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.]

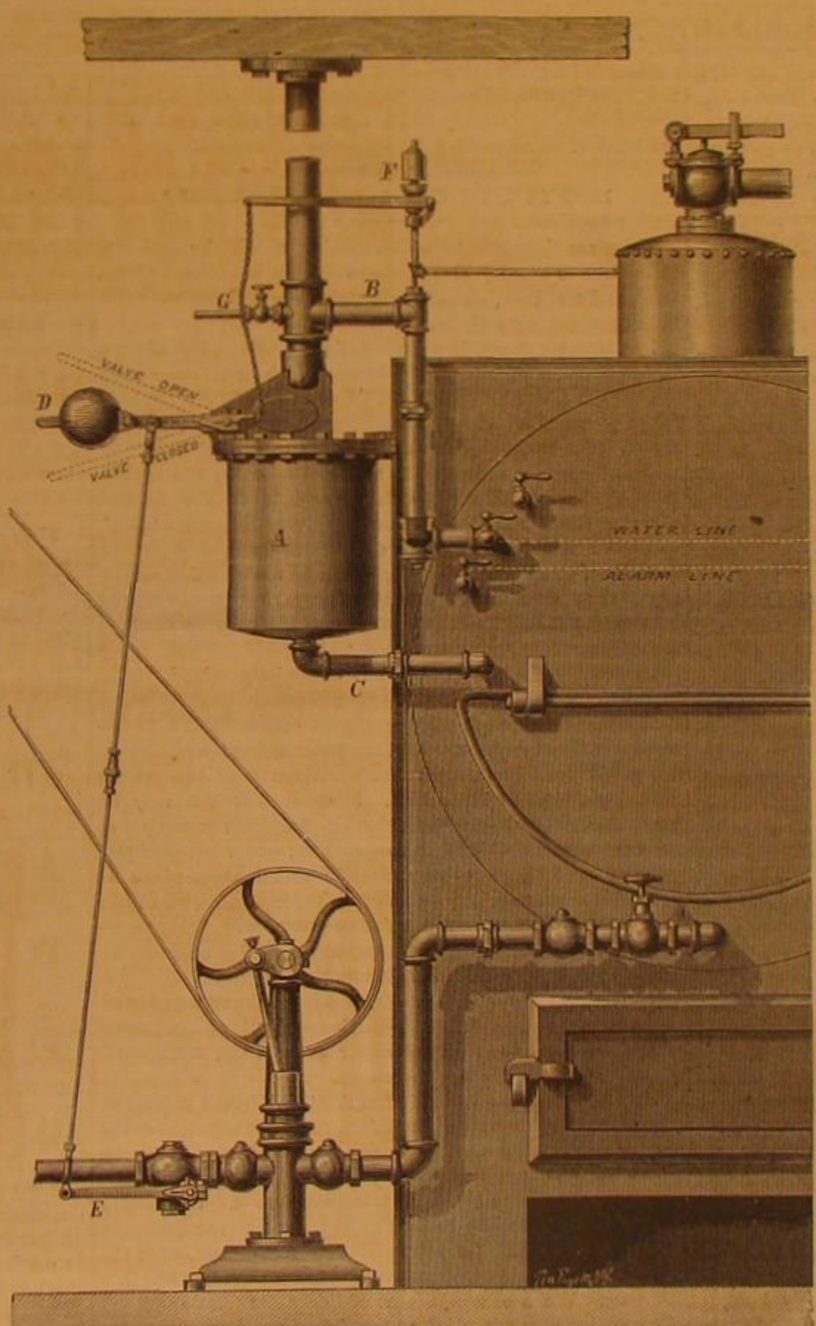
COMBINED REGULATOR AND ALARM.

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.



BERRYMAN'S COMBINED REGULATOR AND ALARM.

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.

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 (1,800 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, Casselius 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 \$300 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 ¼ 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 $\frac{1}{6}$ to $\frac{1}{20}$ of their length before crushing; the ultimate tensile strength was found to be about $\frac{1}{6}$ 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 3¼ 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 6½ 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.

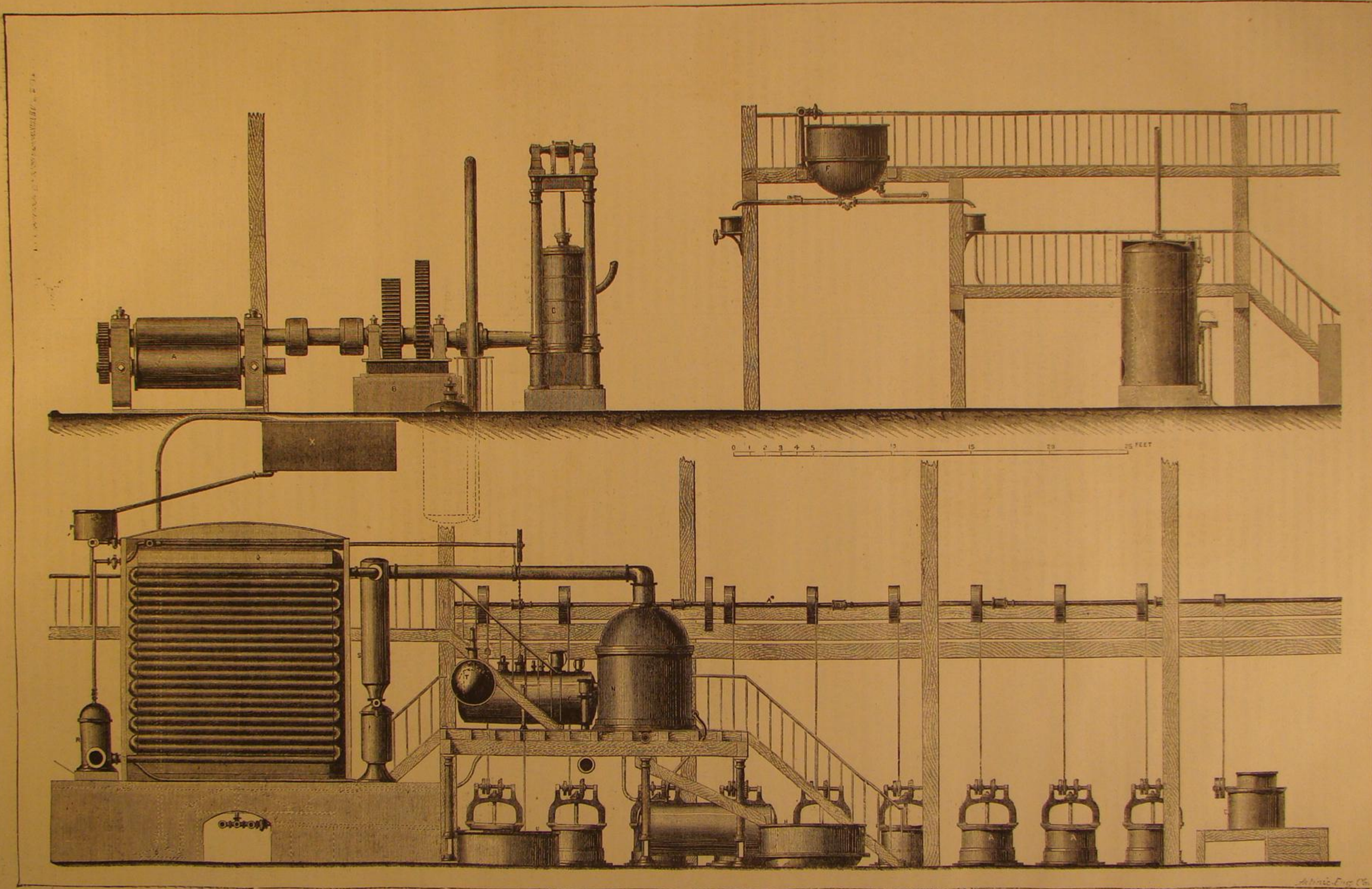
In the practice of medicine, as in other worldly matters, certain things are in fashion for a certain time. Bleeding and mercury have had their day; cod liver oil and chloral hydrate are already on the wane; alcohol and bullock's blood are now in vogue among the Parisians—the former for fevers and all 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)	7,050
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	8,636
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	8,042	Timber Line (Parry).	
Missouri City	9,073	On Pike's Peak	12,000
Head Virginia Cañon	9,020	On Snowy Range	11,800
Idaho	7,149	On Mount Audubon	11,273
Georgetown	8,245	On Long's Peak	10,800
Berthoud Pass	10,898	On Wind River Mountains	10,160
Boulder Pass	11,610	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 6¼ 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.

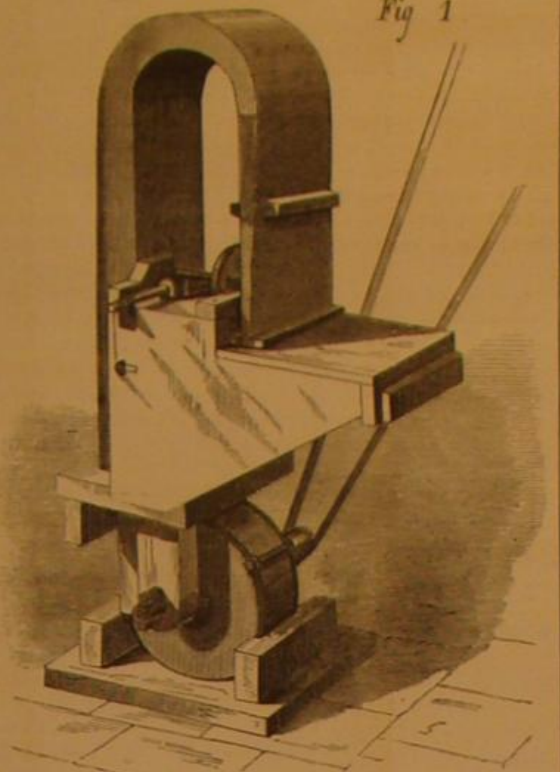
SOMEBODY says there should be a woman in every firm of architects to look after the closets. When you build your house, you may tell the contractor, until you are black in the face, "We will have a closet there." He will not put one there until he has seen madam, and ten to one, when he has seen her,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

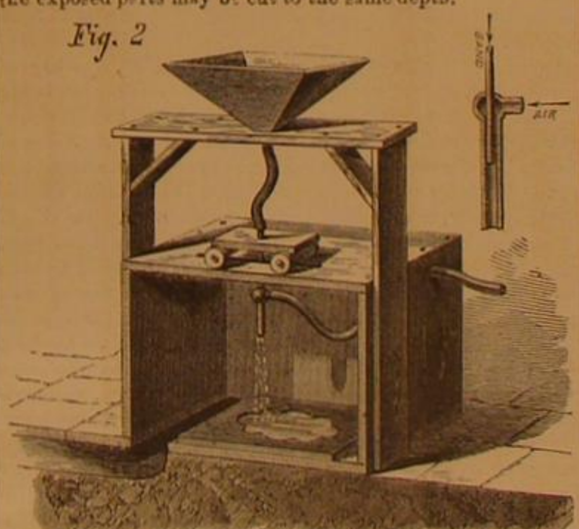
Fig 1



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 ⅛ 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 ⅜ 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 ¼ inch deep, or about 12½ inches in all, or 200 times the thickness of the caoutchouc. With a supply of steam equal to about 1½ horse power, at a pressure of about 100 lbs., the cutting effect per minute was about 1½ 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.

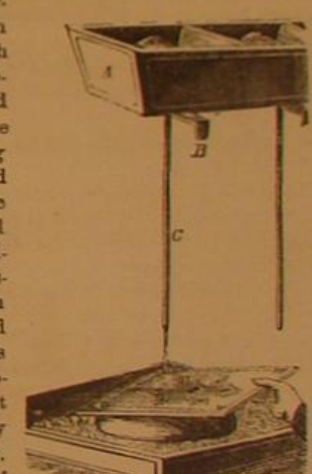
Various forms of apparatus may be used to execute the work. In our engraving, Fig. 1 shows a device for roughening sheet glass. The air blast is produced by the fan below, and the air rises through the curved tube, carrying the sand up with it, which is thrown into the air tube by an endless belt of 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.

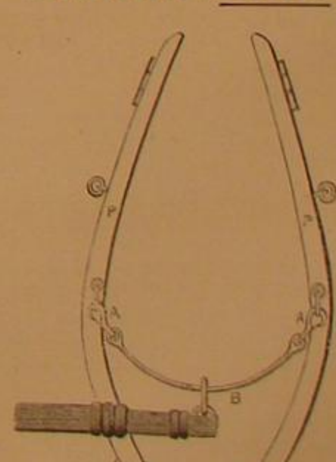
Subsequent to the patent of Mr. Tilghman, which bears date Oct. 11th, 1870, Geo. F. Morse, of New York, obtained a patent on a more simple contrivance for accomplishing similar results to the Tilghman process, which we also illustrate. The latter patent bears date November 21st, 1871.

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 grea[illegible] of working people are paid off. The custom, we [illegible] 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, ½ 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 1¼ to 1½ 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 ½ 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), 6½ 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 2½ inches deep. Thus the battery, with the metal strips immersed, occupies a space only 6½ 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

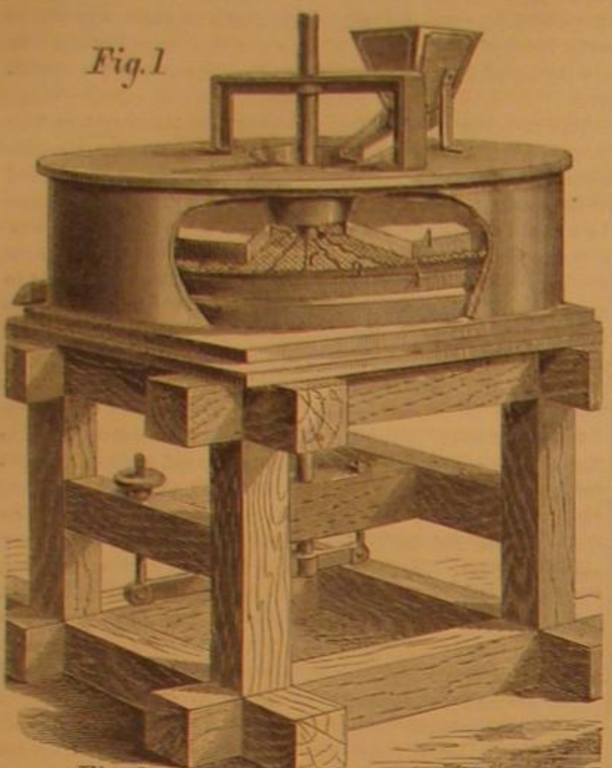
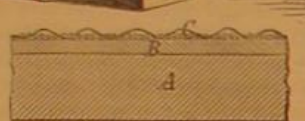


Fig. 2



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 hull. i ng 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 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 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.

Fig. 2.

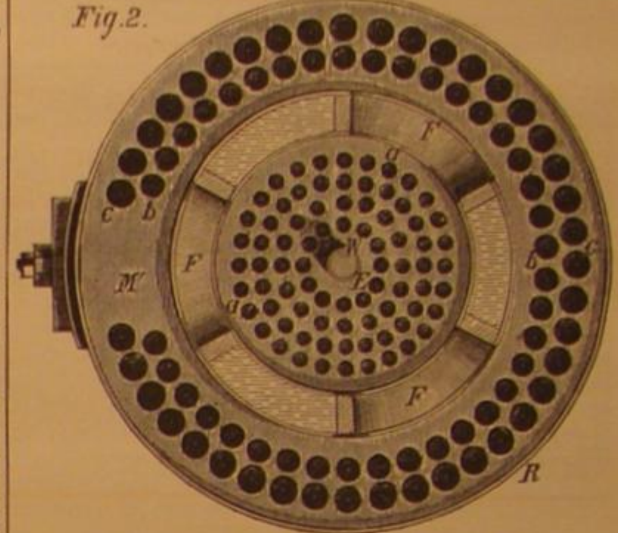
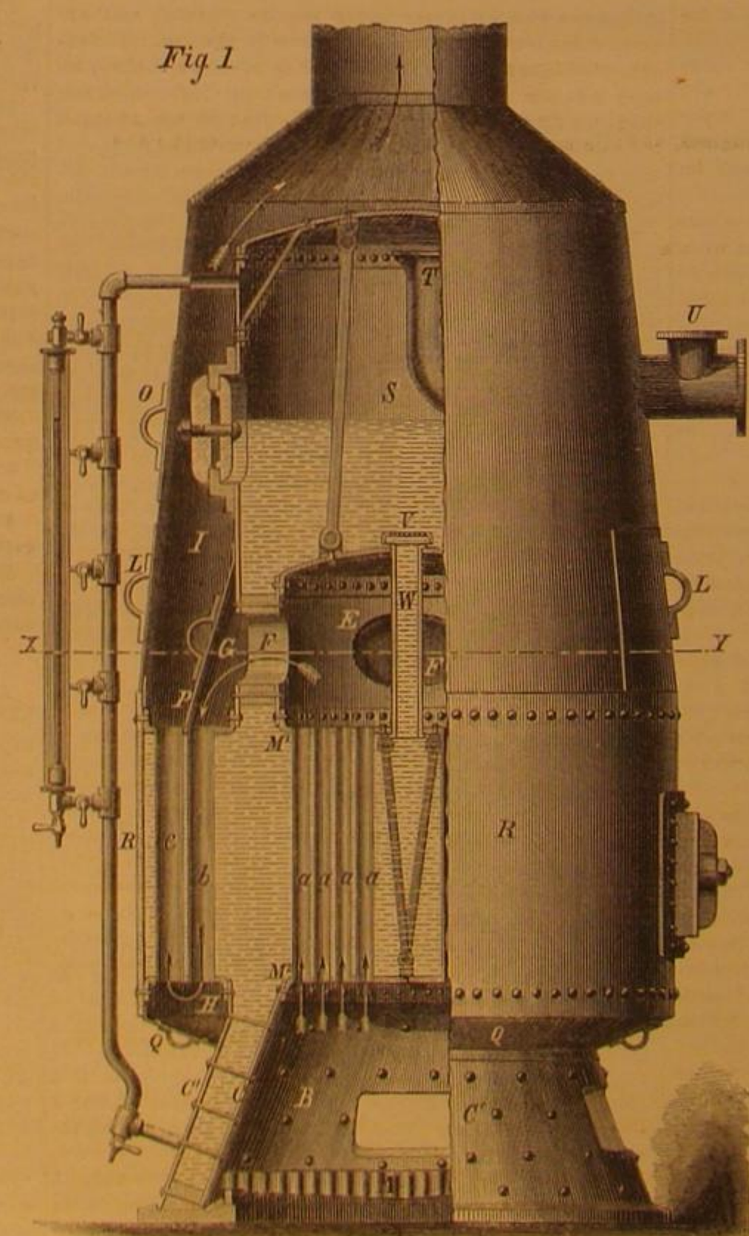


Fig 1



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 *Journa l 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.

TERMS.

One copy, one year	$3 00
One copy, six months	1 50
CLUB RATES { Ten copies, one year, each $2 50	25 00
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TO BE HAD AT ALL THE NEWS DEPOTS.

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 contractor 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 conseqently 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 3½ 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 81.—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. I., 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 be 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 l ven tion 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. Seidls, 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.

21,293.—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.
21,332.—RAILROAD CAR SEAT.—C. M. Mann.
21,367.—STRAW CARRIER.—F. W. Robinson.
21,372.—FARE BOX.—J. B. Slawson.
211,381.—BRACELET.—F. M. Sweet.

Practical Hints to Inventors.

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

How Can I Obtain a Patent?

is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and 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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MUNN & CO. 37 Park Row, N. Y.

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 36,000,000; 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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Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing

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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.
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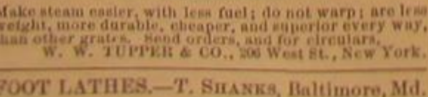

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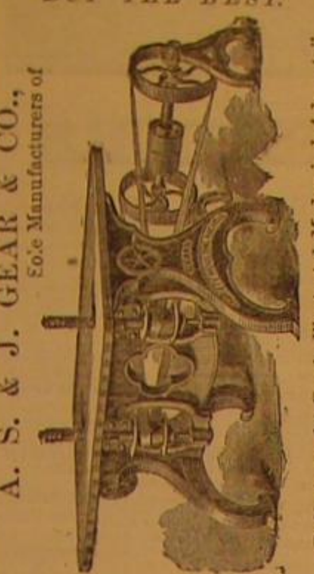

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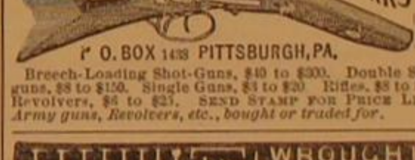

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