, as the air in the air chamber will receive the shock and be compressed, and thus relieve the pipe. By means of the nut the valve can be adjusted to suit any head of water, and so as to protect the pipe as well as the range boilers connected therewith.

Lifting Jack.—John J. Stuart, of New York city.—This invention has for its object to furnish an improved jack for raising wagons and other carriages to enable their wheels to be conveniently removed for oiling their axles, and consists of a pipe of suitable length attached to a foot or stand. Within the former slides a smaller tube. Holes are cut in the outer pipe to receive a pin which is inserted beneath the lower end of the inner tube to keep it in place. A lever attached to the exterior pipe has a pawl pivoted to its forward arm. On the free end of this pawl is a hook which passes through slots and takes hold of notches on the inner pipe, thus raising the latter and with it any object under which it may be placed.

Skate Fastening.—Edward Lawson Fenerty, of Halifax, Nova Scotia.—This invention has for its object to improve the construction of the improved skate fastenings, for which letters patent No. 121,092 were granted to the same inventor, November 21, 1871, so as to make them more convenient in use, no wrench or key being required to adjust them to any sized boot. The heel of the boot is held in a metallic clamp consisting of a sliding plate actuated by a lever and toothed wheel, which lever may, after being adjusted, be locked. The sole is confined by two side plates which are governed by a third plate resting upon them. This skate can be secured to the foot by a single movement of the lever in the heel piece.

Rock Drilling Machine.—John Cody, of New York city.—This invention has for its object to furnish an improved steam drill enabling a hole to be drilled in a horizontal direction or at any desired angle; and it consists of the combination of the base plate or frame, hollow post, and branched standard, with the frame of a steam drill to support said drill in such a way that it may operate at any desired angle, also suitable appliances to enable the drill to be fed forward to its work by hand. The drill is fastened to the piston rod in such a manner as to be firmly locked in place and at the same time be easily detached or attached as desired. By other mechanism it is caused to rotate automatically as it moves back after making a stroke.

Submerged Pump.—David G. Hussey, of Nantucket, Mass.—This invention furnishes a submerged double acting pump, which can be worked at any angle or number of angles, and at any distance from the well or cistern; and it consists in a pump barrel, which is made with flanges at both ends. The inner faces of its heads are recessed to form seats for the valves, which serve as passage ways for the water. The water enters at the upper end of the pump through holes in the head. The piston rod is made hollow. The piston heads are at a little distance apart, and midway between them is a fixed flange. Valves are placed between the piston heads and the flange so as to close the ingress openings for the water through the piston heads, which water passes into the interior of the piston rod through holes in its sides between the piston heads and the flange. The upper part of the piston rod is pivoted to an arm of a three armed lever. The three armed lever is pivoted to any suitable support at the mouth of the well or cistern in which the pump is placed, and its upper arm is extended to enable the pump to be worked from this point when desired. To arms of the lever, at equal distances from its pivoting point, are attached the ends of two rods or chains, which are connected with the ends of the opposite arms of a four armed lever, pivoted to some suitable support at any desired distance from the well or cistern, and at the point where an angle is to be formed in the connecting rods or chains. To the ends of the other pair of opposite arms of the four armed lever are attached the ends of connecting rods or chains, the other ends of which are attached to the operating lever at equal distances from the pivoting point of said lever. In this way any desired number of angles may be formed in the connection rods or chains, so that the pump may be operated from any desired point.

Tweer.—Theodor Gilson, of Port Washington, Wis.—This invention consists of a novel arrangement of the devices comprising a tweer, with a hollow oval headed plug below a large circular opening in the cap, whereby said devices may be adjusted to cause the air to escape both around the oval head in an annular jet, and through the hole of the plug in a central jet, or through either alone, and to vary the quantity discharged through either at pleasure.

Shirt.—John A. Peters, of Jordanville, N. Y.—This invention relates to the construction of dress shirts for gentlemen's wear; and consists in a device for keeping the bosoms smooth and taking up the slack cloth around the waist. Straps are attached to the body of the shirt beneath the arms, which are buttoned one to the other, which draws the back and the front of the shirt together, so as to bring the surplus cloth between the two straps under the arms.

Band Sawing Machine.—Hosea D. Bliss, of Hamburg, Iowa.—This invention relates to improvements in the class of band sawing machines wherein the saw is so hung as to be inclined from a vertical plane when desired; and it consists, chiefly, in the construction and arrangement of parts whereby the standard carrying the pulleys upon which the saw is mounted may be adjusted at various angles to the reciprocating table with ease, dispatch and certainty. The inventor proposes to use a band saw with teeth of such form that it can be reversed by being turned inside out whenever the teeth are blunt on one side. Regular V-shaped teeth, properly upset, will best answer this purpose.

Pump.—Frederick R. Lockling, of Hannibal, Mo.—This invention consists of a long hollow pump piston whose lower end has over twice the area of the upper end exclusive of the water openings, and is arranged in two packings with an air or water chamber between, so that the upper part, which works in a chamber into which the water is forced, displaces only half the water the lower part does, to equalize the discharge as much as possible and produce a continuously discharging single acting pump by the aid of an air cushion in the said chamber at the upper part of the piston. The invention also consists of an air and water packing for the piston produced by empty grooves in the piston bearings, into which the water and air work when the piston is operated, and constitute a packing by obstructing an active or direct flow through the slight space between the piston and its bearings. The invention also consists of the application of a dasher to the cistern or well, suspended from the pump handle by a rod into the water below to stir and agitate and mix the air with it to avoid the pumping of dead water.

Plow Colter.—William H. Hoefelman, of Columbus, Neb.—This invention relates to a new plow attachment for causing weeds, stalks, and stubble to be covered by the plow while the same is turning the soil, with the object of removing such stalks, etc., from the way of harvesting machines, which they frequently clog, and of utilizing the same to enrich the soil. The invention consists in the use of a colter applied to the plow beam, and combined with a laterally projecting curved arm for turning the weeds, etc., which have been detached by the colter.

Newspaper File.—William R. McNorton, of Livingston, Ala., assignor to himself and Thomas A. Johnston of same place.—This improvement in paper files consists of thin metal bars or plates with a series of transverse pin holes attached to one of the paper clamping bars at right angles and passing through the other, and held by pins and keys to clamp the paper fast between said bars, the pins being passed through the said perforated bars at the back of the clamping bar; and the two clamping bars are clamped firmly against the paper by the said keys, which being slotted are driven under the pins against the paper clamping bar along the perforated bars which come in the slots.

Bedstead.—Dennis O'Leary, of Hubbard, O.—This invention relates to a new simple construction of wrought iron bedsteads, whose parts are united together in such manner that the bed bottom can be raised up or down at will.

Elastic Pad for Corset.—Benjamin Bernstein, of New York city.—This invention has for its object to furnish an improved adjustable spring pad for ladies' corsets or other articles of dress, which shall be so constructed and arranged that it may be readily expanded and contracted, as may be required, and which shall, at the same time, be light, strong, and durable; and it consists in the construction and combination of various parts, chiefly made of metal wire, forming a device designed to be inserted in a corset between its inner and outer coverings, the wires being secured to one or both said coverings by sewing, by fastening similar to hoop skirt fastenings, or in any other convenient and reliable manner.

Sash Holder.—Albert R. Judd, of North Adams, Mass.—This invention consists of a pawl for locking the sash shut, and an eccentric pawl for fastening it open, combined in one piece and pivoted to the sash, with a spring and a pair of inclined planes combined with the pivot of the pawl in such manner that shifting the pawl on its pivot to bring either part into action shifts the spring so that it acts upon the one brought into action to insure its taking hold of the window frame or other part it is to act upon.

Blacking and Brush Holder.—Ephraim H. Sweetser, Salem, Mass.—This invention consists of improvements in the construction of the blacking box and daub brush holders illustrated on page 323, last volume of the Scientific American, by the same inventor. The inventor has arranged the cover to fit over the outside of the cup instead of inside, as heretofore, for preventing the smearing of the lower edge with blacking, which occurred, when it fitted inside, by the accumulation of blacking in the cup. The apparatus is designed both for shoe and stove blacking and brushes, or other polishing matters.

Machine for Mortising Blind Stiles.—Mahlon W. Collins, Enfield, N. H.—This invention consists in combining with a pair of stile mortising tools a table and carriage, both movable longitudinally and independently, but the latter carrying the former in an obliquely forward and upward direction. The inventor states that he has arranged all the driving wheels and belts, likely to be injurious to the attendants, inside of the frame, where they are guarded by it, so that there is but little or no danger of accident.

Fluting Machine.—Edward Mortimer Deey, of New York city.—This invention consists of a construction of hollow rollers having gas burners in the hollow spaces for heating them, calculated to prevent the cutting off of the air supply for combustion by the accidental closing of the hollow ends of the rollers by the goods being ruffled. Second, it consists of an arrangement of supports for the gas tubes, by which the supports therefor, heretofore used at the ends of the rollers, where the goods to be ruffled are presented, and which have to be removed each time the rollers are, are dispensed with. Thirdly, it consists of a very efficient and reliable arrangement of apparatus for suspending the upper roller support and raising and lowering it; also, the adjustable pressure springs therefor.

Heating Stove.—Samuel D. Tillman, Jersey City, N. J.—This invention consists in the arrangement of a series of elliptical shaped air tubes parallel to each other across the diameter of the radiating chamber. Also in the arrangement of an air heating chamber between the said tubes and the fire box, whereby the largest possible volume of cold air is claimed to be heated in the least possible time. The tubes are placed side by side within the radiating chamber, in such a manner as virtually to divide the chamber into two compartments—the front compartment, with which the fire pot communicates, being the hot smoke chamber, and the rear compartment being the cold smoke chamber. The formation of the tubes being elliptical is the most favorable for the easy passage of the products of combustion between them. The hot smoke and air are passed between the tubes in thin sheets, owing to the small space between the tubes, so that the loss of caloric from non-contact with the tubes is quite trifling. All of the tubes are heated simultaneously and to the same degree. The heat of the fire cannot be more fully concentrated upon one tube than upon the others. Another advantage of this arrangement of the tubes is that the radiating chamber can never become filled with soot or ashes, for a rod may be at all times passed up through the open door and smoke hole between the several tubes, whereby they may be cleaned expeditiously without taking the apparatus apart or even allowing the fire to go down. This arrangement, therefore, permits the use of wood or bituminous coal for fuel equally as well as anthracite coal.

Tailor's Crayon Holder.—John A. Gooch, Biddeford, Maine.—The case is made open at one edge, and of such a capacity as to receive the marking lead or crayon. A slide placed in the interior of the case may, by turning a screw in one direction, be pushed outward to push out the lead or crayon as it wears away, and by turning the said screw in the other direction may be moved inward to allow the lead or crayon to be pushed into the said case. The lead or crayon is kept from dropping out of the case by the spring which bears against its side. The lead or crayon is made thin to adapt it for use in the case without requiring the said case to be made so thick as to be inconvenient in use or in carrying it in the pocket. By holding the apparatus, while using it, inclined to one side for a while, and then inclined to the other side for a while, the wear will keep it sharpened, and the use of a knife for sharpening it will never be required.

Machine for Nicking Rib Collars for Umbrellas.—Robert Marshall, Philadelphia, Pa.—This invention consists of a feeding and holding disk, which receives and carries the collars to the milling tool for cutting the groove, and then to a nicking saw for cutting the nicks; a mandrel for rotating the collar against the milling cutter by a continuous rotary motion, another mandrel for shifting the collar in front of the nicking saw, and spacing and holding it for nicking, and automatically operating gear, whereby the blanks, which are delivered by hand or otherwise to the aforesaid disk, at intervals as it is intermittingly revolved, will be automatically milled or grooved, nicked, and discharged.

Vegetable Cutter.—Thomas Bolton, Northampton, Mass.—This invention consists of a board or plate with a transverse slot extending nearly across it about midway between the ends, and chamfered or beveled on the under side each way from the slot, so that the walls of the latter are thinned down sufficiently to allow the slices to escape. And over the slot is a double edged cutter, a little narrower than the slot, with both edges beveled on the under side, which said cutter is secured to the board at each end on adjustable bearing plates, which are constructed in two or more parts of different thicknesses for supporting the cutter higher or lower on the board according to the required thickness of the slices to be cut. A guide may be placed along one or both edges of the board to keep the vegetables to be cut from sliding off the edges.

Brush.—John Ames, Jr., Lansingburg, N. Y., assignor to John Ames, of same place.—This invention has for its object to improve the construction of wall brushes, known also as flat paint brushes, paste brushes, etc., and which may also be applied to whitewash brushes, so as to produce firmer, stronger, and more durable brushes than the brushes made in the ordinary manner. The butts or roots of the bristles are clamped in the tapering or dovetailed space between the tapering metallic ferrule and the tapering base of the handle, so as to be held firmly and securely in place, rivets or screws preventing the possibility of any of the parts working loose.

Bedstead Key.—Herrmann Stein, New York city.—This invention has for its object to produce a wrench or key which can be conveniently used on bedsteads for turning the connecting bolts or pins, and whenever a straight or rigid wrench is difficult to apply. The invention consists in connecting the head of the wrench to the shank so as to form a flexible joint, thus permitting the application of the instrument in corners or wherever other ordinary wrenches or keys are difficult to apply. It is a very effective and convenient implement, cheaply constructed of malleable iron and will take the place of the ordinary bed key.

Card for Wrapping Thread, etc.—Hugo Sutro, New York city.—This invention relates to a new form for holding braided or other threads; and consists in notching a card at the ends to produce visible and accurate subdivisions of the skeins wound thereon. This is for the purpose of keeping the skeins so fully separated that they cannot become entangled, and that each skein containing a certain length of thread can be cut apart with its section of card, to furnish a desired measure of thread or braid.

General Joiner.—David R. Williams, Sr., Paris, Ky.—The invention consists in working lumber across a wood working machine. The supporting frame of the machine does not require more space than about four feet in length and three in width, and is built of substantial wood work. A horizontal carriage is fitted between two horizontal guide rails, on the upper part of the machine, and is connected with a lever which is pivoted to the frame and serves to adjust the carriage back or forward. A horizontal shaft is hung lengthwise in the carriage to receive at its front end the lathe chuck, circular, rip, or cross cut saw, or other tool to be revolved, and is connected with a drum hanging in the lower part of the frame and receiving rotary motion by suitable mechanism, so that the shaft will also be turned. A longitudinal adjustable rest is placed upon two rails of the frame, so that its center pin will be in line with the axis of the shaft. It can be clamped to the rails by suitable means. The carriage can be fastened in suitable position. Vertically adjustable side plates are placed at the sides of the frame upon a separate longitudinally adjustable frame. When the latter is, by means of a screw, moved backward, the plates will be elevated, and they will be lowered when the frame is moved forward. This machine, with proper additions, can be used for tonguing, grooving, planing, molding, and all manner of work.

Refrigerator.—Benjamin N. Hatcheson, of Greenpoint, assignor to Gustave Autenrieth, Hunter's Point, N. Y.—This invention has for its object to improve the construction of refrigerators or ice boxes in such a manner that the escape of the coal filling over the top of the sheet metal lining will become impossible, as well as the entrance of air and moisture from within into the space containing the coal or other non-conducting filling. The invention consists in the use of strips, placed against the flush inner edge of the refrigerator top, and overlapping the face of the sheet metal lining.

Blast Furnace Charging Apparatus.—William A. Miles, Salisbury, Conn.—This invention relates to a new apparatus for charging all kinds of blast furnaces with the material to be treated therein, and has for its object to prevent the escape of gases through the charger while feeding the material to the furnace, and also to allow the evening or leveling of the material in the charging vessel. It consists of sliding plates arranged at the bottom of a blast furnace charger, to move simultaneously together or apart, and also a lid combined with the charger and sliding plates which is opened to admit the material to be charged and which, when closed, prevents the escape of gas during the admission of the charge to the furnace.

Cultivator.—Lafayette K. Tipton, Easton, Mo.—This invention, which has for its object to furnish an improved wheel cultivator, consists of a suitably made frame work body resting upon two wheels which revolve on journals in short axles. To the rear of this framework two plow beams are so attached as to be susceptible of both vertical and lateral motion. On each plow beam a handle is fastened and also two inclined standards, on the lower ends of which are shanks and plow plates. By means of a hook attached to either plow beam, hooking in a curved rod on the upper part of the framework, the plows can be supported away from the ground in turning or passing from place to place. The lower portion of the framework is of such a hight as to pass over the tops of all plants, while space is left between the inner ends of the short axles for the passage of the row of plants so that they may not be injured or broken by being struck. The plow plates can be adjusted to throw the soil toward or from the plants and the plows may be arranged to work further or closer to the row under cultivation.

Glove Envelope.—Andrew D. Foster, Sayville, N. Y.—This invention has for its object to furnish an improved device for preserving kid gloves from becoming spotted, soiled, faded, mildewed, or otherwise injured while in the hands of the retailer and in the hands of the purchaser, and not in use. It consists in the preserver made in the form of a long narrow envelope, with the flap at one end left loose for the insertion and removal of the gloves. In the body of the preserver is formed a small flap, so that by turning up the said flap the color of the gloves can be seen by the purchaser or user in making a selection. Upon the face of the preserver is designed to be printed the name, or the name and trade mark, of the manufacturer of the inclosed gloves, the number or size of the gloves, or business card of the dealer.

Brush Rack.—Edwin F. Ames, Lansingburgh, N. Y., assignor to John Ames, of same place.—This invention has for its object to improve the construction of the brush rack so as to make it more convenient in use. It consists in making the lower cleat stationary, notched upon its forward edge, and provided with buttons. It furnishes a simple and convenient rack for holding painters' brushes. It is adapted for various sized brushes in the same rack, and is useful in every paint shop.

Hasp for Trunk Lock.—Edward L. Gaylord, Bridgeport, Conn.—This invention has for its object to furnish an improved hasp for trunk locks which shall be simple in construction and convenient in manufacture, so constructed as to hold the hasp out, so that, should the trunk lid fall accidentally, the hasp cannot strike against the edge of the trunk body and be broken, bent, or injured; and it consists in the combination of the spring and plate with the hasp and a slotted hasp plate. The spring, placed in the space between the bar and the hasp is bent, and by its elasticity holds the hasp out, the ends of the said spring resting against flanges formed upon the side edges of the hasp to keep the spring in place.

Bag Lock.—Edward L. Gaylord, Bridgeport, Conn.—This invention has for its object to furnish an improved traveling bag lock, simple, convenient, and so constructed that it may be unfastened with one hand while the other is carrying the bag, so that the bag may be conveniently opened in the street or other place where it cannot be conveniently set down. An inner plate and the case of the lock are secured to each other and to the frame of the bag by rivets which pass through the said case and plate and through the said frame, so that the lock can be attached to the frame after the bag has been finished. In the side of the case is formed a hole to receive a catch which is attached to a block that slides up and down in a recess formed in the inner side of the plate or in a strengthening plate placed upon the inner side of said plate. To the block is attached a knob, the stem of which passes through a slot in the plate. The catch is beveled off upon the lower side of its forward end, and has a shoulder formed upon its upper side. By this construction, as the catch is pushed through the hole in the case, it compresses the spring attached to the plate. As the shoulder of the catch passes within the case, the said catch is raised by the elasticity of the spring so that the shoulder of the said catch may catch upon the side of the case above the said hole, and thus fasten the bag. The bag is locked by a bolt which is pushed forward along the plate so as to pass beneath the spring.

Blacking Box Holder.—Robert R. Forrest, Washington, Pa.—This invention relates to a mode of holding blacking boxes during the process of blacking boots and shoes; and it consists in a spring handle or holder constructed of band iron of any shape, or round wire, or of wood, and formed by doubling such metal, so that the bend will form a spring. On one or both sides of the legs of this spring handle, a recess is formed to receive the bottom of the box.

Cotton Gin Flue.—James W. Gaines, Clarksville, Texas.—In this invention, by the arrangement of a valve or set of valves in the flue that leads the lint cotton from the gin stand to the lint room, the inventor proposes to throw the lint cotton into different rooms without stopping the gin. In the ordinary way of ginning, the cotton is thrown into one room, so that the gin has to stop until the cotton in the room is baled or packed. By this plan the gin can be kept running; and if there are more than two rooms wanted more than one valve can be used. By having a partition in the lint room, the cotton can be thrown first into one room, then into another.

Stove Pipe Damper.—Warren Wasson and George W. Dungan, Genoa, Nev.—This invention relates to improvement in the class of dampers and their attachments wherein the damper has its spindle prolonged for a handle or thumb piece by which to turn the damper, and this thumb piece has a stud pin projecting backward toward the pipe, parallel with the journals, to enter any one of a series of holes in a circular line around the axis, for holding the damper closed or open, or partly open, the said pin being introduced to the holes or withdrawn by sliding the damper endwise on its axes. The invention comprises a peculiar arrangement of the supports for the plate having the aforesaid series of holes for attaching it to the end of a section of pipe and allowing the other section to be joined to the one having the said plate attached.

CAKE PAN.—William C. Butler, of Louisville, Ky., assignor to himself and W. E. Arnold of same place.—This invention has for its object to furnish an improved pan for baking cake which shall be so constructed that the cake may be removed from the pan when baked without being broken even should it adhere to said pan; and it consists in the detached bottom and tube, constructed to adapt it to be applied to a cake pan.

BELT SHIFTER.—Toppan P. Rodgers, of Taunton, Mass.—This invention relates to the sliding belt hole covers used around belts running through floors to shift from side to side as the belts shift and keep the holes covered; and it consists of raised ribs or ways on the plate, which is attached to the floor for the shifting cover to rest and move on, with guide pins in the said plate projecting upward through slots in the cover to guide the latter, whereby the said cover is not liable to be clogged so as to obstruct its working freely, as when arranged in dovetail guides as heretofore, and is rendered practically successful. This invention also comprises a connection of these raised ribs or ways at each end of the belt hole by other ribs of the same hight, both for supporting the ends of the sliding cover and for preventing the escape of the water, used in washing the floors, down through the belt hole.

SAP BUCKET BRACKET.—John J. Pellett, of Oconomowoc, Wis.—This invention relates to a new manner of supporting buckets on maple trees by means of vertically adjustable brackets, which are applied thereto without injuring the trees. The invention consists in the use of brackets, which are fastened to the trees by means of wires or cords that embrace the same. By this means the buckets can be applied in suitable position and shifted to different hights from year to year, as may be found necessary.

ROASTING AND DESULPHURIZING FURNACE.—William Bushnell, of New York city, assignor to himself and Joshua Hunt, of Catasauqua, Pa.—In operating this desulphurizing and roasting furnace, the inventor commences by charging carefully a layer of coal upon the grates and placing upon it a layer of ore, and thus alternate with a stratum of coal and a stratum of ore, until the furnace is full up to the lower end of the charging tube; and next he fills the charging tube in same manner, graduating the quantity of coal in accordance with the character of the ore, being careful not to use too much coal. He then makes fires in the fire grates and keeps them up until the coal in the stack is fairly ignited, when they are allowed to go out. The charging of the furnace is thereafter performed through the throats of the charging tube, taking care to keep the tube constantly full. The gases generated in the lower part of the furnace pass up through the ore and coal, gradually intensifying until they reach the surface of the main body of the ore at the commencement of an annular chamber, when they burst into flame, and seizing upon the vaporized sulphur carry it speedily into the atmosphere—a result attained by the use of the charging tube and the open annular chamber surrounding the tube and the boiler, and not reached by any other known plan.

SAWING MACHINE.—Enos Goble Budd, of Budd's Lake, N. J.—This invention relates, first, to a frame for supporting and guiding the saw and its operating mechanism, which is to rest upon and be secured to the log to be sawn; and, secondly, to the arrangement of the said mechanism, the same consisting, in the main, of a novel application of a pair of "lazy tongs," one being always in the act of opening as the other is closing; and, inasmuch as they are connected with the saw, a reciprocating movement of the latter is obtained. There is considerable novelty in this invention and we shall be glad to receive an account of the result when a machine has been put in operation.

PUMP.—James A. Sinclair, Woodsfield, Ohio.—The invention consists in a pump cylinder formed of three tubes, of which the innermost is divided longitudinally, the outermost metallic one is in one piece, and an intermediate one is made of cement. By this construction, the inner sectional tube can readily expand against the cement while the latter furnishes an impermeable enclosure to prevent contact between the liquid and the outer metallic tube.

STEAM BOILER.—Philip Estes, Leavenworth, Kan.—The invention consists in arranging and connecting certain water spaces with a boiler so as to create a heating surface larger than usual, thus economizing fuel and lessening the cost of generating a given supply of steam.

STRAW CUTTER.—John O. Tyler, Roxobel, N. C.—This invention consists of a straw cutter in which the feeding of the straw is effected partly by gravitation and partly by the cutters, which are made to revolve under a hopper with an opening in the bottom, and some of them are provided with hooks on the points or ends for catching the straw and drawing it down to the place for cutting it into short pieces. The invention also consists of a pair of curved slotted plates, combined with the hopper and the cutters for conducting the straw to the place for cutting it; and it also consists of a slotted plate combined with these sliding plates and the cutters.

BUSTLE.—Sherman Smith and Daniel L. Smith, Skowhegan, Me.—In this apparatus the horizontal ribs for swelling or bulging out the dress are supported on one, two, three, or more strong ribs or stays projecting from the waistband and curving downward, and at the waistband they bend downward so as to extend along the back of the wearer a sufficient distance to constitute a rest for a brace for the upper projecting portions. The arrangement of this brace adjustably both on the upper and lower parts of the stays, or either of them, so as to be adjusted to hold the projecting stays higher or lower, and the apparatus for adjusting, comprises the invention.

SAW MILL EDGER.—George Willett, Friendship, N. Y., assignor to himself and J. W. Hilton, of Bradford, Pa.—This invention relates to a new means for adjusting the top frame of a saw mill edger, and also to a new mechanism for regulating the speed of the feed rollers and reversing their motion. It consists, first, in providing the top frame with pendent racks at the ends, and in combining therewith toothed segments on a rock shaft, so that when the latter is turned the frame will be evenly elevated or lowered, to be adjusted to the thickness of the board to be edged.

HEAD BLOCK FOR SAW MILLS.—George Willett, Friendship, N. Y., assignor to himself and J. W. Hilton, Bradford, Pa.—This invention relates to a new mechanism for feeding the head blocks of saw mills in the carriages; and consists in the employment of two reciprocating ratchet bars, which are operated by crank connections with a rock shaft, and with which spring pawls, that are attached to the head block, are in contact, so fashioned that when the ratchets are moved alternately back and forth the one moving forward will actuate the head block in the desired manner, the other ratchet meanwhile moving back to be ready for its next forward movement, during which to actuate the carriage.

STONE SAWING MACHINE.—George A. Davidson, of Malden, assignor to himself and Horace T. Caswell, of Troy, N. Y.—This invention relates to grooved metal bars which are placed on the platform holding the stone under the saw. Said grooves will be deep enough to let the saws, which are not always exactly level, work entirely through the stone from end to end before striking the bottom of the grooves, and thus the inventor saves the damage to the platform or scantlings, placed thereon to hold the stone in the common way, which are so cut up in a short time as to be worthless.

CULTIVATOR.—William R. Robinson, Mattoon, Ill.—This invention consists in the combination of a pivoted step which bolts the handles of a cultivator to the plow beam, also a brace bar which supports the handle at the desired elevation. The middle part of the braces is made flat to rest upon the upper side of the plow beams, and is secured to said beams by a bolt, several holes being formed in said flat or horizontal part to receive the said bolt to enable the handles to be inclined to either side or adjusted in line with the beams, as may be desired.

WAGON STANDARD.—Patrick Sweeney, Cordova, Ill.—In this invention the stake is driven from the cap plate into the socket, and is readily removed by taking out the bolts. The socket and the cap plate being firmly united together and the plate securely attached to the bolster by bolts (one or more) the stake is well supported without mortising the bolster, and is, consequently, readily renewed or changed, as occasion may require.

PAPER CUTTING MACHINE.—Edwin R. Sheridan and Theodore W. Sheridan, of New York city.—In this invention the paper knife is brought down with great force by means of a hand lever, which actuates segments of gear wheels which mesh in the teeth of racks on the bars attached to the blade. The hand lever is released after making a stroke; a weighted lever carries it back and also raises the knife ready to repeat the operation.

SASH HOLDER.—George W. Richardson, of Columbus, Ky.—This invention consists of a long flat spring in a case next to the sash, with a curved bar behind it, and behind said bar a pinion on a knob spindle gearing with the said bar so as to raise or lower it by the turning of the said knob spindle, by which the said bar, which has the ends suitably formed for the purpose, will be caused to wedge at its ends in between the pinion and the spring, and force the latter against the sash; and this spring is faced with roughened india rubber, or other substance, adapted to hold the sash by friction. The upper end of the said bar holds the sash up and the lower end holds it down.

CONVICT'S SHACKLE.—Peter Runquist, of Steilacoom City, Wash. Ter.—This invention relates to the inclosing or boxing of the jaws of the ordinary or Gardner shackle with case hardened or hardened steel boxes; the said boxes closely fitting the jaws, and closing in upon and to the ring or circle of the shackle, and then riveted through and through the box and jaws with a countersunk rivet. The object of the boxes is to prevent the convict from making the steel hardened jaws of the Gardner or other shackle cut their own rivets.

HOT AIR FURNACE.—Wilmot W. Dodge, Boston, Mass.—This invention consists in a hot air chamber and cold air chamber, separated by a partition, having dampers when applied to a hot air furnace, and also pipes passing through the combustion chamber, whereby fuel is greatly economized.

HOISTING ATTACHMENT FOR THE SHAFTS OF WELL AUGERS.—Henry H. Russell, Maysville, Mo.—The invention consists in providing the shaft of the auger with a collar, band, and pivoted arm. The collar is keyed or otherwise securely attached to the shaft. Upon the collar is placed an open band to the ends of which is pivoted the end of an arm, to which arm is attached the lower end of the rope, by which the auger is raised and lowered. The arm, when the auger is being turned, hangs down and thus keeps the rope from being wound upon the shaft, so that it is always ready to raise the auger when required.

PERFUMED OPERA CHAIN.—Solomon Fredrick, New York city.—This invention relates to a method of perfuming jewelry by attaching thereto a vessel or tube closed at one end and containing a piece of sponge saturated with perfume. The open extremity of this reservoir is surmounted by a perforated cover.

BINDERS' ATTACHMENT FOR HARVESTER.—Chauncey G. Price, Alkana, Iowa.—The grain, as it falls by the sickles, is caught by a platform, up an upward extension of which it is swept by a rake. It then passes to an inclined plane down which it slides to the trough, from which it is removed by the binders. The platform upon which the binders stand is bolted to the frame work of the reaper. The binder's tables, upon which the grain is laid by the binders to be bound, are attached to the platform; the gavels may thus be conveniently bound before being dropped from the machine.

DOG MUZZLE.—Charles de Quillfeldt, New York city.—This invention consists in having the portion of the frame of the muzzle under the lower jaw to spring downward and allow the dog to open his mouth as widely and nearly as freely as when unmuzzled, the spring returning the said part of the frame again as the mouth closes.

CIDER MILL.—John McGrew, Ravenswood, West Va.—The invention consists in a cider mill which crushes the apples, conveys the pumice through an intermediate space and delivers it between two pressing rolls, where the juice is expressed, the pumice discharged and the cider conducted into a suitable receptacle.

FEED RACK.—Jabez L. Rhodeback, New Way, Ohio.—This invention relates to a new rotary feed rack, the nature of which is explained by its name. It can be turned or reversed, to be cleaned, and is so arranged that the animals can feed from the ends. The invention consists in composing the rack of rods, which cross a horizontal beam or scantling, and form four racks of which either one can at any time be used.

MORTISING CHISEL.—Lawrence S. Shuler and James Carpenter, of Jeffersonville, Ind.—This invention relates to that class of chisels so made as to draw out of a mortise the chips and shavings which it detaches from the the block. The invention consists in providing the chisel with a roughened or grooved inner face and with similarly roughened lips or side flanges.

LATH MACHINE.—Oliver C. Meigs, Dubuque, Iowa.—This invention consists of a combination of a pair of toothed drawing or feeding disks or rollers with a pair of bolting saws and the ordinary feed rollers; said toothed rollers are suspended by an oblique frame from an axis over the saws, so as to work on the upper sides of the cut bolts and rise and fall with the irregularities of the surfaces of the slabs, said rollers being driven by machine chains worked by drums on the axis, from which the roller-supporting frame is suspended, and said chains are inclosed in cases to prevent them from being clogged with saw dust. The said swinging frame or support for the rollers has chains or links connecting its lower end with a support above, to prevent the rollers from falling too low when the bolts pass from under them.

SCREW DRIVER.—John S. Armstrong, St. John, Canada.—This invention consists of a split or divided plate or bar, whose ends for entering the nick of the screw are each in the form of a frustum of a wedge, arranged so that the narrow ends meet when the two parts, which are capable of moving toward and from each other, come together; with which said divided bar is a handle, and a suitable means for forcing the said wedge ends together when applied to the screw. The said improved screw driver is designed especially for screws with nicks widest at the ends and contracting toward the middle, the object being to hold the screw on the driver by wedging the latter into the nick, so that the screws may be guided by the driver, and the latter will be prevented from slipping off the screws while turning them, as does the common screw driver.

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DESIGNS PATENTED.

6,096.—CAMPAIGN BADGE.—T. H. Denison, Baltimore, Md.
6,097.—WATCH PLATE.—V. Gerard, New York city.
6,098.—WATCH BRIDGE.—J. L. Mathey, Hoboken, N. J.
6,099.—CLOCK FRONT.—W. F. Muller, New York city.
6,100 to 6,115.—CARPETS.—E. J. Ney, New York city.
6,116.—MUCILAGE BOTTLE.—H. S. Adams and B. Fay.
6,117.—CASKET.—J. Nilsson, Brooklyn, N. Y.
6,118.—HAIR NET.—T. Officer, Brooklyn, N. Y.

TRADE MARKS REGISTERED.

976.—SUGAR CURED HAMS, ETC.—H. Ames & Co., St. Louis, Mo.
977.—SOAP.—R. M. Bishop & Co., Cincinnati, Ohio.
978.—SADDLERY HARDWARE.—Coleman, Walker & Co., Elizabethport, N.J.

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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:

22,232.—HORSE RAKE.—C. Garver. Nov. 20, 1872.
22,311.—LAMP SHADE SUPPORTER.—W. F. Shaw. Nov. 27, 1872.
22,436.—FRUIT CAN.—W. W. Lyman. Dec. 11, 1872.
22,572.—SPECTACLE FRAME.—T. Noel. Dec. 26, 1872.

EXTENSIONS GRANTED.

17,236.—COUPLING FOR SHAFTING.—W. and C. Sellers.
21,391.—ATTACHING PROPS OF CARRIAGE BOWS.—D. B. Wright, L. Sawyer.
21,416.—COFFEE ROASTER.—T. Heerman.
21,436.—COUCH FOR RAILROAD CAR.—F. R. Myers and F. H. Furniss.
21,443.—MACHINE FOR TURNING HUBS.—A. Rickart.
21,464.—MANUFACTURE OF BRUSHES.—S. Barnes.
21,474.—JOURNAL BOX.—H. H. Thayer.
21,540.—HARVESTER AND BINDER.—A. Sherwood.
21,541.—PIN STICKING MACHINE.—C. W. Van Vliet.

Practical Hints to Inventors.

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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.

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

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

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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On the 1st of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

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The patent may be taken out either for five years (government fee $20), or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

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SCIENTIFIC AMERICAN

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

Vol. XXVII.--No. 15. [NEW SERIES.] NEW YORK, OCTOBER 12, 1872. [$3 per Annum. [IN ADVANCE.]

NEW METHOD OF DOCKING AND EXCAVATING CANALS AND OF RECLAIMING WASTE LAND.

A public benefactor has been tersely defined as the man who can cause two blades of grass to grow where but one existed before; in our belief, the term is equally applicable to the individual through whose inventive genius valueless bogs or dangerous quicksands can be reclaimed and transformed into solid *terra firma* for agricultural or building purposes. The slow and tedious method of accomplishing this work is already well known. The expense of a large force of men and the first cost of the cumbrous machinery is, as a general rule, so great that unless the land to be reclaimed is situated in a location which renders it of unusual value, the enterprise is rarely productive of profit or, at best, the capitalist is obliged to lay out large sums and wait patiently for returns that will cover the interest on his disbursements.

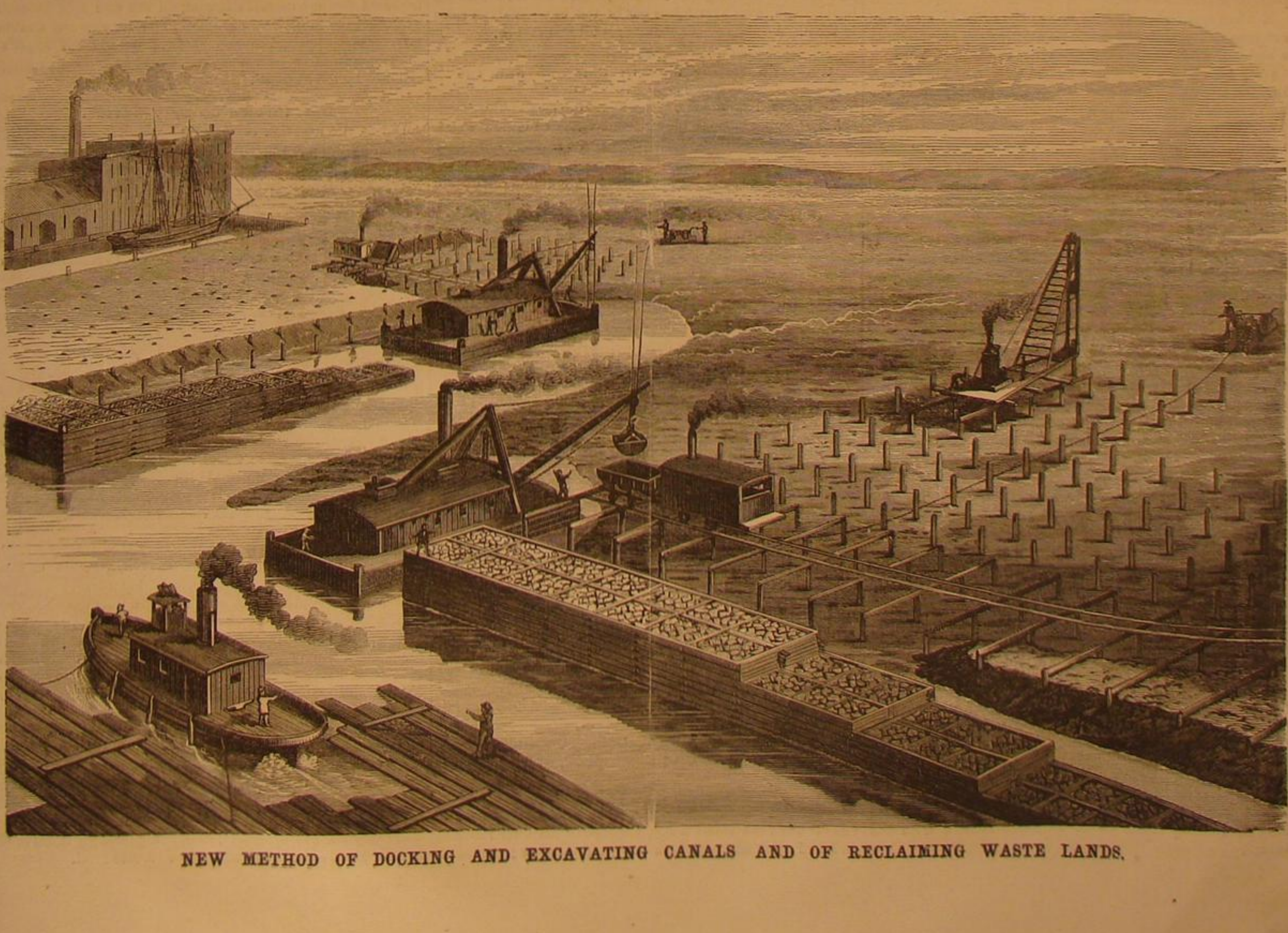
The new mode of docking and excavating canals, basins, and slips through marshes and low lands, which we now present, permits of the use of the excavated earth to grade the adjacent ground. Let the reader imagine the dock front shown in the foreground of the illustration to be the shore of a marsh land, of the nature represented in the distance, full of puddles and quicksand and apparently of no possible value. It is required to cut a basin into this ground at right angles to the line of the bank, say 100 feet in width, and at the same time to fill up the marsh on its either side, so as to make the latter valuable dock property, suitable for the erection of factories, lumber yards, etc. The breadth of the canal being marked out, an additional space of some 30 feet adjoining both boundary lines, thus obtained, is set apart, thus giving a width of 160 feet as an area for the excavating operations. Two pile drivers of the type shown in the engraving are next put to work on either side of this space, driving piles in parallel lines distant from each other from ten to twelve feet. As soon as four or five rows of piles are in place, pieces of sawn timber termed "adjustable" or "movable" caps are bolted to their tops with screw bolts, shoulders having been cut for them to rest upon. The caps are placed, as shown, parallel to the direction of the basin to be excavated, three rows at a time. Upon the first row and at right angles to it, a track is laid, consisting of heavy beams firmly braced and surmounted by iron rails. This track is movable and is not bolted to the cap pieces. Upon it is placed a dumping car, made after a patent of the inventor of the process we are describing, which is so constructed as to deposit its load in the ordinary manner and then immediately return, by its own gravity, to a position ready for filling. Attached to this car is a dummy engine, which draws it along the track. The preparation being thus far complete on one or both sides of the projected basin, dredging machines proceed with the excavation, digging out the interior of the slip close up to the first line of piles for the full width of 160 feet, but leaving directly in its center a "core" or untouched portion of soil. As fast as the dredge buckets remove the earth from the bottom, they are elevated on the derrick, swung over and dumped into the car on the rails. This, when loaded, deposits its burden on the rear side of the track and along the entire length of the same. As soon as the land along the line is raised to its required level, the track, car and dummy must be moved. This is done by attaching a chain or rope to the further end of the track, and bringing it to a powerful hand windlass some distance off. By this means the track is bent forward on the caps, as depicted in the lower right hand side of the illustration. Earth is then carried along and dumped into the additional space thus obtained until it is filled; next, the rope from the windlass is attached to the inner end of the track, and that is pulled forward until it is even with the extremity first moved. The rails are once more straight, but now rest on the second row of caps. The first row, being of no further use, is unbolted from the piles in advance of the third row, and this is carried on in turn with each set of caps until the excavating is completed.

The dredger, meantime, having advanced 100 feet, a crib of that length is prepared of heavy timbers, firmly bolted together. This is towed into position on the bank of the slip and placed exactly on the before determined boundary line of the final width of the basin. As this cut is some 20 feet in width, and as it is placed on the 100 foot line, it must be seen that an excavated space of 10 feet will be left between its outer edge and the first line of piles. The crib is then filled with stones and sunk, the dredging machine proceeds with its work for another hundred feet, another cut is put in position and thus the operation continues until the entire length of the basin on both its sides is excavated, when all the cribs are finally built up even with the grade of the land.

But the core of earth is still in the center of the basin. This the dredging machine now attacks, digging it up and throwing the earth obtained into the excavated space referred to, between the sunken cribs and the outer lines of poles, until the same is filled up level with the adjacent ground. Lastly, the bulk head forming the further end of the basin is built, and the work, with the exception of the finishing and planking of the docks and the final grading of the soil, is complete.

It will be seen that the loose clay and mud is held in the first instance in a measure by the numerous piles; but as soon as the cribs are sunk, its tendency to spread and fill up the basin is arrested, so that it is merely necessary to continue the filling and grading to render the ground perfectly firm. The wet soil from the bottom packs solid in the space of a year, and its surface is made smooth and hard by a top dressing of coal ashes. It thus, together with the piles (to which additional ones may be added), forms an excellent building foundation. This method has been thoroughly tested during the past three years along the water front of South Brooklyn, Long Island. In 1866, all that portion of the city bounded on the north by Third street, east by Fourth Avenue, west by the Gowanus Canal and south by Ninth street was a low, marshy piece of ground, mostly covered at high tide. The Brooklyn Improvement Company here own 600 lots, 25 by 100 feet each, having a water front on Gowanus Canal, and at that time valued at about $200 apiece. It was considered that the best that could be done with the property was to build a dock front, 150 feet long, on the canal, thus making 60 dock lots, 25 by 200 feet in dimensions, which would have been worth at most $10,000 each. Nearly 500 lots would thus be left unreclaimed and comparatively valueless, owing to the large expense incident to filling them up with earth carted to the spot. At length it was decided to adopt the novel plan which we have described. Work was accordingly begun, and it has resulted in the formation of slips at right angles to the canal, which afforded 7,250 feet of dock front or 600 dock lots. The cost of the labor was $70 per foot of dock, or in all $507,500. The value of the completed work is estimated at $400 per foot, or over three million dollars, each lot being worth to-day, instead of two hundred, from five to ten thousand dollars.

Some idea of the rapidity of the process may be obtained



NEW METHOD OF DOCKING AND EXCAVATING CANALS AND OF RECLAIMING WASTE LANDS.

from the fact that, with a single dredger and one dummy engine and car, each basin, measuring 100 feet in width by 800 feet in length, was dug down so as to have 16 feet of water at high tide within the space of a year. Operations are still in progress in the above mentioned locality, which those interested in the reclaiming of land will find of exceeding interest to visit. The inventor and contractor, Mr. John B. Wood, or his agent, will be found upon the spot, or letters for further information relative to rights, etc., may be addressed to 390 Third st., South Brooklyn, N. Y.

THE WONDERFUL REGIONS OF THE WEST.

A member of the Hayden geological expedition, now engaged in surveying the National Park and portions of the Yellowstone river, writes some very interesting particulars to the *Evening Post*.

The branch of the survey under the immediate command of Professor Hayden, having gathered at Fort Ellis, organized as follows: Dr. Hayden, geologist; Mr. Savage, assistant; Mr. Burch, topographer; Dr. Peale, mineralogist; Mr. Holmes, artist; Mr. Logan, executive officer; Mr. Gannett, astronomer; Mr. Wakefield, meteorologist; Mr. Brown, assistant; Mr. Chrisman, photographer; Mr. Bingham, assistant; Mr. Platt, naturalist; Mr. Sloan, assistant.

The survey proceeded across the country to the Yellowstone River. The first natural wonder encountered was the peculiar formation of uplifted strata known as the Devil's Slide. This consists of two parallel walls of reddish clay, running down the side of the mountain with a smooth surface between them, supposed to be composed of cinnabar, the whole forming a curious freak of Nature.

HOT SPRINGS OF GARDINER'S RIVER.

The calcareous deposit along the route announced an approach to the famous Hot Springs on Gardiner's River. We encamped at the foot of the hillside whose surface they have encrusted with such beautiful formations. The snowy whiteness of the deposit, sparkling under the sunlight, presented the appearance of a frozen cascade. The next day a closer inspection revealed new beauties to our gaze. The upper plateau, elevated about two hundred feet above where we were encamped, was covered with little pools from six to eight feet in diameter and varying in depth from a few inches to several feet. The edges were rounded, by the outflowing water, as beautifully as if carved by hand; indeed, they resembled the basins of artificial fountains. The interiors were stained with yellow, red and green from the deposits of sulphur, iron and copper with which the waters are charged, the whole resembling an artist's palette covered with patches of most brilliant colors. A white cloud of steam rises from the mouth of the main spring flowing from the crest of the hill. It is about thirty feet in diameter, while the water is so transparent that one can gaze into the ultramarine depth, but looks in vain for the bottom. The temperature of the water is 132 degrees Fahrenheit. The water escapes into the basins below, where one can bathe, regulating the temperature according to the distance from the source. The edges of these natural bath tubs are decorated with a beautiful bead work that it would be almost impossible to imitate by art.

Not less wonderful, though not so beautiful, is a calcareous cone rising, from out the plane skirting the mountain, to a hight of fifty feet, with a diameter at the base of about twenty feet. It is evidently an extinct geyser, and is formed, like the High Rock spring at Saratoga, by the deposit of the never ceasing flow, forced upwards by the pressure beneath. This, from some natural cause, is gradually closed at the summit. It stands as a monument of a former age.

The country from this point became more difficult to travel, as we were approaching the land of cañons. Several tributaries of the Yellowstone here empty themselves into the main river.

THE GREAT FALLS OF THE YELLOWSTONE.

Two days march brought us to the mouth of the great cañon. Riding along the high plateau crowning its side, we first noticed the basaltic columns, capping the opposite bank with a regularity resembling Art more than Nature and presenting an appearance not unlike a fortification. It is similar to the formation of the Giant's Causeway, and reminded me of that curious place. The scene below was almost fearful to behold, the river fairly lashing the rocks in its rapid descent at the bottom of the cañon one thousand feet deep. The roar of the great falls first announced its presence, and a rapid ride, though scarcely apace with our eagerness, brought them in view.

What shall I say in their praise? How describe them? Montmorency excels in hight: Niagara, in grandeur and force; Trenton, in beauty; but the great Yellowstone Falls combine the beauty of all three. The river flows smoothly as it approaches this, the natural floodgate of the great lake, until, narrowed by the rocks, it precipitates itself over the ledge and falls three hundred and fifty feet on the rocks beneath, sending up a cloud of spray and making a roar that can be heard for miles around. Grandeur and sublimity only can describe the scene.

THE EXPLODING MUD SPRINGS.

About ten miles above the falls we came to a most interesting group of hot springs, named the "Seven Hills." One of these had a powerful steam vent, making a noise resembling a high pressure engine, which we named "Locomotive Jet." The temperature was 197 degrees Fahrenheit, which at this high altitude is boiling point. The crust surrounding the mouth is ever hot, and yet so strong that we could walk over it; and the entrance can only be approached on the windward side, so burning is the cloud of steam emitted from the cavern.

Phenomena of the same nature, but more curious, are the mud volcanoes existing at this place. These are formed by the boiling water forced through beds of clay, softening the earth, and agitated by the propelling gases, thoroughly mixing the same. The gas continually escapes in puffs until, accumulating in sufficient quantity, it finds vent by exploding, throwing the mud from twenty to fifty feet into the air, and sometimes even as high as a hundred feet, as the bespattered branches of the surrounding pines attested.

The Greenland Meteorites.

Professor Nordenskjöld has communicated to the Geological Society a paper on the remarkable masses of meteoric iron from Greenland, discovered in 1870 at Ovifak, and brought home last year by the Swedish expedition under Baron von Otter. They are the chief masses of an enormous meteoric fall which probably occurred during the miocene period, and extended over an area of two hundred English miles, embracing not only that region occupied by the Greenland basalt, but a country composed of granite-gneiss. The theory having been advanced by some geologists that these masses of metal are erupted and not meteoric, Professor Nordenskjöld maintains his view of their meteoric origin on the following grounds: The iron when heated evolves gases amounting in volume to 100 times that of the iron itself; it contains isolated grains of iron sulphide embedded in the iron, which, it was noticed, contains scarcely any sulphur, while the external form of the masses exhibits no trace of their having been poured while in a molten condition into a cavity or fissure. The character of the masses is extremely variable: they are composed of meteoric nickeliferous cast iron, or of nickeliferous wrought iron, or a mixture of both; and in the last case they exhibit most clearly the peculiar figures brought out by etching.

The native iron occurs in the basalt in several forms. It is met with as enclosed and but slightly altered meteorites. It is found filling cracks one or two lines in width, forming probably fragments of meteorites that have been flattened out under the influence of time, or wedged into these cracks in the act of falling, or which have fallen into cracks in the tuff that has been subsequently consolidated. Moreover, brecciiform stones occur, which are composed of fragments of iron cemented together with hydrated oxide of iron and newly formed silicate of iron. Close beside the iron masses in the basalt are found fragments of rock, differing from the basalt itself, and remarkable for being rounded at the edges and having what resembles a meteoric crust on the exterior. The Professor as yet finds himself unable to express any opinion as to the cause of this curious association. Besides all these forms, the native iron is disseminated through the basalt in grains sometimes as large as a pea or bean, but oftener as fine scales.

Within an area of at most fifty square meters were found sixteen meteorites, the weights of which, in Swedish pounds, are as follows: 50,000, 20,000, 9,000, 336, 230, 200, 191, 150, 150, 150, 100, 56, 42, 15, 8, and 6. The three largest have the following diameters, respectively: 2 by 1·7 meters, 1·3 by 1·27 meters, and 1·15 by 0·85 meters. Nearly 100 pounds of lenticular shaped fragments of iron, from three to four inches in thickness, were also taken out of the basaltic dyke close to them. All the masses contain nickel and carbon.

What an Editor Saw in Colorado and the Rocky Mountains.

Mr. Henry T. Williams, editor and publisher of the *Horticulturist*, writes home to his readers a series of letters which he terms "Floral Rambles." We extract from one of these the following:

"Think, ye stay-at-homes, of a ride for six hours with the Rocky Mountains on one side of you, their summits capped with snow and gilded with the unreserved splendor of the sun; then look between you and them and see peaceful valleys and natural parks, the home of thrifty cattle or happy ranchmen's cabins; then to the left of you, and in fact all around you, a paradise of flowers. Never shall I forget one sweet spot, just before reaching the top of the divide, 40 miles from Denver. We stopped in the midst of a prairie thickly clustered with the gilia.

The startling, blazing crimson of the gladiolus was but an ineffectual comparison to the splendor of the colors of these native floral maidens. Rearing their tall stems upward 2½ feet, surmounted with the dazzling crimson, pink and white bells, and millions of them in sight, hardly permitting room for the foot to rest without breaking one—it was indeed a 'joy never to be forgot.'

Acres of sunflowers were strung along our track. Then too, we saw the Mexican poppy, with its pure white, delicate leaved blossom, upward turned as if to drink in the exhilarating sunlight; the ipomœa, or Rocky Mountain creeping convolvulus, hung for us its blue, bell-like blossoms; myriads of little prairie roses blushed with their light pink bloom; lupins erected their stately blue heads, and scores of others, till we were fairly bewildered. * * *

Imagine, then, some of the delights of floral rambles and botanizing among these Rocky Mountains. Perhaps the botanist now coming may not find anything new, where so many have gleaned the field before, but he will always be entranced with the profusion of the flowers, the unusual brilliance of colors, the grandeur of the mountains, the ascent of the peaks, the sublime, inspiring atmosphere, the exhilaration of spirits, and, best of all, a grand appetite, with invigorated bodily powers.

Colorado Springs nestles at the foot of Pike's Peak, a beautiful home for any invalid. Standing on the plains of Fountain Colony, six miles away, where General Cameron had gathered 1,000 inhabitants in one year, there is revealed to you the very best glimpse of the mountain. 'Tis a picture of boldness and variety of color unrivalled in America.

Go, then, to Colorado, and enjoy, besides the flowers, its canons, its scenery, and life-giving atmosphere. One fact seemed curious to me. At elevations of 8,000 feet, I found better lands, a better climate, the temperature was more equable, grass greener, almost perennial in growth, and cattle grazing the year round. Flowers, too, were more profuse and brilliant. Above this the air is too cold and forbidding. Below this brings you to the warm plains, uncertain showers and dry grasses.

At 6,000 to 8,000 feet, I noticed the *euphorbia variegata* in full bloom, well opened out, when for hundreds of miles, the week previous, I rode through central and Western Kansas, 4,000 to 5,000 feet lower, yet it had not opened one fourth of its leaves."

Coal near San Francisco.

For more than a year past it has been quite definitely known that coal existed in apparently workable quantity and of good quality, at a point some six miles from Oakland Center. Recent developments are reported to have shown a vein near the surface, with a thickness of three feet and upwards, and of a quality superior to that obtained at Mount Diablo, and so free from sulphur that iron may be welded with it without difficulty.

The location is at an elevation of about 700 feet above the level of San Pablo Creek Valley, and three quarters of a mile north of the telegraph road. It stands at an angle of about 30°, where it has been opened in a shaft 30 feet deep.

The mines could be reached from Oakland by a roadway through the proposed tunnel of five or six hundred feet, with a grade easy enough for horses to trot up or down. It is said that several enterprising capitalists of San Francisco are interested in the mines, and that coal thence will soon find its way to this market, where it is thought it can be delivered at a cost of only about $3.50 per ton. Adding a fair profit to that figure, this coal if it can be so delivered and is of the quality represented, will prove by far the most important coal discovery on the Pacific coast. With good coal laid down in the city at $5 per tun, there is no reason why San Francisco should not become one of the largest manufacturing centers in the country.—*Mining and Scientific Press.*

Sugar in Urine.

Seegen finds that when the urine contains mere traces of sugar, it gives with the potassic tartrate of copper a mere doubtful deposit of suboxide of copper, of a modified color, and which might be due to the presence of uric acid. He therefore filters the urine through good animal charcoal, washes this with a little water, and searches for sugar in the washing water, which gives as distinct a reaction as a solution of pure sugar. We may thus detect sugar in urines which contain only 0·01 per cent. With urines richer in sugar, that is, containing 0·05 per cent, we obtain in the washing water a precipitate much more distinct than in the urine, either in its original state or after filtration over animal charcoal. A solution of uric acid containing 0·1 per cent gives a decided precipitate of the suboxide of copper; but if the liquid is passed through animal charcoal, all the uric acid is kept back, and the filtered solution no longer reduces the double tartrate of potash and copper. This method is not applicable to quantitative determinations, a part of the sugar being retained by the charcoal.

Dust thrown up by Vesuvius.

During the eruption of Vesuvius which took place last spring, Naples and the surrounding country were visited by a shower of fine black dust. In some places the fall was very heavy, and even in Ischia, at 25 miles distance from the mountain, where the dust examined was collected, the quantity was sufficient to cause great annoyance to the inhabitants. It consisted of aggregations of crystallized quartz, dotted over with the magnetic oxide of iron. This ferroso-ferric oxide was also crystalline, and possessed a high metallic luster. The grains were very uniform in size, and would pass through a wire gage, the apertures of which measured the 16,000th part of a square inch. By boiling the sand in hydrochloric acid, the whole of the iron is removed, and nothing but crystals of pure white quartz remained. Its composition is the same as that of the iron sand which is found in the soil in some parts of the country round Vesuvius, and which is the product of former eruptions; the latter, however, obtains a larger relative proportion of iron, and the grains show a water worn appearance under the microscope. Neither of the Vesuvian specimens contain titanium, which is found in the magnetic iron sand of New Zealand, which has most likely been ejected from the great volcano of Mount Egmont.—*G. Gladstone.*

GLYCERIN IN GAS METERS.—In Dresden, glycerin is generally used in place of water; after it has been so used for some years, it becomes foul and requires purification. The fluid is first heated for 12 hours to from 50° to 60°, and next to from 150° to 130° in order to eliminate water, ammoniacal compounds, and other volatile impurities; the glycerin is next filtered over granulated animal charcoal. Some 300 to 400 cwts of glycerin are annually purified in this manner at Dresden.—*Hasse.*

IT appears to be general opinion on the Continent that the only possible field pieces are breech loaders. Besides being more rapidly manœuvred, they require fewer men, and greater accuracy in aim is obtained; and they possess many other good qualities. It is still, however, a moot question of what material they shall be composed, some being strongly in favor of bronze, while others as strenuously advocate steel.

The Ophir Mines of Utah.

A correspondent of the *Evening Mail*, writing from Salt Lake city, relates his adventures among the Utah mountains, and thus describes the process of mining, and how the silver is extracted from the ore:

Ophir city, says the writer, is an admirable specimen of the mining camp of our country. Two years ago the cañon was in primeval loneliness and desolation; to day it is lined with log houses and lumber shanties, while billiard saloons, bowling alleys, a telegraph station, and a bank exchange are established institutions.

On Sunday morning I turned out for a *douche* under the mountain stream, and then started to explore the Miner's Delight. At so great an altitude as 7,000 feet above the sea level, exertion becomes very oppressive, the air being so rarefied and the lungs feeling as if they didn't get half enough air or inspiration; the nose is liable to bleed, and if that should occur, the difficulty is to get it to stop. I escaped this latter casualty, and after a stiff climb, during which we paused frequently to admire the scenery and take breath, arrived at a yawning chasm, piercing deep into the bowels of the earth, closed with a wooden gate. That opened, I left daylight and, putting one foot in a loop while I balanced myself with the other, was let down a shaft some 170 feet in depth to a chamber excavated out of the solid rock, whence galleries branched out in different directions. The interior of a silver mine is to the unskilled visitor not very interesting; he is unable to discriminate between the varieties of ore and the general appearance presented to his eye is that of a dull yellow or grayish rock, crumbly in texture save where strata of quartz or granite intervene. Here and there the galleries opened into spacious chambers, propped and supported by strong logs of timber where the vein has branched out. There has as yet been no native silver discovered in this locality, the previous metal being found as sulphide, chloride, and pyromorphite in juxtaposition and combination with every known metal, tin alone excepted. Lead, iron, copper, and antimony are found in large quantities, and traces of gold are occasionally met with. The former ones are neglected, and the latter has not been discovered in sufficient quantities to justify exclusive attention to its production. The surface formation is limestone, but on the deep levels the course of the vein is traceable through the primary stratum. In mines as yet undeveloped the attention of the miner is confined to the external deposits, which are unreliable in continuance; whereas in those which are worked by capital, deep shafts are sunk with a view to striking the main lode and so securing an unfailing supply.

There are three methods by which the silver is extracted from the ore, two of them—milling with stampers and working in an araster—being based upon the power which mercury possesses of *forming* an amalgam with silver and gold; the third being a melting process by which silver and lead are run off into ingots of impure metal technically termed bullion. Those ores which contain 25 per cent of lead are melted, while the other ores, in which copper, antimony, iron, and sulphur are present, are treated by dry or wet milling. In melting, an ordinary melting furnace is charged with alternate layers of charcoal, ore, and flux, and a steam blast, on the same principle as that used on locomotive engines, is introduced to create a violent draft and so expedite combustion. There are two tap holes at different distances from the base of the furnace, through the upper of which the slag flows out, while the base bullion is run off from the lower aperture into molds.

Milling may be divided into the dry process in a damp mill, and the wet process in an araster. In the former, the ore is first baked in a kiln and then reduced to a fine powder by the continued action of heavy rammers or stampers, which fall upon it and crush it to an almost impalpable dust. If the ore contains sulphur, it is then mixed with common salt and submitted to the action of fire in a reverberatory furnace; the sulphur is sublimated while the chlorine of the salt takes its place. When sufficiently roasted, the powdered ore is conveyed to revolving barrels with washers in the interior, mercury and a little water are introduced, and the apparatus is agitated for about six hours until all the silver has been taken up by the mercury to form an amalgam, which is then drawn off and strained through a common leather bag. The uncombined mercury drains off, leaving a compact amalgam about the consistence of putty, which is retorted; the mercury distils away and is condensed for future use, and the silver remains in a porous state. It is then remelted and cast into ingots of pure metal ready for the market. The araster is a Mexican machine, and is a cheap substitute for the more expensive outfit of the stamping mill. It is worked by water and consists of a large tub, some seventeen feet in diameter, floored with rock; a transverse bar, to the extremities of which ponderous stones are attached, revolves above, and the tub is filled with a mixture of pounded ore and water. The stones revolve until the grit is all worn away, and then the fluid is transferred to the amalgamating barrels. The remainder of the process is identical with that described above.

So much for mining, milling, and smelting. There are a number of mining districts around Salt Lake city; in fact, every cañon is a district.

How to Secure a Pleasant Expression.

One of our city papers is responsible for the following: Mr. Charles Williams has lately attained celebrity as a sneak thief. Having stolen a lot of laces from a shop in Grand street, been arrested, escaped from the officer, and been recaptured, it was ordered by Superintendent Kelso that his picture should be taken for the celebrated "rogues' gallery." To this Charles, modest as regards his pretensions, no doubt, demurred. When placed in the chair, and the instrument brought to bear on his face, he fell to making the most horrible grimaces, shut his eyes, opened his mouth, and resorted to other devices not improving to his naturally prepossessing countenance. On a second attempt, the unwilling sitter kicked over the camera and knocked out one of the lenses. Finally, by dint of handcuffs and a strap under his chin to keep his mouth shut, a picture was got of the engaging youth, the sole defect of which is that the eyes are closed. Thus the "counterfeit presentment" of Charles, wrapped, to appearance, in infantile slumber, now graces the wall of the rogues' gallery. If all the people gifted with no greater share of beauty than this ornament to society were equally averse to its reproduction, the number of hideous countenances at the doors and in the rooms of the photographers would be vastly diminished.

Gold and Platinum in Russia.

The *Gorni Journal* of St. Petersburg gives some interesting notes on the production of these precious metals in the Muscovite empire. In 1868 were produced (in 993 gold stream works, by 56,261 men, from 14,365,550 tuns of gold sand) 56,068 lbs. of gold, the raw sand yielding 0·000195 per cent on average. The greater part was washed in Eastern Siberia, where the richest stream works exist. At the Government gold diggings, or stream works, near Miask, in the district of Stataoust, the gold bearing stratum of sand is about 2½ feet to three feet thick, covered by 15 feet, of dead gravel. The uncovering of the beds and the delivery of the gold sand to the washing establishments is generally done by contract, and by the cubic fathom. The raw material is first screened in a stream of water, when the small parts flow through ¾ inch sieves upon buddles with transverse wooden laths, behind which the gold particles principally collect. Every 6 or 12 hours, according to the produce of the sand, the laths are removed and the tables washed clean with scrapers, brushes, etc., of this concentrated material, while larger lumps of gold are collected upon the screen from between the larger pebbles. At the larger works the extraction of the metal from the concentrated sand is done by steam power, when the sand is washed through a fine sieve upon a buddle with American frame, where the stuff is still more concentrated, and finally finished upon hand-washing machines. When the raw sand contains much clay or loam, perforated rotating drums are used, instead of simple screens. The washed gold generally contains 10 per cent of silver. Where only hand power is used, 40 men will wash in 10 to 12 hours 40 to 60 tuns of sand, while with the use of machinery 150 men and 50 horses will wash eight to ten times that quantity. The greatest and most productive goldfields of Russia will always be those of Siberia.

Platinum is always washed together with gold, and the production of raw platinum rests finally upon a separation from gold, with the exception of a single locality. The mixture of gold and platinum which is brought to Tagilsk is classified in two sorts. Both are treated with mercury, when the gold is dissolved, while the platinum is left as a residue which is separated from the amalgam by washing. The latter is pressed through a leather bag, and the gold obtained by distilling off the mercury. The raw platinum is by no means clean, but some samples contained, after M. Le Play, other metals, such as platinum, 75·1, palladium 1·1, rhodium, 3·5, iridium, 2·6, osmium-iridium, 0·6, osmium, 2·3, gold, 0·4, copper, 1·0, iron, 8·1, residue, 4·5. The raw platinum is generally sold to England and France at a price of £15 per pound platinum. The production of this metal was from 1828 to 1845—5,247 lbs. on average, and is now 4,000 lb. per annum. The principal platinum stream works are in the Ural Mountains, near Nischnei Tagilsk, and belong to Prince Demidoff and the Russian Government.

Moths among Clothes.

"To prevent the ravages of these insidious pests, the first desideratum is a box with a close fitting lid. Nothing else will serve the purpose of keeping out the moths for any length of time; for where they cannot get in bodily, they will thrust in the ovipositor, and deposit their eggs. To destroy the larvæ and moths, if they have entered, benzole will be found the most efficacious. This may be sprinkled over the apparel; if as before mentioned, the lid is close fitting, the benzole will retain its influence for a length of time. If economy is an object, rags saturated with turpentine, alone or mixed with benzole, may be placed in a corner of the box. It need hardly be stated that a light should not be brought near the box when first opened, as the vapor of benzole is highly inflammable, but soon passes off."

The above item, from an exchange, is all well enough, except the advice to use benzole, which is more dangerous than gunpowder. The latter requires that fire shall not be carried into contact with it, but the vapor of benzole travels of itself to the lamp and explodes. Almost any highly odorous substance will be found useful in place of benzole. For example, cedar wood or camphor may be used, and they have the advantage of being safe.

A New Life Preserver.

A correspondent, Mr. S. H. Starr, writes as follows: "I suggest the following as an improvement: A rubber garment like a pair of trousers, boots and all in one, lined with woolen stuff, reaching from the soles of the feet to the armpits, into which the person could thrust himself or herself, and then secure the garment in place by straps passing over the shoulders. Inside or outside of the garment, under the arms, reaching down not much below the chest and forming a part of the garment, should be the buoying device, say an air chamber surrounding the garment, or better, a chamber filled with cork chips, for when so filled an accidental leak will not destroy its buoyant qualities. Such a garment would securely buoy the body, and at the same time protect it from wet and cold."

Patent Office Decisions.

INTERFERENCE.—ALLEN AND MOODY *vs.* A. C. GILMAN'S LOOM TEMPLE PATENT OF SEPTEMBER 4, 1872.

LEGGETT, *Commissioner:*

Perhaps nothing less than fraud should be considered a sufficient cause for relaxing the rule that a party shall be bound by the date of invention set forth in his preliminary statement.

The question of reasonable diligence only arises between applicants where one is first to conceive the idea of the invention and the other is first to perfect it and reduce it to practice.

Acknowledgment by an inventor of the right to a patent to be in another, and assent to its grant to him—having been so decided by the Supreme Court of the District of Columbia—is not, after its grant, a bar to a subsequent grant of a patent for the same thing to the inventor. Decision of the Board of Examiners in Chief reversed, and priority awarded to Allen and Moody.

The Ransome Artificial Stone.

INTERFERENCE—RANSOME, BESSEMER & RANSOME *vs.* THE PATENTS OF RICHARD NORRIS, JR., NOS. 89,884 AND 92,345.

LEGGETT, *Commissioner:*

Both these alleged processes are designed to be employed in forming the Ransome concrete stone. This stone is a compound of silex and silicate of calcium; but, the latter being insoluble, it is found impracticable to cause their direct mixture and union to form a solid. This is accomplished by first forming a plastic mixture of silex and soluble silicate of soda, and then permeating it with chloride of calcium. The effect is to form silicate of calcium and harden the mixture, and at the same time leave a residuum of chloride of soda, which must be washed away. This effect was first accomplished, imperfectly, it is said, by merely bathing the plastic mixture first formed in chloride of calcium, or by forcing the latter into the interstices of the former by pressure within an exhausted receiver. (See English patent of Frederick Ransome, No. 877 of 1861.) This latter process of placing the plastic mixture in an exhausted air tight vessel, and then admitting chloride of calcium and applying hydraulic or other pressure to it, is the one first described in the Norris patent of July 6. The one next described, which is alleged to be much superior, is that now in controversy, and consists in placing the plastic mixture described in a vessel having a perforated bottom inclosed by an air tight chamber, which is connected by a pipe with an air pump. Chloride of calcium is placed in the vessel over the mixture, and the air exhausted from beneath. Pressure from above other than that of the atmosphere may or may not be applied, at option, to drive the solution through the mass. Afterward water may be applied in the same manner to wash away the residuary chloride of soda. This is termed the "filtering" process. It is evident to me that by the process first named, or the "exhaust" process, the chloride of calcium or water could only be forced *into* and not *through* the mass, as by the filtering process, which affords an opportunity for its escape. It is also evident, and is in proof, that the result of employing the filtering process would be a more perfect hardening of the stone in all its parts than could be accomplished by the exhaust process. I regard these processes, therefore, as materially different from each other.

I agree with the Board that the rebutting evidence put in by the applicants was properly admitted and considered by the Primary Examiner, and their decision, awarding priority to Ransome, Bessemer & Ransome, is affirmed.

Patent Decisions of the Courts.---United States Circuit Court, Northern District of New York.

BUERK *vs.* VALENTINE.

In Equity.—Before Woodruff, Circuit Judge.

This was a suit in equity, brought by Jacob E. Buerk against Dennis Valentine for the alleged infringement of two several letters patent for watchman's time detectors, granted to complainant June 5, 1865, and March 8, 1870, the latter being a reissue of the patent originally granted to one John Buerk.

The mere fact that defendant's machine has specific points of difference as compared with complainant's will not protect him from liability, if complainant's patents are valid and the devices protected thereby are incorporated in defendant's machine.

John Buerk held to be the first inventor of a time detector containing a combination of spring points to be operated upon by a series of keys (susceptible of numerous combinations) with a watch movement, all in one case, carried by the watchman, and by successive punctures indicating the particular key, and thereby the station at which each was made.

Such a device is not anticipated by a detector operated by pressure upon a pin or button exterior to the instrument, and in which the record might be made irrespective of the station at which the instrument may be at the particular time.

Making a prior device which will serve a like useful purpose is not necessarily anticipating an invention.

Where the mechanical means employed are different and the mechanical result is different, one does not anticipate the other.

Where the defendant placed the spring points in his time detector in the lid of the box or case, perforating therewith downward, instead of placing them under the plate or frame supporting the watch movement and perforating upward, although he was thereby enabled to dispense with the annular fixed index, for which he substituted the mark of an arrow: Held, that the mechanical construction was the same in all that constituted the principle or mode of operating the instrument.

Where a patent was granted for fourteen years from January 1, 1861, instead of fourteen years from October 29, 1856, the date of the French patent upon the same invention: Held that the error was a proper one to be corrected by reissue.

A complainant's rights under such a reissue are not other than those of any inventor whose first patent is void for mistake or error which is corrected by a reissue.

He cannot recover for alleged infringements prior to reissue, but may for subsequent infringements.

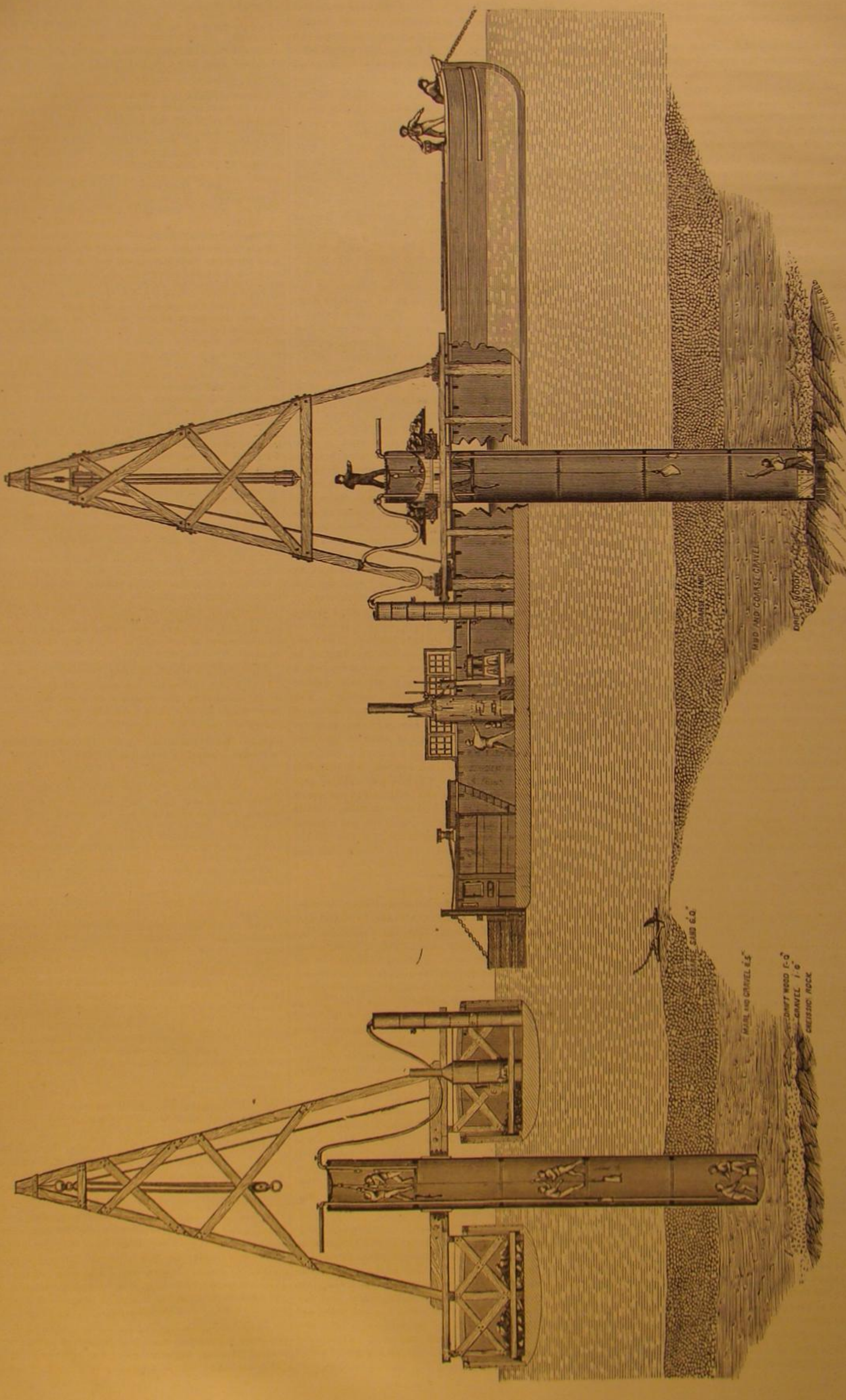
The notoriety or use of the patented invention, after the first application and prior to the reissue, will not render such reissue void, although the original patent issued on such application was wholly invalid.

Patent sustained. Decree for plaintiff.

PNEUMATIC MACHINERY FOR BRIDGES.

The engravings accompanying this article, for which we are indebted to the *Railroad Gazette*, represent the appliances used by J. W. Murphy, engineer, in sinking, by the Plenum pneumatic process, the iron cylinders which form the piers of the bridge now being built, over the Schuylkill river, by the city of Philadelphia. The pier cylinders are made in sections ten feet in length, one and a quarter inches thick, and vary in diameter from four to eight feet; and they are attached together by means of inner flanges and bolts, the joints being made perfectly air-tight.

In order to form a support for these heavy weights while they are being bolted together and placed in position with regard to line and distance, two canal boats, strengthened by bracing, are used as shown in longitudinal and cross section, in Figs. 1 and 2. These boats lie parallel to each other, distant about fifteen feet, and are firmly moored. Stretching across the opening between the boats are heavy clamps, made of strong beams, which are so arranged as to be drawn together or forced apart by iron rods. Between these clamps



PNEUMATIC MACHINERY FOR SINKING PIERS OF SOUTH STREET BRIDGE, PHILADELPHIA; DESIGNED BY J. W. MURPHY, C. E.

the sections of the column are placed by means of the large four-footed derrick. Each section is held, by friction caused by tightening the clamps by the rods, until the section which is to be next above it is placed in position and bolted. The clamps are loosened and the column allowed to slide down until the second section occupies the place of the first, and is tightly clutched. This continues until the bottom edge of the column is within a foot or two of the mud. The boats are then placed in their final position, the clamps loosened, and the entire column allowed to settle into the bottom of the stream as far as the weight of the metal will carry it.

The air lock which caps the cylinder consists of two heavy cast iron circular plates of the same diameter as the column. One of these plates makes a floor to the lock chamber, and the other, the roof, while the sides are formed by the interior surface of the cylinder itself. The diaphragms are held in place by the same bolts that unite the two upper sections of the column, and are pierced with central trap doors which fit tightly and open downwards. Openings are also made for the air supply pipe shown on the left of the lock in Fig. 1, the water exhaust pipe shown on the right of the lock in the same figure, and the equalizing pipes occupying a central position between the two in the engraving. When the column is allowed to slide through the clamps, the water of course rises within it to the normal level of the river. Before workmen can enter, this must be expelled and kept out.

Air is compressed by means of a Burleigh compressor, and is forced into the storing reservoir shown immediately to the left of the cylinder in Fig. 1. Thence it passes through the air supply pipe, and enters the column immediately under the floor of the air lock, the door of which is tightly closed. The pressure thus brought to bear on the water forces it out from under the lower edge of the cylinder; or, in case the bottom of the column is sunk in a stratum of mud impervious to water, the contents are expelled through the water exhaust pipe, out over the top of the cylinder. The men now enter the air lock, close the upper door, open the equalizing pipes, and allow the compressed air to enter the chamber until the density of the atmosphere therein is the same as that in the cylinder below. They are then enabled to open the door in the floor, and to descend to the bottom of the cylinder by means of a rope ladder. Excavation then goes on, the material being hoisted in bags which are heaped against the sides of the air lock until the time of duty of the workmen has expired. The men then enter the chamber, shut the lower door, and allow the compressed air contained to escape, so that the upper trap may be opened and the material removed. Another gang of workers then enter, and the operation is repeated.

As soon as the digging reaches the lower edge of the column, a sink is formed by cutting off the air pressure and allowing that already in the main cylinder to escape by the equalizing pipes. The water then rushes in, loosening the soil at the bottom, and the column, being no longer buoyed up, sinks of its own weight still deeper into the mud. The water is then forced out again, and work goes on as before.

To overcome the tendency of the cylinder to rise, caused by the strong upward force of the compressed air against the diaphragms, the clamps before mentioned are fastened directly to it and, at the same time, support a mass of stone of sufficient weight to counterbalance the lifting pressure. When the column has reached the bed rock of the river, the latter is chiseled to a level bearing, and the cylinder bolted thereto by heavy iron brackets which go completely around its inner circumference. The interior is then filled with rubble masonry laid in hydraulic cement. The first ten feet of this work is done under pressure, after which the work is continued with the diaphragm doors open the same as if it were an open wall.

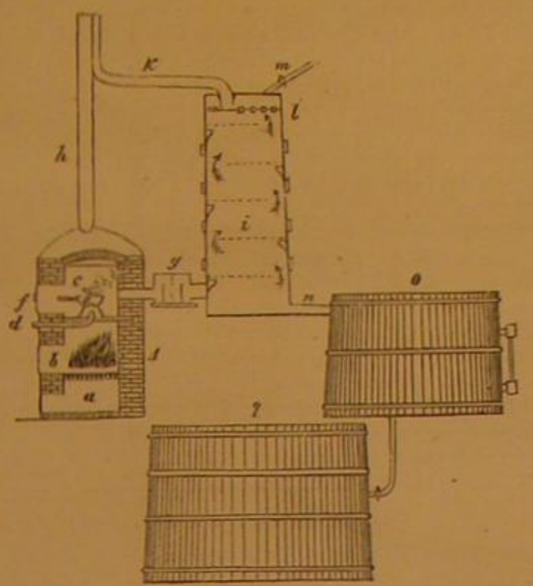
The columns are finally brought to a level by extra sections cast after the total lengths to the rock is ascertained, and are braced together outside by I beams and tie rods. Timber crib work, filled with stone, protects them from passing vessels and the flow of ice.

THE USE OF SULPHUROUS ACID IN DISTILLERIES.

The discovery that mashes, especially mashes of Indian corn, rye, and wheat, yield more alcohol when treated with sulphurous acid than when merely treated in the ordinary way, is due to the brothers Fleischmann, of Olmütz, Austria, and was made in 1860. The starch granules in the grain are, as is well known, inclosed in integuments which are only partially broken by grinding, so that only part of the amylum is thus exposed. In order to overcome this difficulty, it has been suggested to steep the flour in water. However, it was found that steeped flour soon becomes sour, especially in warm weather, so that, in the process of mashing, less sugar was formed than heretofore. Here the preserving quality of sulphurous acid suggested itself. It was found that it acts by dissolving the husky coverings of the granules, and that it alters the fermentation of the corn in such a manner that the mashes never flow over in fermentation. Moreover, the formation of lactic and acetic acid, which always causes a loss of alcohol, is entirely prevented by the use of sulphurous acid gas. And, what is also an important item, the gyle tun need not be so constantly scoured and washed. Sulphurous acid gas is readily absorbed by water, which accordingly increases in specific gravity, so that its strength may be determined by the saccharometer. Formerly sulphurous acid was produced by heating a mixture of charcoal and oil of vitriol. The latter loses thereby part of its oxygen, which combines with the carbon, while sulphurous acid escapes in a gaseous form. When used in distilleries, it was prepared in a vessel lined with lead and conducted into the contents of the mash tun; but, as the process was expensive and troublesome, it was suggested that the gas be produced by burning roll sulphur and passing the smoke into water.

In the last number of the *Practische Maschinen Constructeur*, L. Krupski mentions an apparatus which is used for this purpose, of which the following is a description:

A is a brick or cast iron furnace, consisting of three compartments: *a*, the ash pit, and *b*, the fireplace, covered with a cast iron plate; *c* has a hearth on which the vessel containing the sulphur is placed, all being provided with suitable doors. There is a bent cast iron pipe, *d*, passing through the wall of the furnace and the hearth plate. In compartment *c* there is a flat cast iron pot, with a socket in its center. Pipe,



USE OF SULPHUROUS ACID IN DISTILLERIES.

d, and socket, *e*, serve to carry air into the burning sulphur. Moreover, the door is provided with a two inch air hole, *f*. with a slide to regulate the access of air. This compartment is arched over with brick. The smoke ascends through *h*. From *c*, the sulphurous vapors pass into compartment *g*, which is divided into four divisions by cast iron plates, so that the sublimed sulphur may deposit itself instead of being carried over into tower, *i*. From *g*, the gas passes into tower, *i*, consisting of five compartments, formed by perforated projections, which may either consist of wood, cast iron, or sheet lead. These projections are placed alternately on either side, but there is room left for the sulphurous vapors, which escape through pipe, *k*. In each compartment of the tower, *i*, there are windows four inches square, opposite each other. They serve for the purpose that the ascending of the gas may be observed. In the top compartment there is a division, *l*, which is provided with holes of the size of goose quills, in each of which a pointed stopper is inserted. The space formed by the division, *l*, serves for the reception of the water, which passes through pipe *m*. The stoppers serve to regulate the influx into the tower; but this arrangement may also be replaced by a rose.

The operation is commenced by placing the necessary quantity of sulphur in pot *c*; the fire is now lighted, and the sulphur is liquefied and inflamed. From the bottom of the column or tower, *i*, pipe *n*, leads into reservoir, *o*, which is provided with a gage, and thence the water impregnated with the sulphureus vapors flows into the gyle tun, *q*. The tower or column is eight feet high and two and a half feet wide, the distances between the projections are one and a quarter feet, with the exception of the division, *l*, the distance of which from the cover is only three quarters of a foot. The tower consists of pine wood staves, and is wider at the bottom. The hight to which the vapors have ascended in the tower, after the sulphur is lighted, may be recognized by looking through a window and holding a light before the opposite one; in this case, a nebulous light will be noticed. The flow of water may be regulated by loosening the stoppers more or less, and its quantity may be ascertained by the glass gage of the reservoir, *o*. For one and a half pounds of sulphur 200 quarts should be let in, and the flow should take ten minutes' time. If the sulphur is consumed, a new portion is placed in the pot, but in the meantime the stopcock of the pipe, *m*, is closed. For 5,340 pounds of wheat flour, about five pounds of roll sulphur are required. Indian corn requires one third more, but one pound is sufficient for 540 pounds of potatoes. Rye or wheat malt are steeped while the sulphurous water is cold, covered, and left for twelve hours; then steam is introduced and the mashing machine is set in motion. Indian corn requires twenty-four hours' steeping, but potatoes may be mashed at once. It is proper to retain from potato mashes a portion of the sulphurous water for the cooling vat. Indian corn will yield 20 per cent, rye and wheat 15 per cent, and potatoes 10 per cent, more alcohol if treated by the process above described.

NEW COLORING MATTER DERIVED FROM ANILINE.—Safranine is the substance referred to; it is prepared by heating a mixture of 2 parts of nitrite of aniline with one part of arsenic acid for five minutes at a temperature of from 80° to 120°, then throwing the mixture into boiling water, and neutralizing with lime. The liquor turns a fine red color, and after standing for some time, it is filtered through linen, precipitated by salt, filtered, drained and pressed, when it is ready for market. The nitrite is formed by passing nitrous acid gas through an aniline solution.

"GREENBACKS" AND POSTAGE STAMPS.

NUMBER II.

Thus far we have traced the manufacture of postage stamps and bonds, notes, and fractional currency together, but from this point the processes differ. We shall first follow the greenbacks to their final dispatching to Washington, and then return to the completing operations on the postage stamps. After the last mentioned counting, the bills, that is the large ones, of a dollar and over, are sent to the numbering room. Here are ingenious machines which stamp upon them the red numbers denoting series, etc. The apparatus consists essentially in a number of disks on the surfaces of each of which are raised the ten digits. These disks are placed vertically side by side and so moved by the foot of the operative that a revolution of the right hand disk rotates the one to the left of it a distance equal to that between two numbers on its periphery. This actuates in a similar manner the next disk, and so on to the last. Thus the right disk counts units, the next tens, and thus up to whatever number is required. An ingenious device inks the figures, and a pressure of the treadle brings the combined disks down upon the note. Then, as the latter are raised, the right hand one turns one figure ahead, and so the bills are numbered in regular order, the entire work of the operative being to feed them in and move the lever. This complete, the currency is made into packages and forwarded to the Treasury Department where it receives the well known red stamp; and if it belongs to a National Bank, it travels on to its place of issue, there receiving the signatures, etc. Of course, in cases where the company merely print the back of the note, this numbering process is omitted, it being done by the parties printing the face.

HOW POSTAGE STAMPS ARE GUMMED.

To return to postage stamps. As soon as they emerge from the hydraulic press, they are gummed. The paste is made from clear starch or rather its dextrin, which is acted upon chemically and then boiled, forming a clear, smooth, slightly sweet mixture. Each sheet of stamps is taken separately, placed back up on a flat board, and its edges covered with a light metal frame. Then the paste is smeared on with a large whitewash brush, and the sheet is laid between two wire racks and placed on a pile with others to dry. Great care is taken in the manufacture of this paste. We are informed that it is a common affair for the company to receive complaints from persons, asserting it to be poisonous and that they had been rendered ill by it. These became so frequent that an analysis was made by an eminent chemist of this city, which conclusively proved the paste to be perfectly harmless. Several other absurd ideas on the same subject have been broached. A would-be inventor recently gravely proposed to manufacture the paste into a kind of confectionery, giving it some flavor, so that postage stamps would be sought after as a kind of bon-bons and their sale thereby largely increased.

After the gumming, another pressing in the hydraulic press follows. Then more counting—in fact, to save space, we may note here that stamps are counted no less than thirteen times during their processes of manufacture. The sheets are then cut in half, each portion containing 100 stamps, this being done by girls with ordinary hand shears.

HOW POSTAGE STAMPS ARE PERFORATED.

Next follows the perforation. To understand this process, the reader must imagine two cylinders placed horizontally above each other. Each is divided vertically into several parts and each section is surrounded by a narrow raised band. There are as many of these bands as there are dividing spaces in a perpendicular line between the stamps. Each ring on the upper cylinder is covered on its surface with projections which are very small, very close together, and cylindrical in shape. On the bands of the lower cylinder are indentations, into which these projections accurately fit. In short, the projections and their corresponding sockets make a series of little punches and dies which cut out round bits of the material placed between them. The object in making the cylinder of movable pieces is to allow the distances, between the lines of perforations, to be altered at pleasure. In front of the cylinders is an endless belt on which the sheet of stamps is placed and is thus carried directly between them. As the paper passes through, the perforations are punched, and a simple appliance detaches it from the cylinders. The perforations are first made in a perpendicular line, and then afterwards in a horizontal line by passing the stamps through a similar apparatus differently adjusted. Another pressing follows—this time to get rid of the raised edges on the back of the stamps made by the dies, and this ends the manufacture. A separate apartment is devoted to the packing and sending off the stamps to the different post offices, as they are not, as is the case with currency, sent to Washington. The requisition comes from the Treasury Department to the Bank Note Company, who, if the number of stamps called for exceeds 20,000, pack the sheets in large bundles, or, if below that number, enclose them in half bundles and envelopes and send them registered through the mails. After Congress meets and an appropriation is allowed, suitable arrangements will be made for the distribution of the new postal cards. These are made from dies cut in hardened steel for surface printing, a novel and heretofore considered impossible mode of engraving. The lines instead of being sunk are raised like those of an ordinary wood cut, so that the plate may be used in the same manner as type in any printing press. The completed card shown to us is 3 inches by 5¼ inches in size, made from a fine quality of card board and is of a light buff color. A border of scroll work runs around the edge, while in the upper right hand corner is a very handsome stamp, consisting of a head of Liberty encircled with stars and surrounded with elliptical scroll work. The denomination is one cent, and the color of the work, a rich velvet brown. The inscription is simply "United States Postal Card—write address only on this side, the message on the other." Below are ruled lines, while the reverse is blank.

To convey some idea of the immense number of postage stamps used: In the space of three months, the National Bank Note Company have made over 143 millions of all denominations, valued at over four million dollars. During the present year, 520 millions have been completed, those made in January numbering 76 millions. 38½ millions have been completed in a week, and 13 millions in a single day. Three times as many three cent stamps are used as of all other denominations combined; after them come the one cent, and then the two and six cent. The last weekly return of the company showed a manufacture of over 14 millions of finished stamps.

Correspondence.

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

The Austrian Patent Laws.---Shabby Treatment and Poor Encouragement for American Inventors.

To the Editor of the Scientific American:

Herewith I send you a copy of the proposed law for the protection of new inventions that may be brought to the exposition, and for which patents have not been taken. You will see from the preamble that it has been caused by the article published in the SCIENTIFIC AMERICAN of December 23, 1871, setting forth the difficulties of inventors coming here with their goods, and the want of proper protection. You will at once see that the proposed Exposition-Protection gives no protection beyond the old law, and is simply a deception. It was described to the world through the Austrian press as an adequate protection, when in reality it is a decoy to induce inventors to come here with their inventions before taking out their patents, where their only protection is the old patent law, which is a perfect fraud upon foreign inventors.

In order that you may thoroughly understand the working and rulings of the law, I will give you my experience in a suit, which has now been going on between two and three years and can be continued for ten years if the Patent Office sees fit.

1. All patents must be worked within one year of the date of the issue of the patent.

2. Working before making application for a patent, even if invented in the country, is ruled to be non-compliance with the law.

3. Working a patent between the date of application and date of issue is not complying with the law.

4. Bringing the parts necessary to make a machine or article into the country and putting it together and finishing it in the country is declared to be not manufacturing in the country, according to the law. All of the parts are required by the Patent Office to be made in Austria. It is expected that a ruling will soon be made that all the materials, from which the machine or articles patented are made, must be products of the country.

5. The Patent Office has issued special instructions to its subordinates requiring them to exact the working of all foreigners' patents with the most rigid exactitude.

6. They require sworn proofs that a patent has been worked exactly in conformity with the drawings and specifications thereof. (Patent drawings are very seldom intended for working drawings).

7. If there be a native infringer in the case, there is no end to the number of times you may be required to prove the working of your patent, as the law is so flexible that there is no limit to the number of times it can be demanded; and it is extremely difficult to prove the working to the satisfaction of the Patent Office, even when the article has been invented in the country, and is continually being manufactured in the country even for a period of three years or more.

8. Under the Austrian law, if two experts decide that an infringer's article is like your patent, you can seal up the machinery and stop the work. In this case, the machinery was sealed up; but, on application of the infringer to the Government, the authorities came forward, broke the seals (without any law to sustain them), and thus destroyed the only means of coming to a decision under the Austrian law. Unless a patentee seals up the infringer's goods or machinery, there is no provision in the Austrian patent law by which a suit can be brought to an end. My suit, which has now been going on over two years, has been decided twice in my favor, but immediately (on petition of the infringer to the Patent Office) the case is opened again on the pretence of other testimony, when not a particle of testimony against the invention has been produced. The whole effort of the infringer and the Patent Office is to try to make out that I have not properly worked my patent. My attorney tells me that they can keep on opening the case and demanding that I shall make new proofs of working as long as they can get the Patent Office to grant their request; and he says that the Patent Office always favors the infringer, especially if the patentee be a foreigner. The only mode of getting a decision is by the seals, which is similar to an injunction with us. What can be expected when a Government violates its own law?

9. If an inventor allows two years to pass, after working his patent in the first year without working it again, his patent becomes void.

10. The experts employed in all cases of enquiry, as to an infringer's article being an infringement of a patent, are from the Polytechnic School. My case has been reported on by them three times (and always in my favor), and once previously by two experts who sealed up the machinery; and now the Patent Office has ordered it to be returned again to the Polytechnic School with questions to induce them to change their decision; and I am not allowed to know what those questions are until the day of decision. In addition to this, the papers were sent to the Artillery Committee of the Government to see if they could not furnish proof to destroy the patent; they were kept by them for nearly three months without any notice to me or my attorney.

I have never heard of an American who has succeeded in getting a decision in his favor in this country. Nearly all patents are destroyed by the working clause and the taxation; for an inventor to take a patent here and undertake to comply with the laws, as now administ red, without coming to the country is a simple impossibility.

Austrian manufacturers never hesitate about infringing patents; and if you go to them and tell them they are infringing, they simply ridicule you and tell you Austrian patents are never good for anything. I have had this experience.

I think it is time for inventors to take the position that, if there are to be international expositions, there must be a trifle of protection to the men and their inventions which give interest to these expositions. One of the greatest objections to bringing inventions to this exposition is that none of the countries lying around Austria have patent laws that an inventor can comply with.

I have given you these details that you may know the actual working and effect of these Austrian patent laws.

Grand Hotel, Vienna, August 28, 1872. ***

Theology and Science.

To the Editor of the Scientific American:

I have been a constant reader of your valuable paper for more than 15 years, and was highly gratified to see the boldness in your editorial on "Science and Theology" in your issue of September 7, 1872. And all untrammeled thinking readers here (to whom I showed the article) thought it well written, and a fair statement of the facts.

That theologians have, in times past as now, been stumbling blocks in the way of science is simply a historic fact. That men professing Christianity made discoveries in opposition to what the theologians of their day held as truth is also well known. And that men who advanced any other theory, either in theology or science than that the ruling Christians held as truth, were persecuted, tortured, or put to death is a matter of history. That Virgilles was put to death by the Church—because he held that the earth was inhabited by people on both sides—is also a matter of history.

Copernicus was sentenced by the Church for heresy; and but for his death in a few weeks, he too, no doubt, would have suffered the same fate as did Galileo for the like discoveries which he subsequently set forth. Even the inspired Martin Luther said to his people: "This day we are advertised that a new astrologer has arisen, who presumeth to prove that the earth goeth about (like one riding in a carriage), and not the firmament" (which they believed to revolve while the earth was stationary). "Yea, trees and all; thus we give ourselves up to our foolish fancies and conceits. This fool Copernicus will yet turn the whole art of astronomy upside down." (This last sentence was prophetic, no doubt)." But the Bible teaches us another lesson, for Joshua prayed that the sun should stand still, and not the earth."

In the fifteenth century, the learned divines at Salamanca, in Spain, also condemned the project of Christopher Columbus as being heretical, and they claimed that the earth was fixed and could not be moved, "that no one could pass beyond the uttermost parts of the sea" or "border of the waters," where, the Bible said, "the Lord laid the beams of heaven and then stretched them out like a curtain, and formed them into a tent wherein to dwell." Poor Columbus could get neither encouragement nor means from the church, as theology opposed the idea of a round and revolving earth. It is sheer nonsense for any intelligent mind in this intelligent age to maintain either past or present orthodox theology as having any footing either in history or science.

The greatest age of human antiquity (if theology is true) as maintained to day is less than six thousand years, beginning in the days of Adam and Eve. Yet the Chinese records in astronomy go back twenty thousand years. The eclipses and conjunctions of planets in the days of Fedo—10,000 years ago—have been recalculated by Baily and other astronomers, and they have mathematically demonstrated the truthfulness of the Chinese astronomical records—showing a difference of time of but 51 seconds.

There are none but cowards who, for policy's sake, to-day allow their better thoughts to be crippled and trampled upon by the popular dogmas, which yet hold our struggling nation in chains of mental slavery. For freely expressing their opinions, men should have the honor and respect of every progressive mind, whether they cater to the old established and rusty dogmas or not. It is by the free expression of our thoughts that truth is developed. Open your ears first and listen, then open mouth and speak. This, to day, is a free country. The said editorial I much admire, as will thousands of others. I have been a scientist and theological student for some twenty years. I seek truth, not to cloak any special among idea under, and the thousand various opinions as to what theologic truth is.

As to the scientific facts of the day, we have no divisions of sects, which only exist as to some abstract points which are minor, and on which the evidence is not fully demonstrative. But in theology, let any one demonstrate any point or doctrine now held by the same rule as is demanded in science, and see where he will land. Schisms in theology are numerous, in science, few; hence let science be made the standard of truth, and let it sit in judgment.

Jackson, Mich. G. NEWCOMB, M. D.

Cider versus Juice.

To the Editor of the Scientific American:

Cider machines, cider mills, cider presses, or whatever else may be the correct term for the apparatus employed in manufacturing cider, are certainly in great request this year. It is a pity that there is not a single really good and reasonably priced machine in the market, one that performs its work rapidly and thoroughly, producing cider equal in quality to that produced by the old time "New England cider mill."

There is no use in arguing about the respective merits of the different kinds of patent cider mills. Many of them are convenient; they save time, labor and annoyance, but not one of those that I have seen produces cider which can favorably compare, in purity, color, or flavor, with that manufactured in the good old tedious way by pressing through straw. I hear it said day after day that an ample fortune certainly awaits the lucky inventor of a cider machine which, in one operation, will crush or grind the apples and force the juice out of the crushed mass, in a thoroughly clean and effective manner. I take issue with the advocates of this idea. I maintain that there is a difference between cider and juice, and that for the purpose of manufacturing good, sweet cider, the juice of the apples must mingle with and be in contact with the crushed apples (pomace) for a certain space of time, neither too long nor too short, before it is separated therefrom. Consequently a machine which, in one rapid effective operation, would crush the apples and expel the juice therefrom could not produce properly colored, good, sweet cider.

Am I right or wrong? I should much like to have the contested point settled in a scientific and conclusive manner, through your columns, either by yourselves or by some one of your numerous erudite contributors.

Jacksonville, Pa. E. H.

Milk Sickness, its Causes and Cure.

To the Editor of the Scientific American:

There has scarcely been anything in diseases which has so completely baffled the investigation and skill of the physician as milk sickness; and I have for five years contemplated calling attention to this subject. I lost a brother in June last by this dreadful poison known as milk sickness, and I feel prompted to give a few facts relative to its cause and cure.

Milk sickness is caused by a vegetable poison, and this has been substantially authenticated by a great number of instances coming under my own personal knowledge.

I am having the plant analyzed and I send you a small bundle of it. The specimen I send you was taken from the woods in Miami county, Ohio, where milk sickness is very prevalent. In a neighboring county, three, four, or five persons have died in one family in a season. This poison is a species of the *rhus toxicodendron*, or probably it may belong to *trifolia latifolium* or *trifolia recumbens*; it is found in many of the Northern States among certain growths of timber, and it exists in a wild state in considerable abundance. It is always found where milk sickness exists. I can send you further information, and describe two modes of curing the disease. ORRIN S. MOTE.

Richmond, Ind.

[Our correspondent is taking unnecessary trouble in having the plant analyzed. It is the *rhus toxicodendron*, or poison oak, and its properties are well known. The juice produces inflammation and eruption if applied to the human skin; and the plant itself gives off the poison by volatilization, producing, on persons inclined to erysipelas, an affection exceedingly troublesome, especially when it attacks the face. The vesication will even, in some cases, reach the desquamatory stage, and the face will swell till the features are scarcely recognizable. Saline purgatives and lead water applied locally are among the best remedies. A saturated tincture of lobelia applied to the affected part on a linen cloth has, we believe, done some good, and one well known physician recommends it as a specific. The vesicles have been successfully treated by a subcutaneous application of Monsel's solution (*liquor ferri subsulphatis*.)—EDS.]

Heating and Cooling our Dwellings.

To the Editor of the Scientific American:

Reading an article in your issue of September 14, 1872, I am prompted to offer the following as a more practical and efficient plan, to obtain a mean temperature and a healthy circulation of air in our buildings, than the one offered by M. D.

At the time of erection (or afterward), tunnel or excavate from the basement, 4 feet below surface, any distance practicable from the dwelling; brick this tunnel or lay an iron tube of proper size, and connect it to an air chimney (the higher this chimney, the purer the air, and the greater the distance from the building, the greater the modification of the heat); connect a small tube, leading to each room, to this air passage at the basement, and direct as may be desired for heating purposes. This simple plan will not require any rotary blower or the extra expense of an engine, if the flues and passage ways are arranged properly in the building, and with a greater elevation than the top of the air chimney. The air passing under ground in this manner will be pure and cool in summer, and the cold will be modified in winter; and the method will save a great per cent of fuel during the months of the latter. EGBUD.

A Model Manufacturing Village.

B. G. Northrop gives the following interesting particulars concerning the Fairbanks Scale Works, in a recent letter from St. Johnsbury, Vt. to the *Christian Union*:

Here is a great manufactory of scales, by far the largest establishment of the kind in the world, employing about six hundred men, and nearly four hundred in branch departments elsewhere, and manufacturing over 50,000 scales annually. They are of all sorts and sizes—over three hundred varieties—from the most delicate standard of the druggist or banker, to the ponderous hay, railroad car, or canal boat scales, weighing 500 tuns at a time. They are adapted to the standards of all nations, and marked with the signs of each. This week a large invoice was sent to Japan, and for a long time they have been sold in China, Australia, India, Persia, Turkey, Arabia, (where they have been carried on mules' or camels' backs), in the Barbary States, Cape Colony, Sandwich Islands, Isle of France, all the South American States, and still more largely in the great commercial nations of the earth. The yearly sales amount to about $3,000,000, and the demand is rapidly increasing. The business was never so prosperous as during the present season.

It has long been a marvel how such a concern could be made a permanent success for nearly fifty years in this remote corner of the State, so far from tide water, and with heavy and expensive freightage.

Now, what is the explanation of this marvelous prosperity? What is the condition of the workmen? These points I came here to investigate. For this purpose I inspected the works (covering ten acres), examined the processes, talked freely with the hands as well as with the owners and with the citizens of St. Johnsbury not connected with the factory. To observe the home life of the operatives, I entered their houses and conversed with their families.

This company maintains the highest reputation for integrity. Many names honored abroad are tarnished at home. Only the strictest honesty and fair dealing can stand the test of daily business intercourse with hundreds of hands for nearly half a century. "They do everything on the square" was, in substance, the answer of many citizens and workmen to my inquiries on this point. The company has fairly earned and gained the confidence of their men and of this entire community, and a good name at home naturally follows them everywhere. The workmen say that they are never permitted to do any sham work, even for the most distant market. To quote the pithy phrases of the men, "no shoddy here," "no veneering," "no puttying." The "test room" illustrates the thoroughness of their work. To avoid jar of machinery or movement of the air, all the scales are subjected to the nicest tests before being "sealed." The minutest films of metal are used for the more delicate trials. Masses of iron, weighing hundreds of pounds, are placed alternately on the different corners of the railroad scale platform, and if the difference in position changes the "record," the scale is condemned. The thoroughness of the work and this severity of the test is the explanation of the world-wide reputation of the Fairbanks scales for accuracy.

There is a superior class of workmen in this establishment. All are males. Their work is proof of skill. Their looks and conversation indicate intelligence. They are mostly Americans, and come from the surrounding towns. More than half of them are married, and settled here as permanent residents, interested in the schools and in all that relates to the prosperity of the place. Many of them own their houses, with spacious grounds for yard and garden, and often a barn for the poultry and cow. These houses are pleasing in their exterior, neatly furnished, and many of them are supplied with pianos and tapestry carpets. The tenement houses, also, are inviting and comfortable, and surrounded with unusually large grounds. The town is managed on temperance principles, and drunkenness, disorder and strife among the hands are almost unknown.

I examined the pay roll and found the wages very liberal. The workmen seem well satisfied on that score. Wherever it is possible, the work is paid for by the piece. The work itself is largely done by machinery, and that *sui generis*, invented here and for the special and peculiar results here reached. The men are encouraged to expedite their processes by new inventions, and they share largely in the benefits of all such improvements. Paying by the piece has worked well here. This plan stimulates industry, promotes skill, and fosters inventiveness. It apportions rewards to the quantity and quality of work done. But more than all, this plan is recognized by the men as just and satisfactory. With the time left practically to their own choice, there is no eight hour movement here. No labor league or union has ever existed—no strike ever been suggested. This would be a poor place for the "Internationals" to preach the gospel of idleness or agrarianism.

There has evidently been mutual sympathy and interest between employer and employed. Governor Fairbanks, one of the founders, used to say to the men: "You should always come to me as to a father." He maintained relations of kindness with them, visiting the sick, helping the needy, counseling the erring, encouraging their thrift, enjoining habits of economy. He taught them that it was their interest and duty to "lay up" something every month, and that the best way to rise in the social scale was to unite economy with increasing wages. The fact that so many of the workmen are "forehanded," besides owning their homesteads, is due to his teaching and example. The worth and dignity of work, he illustrated in theory and practice. The notion that labor was menial, or that the tools of trade or farm were badges of servility, he despised. His sons worked in the shops and thoroughly learned the trade. The brothers of the Governor were in full sympathy with him, and the same spirit characterizes the sons and the surviving brother who now manage the concern. There is still the fullest and happiest conciliation between labor and capital. It is not strange that the workmen "hold on." Their permanency is a striking fact. Many have been here from twenty to forty years. I conversed with one man over seventy years of age—a foreman—who has worked here "from the start," forty-three years.

Years ago the men were aided in forming and sustaining a lyceum, and liberal prizes were offered for the best essays read. Recently, Horace Fairbank has founded a library and opened a large reading room, free to all. The Athenæum containing the library, reading and also a spacious lecture hall, is an elegant structure, 94×45 feet two stories high. The books, now numbering 8,300, are choice and costly. Having visited nearly every town of Massachusetts and Connecticut, and traveled widely in this country, I have nowhere found in a village of this size an Athenæum so costly, a reading room so inviting, and a library so choice and excellent as this. These various provisions for the improvement, happiness and prosperity of this people, coupled with liberality and fairness in daily business intercourse, explain the absence of discontent and the uniform sympathy, good feeling and harmony which prevail.

I have nowhere seen a better practical solution of the labor question.

Transparent Stereoscopic Pictures upon Paper.

M. A. De Constant, writing in a recent number of the *Photographisches Archiv*, describes a method which has been frequently employed by him for some time past for preparing photographic transparencies upon paper. The pictures produced may be employed for a variety of fancy purposes, and are very suitable for stereoscopic productions. His manner of proceeding, he briefly describes as follows:

"Some thick albumenized paper is chosen for the purpose, which has previously been well sized. This is sensitized in the ordinary manner, and, after drying, printed under a negative in the pressure frame, the face, or albumenized surface, of the paper being turned away from the negative, and not placed in contact with the negative film as usual. The printing operation must be carried on rather longer than when the face of the paper is being printed, so that an exceedingly vigorous picture is produced. The depth of the print can only be correctly judged by an examination of the paper by transmitted light, as the image is formed in the body of the paper itself, and not simply upon the surface of the reverse side of the sheet.

"The coloring of the picture is also proceeded with on the reverse, and not upon the albumenized face of the paper, and for this reason the laying on of the colors is very much simplified. The water colors of Newman, or any others, may be used for the purpose. No spots or patches are produced, for the tints spread uniformly over the paper.

"This process I have now employed with much success for a period of ten years, and have applied the pictures produced to several purposes. For lamp and other transparent screens they are especially suitable, forming handsome ornamental productions of this nature."

Wheatstone's Patent Magnetic Counter.

This instrument has been devised for the purpose of counting and registering the periodical motions of any machine, whether rotary or oscillating. It may be applied either near or at any distance from the machine whose motions are to be registered. It is less cumbrous than mechanical registers, and cannot be tampered with by persons in charge of the machine.

No voltaic battery is employed, the electric currents being produced by a small piece of iron attached to the moving part of the machine, working before the poles of a magnet; it therefore requires no more attention than an ordinary piece of mechanism.

Among the purposes to which this register has been applied are the following:

To count the number of impressions produced by any printing machine.

To count the number of revolutions of a screw or paddle shaft of a steamship.

To count the number of visitors who enter a theater or any public place.

By means of these instruments, also, the rate of working of any number of machines may be seen and compared by the overseer in any distant apartment, without the necessity of visiting the machines themselves.

Woolen Manufactures of the United States.

The complete statistics of the manufacture of woolen goods in the United States, as returned at the ninth census, for the year ending June 1, 1870, have just been sent to press from the Census Office and exhibit the following totals: Of the 2,891 establishments in the United States, there are in Pennsylvania, 457; New York, 252; Ohio, 223; Massachusetts, 185; Indiana, 175; Missouri, 156; Tennessee, 148; Kentucky, 125; Illinois, 109; Connecticut, 108; Maine, 107; Iowa, 85; New Hampshire, 77; West Virginia, 74; Virginia, 68; Rhode Island, 65; Vermont, 65; Wisconsin, 64; Michigan, 54; North Carolina, 52; Georgia, 46; Maryland, 31; New Jersey, 29; Texas, 20; Utah, 15; South Carolina, 15; Alabama, 14; Arkansas, 13; Delaware, 11; Mississippi, 11; Minnesota, 10; Kansas, 9; Oregon, 9; California, 5; Louisiana, 2; Florida, 1; and New Mexico, 1. The capital of these 2,891 establishments is reported at $98,824,531. The number of steam engines is 1,050, with a horse power of 35,900, and water wheels with a horse power of 59,332. The number of sets of cards is 8,366, with a daily capacity of 857,392 pounds of carded wool; number of broad looms, 14,039, narrow looms, 20,144; spindles, 1,845,496. The average number of hands employed during the year has been—of males above sixteen, 42,728; of females above fifteen, 27,682; of children and youths, 9,643. The amount of wages paid to these hands during the year is reported at $26,877,575; the total value of the materials used during the year was $96,432,601, of which the amount paid for chemicals and dye stuffs was $5,833,346. There were consumed during the year 17,311,824 pounds of foreign wool; 154,767,075 pounds of domestic wool; 17,571,-929 pounds of cotton; 19,372,062 pounds of shoddy; 2,573,419 pounds of woolen yarn; 3,263,949 pounds of cotton yarn; 1,312,560 yards of cotton warp; 140,733 pounds of warp. The value of all other materials used was $5,670,250.

Among the productions of these 2,891 establishments are 63,340,612 yards of cloth, cassimeres and doeskins, 58,965,286 yards of flannel, 1,941,866 yards of felted cloth, 2,663,767 yards of repellants, 2,853,458 yards of tweeds and twills, 14,078,559 yards of satinets, 5,506,902 yards of kerseys, 24,489,985 yards of jeans, 14,130,574 yards of linseys, 1,932,382 yards of negro cloth. Number of pairs of blankets, 2,000,439; number of horse blankets, 58,553; number of carriage robes, 22,500; number of coverlids, 226,744; number of shawls, 2,312,761; number of pounds of rolls, 8,683,096. Total value of production, $155,405,058.

Tests of Building Stone.

In a paper read at the recent meeting of the American Society of Civil Engineers, Mr. Robert G. Hatfield, architect, of this city, described a machine made by him for practically testing the strength of building materials. It is a platform scale set in a table, and so arranged with hand wheel and gearing as to produce a pressure upon the platform. This pressure is transmitted in the usual manner, by levers on knife edges, to the scale beam. By an ingenious contrivance suggested by Mr. R. F. Hatfield, the poise upon the scale beam, instead of being moved by hand as the pressure is applied, is made to travel by a clock movement, stopping automatically when reaching the point on the beam which represents the pressure upon the platform, thus indicating truly the highest pressure attained.

The following were ascertained by this machine to be the comparative strengths of the several kinds of stone mentioned, being the weight in pounds required to break a bar one inch square and one foot long in the clear between the bearings:

Grewacke, North River, Blue-stone	250·76	lbs.
" Saugerties "	203·64	"
" Brown Grit "	122·31	"
Eastchester Marble	150·77	"
Portland, Conn., Sand-stone	94·	"
Belleville, N. J. "	88·47	"
Dorchester, N. S. "	66·98	"
Marietta, O. "	62·82	"
Berea, O., "	42·35	"
Amherst, O., "	37·22	"
Bricks, North River, Hard	42·74	"
" Staten Island	42·03	"
" Philadelphia Pressed	41·85	"
" Colabergh	41·52	"
" Perth Amboy	26·36	"

The above were the best results. Some specimens of materials from the same localities exhibited considerably less strength than that here indicated.

How Trees are Killed by Lightning.

All who have examined a tree which has been destroyed by a "thunderbolt" will have noticed not only how the layers of the wood have been shattered and separated into strips, as if full of wind shakes, but also the dryness, hardness, and brittleness of the wood, as though it had been through the process of curing in a kiln. This is attributed to the instantaneous reduction of the sap—the moisture within the wood—into steam. When this moisture is abundant, as in May or early June, the amount and force of the steam not only bursts and separates the layers and fibers, but rends the trunk in pieces or throws off a portion of it, down a line of greatest power or of least resistance. And when the amount of steam thus suddenly generated is less, owing to the drier condition of the stem from continual evaporation and leaf exhalation, there may be no external trace of the lightning stroke; yet the leaves will wither in a few days, showing that the stem has been rendered incapable of conveying supplies, and the tree will either partially or entirely die. Still lighter discharges may be conducted down the moist stem, without any lesion or hurt.—*Building News.*

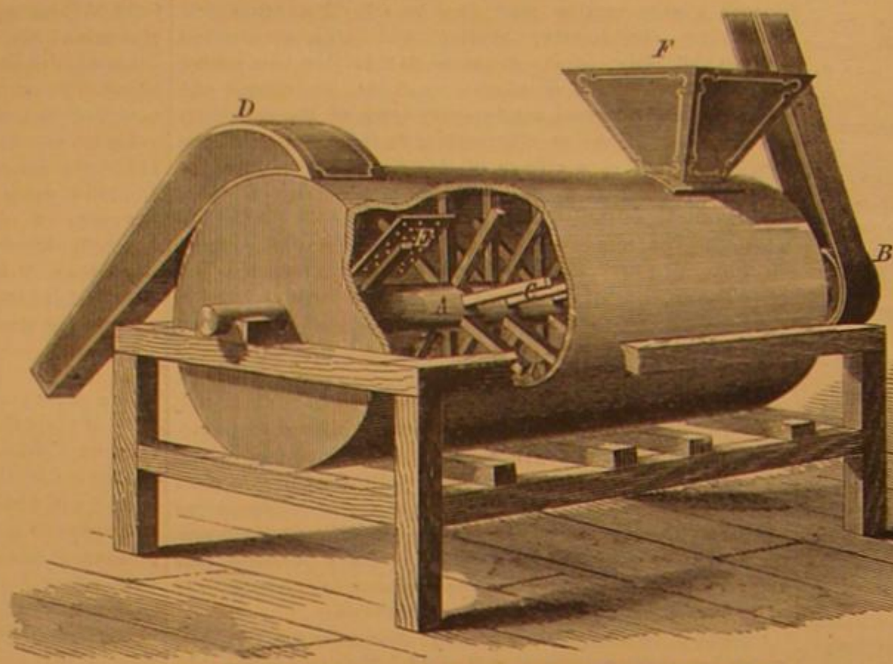
ONE of the most popular of the papers read, at the late meeting of the British Association, was one on the "Higher Education of Women," by Miss Emily Shirreff. Schools were wanted, she said, which would effectually banish that flimsy teaching, that substitution of ill-taught accomplishments for solid knowledge which called down the severe censure of the Schools Inquiry Commissioners, and should be placed beyond the control of parental caprice and the freaks of fashion.

Two measures of hydrogen always combine with one of oxygen. Oxygen is sixteen times heavier than hydrogen, and it therefore follows that one part by weight of hydrogen unites with eight parts by weight of oxygen. Whenever chemical action takes place, a similar definiteness and invariability is observed in the quantities concerned. Eight parts by weight of oxygen, for instance, will always combine with 32 of copper, with 103 of lead, or with 100 of mercury; and 100 of mercury will always combine with 16 of sulphur, with 80 of bromine, or with 127 of iodine. It often happens, indeed, that two elements will combine, under suitable conditions, in more than one proportion; but even in these cases the higher proportions always bear a simple numerical relation to the lower ones.

COFFEE WASHING MACHINE.

In our illustration is shown a new device designed to be used for removing the mucilage and other matter adhering to the coffee beans, previous to drying them or preparing them for use or transportation. A cylindrical vessel is supported in a slightly inclined position on a suitable frame. Within the former is a shaft, A, the ends of which have their bearings either on the heads of the cylinder or on the frame as shown in the engraving. This shaft is rotated by means of a pulley, B, which communicates with suitable machinery. Within the cylinder and projecting from the shaft are radial beaters, C, while in line with the spout, D, through which the washed coffee emerges, is also attached the shaft, a series of blades, E. The coffee to be washed, together with some water or other liquid, is poured into the hopper F, through which it passes into the cylinder. There it is subjected to the action of the beaters, which, rapidly revolving, remove all mucilage and other matter not required in connection with the bean. The coffee descending the slight incline of the apparatus is at length discharged by the action of the revolving blades, E, through the spout.

This invention was patented July 16, 1872, through the Scientific American Patent Agency, by Mr. José Guardiola, being one of a number of inventions by the same inventor of appliances used in manufacturing sugar and treating coffee for market in Guatamála. For further information, address care of Ribon & Muñoz, 63 Pine street, New York, or care of J. C. Merrill & Co., 204 California street, San Francisco, Cal.



GUARDIOLA'S COFFEE WASHING MACHINE.

IMPROVED ORE SEPARATOR.

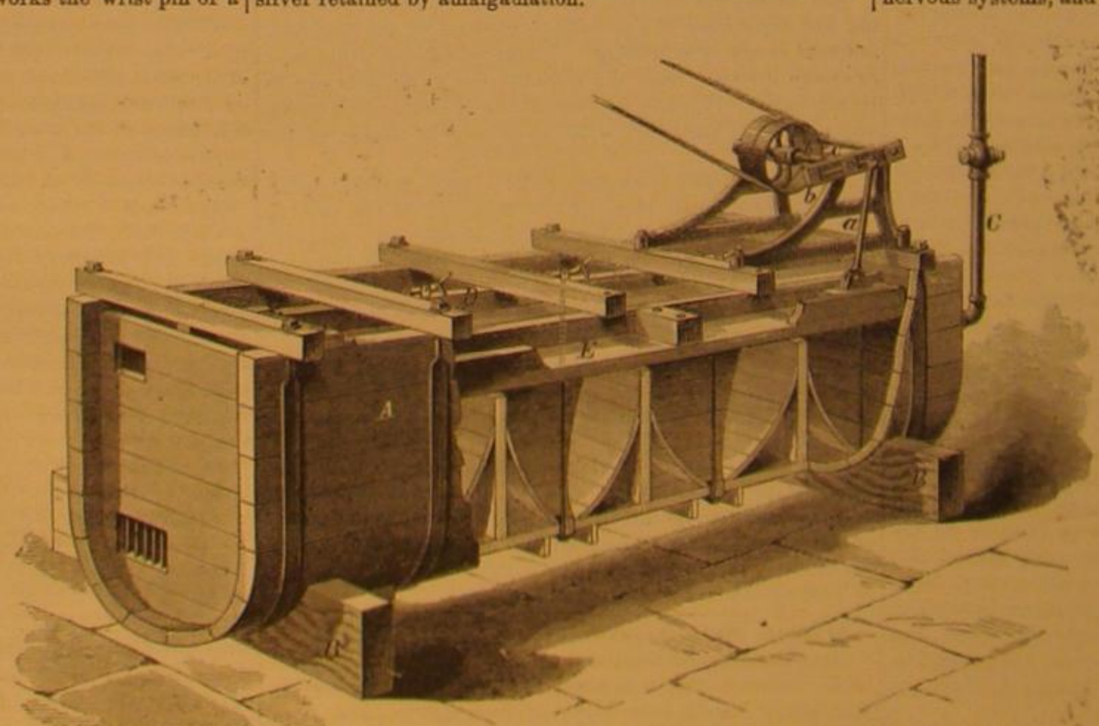
In the device shown in our illustration, technically termed a continuous one plunger jig, the principle involved is the separation of ores in water, in contradistinction to the ordinary dry process. The apparatus is claimed by its inventor to combine many of the best points of similar machines in use in Europe, together with improvements of his own, the mechanism of the whole being so combined as to render it simple, effective, cheap, and easy of repair.

A, in the illustration, is the trough in which the sieves, four in number, for effecting the separation, are arranged. This vessel is of suitable length, with a nearly semi-cylindrical bottom, and is rendered stationary by suitable fastenings to the supporting frame, B. It is supplied with water by the pipe, C, which communicates with its interior by an inwardly closing valve. The upper part of the trough, A, contains a longitudinal partition, D, which, however, does not reach entirely to the bottom, serving merely to separate the plunger, E, on one side from the sieves on the other. The plunger is a flat piece of wood or plate, pivoted at one end to the vessel while its other end is, by a pitman, *a*, connected with a slotted lever, *b*, in the slot of which works the wrist pin of a crank, *c*, on the operating shaft, F. The plunger is, therefore, vibrated up and down, its upward motion drawing the water in through the pipe, C, and down through the sieves; while in its descent it shuts the valve through which the water enters, forcing the water in the trough up through the sieves. In order to make the latter motion the quicker of the two, the wristpin of the crank, *c*, is nearer the pivot of the lever, *b*, when swinging the same down, and further away from the pivot when raising it up. At the end of the last sieve and between every pan, are transverse partitions which divide the trough into separate chambers for the collection of the several kinds or grades of ore, each partition being only sufficiently recessed on top to permit the necessary vibration of the plunger. The motion of the latter being greatest near the shaft, a larger amount of water is forced through the first sieve than through the next, and so forth. The bridges between the sieves are made sharp ridged so as to offer as little resistance as possible.

Special attention is called to the advantage of the single plunger. By the inflowing supply water, which has its outlet from below and through the sieves, the down motion of the water and suspended ore, after receiving the uplift by the descent of the plunger, is partly arrested, and the separation of particles according to their specific gravity thereby greatly facilitated. By the constant stream of clear water from under the sieves, all deposition of refuse material below and on the latter is prevented.

It is claimed by the inventor, who is a practical mining engineer, that this form of ore separation entirely obviates the necessity of concussion hearths, slime hearths, and buddles, thus greatly reducing the expenses of mineral dressing establishments. The working of different sizes of rock is provided for by making the wrist in the crank movable, and also by permitting pulleys to be interchanged. The variation of plunger lift is from one eighth inch to two and a half inches, and the difference in number of revolutions per minute from 120 to 160. The principles governing the adjustment of the machine may be briefly summarized as follows: The lift should be higher as the size of mineral is coarser; the quickness of motion should be greatest for the finest sizes, and the richer the ore, the thinner should be the sieve bed. The inventor states that, in separating metallic mineral or rock according to quality, the action of this apparatus is so complete that in leading a stream of water and particles of rock into the upper sieve, the jig will, without interruption, separate all valuable parts and deposit them in the tank partitions, whence they are removed by working the valves, while the waste rock will emerge from the opposite end. The first sieve will produce the metallic mineral pure and clean, the second sieve serving to catch those portions escaping the action of the first. The result should be daily returned to the first sieve, at a time when the general stream is interrupted, so as to be again submitted to its action. The third and fourth sieves are used similarly to the second, as reserves, or for separating material of less specific gravity than that acted upon by the other sieves.

Another point of advantage claimed is that this machine will save, separate, and thus render marketable the tailings in streams flowing from quartz mills. These are, first, such gold as by the influence of sulphur is coated and rendered unsusceptible of amalgamation; second, the mercury which, becoming finely scattered, has been washed away by the current; and, thirdly, the metallic ores contained in the rock, copper, lead, antimony, nickel, etc., besides the gold and silver retained by amalgamation.



CAZIN'S ORE SEPARATOR.

Patented through the Scientific American Patent Agency, July 2, 1872, by Mr. Frederick Cazin, superintendent of the Frumet Lead Mining and Smelting Works, Frumet, Mo., from whom further particulars may be obtained.

To Cut and Bore India Rubber Stoppers.

Dip the knife, or cork borer, in solution of caustic potash or soda. The strength is of very little consequence, but it should not be weaker than the ordinary reagent solution. Alcohol is generally recommended, and it works well until it evaporates, which is generally long before the cork is cut or bored through, and more has to be applied; water acts just as well as alcohol, and lasts longer. When, however, a tolerably sharp knife is moistened with soda lye, it goes through india rubber quite as easily as through common cork; and the same may be said of a cork borer, of whatever size I have frequently bored inch holes in large caoutchouc stoppers, perfectly smooth and cylindrical, by this method. In order to finish the hole without the usual contraction of its diameter, the stopper should be held firmly against a flat surface of common cork till the borer passes into the latter.—*W. F. Donkin, in Chemical News.*

A Remarkable Volcanic Eruption.

Recent intelligence from the Sandwich Islands is to the effect that on the 13th of August a great eruption of the volcano at the summit of Mauna Loa took place, the light being very bright, as seen from Hilo and Howaii. The Honolulu *Gazette*, in its issue for August 28, gives the following particulars, saying:

"Our latest advices from Hawaii inform us that the eruption still continues in Mokuaweoweo, at the summit of Mauna Loa. A column of fire or lava is constantly being thrown up several hundred feet above the summit of the crater, presenting, in the night, a most imposing spectacle. The people living around the base of Mauna Loa are in momentary expectation of a lava flow from the sides of the mountain. When it is considered that the floor of the crater is something like 500 feet below the rim, and that the column of lava is estimated to be thrown something like 200 feet above the rim, it must be thrown up at least 700 feet. The column must also be immense, as it can be seen distinctly from all sides of the mountain, which, in the night, it lights up in grand style. The eruption reached its grandest dimensions about eight days before our informant left the coast of Hawaii, since which time the column of fire had not perceptibly diminished."

Wine a Poor Beverage.

In all our common articles of food the elements of nutrition and respiration are so nicely balanced in their proportions that, for the diet of a healthy man, there is no necessity for adding an extra quantity either to the one class or the other; or, in other words, the supply of nutrition and of animal heat is so admirably equalized in the composition of common food that any material derangement of the proportions which it affords is attended with a corresponding derangement of the vital functions. It is obvious, therefore, that if we add a portion of alcohol to the food taken into the stomach, the elements of respiration are increased and the animal heat augmented in a proportionate degree. No part of the alcohol can go to form the tissues of the body, or to renovate and sustain them, as it is destitute of nitrogen, and not an element of nutrition. It can only serve as an element of respiration, to be burned in the lungs of a man, and to add to the amount of his animal heat. The result is that, as the quantity of alcohol is increased from habit, an unnatural exhilaration is produced, leading to an overtasking of the muscular and nervous systems, and to premature decay in the manhood of the victim. To use a familiar phrase, he has "lived too fast." Let us gain a clearer view of this point by contrast. We know that an insufficient supply of food tends to produce paleness of the cheek, because both the animal heat and the nutrition are less than are demanded to keep up the healthful condition of the system. On the other hand, where age has not indurated the skin, an abundance of food keeps up the vital powers, and the face, possessing the ruddy color of health, bears testimony to a well stored stomach. But when alcohol is added, in such a case, in excess, the nice balance between nutrition and respiration is destroyed, the healthful action of the animal functions is impaired, the ruddy glow of health disappears from the cheek, the deep red of the furnace heated by flame overcasts the countenance, and the habits of the inebriate stand revealed. Now, if pure alcohol will do all this upon a healthy constitution—and none dare gainsay this truth—how much more fatal, and how much more speedy, must be the production of the crisis in the drinker's career, where deleterious compounds are used in its stead?—*California Culturist.*

Rotary Puddlers.

At various works in the north of England, the construction of the Danks furnace is being hurried on. A number of these furnaces will soon be at work, and will be practically tested on a large scale. At some places arrangements are being made for running the pig metal direct from the blast furnaces into the Danks puddling furnace.

Another new rotary puddling furnace has been invented by Mr. Defty, a working man in Middlesbrough, England. His plan is to feed a long revolving chamber from a cupola and run off the puddled iron constantly into ingots.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK

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

TERMS.

One copy, one year	$3 00
One copy, six months	1 50
CLUB RATES { Ten copies, one year, each $2 50	25 00
CLUB RATES { Over ten copies, same rate, each	2 50

TO BE HAD AT ALL THE NEWS DEPOTS.

VOL. XXVII., No. 15. [NEW SERIES.] *Twenty-seventh Year.*

NEW YORK, SATURDAY, OCTOBER 12, 1872.

Contents:

(Illustrated articles are marked with an asterisk.)

AMERICAN INVENTORS IN AUSTRIA.

Our editorial, calling the notice of American inventors and manufacturers, who may design to contribute to the Vienna Exposition of 1873, to the fact that the Austrian patent laws afford them no protection whatever, and that there is virtually no check placed upon the infringement by Austrian subjects of the patent rights of foreigners, was recently, as our readers are aware, made the subject of an expostulatory letter from General T. W. Van Buren (the United States Commissioner to the Exposition) which was lately inserted in our columns. The writer, it will be remembered, states that steps have been taken to pass a law remedying the above mentioned evils, that foreign exhibitors will be given free certificates securing priority of Austrian patent for their inventions, that the government of the country is benignly disposed toward Americans, and so on in similar tenor.

Now, notwithstanding the intimations of our correspondent to the contrary, nothing is further from our intentions and desires than to place the slightest obstacle in the path of the inventor leading to his future benefit, nor do we, on the other hand, wish to render the laborious duties of the honorable Commissioner any more arduous than they now are. We fully agree with him in the belief that the Exposition will be one of the grandest, if not the most magnificent, the world has ever beheld. The tidings of the preparations now in progress indicate that the glories of the World's Fair of England and the French Exposition of 1867 will be over shadowed. Further, we believe, without doubt, that no one, American or otherwise, can fail to be vastly benefitted by an inspection of the industrial products of the entire globe, and we freely acquiesce in the opinion that the enterprise will afford a stimulus to inventive genius in every country. Moreover, we, and so doubtless will every reader of our journal, confess to a patriotic pride in having the United States the largest and best represented nation in the Exposition. To all this we willingly agree; but we cannot perceive how "proposed laws" or the general sentiment of the Austrian government is to affect the unequivocal, undeniable fact, which at the present moment is found clearly enunciated and unrepealed in the statute books of that country, in substance if not in words, that while Austria entices the foreigner, by specious promises of possible benefit from a magnificent display, to import his inventions within her territories, she permits her subjects to pirate and convert the same to their own uses without let or hindrance. This is the plain unvarnished truth, and the reader can see its practical exemplification in the letter of one of our correspondents, now in Austria, published in another column, detailing his recent experience in the Austrian courts. The recital needs no comment as to the therein described manner of conducting legal investigation, nor as to the gross abuses it plainly sets forth; though, perhaps, we may call attention to the fact that it clearly indicates the sincerity of the sentimental protestations of the Austrian government toward American inventors.

With regard to the "proposed law": With the letter above alluded to, we were favored with a copy of this act which is stated to have passed one of the houses of the Reichsrath, and is to be submitted to the other. In substance, it is as follows: Natives and foreigners exhibiting articles, in the Exposition of 1873, which under certain Austrian laws form the subject for the grant of a privilege, trade mark or design patent, may obtain a certificate of protection therefor from the Director General of the Exposition. The application for the same is to be filed with this functionary, and must be accompanied by an exact description of the article, or proper plans if required, or in the case of a trade mark, etc., two separate copies. The certificate of protection is to be issued without charge and is to secure to the grantee, from the date of his application to Dec. 31, 1873, inclusive, "*the same rights which would be granted him by an ordinary privilege (patent) or by the ordinary registration of a trade mark, design, or model.* Applicant has the *right* to apply, previous to the expiration of the above period, for a regular patent to be allowed *as prescribed by law.*" A separate article provides that the decisions of the Director General as to the grant or refusal of certificates *cannot be complained against or appealed from.* The bill then specifies the mode of registration and number of registries to be kept, states that the certificates shall be published in the Austrian and Hungarian official journals, and declares the registers to be open to public inspection; but that the descriptions, plans, and models may be kept secret, if so requested in the application; and, finally, charges the Secretary of Commerce with the execution of the act. The preamble sets forth that the modification of existing regulations was suggested by a paper in the SCIENTIFIC AMERICAN, which was the editorial alluded to in the beginning of this article.

It is hardly necessary to point out to an intelligent reader that this so-called protective act is a deception, and is, as our correspondent says, utterly worthless. The bill does not alter the practical status of the exhibitor of a new invention. It simply obscures the main point and deceives the reader with a piece of parliamentary sophistry which amounts to nothing.

A simple contrast with the provisions contained in the patent laws of our own country will speak more strongly in reprobation of the course of the Austrian Government than any denunciations that can be uttered. The Austrian inventor in the United States enjoys all the rights of our native citizens, and his patented interests are by law jealously guarded. An Austrian inventor, should he come here to obtain a patent and find that any one has pirated his invention, or even begun its manufacture in advance of him, may still obtain a patent and put an end to the infringement. When an Austrian obtains a patent in the United States, the grant really belongs to him to dispose of, work, use, and manage, just as he thinks proper, without government interference. The Austrian Government treats the American inventor in a very different manner, as the letter of our correspondent shows.

While regretting deeply the spirit that seems to govern the action of the Austrian officials, we cannot but believe that if our representatives in that country should place the case before the government in its proper light, asking simply a reciprocity of benefits, laws would not be merely "proposed," but enacted, which would effectually do away with the present abuses. In such event, we can promise that America will forward such contributions and will evidence her vast growth in invention and industrial pursuits in a manner that will excite, not only the wonder and admiration of Austria alone, but of the whole continent of Europe.

HOW DO WE TAKE COLD?

"By sudden changes of temperature, surely," is the answer ready upon the tongue of ninety-nine out of every hundred persons who may read or hear the question that heads this article. But how do sudden changes of temperature give us cold? Too sudden contraction of the pores of the skin; sudden checking of the sensible or insensible perspiration, sudden change of circulation by which the blood is thrown, from the surface inward, upon the vitals, causing congestion, etc. All these are phenomena which may, some or all of them, be connected with too sudden or too great changes of temperature, but they fall short, even when taken all together, of accounting for that very ordinary, very amazing, and too often seriously injurious infliction, a bad cold.

Few of us but can count scores of instances in which we have been exposed to very sudden and very great changes of temperature, from warm to cold, without other inconvenience than an uncomfortable chill, while we can also count many instances in which we have taken very severe colds without being able to tell how or where we came by them. The slight and almost imperceptible, frequently unobserved, causes of cold have not, perhaps, been as closely traced as they should and may be. It seems not so much the change as the kind of change which gives rise to the unpleasant result. The leaving off of an accustomed garment, even when the lack is not uncomfortably felt, the exposure of the feet to wet or chill, a few minutes with the head uncovered in the cool outdoor air, but above all exposure to a draft of air, especially, as is generally believed, on the back of the head or neck, are all familiar examples, of which most of us have had melancholy experience. Of the last—the draft upon the back of the head or neck—the danger is proverbial. Witness the proverb, Spanish we believe it is originally: "If the cold wind reach you through a hole, go make your will and mend your soul." Or the Persian malediction: "May a cold wind blow in the back of your neck."

Indeed there seems to be, especially to peculiarly sensitive constitutions, almost a certainty of cold in such currents of air. There may be no chill, not even uncomfortable coolness, and yet the symptoms of a cold manifest themselves almost as suddenly and fully as decidedly as sneezing follows the introduction of some irritating substance, snuff, for instance, into the nostrils. By immediately heeding the warning of the first premonitory sneeze, and at once changing the position of things so as to avoid the cause, the cold may be and often is averted. But the danger is that the cause, being so slight and coupled with so little present annoyance, is apt to pass unnoticed or disregarded until too late.

We have all at some time experienced in ourselves exceptionally sensitive conditions under which it seemed impossible for us to avoid, as is said, sometimes "taking one cold on the top of another:" what a gentlemen not long since in the presence of the writer called a "summer cold," in which one seems to take the more cold the warmer he is: it is a sort of sweating cold, one of the most disagreeable if not the most dangerous class of these inflictions. In this condition, the slightest draft sets one to sneezing, and it seems impossible to avoid constant accessions to the malady. But why? The sudden change of temperature theory will certainly not explain those cases where it is hardly possible to preserve a temperature sufficiently even to prevent taking cold, and those cases where cold is taken unconsciously. No hypothesis but that of a direct irritant acting upon the mucous surfaces of the lungs and air passages seems to suffice for the phenomena of a certain class of colds. That there is such an irritant in the air, in quantities varying according to the meteorological conditions, is well known, but all its properties and effects are not yet perhaps fully understood.

That ozone is such an irritant is a well understood fact; but to what extent colds, in the head, throat and lungs, are due to its agency is an open question.

M. Houzeau, describing in *Les Mondes* a process for the instantaneous oxidation of pure alcohol, in which process ozone is the principal agent, says in conclusion: "I cannot too strongly recommend the greatest caution to chemists in the use of concentrated ozone; inhaled, even in small quantities, it occasions suddenly an inflammation of the mucous membranes, which, as I have had occasion to witness, may cause spitting of blood." Such being the undoubted effect of concentrated ozone, it is certainly a plausible theory, to say the least, that currents of air containing this substance in unusual quantity, may cause such irritation to a greater or less degree, and thus be the cause of colds. In support of this theory is the fact, well known to physicians, that colds are frequently almost epidemic when there is no remarkable change in the weather, while again very great changes may be comparatively unattended by them. Said an experienced physician: "When I have one patient afflicted with a certain kind of cold in the head, I always expect more cases of the same kind." Hence the term *influenza* or influence, supposed to be in the air. Is this influence ozone?

But if colds in the head, throat and lungs, are caused by the presence of a direct irritant upon the mucous membranes, why should unwonted exposure, often in a very slight degree, give rise to colds, or why should a current of air upon the back of the head or neck be proverbially a cause for it? If breathing highly ozonized air is the cause, we should expect it to be most effective when taken directly from the front. Or may it not be possible that the phenomena of cold-taking have not yet been carefully observed, and that we are to a certain extent dealing with traditional assertions, rather than actually observed facts? There is nothing more unreliable than the observations and deductions of unprofessional people with regard to the causes of their ailments. Yet it seems to have been taken for granted that the causes, of this annoying and in many cases distressing and dangerous malady, are understood by everybody, while, to the mind of the writer at least, there are, in the list of ills that flesh is heir to, few that have more mystery about them than this, perhaps the most frequent of all.

INTEROCEANIC CANAL.

Mr. James C. Madeley, in a letter to the *Engineer,* takes the ground that a canal across the isthmus, between the Atlantic and Pacific oceans, is perfectly practicable, and that the available route lies across the isthmus of Panama where the railway crosses; and gives as a reason why this route was not examined by the present exploring expedition that "the Government knew all about it." This latter point may be well taken. It is not unfrequently the case that the actually feasible is overlooked in searching for something better.

The cost of such a work, even at the exorbitant prices of the construction of the Panama railway, is estimated at $100,000,000 for a canal about the same size as the Suez. It would necessitate cutting some miles in length, with a summit depth of about 180 feet, rapidly decreasing from the summit each way, which cutting, with the locks, would constitute the principal cost. The length would be about that of the Panama railway, that is, about 47½ miles.

The writer compares the several proposed routes, and shows the advantages to be all with the one under discussion, aside from the facilities afforded by having a railway along the route during the construction; the views expressed are worthy of consideration. That the canal is to be made, sooner or later, is only a question of time. Considered with reference to the benefit to be derived from such an enterprise, the cost, even at twice $100,000,000, is a mere *bagatelle.*

EFFORTS IN GERMANY TO PREVENT EMIGRATION.

As currents of air and water act in accordance with certain unchanging laws, so tides of emigration and immigration are governed by stimuli presented by the natural and artificial advantages of different localities. To the mechanic, the artisan, the laborer, our country presents inducements, compared with most of the countries of the Old World, which may be said to almost compel the influx of these classes. It is in vain, therefore, that the German Government issues threatening circulars against emigrants, and declares that they will be treated as outlaws over whom has been instituted a special surveillance and supervision. There is room for them in our factories, our workshops, our industrial enterprizes, and on our limitless Western plains, and while there is room for them they will come.

A REDUCTION in the price of steel is promised for December next.

DEVELOPE YOUR INVENTIONS.

Many persons gifted with inventive talent are prone to neglect it from the supposition that the field is already crowded, and that but little inducement is offered to compensate for the outlay of time and money necessary to secure an invention. That this is fallacious, every observing person can testify. So far as useful inventions are concerned, the demand is unlimited, but we fancy one reason for the disappointment of some is found in the fact that they look more to the *éclat* or publicity attaching to a novel and sensational invention than to the solid advantages accruing from a useful and practical one. Thus many scheme upon flying machines, or mechanism to develope great power from a limited supply, apparatus to extract the milk of cocoa nuts, or similar contrivances of doubtful utility when perfected, and find, after all their labor and expenditure, that there is little or no market for the wares they can produce, or that, having invented the machine, their task is but half accomplished till they invent a demand for it also.

Whatever may be said to the contrary, our experience teaches us that the inventive faculty is a rare one, a gift that individuals have no moral right to neglect, and a means, if properly directed, of raising its possessor to affluence. Aladdin's lamp was an incumbrance compared to it; for where the said Aladdin was compelled to furbish up a presumably ill smelling, brazen utensil, and await the appearance of the quite intolerable personage who was its slave, the inventor has only to set his wits to work, or follow out the hints his talent constantly gives him, to laugh Alladin and his possession to scorn. Our readers must receive this in good faith as it is written, for we can recall scores of men who have raised themselves from extreme poverty, and in many cases from actual want, by simply cultivating their powers of observation, and applying them to remedying defects existing in the arts and sciences. These men were by no means "great discoverers" in the ordinary sense of the term, but did the duty nearest them by correcting palpable defects coming under their notice; and, having once conceived an idea, by following it to the end. It is not necessary to strengthen this position by practical examples; any one who takes the trouble to reflect can see that it is correct in all points.

We say then, in conclusion, that, if you have a really good and useful invention, a machine, process or what not, for lightening labor, reducing expenses, or increasing the production of staple articles, you have a valuable property that cannot fail, with ordinary business management and sagacity, of a satisfactory return. Bring it forward and secure it, for while you are neglecting it, some other person of more energy is scheming to anticipate you.

DISINFECTANTS.

Disinfectants may be divided into three classes: 1. Those that arrest fermentation (antizymotics); 2. Those that effect chemical decomposition; 3. Deodorizers. Those of the first class include the coal tar products, heavy oil of coal tar or dead oil. Carbolic acid and its preparations are included in these. Dead oil has been used extensively; but in its commercial form, it is very apt to be without the peculiar virtue it possesses in the crude state. This is owing to the absence of carbolic acid, which is usually extracted before it is put in the market. Carbolic acid, obtained by treating this crude oil with hydrate of soda and lime, is expressed by the symbol $C_{12}H_5O,HO$. The impure form is that best adapted for the purpose of disinfection, both by its low cost and its easy solubility. Its disinfecting power is most markedly shown in contact with putrifying nitrogenous matter. Carbolic acid when mixed with chalk is sold under the name of carbolic powder. This is a very poor disinfectant, not only because 70 per cent of it is an inert substance, possessing no disinfecting properties whatever, but because, after a few hours, the carbolic acid passes off into the air. Carbolate of lime is a valuable preparation, however, for it contains two disinfectants of different orders. This substance is not, strictly speaking, a chemical salt, but is hardly more than a perfect impregnation of the lime. A very good preparation, and one that will meet all requirements, is the following: Crude carbolic acid, 1 ounce, sulphate of zinc, 8 ounces, water, 3 gallons. Carbolic acid effects its disinfection by a coagulation of the albuminous matters.

Under the head of disinfectants of this order, we find sulphate of zinc, protosulphate of iron, and sesquichloride of iron. All of these enter, to a greater or less extent, into different preparations offered for sale. The Girondin fluid, so much used of late, is a combination of the dead oil of coal tar, sesquichloride of iron, and other substances. For the disinfection of low damp places, cellars, and sinks, the sesquichloride of iron is invaluable. Condy's fluid, which can be made on a small scale by mixing together two ounces of red lead, two ounces of common salt, and four ounces of oil of vitriol, is a powerful antiseptic agent.

The second class, namely, disinfectants effecting chemical decomposition, may be enumerated as lime, chlorine, sulphurous acid, sulphate of copper, chloride of zinc, and soda or Labarraque's solution, permanganate of potash, bromine, etc. etc. These substances work by oxidation of the offensive substance, or by destruction of the germ. This is seen most markedly when the permanganate of potash is used, when the black oxide of manganese is thrown down as a fine powder. Chloride of lime is one of the best disinfectants, either alone or with other substances. When it is used in damp places, it should be mixed with carbonate of soda or some other substance to counteract its hygroscopic properties. Sesquichloride of iron is especially indicated for privy vaults where there is evolution of sulphuretted hydrogen gas. The sulphur is precipitated, while the hydrogen is set free. The iron acts most energetically as a check to fermentation. Most of these disinfecting substances owe their efficacy to the chlorine contained, and probably those emitting the largest quantities are the best.

Sulphurous acid, formed by the combustion of sulphur, stands unrivalled as the most perfect disinfectant of rooms and buildings impregnated with the germ of the eruptive fevers. In small pox, scarlatina, and measles, particularly, the room occupied by the patient should be well fumigated by this substance. For the prevention of the spread of cholera and the inflammatory diseases of the alimentary canal, carbolic acid and chlorine are the best. Bromo chloralum ($Al_2Cl_3,2BrO$) possesses remarkable powers of absorption of sulphuretted and phosphoretted hydrogen gases; it is, therefore, indicated for the disinfection of privy vaults and sinks, where these gases are found. It is a new preparation of a straw yellow color and fluid consistency. The sesquichloride of aluminum, from which it is made, is a crystalline salt, rapidly deliquescing. It is manufactured by several English and American chemists, but owing to its comparatively high price, it will not come into general use as long as we have cheaper disinfectants with greater virtues. One advantage is its slight odor.

Absorbent deodorizers are the third class, and consist of substances that merely absorb the effluvia from putrid and decaying matters. Such are charcoal, both animal and vegetable, and dry earth. A cheap variety of bone charcoal has lately been used which is mixed with peat. All of these substances must be finely pulverized and dried. Dry earth has proved its extraordinary virtues in the patent earth closet, and in the hospitals of Philadelphia. At the latter place, it was found not only to absorb the septic matter from wounds, but to destroy all traces of odor in the wards.

There are many household agents that are constantly used. Among them are burnt vinegar, burnt sugar, pastilles and the like, but the bad smells are only disguised for the time.

Disinfectants may be used either in form of solution, or in the dry state. Either of the substances alluded to above should be placed in saucers, in the upper part of the room as near the ceiling as possible; and in vaults, privies, and other places of the kind, they should be liberally sprinkled on the surface of the offensive substance. Chlorine gas may be generated in a simple manner by exposing four ounces of the black oxide of manganese, moistened by eight ounces of oil of vitriol, and four ounces of water in a shallow earthen pan; this mixture will continue to liberate chlorine for several days. Cloths dipped in the carbolic acid solution and hung about the place to be disinfected will completely remove all bad odors.

MOLDING SAND FOR IRON FOUNDERIES.

Molding sands, according to Robert Mallet, may be divided into two classes: the first consists of those in which the grains are simply fine fragments of hard minerals (quartz or felspar) and which are reduced, washed and rounded off by Nature. To the second class belong those in which each grain represents a small natural crystal. Although round grained sand may be a good molding material, the best kind is undoubtedly the one in which a large portion of the quartz is present in the form of crystals. The best English sand occurs in the oldest formations, the carboniferous group and the trias; and although good kinds of sand are found in the more recent formations, the English molder prefers generally the "red sand" from the new red sandstone to meagre or fat sand of alluvial origin.

These are the principal considerations; but it is, moreover, according to Mallet, important to know whether the sand possesses the necessary durability, that is, whether it can repeatedly furnish good molds. It is true that any sand may serve the purpose once; but for the second time, the molder often is obliged to use it for refuse casts. Such sand is termed "burned," and it must be replaced by a fresh supply. When freed from clay and carbon and then compared with fresh sand under the microscope, we find that the grains of the former are cracked and divided into fine fragments. Originally, such sand generally consists of fragments of crystals with fissures, often filled with iron ocher or oxide of iron; in other instances, it is of a different molecular condition, so that it will decrepitate as soon as it is sufficiently heated. The change constitutes what is called the burning.

In selecting molding sand, therefore, it must be seen that the grains are solid and not broken particles, and that they are not likely to crumble. These conditions are generally fulfilled by the new red sandstone (which, by the way, occurs in the valley of the Connecticut river), provided that it has not too long been exposed to the influence of air and water.

In castings of great depth, where the liquid metal presses with great force upon the sides, it is often difficult to prevent, upon the surface of the casting, fusion of the rims and the formation of furrows on the sides of the forms. The mixture of iron and fused silicates produced resists the best cast steel chisels, and the blackening is sometimes torn off in large pieces. In making moldings for Bessemer steel, which have to resist a higher degree of heat, it is best to prepare a sand or loam from fine clay and quartz. In the steel works at Bochum, Prussia, they cast tyres and wheels for rolling mills of steel, and the manner of making the molds is still considered a secret. Mallet supposes that the sand used consists of a mixture of fine grained crystalline quartz sand and of still finer crushed "artificial sand," which is produced by crushing steel melting pots. It is likely that both materials are bound together with a moderate admixture of wet clay, prepared from the white fireproof clay of the carboniferous group. As regards the coal dust, it may be anthracite or the levigated coal of gas retorts. The blackening seems also to consist of pure fireproof clay and meager coal.

Excellent natural molding materials are the titanic iron sands of the western Italian coast (between the Tiber and Naples) and of New Zealand, which are likely to find great use for casting. This is the case with the volcanic tufas, consisting of light refractory dust, which occurs of all colors, but is generally whitish yellow or gray. This tufa sand is found in all countries and is exceedingly well adapted for casting works of art. For massive castings and bronze, such materials are most valuable. Respecting the parting (isolating) sand, it should be clear, of fine grain, dry and of bright color, so that, in opening the molding boxes, the surfaces of the castings may be readily distinguished from the surfaces of the box.

For blackening, they use in England mostly coal dust and soot. Sometimes the sand is mixed with foreign substances, such as molasses and water, beer, yeast, oil, the washings of the starch factories, etc. The addition of coal dust, which is used to the amount of one fifteenth to one twentieth for green sand, and of one twentieth to one tenth for artificial sand, is common. Experience, of course, can be the only guide in selecting the proper proportions.

Among the means for regenerating the sand, the following are in use: Plowing and heaping up in long rows with furrows of from one to three inches; in this state, it is allowed to lay for some time, whereupon it is mixed with fresh coal.

Let us add a few remarks on the process of blackening. The mold is dusted when green sand is used, and brushed over with black wash when dry sand or loam is employed. With regard to the question in what manner these materials act, it has been shown by Schafhäutl, that coal, if brought to a white heat, may form graphite. Graphite is formed in blackened molds, provided that the heat was not sufficient to burn it up; this may be seen in a microscopic examination of the castings. This graphite may act in a twofold manner; first, the crystals lay themselves flat against the sides of the mold and thus prevent the iron from penetrating into the same, or oxide of carbon is formed, which prevents the iron from oxidation. Whether or not cementation (reaction between the blackened mold and the slowly cooling metal) takes place is difficult to decide, but it is certain that a casting produced without blackening shows a different appearance from that of a well executed casting, which has a uniform, bluish gray surface with close grain.

We suggest to founders that—considering the great lack of trustworthy information respecting molding sands still existing among the craft—they would do well to communicate their experience to the technical periodicals of the country.

ANIMAL HEAT AND DISEASE.

All animals have a temperature above that of the gaseous or liquid medium in which they live. The temperature of warm blooded animals remains nearly the same in all climates; in man and other mammals, it is, on an average, 37° C.; in birds about 41°. On the other hand, cold blooded animals have a temperature varying with that of their medium, and always slightly in excess of it. Animals of warm blood show slight normal variations of temperature with, for example, the seasons, the hour of day, sleep, food, digestion, age, etc., but we propose at present to consider the abnormal variations which arise when the equilibrium of the system is disturbed.

So delicate, as we all know, is the mutual dependence of the various parts of the body that, when the least injury is inflicted on one, there ensues disarrangement of the whole. The nervous system, charged with maintaining the harmonious intercommunication of the frame, transmits on all hands the abnormal impression. It is not the generator of animal heat, but it is the regulator of it; it directs and superintends, so to say, the production and distribution of heat according to the varying bodily requirements. Any injury done to the nerves tells on the animal heat. By cutting the sympathetic nerve of a rabbit at the neck part, M. Claude Bernard produced an elevation of temperature of several degrees. In this and like cases in which the nervous action is suspended, the blood flows in greater abundance, carrying with it more thermal energy. Where the opposite takes place, the blood vessels contract, and the temperature falls.

Insufficient food and abstinence affect animal heat, but not immediately. The system continues at its normal temperature till it has exhausted its reserve of combustible material. Then it gradually becomes cold. If an animal which has been deprived of food several days be put into a medium moderately heated, its functions will somewhat revive; but the change is of very short duration.

The hand of a person who suffers from some inflammation of the chest, or from infectious fever, is burning hot; that of one who has dropsy, or emphysema (in which the body is distended through accumulation of air), is cold as marble. The morbid influence is almost never compatible with the normal temperature of the body. In the times of Hippocrates, before there was any examination of the pulse, elevation of temperature was looked on as the essential element in fever. Galen defines fever "an extraordinary heat (*calor præternaturalis*). Nor has this idea been overthrown by modern research. The pulse may rise to extreme limits without febrile action—as in hysteria. Whenever the heat of the body exceeds 38°, it may be affirmed there is fever. When it falls below 36°, we have what is called *algor*. Thus the proper limits of normal heat are about two degrees. On either side of these limits, the state becomes one of disease.

Acute inflammations, such as those in pleurisy, bronchitis, erysipelas, etc., are characterized by a period of 36 hours, or about two days, in which the temperature gradually rises to 41°. On the third day it begins to fall, and does so (with slight variations) during three to seven days, when the disease has run its course. Where the temperature gradually increases after the third day, a fatal issue may be looked for. Persistent heat is here the precursor of death. In such diseases as variola and scarlatina, the heat increases until cutaneous eruption; there it remains at its maximum (about 42½° in scarlatina) till the eruption is completed—when it begins to descend irregularly to the normal state.

Animal temperature also rises in such cases as wounds, tetanus, aneurism, etc.; in strangulations, certain kinds of poisoning, burns, and other cases, it falls.

Such increase and diminution in animal heat can only be attributed to a corresponding change in energy of the combustion which goes on in respiration. In what precise way morbid influences accelerate or retard the calorific process does not clearly appear. Some medical men suppose a fermentation in the blood, producing such small organisms as bacteria and vibria. Others think that when local inflammation takes place, the inflamed organ communicates heat to the whole body, like a stove in a closed space. Others explain it by nervous action.

Swammerdam, in the seventeenth century, seems to have been the first who employed the thermometer in treatment of disease. De Haën and Hunter, in the last century, also made use of it; but it is only recently that clinical thermometry has assumed a large importance. The spirit of research has not been content with noting the fact of a change of temperature in disease; but the variations have been followed, day by day, hour by hour, and carefully recorded. Curves are drawn representing these variations; and each disease has its characteristic curve, which is modified in a determinate manner when the disease is subjected to this or that curative agent. By comparing such curves with the symptoms observed, the stage of progress can be ascertained and treatment suited to it. For diagnosis, it proves often most valuable. Thus, in cerebral hemorrhage, the temperature falls suddenly to 36° and even 35°; while, in an apoplectic attack, it remains at about 38°. These two maladies, quite distinct in reference to treatment, are yet liable to be confounded by the observer. The thermometer obviates such confusion. So with other cases.

In the foregoing facts, we have a sample of the benefit practical medicine may derive from physical science, and the precision it may attain by the application of instruments capable of measuring morbid symptoms. In banishing the often imperfect and erroneous judgment of the senses, and substituting, as far as possible, the distinct indications of an exact instrument, a large proportion of the obstacles to methodical treatment of disease are removed. Such instruments, besides, often reveal peculiarities which would escape direct observation. Clinical thermometry is to be reckoned an undoubted advance in the science of medicine.

EDMUND HENRY KNIGHT.

It is with deep regret that we record the death, at the early age of 40 years, of Mr. Edmund Henry Knight, of the editorial staff of the SCIENTIFIC AMERICAN. He was formerly a leading and well known member of the City of London Literary and Scientific Institution. He came to this country in 1852, and soon became a contributor to several of the magazines and periodicals. But the branch of literature in which he peculiarly excelled was in the writing of descriptions and analyses of machinery and mechanical devices. His perception of the construction and arrangement of the parts and merits of a machine was almost intuitive, and the whole apparatus seemed to be formed in his mind at once, whether assisted by a drawing or a mere verbal description.

The pleasant amiability of his manner secured for him many friends, by whom his memory will be warmly cherished.

THE FAIR OF THE AMERICAN INSTITUTE.

Since our visit of last week, a new boiler, the Whittingham, has been placed in position, making four in all now supplying steam to the various machines. This boiler is of novel pattern. Its tubes, which are inclined and extend lengthwise, are made double, the heat passing around the exterior of the outer tube and then back through the inner one, while the water is contained in the space between the two. Tests will be applied to this generator, we understand, during the progress of the exhibition, from the results of which we shall be able to judge of its merits. Resuming the article in our previous issue, we continue the description of the

STEAM ENGINES.

A handsomely built Massey rotary engine of 150 horse power is one of the most attractive machines on exhibition. Attached to it is a new and improved arrangement which enables the engineer to increase or diminish the point of cut-off at will while the engine is in motion. Kipp's revolving cylinder engine is remarkable for its compactness. The one exhibited is of six horse power, though occupying but 22 inches square of floor space, and being but 30 inches in hight. The cylinder contains two double pistons at right angles to each other, their connecting rods being in the same vertical plane, both operating the same crank. Steam is admitted at the side. The exhaust communicates with a feed water heater underneath the machine, thus utilizing the warmth of the steam. Babcock & Wilcox exhibit a vertical steam engine of ten horse power, designed for steam yachts, which seems excellently adapted to the purpose.

HOISTING ENGINES.

One of the best finished pieces of machinery in the Fair is a geared hoisting apparatus, from Cook, Rymes & Co., of Charlestown, Mass. The engine is of the ordinary horizontal type. There is a small rotary hoister, from Lighthall, Beckman & Co., displayed, which seems to give very fair results, doing good work with a steam pressure of 60 pounds. Its movements are entirely controlled by steam pressure. Wm D. Andrews & Brother, in addition to their well known friction hoisting engine, exhibit a new differential gear hoister for elevators. In the interior of a drum attached to a shaft are two sets of gear, for hoisting and lowering respectively. One third of the gearing is always engaged, so that it will always hold in event of a belt breaking. On the shaft are two pulley wheels which are made to revolve in opposite directions by similarly arranged belts. Either wheel can be thrown into operation to hoist or lower, as required, by means of a Volney Mason double friction clutch moved by a hand lever. This invention seems to be one of the safest yet devised for the above mentioned purpose.

PUMPS.

Under this heading, we have little of novelty to describe. Andrews & Brother and Heald & Cisco exhibit two huge centrifugal pumps which, from the cataracts of water they discharge, form subjects of great interest and call forth innumerable expressions of wonder from uninitiated visitors. There are two vacuum pumps. Prall's consists of two cast iron empty cylinders, on the outside of which the valves are situated. They operate by allowing the enclosed steam to condense, thus forming a vacuum into which the water rushes. The stream is then expelled by direct pressure of steam. Hall's pulsometer or magic pump is a similar invention, but more compact, as it is cast in a single piece.

White & Moritz exhibit a horizontal pump, with guides and an outside thread on the stuffing box gland. These manufacturers show the working of their pump valves through a plate of clear glass inserted for the purpose. The idea is a good one and should be followed. Hardick's Niagara pumps are, as usual, in a prominent place. Four are on exhibition, and all noticeable for remarkably good workmanship. Condé & Co., of Philadelphia, display a very simple horizontal pump. The steam valves are uncovered by the piston at each end of its stroke, thus doing away with tappets and other gear. E. T. Jenkins has a new pneumatic pump, which forces air into barrels and thus causes their contents to be driven out. Several other steam pumps are exhibited, which call for no special comment.

GAGES, GOVERNORS, BOILER ATTACHMENTS, ETC.

The Recording Steam Gage Company has four of its instruments, and Charles G. Willey shows a 24 inch steam gage, in operation. Three governors are exhibited, two already well known, the Shive and the Condé, and one of novel invention, the Duff. The latter consists essentially in the arrangement of a centrifugal or rotary pump, receiving motion from a steam engine and working in a barrel or cylinder containing a piston which connects with the throttle valve in such a manner that, when the speed of the engine increases beyond the desired point, the pressure of the fluid, brought to bear on the governor piston by action of the rotary pump, closes the throttle valve. The Berryman Manufacturing Company are represented by their feed water regulators on all the boilers. The Albany steam trap, recently described in our columns, is also in operation. In belting, the only novelty is the double triangular belt described in our preceding article.

There are surprisingly few novel inventions, under the heading of this paragraph, on exhibition. Whether it is because the Fair is still incomplete (although the space seems well occupied), we are unable to state; but in the machinery department generally the number of machines not only appears to be smaller, but the variety is less and the articles displayed are of inferior interest to those contributed to the exhibitions both of last year and the year before.

Statistics of Cotton Manufacture.

The Census Office at Washington furnishes the following statistical information relative to the cotton industries of the United States. The number of distinct establishments is 956. Of these, Massachusetts has more than any other State, 191, while Virginia has but 11.

Number of steam engines, 448; aggregate horse power, 47,117. Number of water wheels, 1,250; aggregate horse power, 102,409. Number of looms used, 157,310; frame spindles, 3,694,477; mule spindles, 3,437,938. Hands employed, 47,790 males above sixteen years; 69,637 females above fifteen; 22,942 children and youths. The aggregate amount of wages paid during the year was $39,044,132. Materials used, 6,222,180 pounds of cotton yarn, 136,100 pounds of cotton warp, 5,234,260 pounds of cotton waste.

Value of mill supplies, $10,910,672; total value of all materials, $111,737,686. Articles produced—478,204,181 yards sheetings, shirtings, and twilled goods; 34,533,462 yards lawns and fine muslins; 489,250,053 yards print cloths; 30,301,087 pounds yarn; 11,560,241 dozen spools thread; 73,018,045 yards cotton warps; 11,118,127 pounds batts, wicking, and wadding; 493,892 tablecloths, quilts, and counterpanes; 2,767,060 seamless bags; 5,057,454 pounds cordage, lines, and twines; 906,066 pounds thread; 8,390,050 yards cotton flannel; 39,275,246 yards ginghams and checks; 7,921,449 pounds waste; 484,400 pounds tapet wadding; 405,585 pounds seamless bags; 13,940,895 yards cassimeres, cottonades, and jeans; 10,811,028 pounds miscellaneous products. Aggregate weight of goods produced, 349,314,592 pounds; aggregate value of product, $177,489,739.

STEAM SCREAMING PROHIBITED.—By an act of Parliament the use of steam whistles, for summoning and dismissing workmen or persons employed in any manufactory or other place, is prohibited in England under a penalty of $25.

Reaping Machine Trials.

A competitive trial was lately made at Brampton, England. An influential committee was appointed, the judges selected being Mr. M'Kinnell, of Dumfries, Mr. Dods, of Hexham, Northumberland, and Mr. Little, of Fauld, Longtown; and no fewer than forty three machines by the principal manufacturers in England, Scotland, and America were entered for competition. The machines were divided into three classes, but the great interest centered in the self delivery reapers, which, from their independence of manual labor (requiring only the driver), are fast superseding the manual delivery machines. The trials commenced in a sixty acre field of oats, the land being rather hilly, and the crop much laid. The judges selected five of the machines for further trial. On the following day, these selected machines underwent a more extended trial. Towards the conclusion it was evident that the first prize lay between the "International" reaper of Messrs. Howard, of Bedford, and the American machine invented by Messrs. Kirby, of Auburn, New York State. The final test, however, was cutting a tangled and twisted crop, which the Howard "International" machine accomplished without difficulty, the American Kirby choking. The first prize was, therefore, unanimously awarded to Messrs. J. and F. Howard, Bedford, and the second to the Kirby machine. Messrs. Brigham, of Berwick-on-Tweed, was highly commended, and Mr. Bickerton, also of Berwick-on-Tweed, was commended. The trials were attended by all the leading agriculturists of the district, and the interest manifested in the proceedings was sustained to the end. The arrangements were good, and were all carried out in an able manner under the superintendence of the honorary secretary, Mr. Coulthard.—*Engineer.*

THE Postmaster General has contracted with the White Star line of steamers for the transport of the United States mails, between New York and Queenstown, Ireland, for one year, ending December, 1873, the compensation being the amount received for sea postages. A steamer leaves this port every Saturday. It appeared, on careful examination, that the steamers of this line average about twelve hours less time than the ships which have heretofore carried the mails.

In a boiler of fair construction, a pound of coal will convert 9 lbs., of water into steam. Each pound of this steam will represent an amount of energy or capacity for performing work equivalent to 746,666 foot pounds, or, for the whole 9 lbs., 6,720,000 foot pounds. In other words, one pound of coal has done as much work in evaporating 9 lbs. of water into 9 lbs. of steam as would lift 2,232 tuns 10 feet high.

DURING the month of August there were sixty-three railway accidents reported in this country, one person being killed and ten injured. From January to August inclusive of the present year, there were 235 railway accidents, 156 persons were killed, and 489 others were injured.

ON THE USES OF GAS.—Mr. Henry Wurz, editor of the *Gas Light Journal* of this city, announces that he has in preparation a new work upon the utilization of gas for lighting, warming, cooking, kindling, motor, and other purposes, adapted for popular instruction on these subjects.

A Tyndallic Ode.

[*Tune:* "THE BROOK."]

I come from fields of fractured ice,
  Whose wounds are cured by squeezing,
They melt and cool, but in a trice
  Grow warm again by freezing;
Here in the frosty air the sprays
  With fern-like hoar frost bristle,
Their liquid stars, their watery rays
  Shoot through the solid crystal.

I come from empyrean fires,
  From microscropic spaces,
Where molecules with fierce desires
  Shiver in hot embraces;
The atoms clash, the spectra flash,
  Projected on the screen,
The double D, Magnesium b,
  And Thallium's living green.

This crystal tube the electric ray
  Shews optically clean,
Nor dust or cloud appear—but stay;
  All has not yet been seen;
What gleams are these of heavenly blue,
  What wondrous forms appearing?
What fish of cloud can this be, through
  The vacuous spaces steering?

I light this sympathetic flame
  My slightest wish to answer,
I sing, it sweetly sings the same,
  It dances with the dancer;
I whistle, shout, and clap my hands,
  I hammer on the platform,
The flame bows down to my commands
  In this form and in that form.

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.—WELDING CAST IRON TO STEEL.—On page 144 of the current volume of the SCIENTIFIC AMERICAN, there is a description of the manufacture of axes by welding cast iron, as it comes from the flask, to steel. There are a great many of your readers who would like to know how it is done.—J. P.

2.—CRACKS IN GLASS.—Having recently found a crack in a bottle which I was cutting in two, I was surprised to see that, when I tapped the bottle gently with a pestle, the crack elongated and immediately shortened again, so that the closest inspection did not discover any trace of the extension of the fracture. Can any one explain this?—A. C. R.

3.—CEMENTING WOOD TO GLASS.—What is the best cement for this purpose? There is a moderate strain on the wood.—W. R. JR.

4.—GALVANIZED IRON BOILERS.—You have cautioned the public against using these; what is the best kind to replace them? How can I remove the zinc coating? The water comes 200 feet in a lead pipe, and I consider that arrangement sufficiently poisonous for the present.—P. M.

5.—ELECTRIC LIGHT.—How can I make an electric light and the battery therefor, and how strong a battery do I need?—F. D.

6.—DECOMPOSITION OF COAL.—Is anthracite coal injured by exposure to the weather? If so, what changes take place in it? I find that a sample immersed in water for 48 hours does not increase in weight.—C. M.

7.—OZONIZING OIL.—What is the cheapest and simplest manner of introducing ozone or ozonized air into oil?—B. S.

8.—PLANTS GROWING IN WATER.—What species of plants will grow best in a vessel supplied with water only? What seeds, besides acorns, will grow when suspended near the surface of water?—J. W. K.

9.—STAINS ON PRINTS.—I would like to ascertain how water stains can be taken out of prints without injury to the picture? Also how to remove stains caused by mildew?—K.

10.—BISULPHIDE OF CARBON.—I would like to obtain bisulphide of carbon perfectly pure, while in a gaseous state. Is there any agent to pass it through that will rid it of the sulphuric acid, sulphuretted hydrogen, or particles of sulphur?—H. B. B.

11.—SLIP OF DRIVING WHEELS.—Are not the driving wheels of a locomotive more liable to slip on the track, and do they not have less power to keep up the rotary motion when on the stroke that brings the connecting rod between the track and axle than when on the opposite over stroke?—C. T.

12.—BLENDING SOAP AND CHALK.—How can I mix castile soap (which is fresh and still soft) and precipitated chalk, ⅔ of the former and ⅓ of the latter, on a small scale? I have used a mortar and pestle, but in mixing 200 or 300 pounds this will not answer the purpose.—W. K.

13.—SPECIFIC GRAVITY.—D. B., of N. Y., on page 170, in answer to J. P., query 15, page 153, states that a body will weigh more at the poles than at the equator, owing to the flatness of the earth at the poles. Query: Does not the centrifugal motion of the earth at the equator partially counterbalance the force of gravitation? If so, is not that another reason why a body will weigh more at the poles than at the equator? And if not why is the earth at the equator raised, and at the poles depressed?—H.P.C

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.

CARBON FOR BATTERY.—J. G. C. asks: What is the carbon used in Bunsen's and other batteries? Will charcoal answer the purpose? Answer: Charcoal will do, but the best carbon plates are made by taking coke from gas works, pulverizing it, making a paste with a little flour and sufficient molasses, molding it into shape, and drying it in an oven.

CEMENTING WOOD TO IRON.—W. T. V. asks for a means of firmly securing wood fitted tightly into a cast iron socket. Answer: Paint the inside of the socket with oil paint (white lead will do), then glue the wood in with strong glue.

R. B. suggests the employment of Mr. Lamm's fireless engine for the propulsion of omnibuses or cars on ordinary roads. Omnibuses drawn by road steamers are used in Scotland with much success.

P. S. B., having had a dispute about self acting machinery, says: Please say if there has ever been a clock made that went of its own movement, making its power by which it moves, or, in other words, a self winder. Some parties assert that a clock of this kind was manufactured by a watchmaker in Schwerin, Mecklenburg-Schwerin, Germany. Answer: We have seen a clock that was wound by the rise and fall of oil contained in a tube, in which was a piston. The expansion and contraction of the liquid, caused by the ordinary changes in the atmospheric temperature, was made to operate the piston, one end of which was provided with toothed racks, and so arranged that the motion of the piston acted on the barrel of the spring to wind it up. This clock was exhibited as a "perpetual motion." As to the particular clock you speak of, we have no information.

RUSTY LIGHTNING RODS.—A communication in your paper a few weeks since, on the lightning striking the rod on the Washington monument at Baltimore, has induced me to ask whether a rusty rod is of any use in protecting buildings? A few years ago a company came around putting up a cable rod. I had an old rusty rod up at my house. They said a rusty rod did no good, and said they formed a battery in the ground by putting a piece of copper and zinc around the rod, which prevented it from rusting, and would take off any rust there might be on it, which statement was a humbug. In less than one year it was as rusty as it could be, and as the one they took down. Now there are other parties around, saying a rusty rod is of no use, and wanting to take down this rod and put up theirs, a galvanized rod.—H. C. Answer: There would be no advantage in the change. A rusty rod will conduct the electricity as well as if it were galvanized.

POSITION OF ECCENTRIC ON CRANK SHAFT.—To M., query 11, page 123.—In a well constructed slide valve engine, the extreme throw of the eccentric is about three eighths of a revolution in advance of the crank (when a rock shaft is not used), and not at right angles, as argued by the foreman spoken of. And you are right in regard to placing it in position so that the valve will open at the right point. The foreman should assist a machinist in setting up some slide valve engines.—G. B. S.

CLOSING THE PORES OF WOOD.—O. S. C. asks for directions for closing the pores of wood so as to make it air and watertight. Answer: Painting or varnishing will effect it; if you use varnish, choose one that will resist air, water, or whatever else your wood may be subjected to.

L. K., of Mass., sends a mineral specimen and desires to know what it is, and if it is worth anything, and what it is used for. It was, he says, dug out of the earth in one of the hills in his town. He found also another article on the same hill which is very fine earth and seems to be full of bright gold colored dust, so that when rubbed in the hand it presents a bronze appearance. Answer: The specimen you send is kaolin earth, resulting from the decomposition of granite. It consists mainly of silica and alumina, and is used, when pure, in the manufacture of porcelain ware. The other substance referred to is probably micaceous or talcose earth; we cannot decide without a sample.

L. S., of Pa., writes: Enclosed I send you a sample of incrustation from my steam boiler. Whatever it is, it eats through the iron very rapidly, and blowing the boiler off once a day does not seem to relieve it at all. I use water from a natural spring. I think it is mostly salt in the water, with perhaps some lime which gets into the water courses from the surface, as there is a great deal of salt water pumped out of the oil wells and allowed to run out upon the ground. I should like you to tell me what this sample is composed of, and what I can use to counteract the effect of it on my boiler. I read a short time ago that the Oneida Community had overcome a somewhat similar trouble by the use of tannate of soda. Could you tell me the proportion to use and whether it would be beneficial in my case? Answer: The corroding substance is, as you suspect, chloride of sodium (common salt), with lime, iron, and other impurities. In our opinion, it will be far cheaper to secure rain water for your boiler than to attempt to neutralize this with any chemical substance.

DIAMONDS.—To C. W. P., query 1, page 138.—The best test is experience; but if it be not a diamond, it can be scratched with a file. A diamond also is cold to the touch, and all imitations are w rm. As regards the value there is no rule, as stones vary in color and shape. The old English rule, previous to 1843, was to square the weight of the stone and then multiply by 40, but now it would be more nearly right to square the weight and multiply by 120. This rule only applies to white and perfect stones.—J. H. G., of N. Y.

FETID WATER.—To E. H. H.—The cistern is made of white pine. The water is from the roofs covered with pine shingles. The water does not come in contact with paint of any kind. The pump pipes are of iron, conductor pipes, of tin. The pump is used constantly.—F. D. H., of N. Y.

POSITION OF ECCENTRIC ON CRANK SHAFT.—To M., query 11, page 122.—You are right and your foreman is wrong. The position of the eccentric varies with the lap and lead of the valve; a valve cutting off at ⅝ stroke does not have as much lead as one does cutting off at ⅞ stroke. The more lap you have, the more lead you have, because if the valve is longer (or has more lap), the eccentric has to be farther ahead to open the port. Engines running very fast require more lead than slow ones.—C. W. W. of Ind.

TO DETECT SULPHURIC ACID IN VINEGAR.—Mince the pickles with a glass or ivory knife, and then pour over them a little weak ammonia. If a blue color be produced, it is certain they contain sulphuric acid. The above is as simple and certain as any test I have ever tried.—D. N. B., of Pa.

VALUE OF PURE GOLD.—To S. A. G., query 7, page 138.—The value of gold, 24 carats fine, is $1·04 to $1·06 per dwt.—J. H. G., of N. Y.

EXTERMINATING ANTS.—I send the *modus operandi* of Texas: Take four ounces of cyanide of potassium and one pint of water, and after it is dissolved, pour one tablespoonful or more down their nests or where they frequent. The effect is so powerful that the smell will kill them, but it must be used with care, as it is poison to man and beast.—M. M., of Texas. We advise no person to use the remedy. Better endure the ants than the risks of poison by having cyanide of potassium about your house.—EDS.

GUNPOWDER IN CARTRIDGES.—To C. W. L., query 17, page 153.—Gunpowder in paper cartridges, if kept dry, does not deteriorate. A great difficulty, however, arises from the utter spoiling of the fulminate or priming, even in metal cartridges, so rendering them quite useless. Such cartridges, kept in a ship or other magazine, in the course of twelve months or less are ruined.—E. H. H., of Mass.

THE MAGNETIC POLE AND THE MERIDIAN.—L. H., in query 3, page 106, asks "how far the pole star is from the zenith of the north pole?" I suppose he means "what is the regular distance of the pole star from the north pole, that is, the azimuth?" I could answer more to the point if he had stated his latitude. The present polar distance of the north star is 1° 22′ 13·4″. The azimuth may be found by the following formula: Let A=azimuth, P=polar distance=1° 22′ 13·4″, L=latitude of place; then A=the sine P divided by the cosine L. To find the magnetic declination (variation), observe the extreme elongation of the pole star, and add the azimuth to the bearing, if the elongation be east. If the western elongation be used, the difference between the azimuth and bearing is the true declination. To find the true meridian: 1st. Suspend a long plumb line from some elevated point, and let the plumb bob pass into a pail of water to reduce its vibrations. Set up a compass or other instrument about 20 feet south of the plumb line. When the pole star and *Alioth* are bisected by the plumb line, that is, when they are both in the same vertical plane, or more accurately 17 minutes afterwards, the pole star is in the true meridian; sight to it then, and fix the line or observe the reading, which will be the true declination of the needle. 2d. Sight to the pole star while apparently moving westward, observe when it seems to come to rest a few moments; it is then at its extreme western elongation. Fix the line thus obtained. Observe likewise the extreme eastern elongation and fix the line, and a line midway between the two is the true meridian. If a transit or theodolite is used in the above observations, it will be necessary to illuminate the cross hairs by the light of a lamp or candle reflected upon them from white paper, as those stars can only be seen in the dark. *Alioth* (*Epsilon ursæ majoris*) is that star in the Great Dipper which is nearest the bowl, and is the third from the end of the handle. Declination in the Western States is east, and *vice versa*.—J. B. J., of Mass.

POWER FOR FAN.—A. D. L., query 9, August 17, will not find any one to tell him how much weight will be required to drive his fan unless he can say how much the work will be; and that will depend chiefly on the pitch of his fan. But he wants 9,000 revolutions in an hour, whatever that pitch may be, and he has 10 feet or 120 inches, or 2 inches per minute, as the speed of his weight. If his barrel be 3 inches in diameter, and the wheel, say, 12 inches with 60 teeth acting on a pinion with 6 teeth, and this pinion carries another 60 teeth wheel, the latter, engaging the pinion of the fan shaft, having 9 teeth, he will get about 9,000 revolutions when his weight has run down; in this case, as he does not know the power exhausted at the working point, he must pile on the weight until he gets the right speed. If I have calculated right, 100 pounds weight would be balanced by about a quarter of a pound added to a leaf of the fan; but a quarter of a pound pressure upon the air displaced by one leaf of the fan would produce a pretty good effect. Will he let us know how he succeeds?—R. H. A., of Md.

PRESERVING POLISHED STEEL SURFACES.—To F. & N., query 22, page 138.—Warm equal parts by weight of white wax and spirits of turpentine, so as to make a salve; lay a very thin coat of it on the polished article, and rub it uniformly over with a dry piece of linen. Or, melt one ounce of paraffin in a glass with a wide mouth by putting the glass in hot water; then add 1½ ounces of petroleum and shake the mixture in the corked bottle until it has stiffened to a salve, which is to be applied as before stated.—A. G. S., of N. Y.

BURSTING OF SAWS.—To J. A. H., query 14, page 58.—It is possible for saws to be run at so high a rate of speed as to burst. An instance came to my knowledge in the town of Blanchard, Piscataquis county, Maine.—F. S. B., of Me.

RED ANTS.—J. C. W., August 10, enquires how to get red ants out of a cupboard. Here is a plan that never fails. Moisten a towel with sweetened water, grease, or anything that will attract them, and spread it in the cupboard, and as soon as it gets covered with them, take it out, and throw it in a kettle of boiling water. Repeat the operation till you kill the last one of them. I have destroyed a whole colony of them in a single night.—D. W. B.

DRILLING HOLES IN GLASS.—W. V. B., query 11, page 138, is informed that to drill holes of any size in glass, he has simply to secure, over the place to be drilled, a thin piece of pine (like that used for backing pictures) with a hole through it the size of the one desired in the glass. This is simply a guide for steadying the drill at starting. The drill is a brass tube of the size desired, the thinner the better. Put a center into the top of it, and run with a common bow, like that used in drilling by watchmakers. Feed the drill with rather fine emery, and keep wet with a saturated solution of gum camphor in spirits of turpentine, and you can drill glass as easily as brass. The tubular drill cuts out a circular core, and the hole can be smoothed or enlarged to any desirable extent with a round file wetted with the solution referred to. Keep the drill upright.—W. E. H.

Communications Received.

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

On a New Method of Telegraphing.—By C. W.
On Spectrum Analysis.—By W. A. M., Jr.
On Binary Engines. Being a reply to a recent Editorial Article in the SCIENTIFIC AMERICAN.—By. J. A H. E.
A Mechanical Eye.—By J. E. E.
On the Force of Falling Bodies.—By W. A. A.
On the manufacture of Portland Cement.—By A. O.
On Desirable Household Articles.—By F. G. W.
Science and Theology.—By W. L. T., also E. B.

Recent American and Foreign Patents.

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

STOP COCK.—John Stevens, of New York city, assignor to Joseph H. Devlin, of same place.—This invention relates to a new construction of valve or stop cock for gas, steam pipe, etc., with the object of insuring a good fit, even wear, and satisfactory operation by simple and economical means. The invention consists chiefly in making the valve proper of a perforated disk, which is drawn against the lower side of a perforated plate and turns thereon to open or close the apertures. With this feature is connected a new manner of arranging the upper part of the valve mechanism for giving the valve the requisite quarter turns and holding it tight against its seat.

FRUIT DRYER.—Albert Paige and George Wilkinson, of Chicago, Ill.—This invention relates to a combination, with a fruit pan, of a steam generator having steam tight valve spout and a heater, confined in a heat retaining case, and coming only in contact with the bottom of the generator, whereby the fruit may be steamed and a high heat continuously applied until insects are wholly destroyed, while the evenness of temperature in steam prevents any injury to the fruit and allows all parts of it to become uniformly permeated with the heat.

STEAK MASTICATOR.—Richard F. Cook, of Jacksonville, Florida.—This invention consists of a grooved or corrugated table and a corrugated roller combined in such manner that the steak, being placed on the said table and the roller turned forth and back, the latter will roll over the steak, and crush and masticate it very efficiently, the table and roller being held in contact with each other or with the steak between them by springs, which compensate for the variations in the thickness of the steak.

MACHINE FOR PRESSING ROOFING TILES, ETC.—Calvin J. Merrill, Upper Alton, Ill., assignor to himself, Frank F. Merrill, and Charles C. Merrill, same place.—This invention has for its object to furnish an improved machine for pressing roofing tiles, window caps and sills and other articles, of potter's clay, and consists of segments of wheels or cylinders, which are pivoted to a suitable frame work. To the faces of the segments or cylinders are attached one or more sets of dies, which are so constructed as to give the desired form to the article to be made. The dies are curved to correspond with the curvature of the faces of the segments, wheels, or cylinders, so that they may begin to press the clay at one corner or edge, and may pack and press the clay into all parts of the dies, forcing the surplus clay out at the other corner or edge. In forming roofing tile, the nail holes are formed in the clay while under great pressure by pins inserted in the segments or cylinder, and which pass out through holes in one die to rest against the other die. In using the dies, a small metallic plate, of the same form as the lower die, is placed in said lower die, upon which the clay is pressed, so that the pressed article may be removed from the die by raising the said plate. Suitable mechanism conveys power to the apparatus.

FENCE.—Henry B. Ramsey, Rockville, Ind.—The object of this invention is to furnish a portable fence for farm and other purposes, consisting of panels composed of horizontal rails or slats and upright battens. The fence is supported by means of ground sills and braces attached to alternate panels. The rails are nailed to the battens in the usual manner, and the sills are fastened to the battens by nails or bolts, so as to make the connections secure at about the middle of the sills. The sill will extend about an equal distance in each direction. The brace is attached to one end of the sill, and extends at an angle to the top of the batten, and is fastened at each end. A recess is made in one or more of the rails (preferably in the middle rail). In putting the panels together, the ends of the two panels lap each other, and a projection on the one panel engages with the recess on the other. A notch fits over the top of the sill, while the bottom rail fits into a prepared space, and the second rail from the top fits under the brace where the brace forms an acute angle with the batten. For turning an angle the panels are secured together by bolts. The ends of the panel are prepared alike, so that it is connected to another panel with sills and braces prepared at both ends, as has been described.

MACHINE FOR PUNCHING METAL.—Norman C. Stiles, Middletown, Conn., assignor to the Stiles and Parker Press Company, same place.—This invention consists, first, of a stripper for holding the bar of metal for the withdrawal of the punch after punching the hole, so arranged that it will oscillate when the bar is drawn against it and take any position or inclination that the upper surface of the bar may have, so as to bear alike on opposite sides of the punch, and thus prevent the bar from tilting and the frequent breaking of punches. Secondly, the invention consists in having the stripper suspended from the upper portion of the frame, so as to leave a clear space above the bed die to allow the turning of bar or plate to be punched in any direction, and to facilitate the presenting of wide plates to the punch. Thirdly, an arrangement for adjusting the eccentric toothed ring, by which the punch is shifted higher or lower, whereby a nicer or finer adjustment can be made than with the arrangements heretofore used; and, fourthly, of a punching machine with the plate or table, whereon the bed die and the upper portion of the frame and operating gear are mounted, so pivoted to a stand and provided with braces that the table can be tilted backward to the extent of ninety degrees or less to facilitate the discharging of the punched or stamped articles; the object being to have the table stand at an angle of forty-five degrees, or thereabout, so that the work will slide or fall away from the die as soon as it is stripped from the punch. (See engraving on page 207, volume XXVI. SCIENTIFIC AMERICAN.)

CLOTHES RACK.—Charles J. Schaefer and George W. Schaefer, of Yonkers, N. Y.—This invention consists of a series of bars pivoted upon a holder for swinging horizontally to spread out for receiving the clothes; and the said holder is pivoted to a clamp for securing to the edge of a table, door, or other projection. The said clamp may be secured either to a horizontal or vertical projection and still hold the bars horizontally.

BUTTON.—Alonzo H. Savage, Ashtabula, Ohio.—This invention has for its object to furnish an improved device for fastening buttons to garments in such a way that they will not pull or tear out, and which will enable the buttons to be applied without thread, needles, or machine; and it consists in the combination, with the button plate or head, of a spiral wire or spring, forming the shank and inner plate of the button.

MILK VESSEL.—Maria L. Shade, Fair Grove, Mo.—The object of this invention is to furnish vessels for keeping milk and cream, which shall be secure against worms, insects, etc., and it consists in a round vessel with a contracted base, the expanded rim of the vessel being provided with a surrounding flat flange and a conical pivoted cover, the latter being secured in place by a spring catch.

TURBINE WATER WHEEL.—George C. Stevens and Josiah F. Stevens, of Ayer, Mass.—This invention relates to a new gate arrangement—gate adjusting mechanism; to a new form and construction of guides, and to an adjustable feature of the wheel case; all with the object of improving the operation and facilitating the proper adjustment of all parts of the wheel. The invention consists in the application to turbine wheels of a series of balance gates, each adapted to close two chute channels; in plates that are affixed to the chutes to insure a tight joint; in making the wheel case vertically movable on the gates as they wear; and in making the gates adjustable in pairs.

HORSE HAY RAKE.—George L. Ives, Rome, N. Y.—This invention has special reference to an improvement in the arrangement of the crank shaft and tripping mechanism, whereby the rake is raised and lowered for discharging the gathered hay. The inventor proposes to extend the crank shaft to both wheels, and gear it with them by pinions and wheels, and arrange the pinions so they can turn backward on the crank shaft loosely, but provide a ratchet and pawl so that in turning forward they engage the shaft and turn it. Thus a double geared arrangement may be obtained for working the rake without side draft, and yet it will not interfere with the running of the machine around curves, or the turning of one of the truck wheels faster than the other.

IMPROVED CORPSE PRESERVER.—Nicholas F. Curran, Baltimore city, Md.—The invention consists in placing double glasses with covers on the top of case, in arranging air spaces between the outer shell and ice spaces, in attaching ice chambers rigidly to sides but entirely independent of top and bottom, and in making the whole burial casket in three pieces. By these improvements, the body can be first laid out on the cooling board, the other parts of casket then put around it, and boxes of ice finally placed in their appropriate chambers. This avoids all nailing, screwing, rattling of ice or shifting of the body, and is doubtless a very decided improvement over anything heretofore known in this branch of art.

IMPROVED FARE BOX.—John C. Schooley, New York city.—The great aim in this invention is chiefly to provide a hand or portable fare box so constructed as to insure two results: 1st, that the money or fares once deposited cannot be abstracted through the mouth or entrance, and 2dly, that the natural movement of the hand in raising the box to receive a fare shal cause the fare last put in the box to be deposited in the inner compartment or chamber out of reach of wires or other means of manipulation which may be employed to secure it. The object is attained by a peculiar but exceedingly simple arrangement of inclined planes or partitions and hinged valves. For particular or further information, see the patent.

WASHING MACHINE.—John S. Ord, Soquel, Cal.—The invention consists in simultaneously operating two corrugated rubbers reversely over clothes resting upon a stationary rubber, in using a slotted holder and double crank shaft to give simultaneous but reverse motion to the top rubbers, in combining the top rubbers operated by a crank shaft passing through their slotted holders, with a top bar in movable bearings.

DROP HAMMER.—Norman C. Stiles, Middletown, Conn., assignor to the Stiles and Parker Press Company, of same place.—The invention consists in certain improvements upon drop hammers or presses. The spool for raising the hammer by the belt is arranged on the shaft so that it can turn independently of it and slide endwise, with a considerable range between the clutches, with which it connects alternately. Said clutches are connected with and turned by their respective driving wheels, which turn in opposite directions and are kept constantly in motion. A wide collar is made at one end of the spool, with a groove in its face, with which the pin of a shifting bar engages to move the spool endwise for connecting and disconnecting it with the clutches, also to keep the spool clear of the clutches when the hammer falls. To have the spool turned alternately by the two driving wheels to raise the hammer, it is necessary for the shifter to be moved as follows: The spool being midway between the clutches at the moment the hammer begins to fall, said shifter will then move the spool—say to the right—into gear with clutch plate 1, which raises the hammer; then said shifter will move the spool to the left far enough to disconnect it from clutch 1; then, when the hammer falls again, it will move again to the left, gearing the spool with clutch 2; then, after the hammer is raised, it will move to the right to the center; and then, after the hammer again falls, it will move to the right to connect with clutch 1 again, and so on.

SEED AND GUANO DISTRIBUTOR.—William J. West, Greenville, S. C.—The invention consists in providing a seeder hopper with a pendent swinging shoe, whereby the grain and guano are held until said shoe is tilted, shaken and caused to distribute it; in providing the shoe with a leather or other tube placed centrally at the conveying end so as to place the seed always in the middle of the furrow; and in a plumb, so placed as to enable the operator always to know when he has the shoe at the proper inclination.

IMPROVED SOLDERING APPARATUS.—Wm. D. Brooks, Baltimore, Md.—The invention consists in a new mode of applying a blowpipe to soldering machinery, of absorbing and carrying off the heat that rises from the burners, of adapting the cap holder to adjust itself to the can which is being soldered, and of preventing the escape of heat in a lateral direction. By these improvements, the tray can be slid forward and the cans can be soldered as fast as they can be handled, while a sounder joint than usual is provided in one tenth the time and at greatly less expense.

CHECK VALVE INDICATOR.—Joseph G. Blackburn, New York city, assignor to himself and Frank M. Kimberly, same place.—This invention has for its object to furnish an improved device for attachment to check valves to show whether they are working properly, and which may be applied with the same facility to an old as to a new valve. The invention consists in combining a glass tube, stem, and bonnet with a check valve, so that the latter can always be seen by the engineer, while the former can be readily detached to obtain access thereto.

NEW BOOKS AND PUBLICATIONS.

THE SALE OF PATENTS. By William E. Simonds, Attorney and Counsellor at Law, Hartford, Conn. Price $1.25.

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Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From August 30 to September 9, 1872, inclusive.

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FOR THE WEEK ENDING SEPTEMBER 10, 1872, AND EACH BEARING THAT DATE.

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6,119.—Campaign Lamp.—T. Adams, Hudson City, N. J.
6,120 to 6,126.—Oil Cloths.—J. Hutchison, Newark, N. J.
6,127 and 6,128.—Oil Cloths.—H. Kagy, Philadelphia, Pa.
6,129 to 6,133.—Oil Cloths.—J. Meyer, Lansingburgh, N. Y.
6,131.—Range Stove.—J. R. Rose and E. L. Caleiy, Jr., Philadelphia, Pa.
6,135.—Base Burning Stove.—D. Smith, Albany, N. Y.
6,136.—Show Case.—L. Wiegel and J. Lehnbeuter, Cincinnati, Ohio.
,137 to 6,139.—Carpets.—G. C. Wright, New York city.

TRADE MARKS REGISTERED.

981.—Wine of the Allspice.—G. De Cordova, New York city.
985.—Canned Oysters, etc.—D. D. Mallory & Co., Baltimore, Md.
986.—Wool Detergent, etc.—Myers & Co., Philadelphia, Pa.
987.—Hogs' Lard.—W. H. Popham, New York city.
988.—Smoking Tobacco.—J. Schriber, Cleveland, Ohio.
989.—Cooking Stove.—Shinnick, Woodside & Gibbons, Zanesville, Ohio.
990.—Well Points and Drills.—W. P. Smith, New Orleans, La.
991.—Shirts.—Stern & Co., New York city.
992.—Saddlers' Hardware, etc.—Van Wart, Son & Co., Birmingham, Eng.

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:

22,310.—Nut-making Machine.—J. B. Savage. Nov. 27, 1872.
22,340.—Pegging Jack.—T. D. Bailey. Dec. 4, 1872.
22,364.—Car Seat and Couch.—P. B. Greene. Dec. 4, 1872.
22,491.—Billiard Cue Tip.—H. W. Collender. Dec. 18, 1872.

EXTENSION GRANTED.

21,077.—Separating the Fiber of Wood.—A. S. Lyman.

EXTENSION REFUSED.

21,465.—Sewing Machine.—S. C. Blodgett.

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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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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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STROUDSBURG, September, 1872.

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THE TANITE CO. take this means of assuring that Public that even the possession of Patents for a *PERFECT* Solid Emery Wheel would not suffice for the successful introduction of the goods, *unless the Patent was backed by expensive machinery, by years of experience, by chemical and mechanical skill unflaggingly applied, by a wide practical knowledge of all the countless manufacturing processes of the day, and by the employment of men skilled in all the Manufacturing Arts.*
All these qualifications THE TANITE CO. possess; and if users, or would-be users, of Emery Grinding Machinery, want to avoid the failures and obtain the advantages of such goods, they will buy STANDARD GOODS, of an ESTABLISHED MAKE, regardless of price, rather than risk the poor economy of untried, low-priced goods.
THE TANITE CO.
T. DUNKIN PARET, President.

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In Size and Form to Suit various Mechanical Uses;
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For Planing, Paper Cutting, Leather Splitting, and other Long Knives.
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☞ Stocks of this Shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass.
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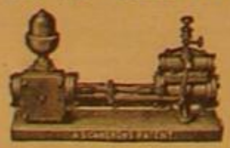

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Cross-cut Saws.
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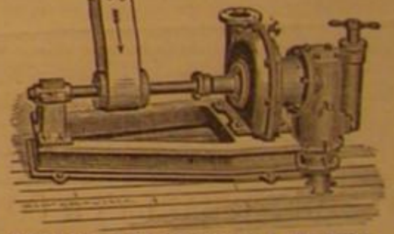

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Two 18 inch cylinder, 42 inch stroke, built by Otis Tufts; in first rate order; taken out to put in more power.
WM. E. COFFIN & CO., 8 Oliver St., Boston, Mass.

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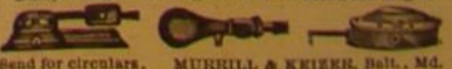

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SCIENTIFIC AMERICAN

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

Vol. XXVII.--No. 16. [NEW SERIES.] | NEW YORK, OCTOBER 19, 1872. | [$3 per Annum. IN ADVANCE.]

IMPROVED STEAM ENGINE.

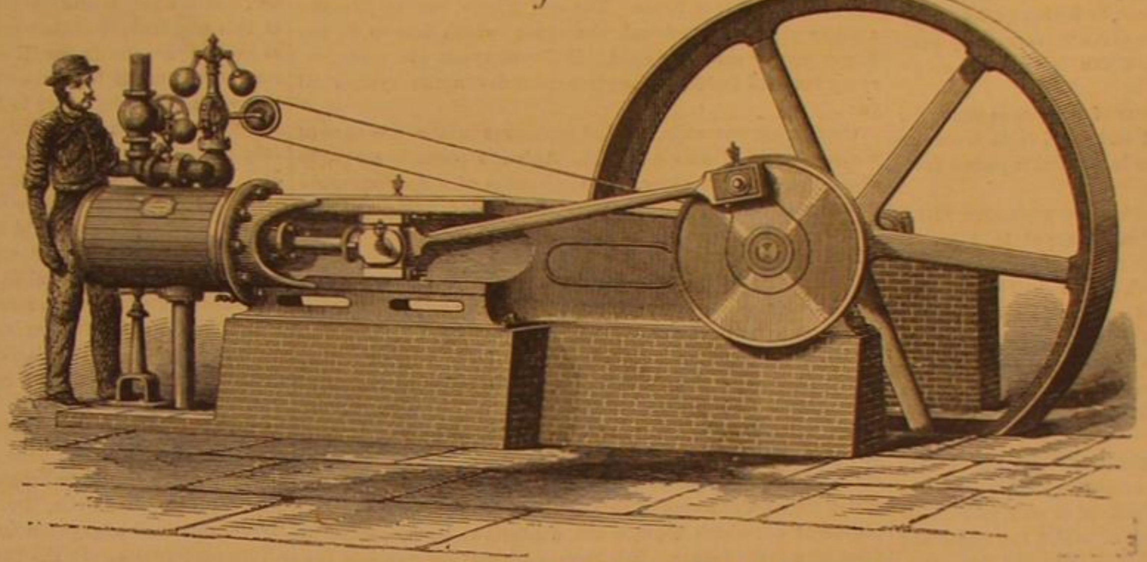
The accompanying engravings, Figs. 1 and 2, convey a clear idea of the construction of a new form of steam engine, in which the improvements relate more especially to increased durability, strength, and consequent economy of wear. It is unnecessary to enter into any detailed description of the working 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 injury.

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.

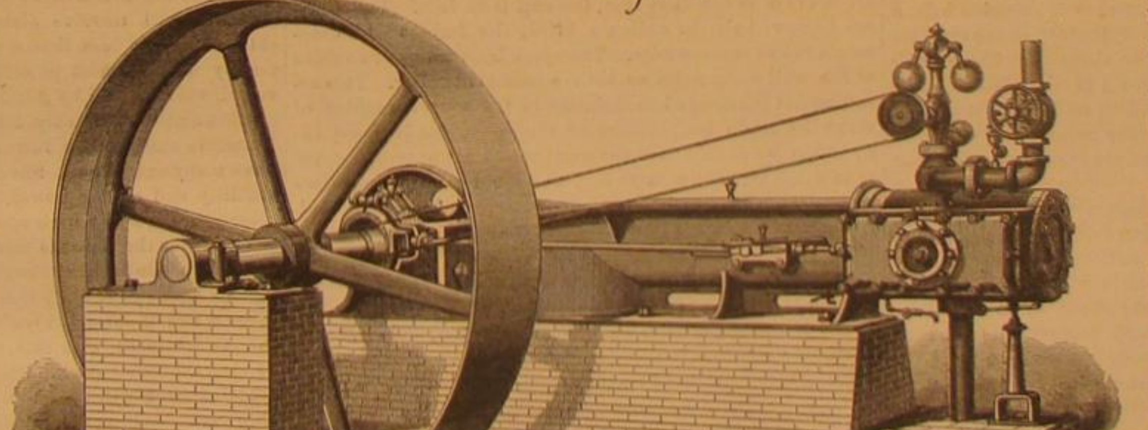
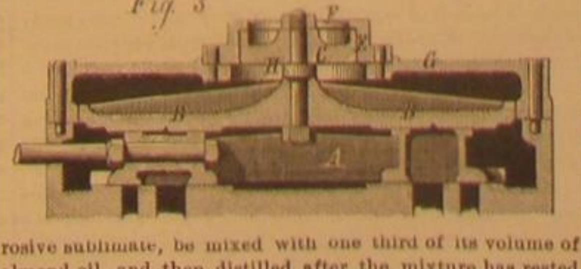


Fig 3



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, notwithstanding 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, in 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 Brelat 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 small businesses where there is not always motive power at 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. Cosmeroy 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 smoke-stack. 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 31¼ 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.

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.

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.

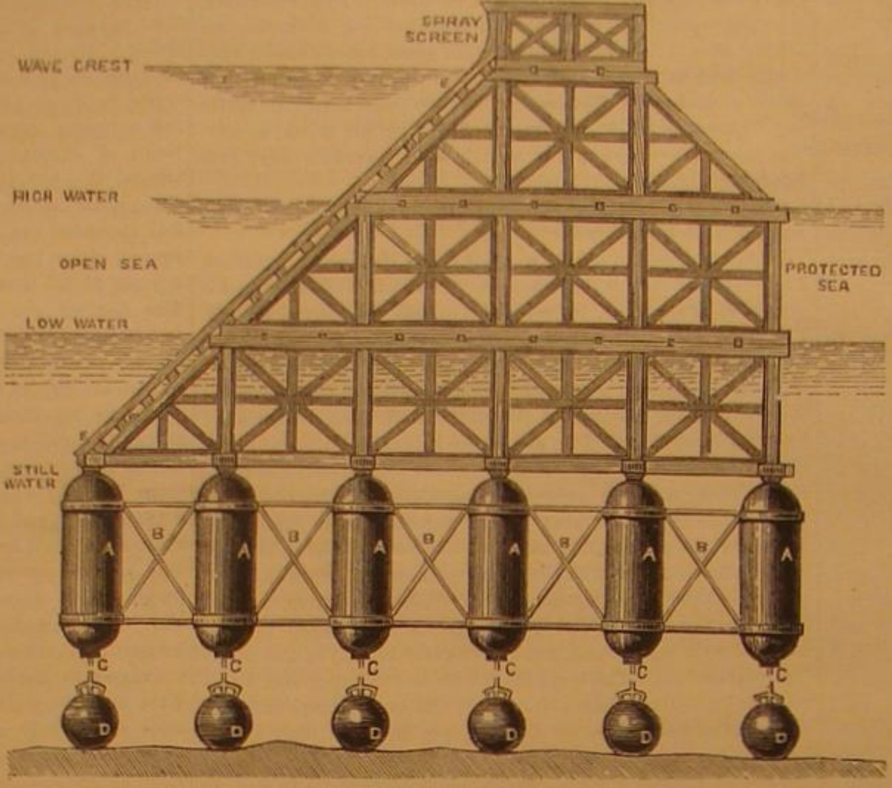
A CEMENT to stop cracks in glass vessels to resist moisture and heat. Dissolve caseine in cold saturated solution of borax and with this solution paste strips of hog's or bullock's bladder (softened in water) on the cracks of glass, and dry at a gentle heat; if the vessel is to be heated, coat the bladder 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.

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 will 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.*

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.

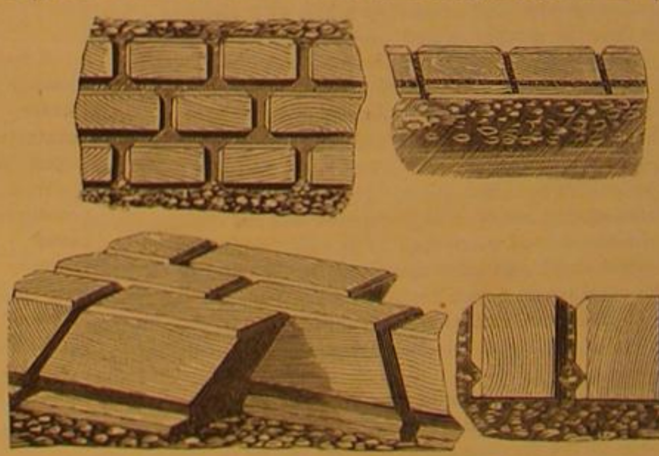
In casting your fly as in the ordinary way of trout fishing, you are annoyed with small fish of one and two years old, for as soon as the fly breaks water, every hook is full of the small fry. In the trailing process, you are not troubled enough to spoil the sport.

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."

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 Paris 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 Trenaunay 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.

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.

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."

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.

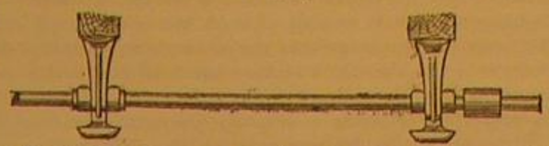
It may be well to note that in a book published in London, in 1841 ("Principles of Mechanism," by Robert Willis, M.A., F.R.S.), mention is made of the use of belts, and what was the practice in America at that time, in these words:

"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

FIG. 1.



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.

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.

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. 2.

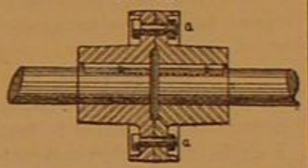
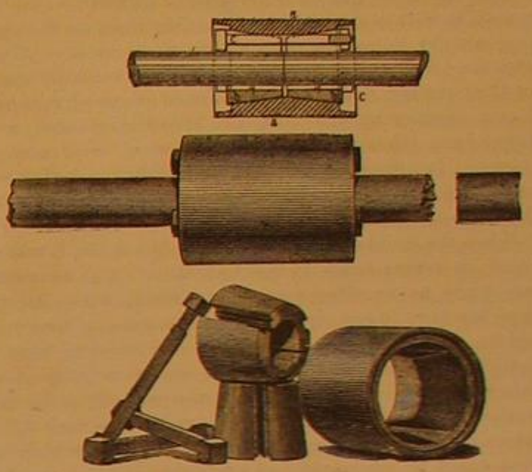


FIG. 3.

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.

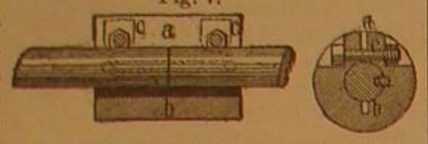
There are, and have been for years, many forms of adjustable couplings in use which do not fill this requirement. Let us take as an example one shown in Fig. 6, in which one long conical sleeve, *a*, fits in a conical hole in the outer sleeve, *b*, and the shafts to be coupled meet in the center, at *c*. The cone, *a*, being split as are the cones in the coupling be-

Fig. 6.

fore described, the conical sleeve, when forced in, will be compressed upon the two ends of the shafts, provided those ends are of exactly the same diameter; but if one is over 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.

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

Fig. 7.



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.

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 1½ 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 John-ton 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 57 × ·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 ·363 × 1·57 — ·57, in addition to the former horizontal pressure of ·637 lbs. Recapitulation: By resolution of the radial forces, ·637× 1·57—1; by resolution of the vertical as independent forces, ·363×1·57—·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, achryanthus, begonias, 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.

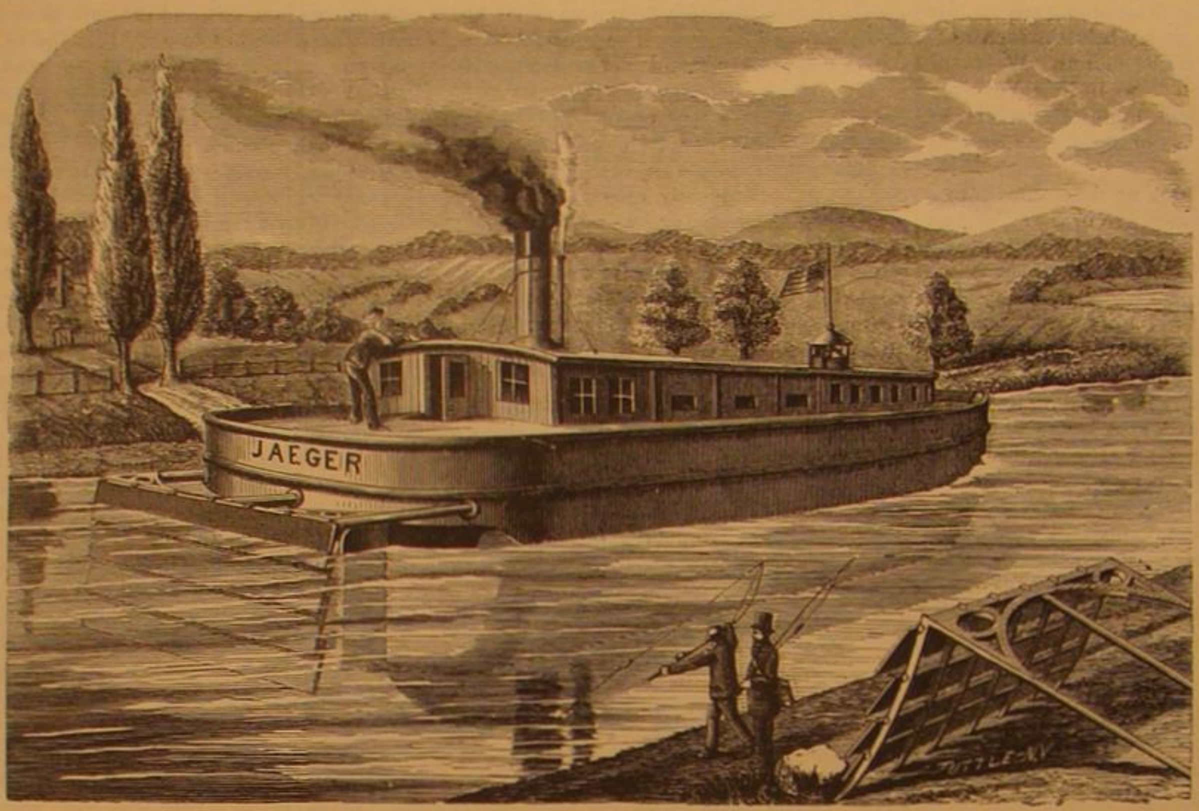
THE Osage orange is a native of Arkansas and southward.

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.

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.



NEW METHOD OF PROPELLING CANAL BOATS.

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.

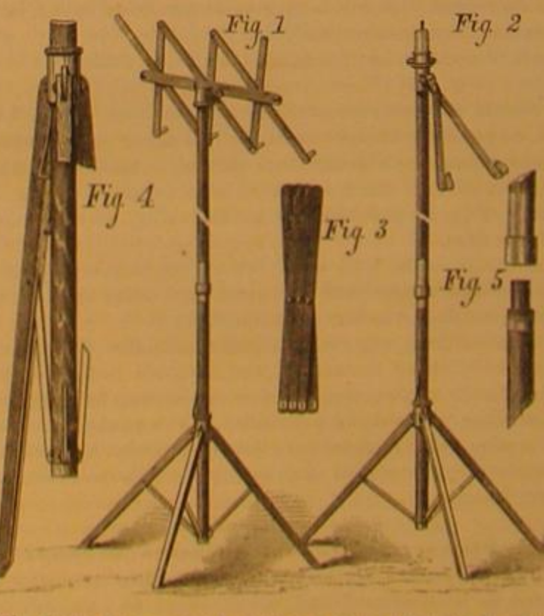
The Importance of Indicators.

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.

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.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK

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

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One copy, one year	$3 00
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CLUB RATES { Ten copies, one year, each $2 50	$25 00
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VOL. XXVII., No. 16. [NEW SERIES.] *Twenty-seventh Year.*

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 temperatnre 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.

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 200 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, *oncideres cingulatus*, common in Pennsylvania at end of summer, and fully illustrated and described on page 55, 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 11, 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.—B. 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.—B. 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; if 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 could not 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 common sand 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 SO3OH 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.]

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SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent, (seventeen years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
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On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
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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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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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This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

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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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