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IMPROVED GOVERNOR.

The new steam governor represented in the annexed engravings is claimed to give a perfect regulation of speed under all circumstances, and especially in case where, a variety of machinery being used, frequent stoppings and startings of the engine are rendered necessary. Its action is such as to allow of the use of iron contractible valves, thereby admitting to the cylinder, it is stated, the greatest possible boiler pressure at each stroke of the piston, thus increasing the power and, at the same time, effecting a saving of fuel, etc. The valves are balanced and, with the seat, are of such metal as will best sustain the cutting action of the steam. We are informed that they may readily be removed and replaced. A self-acting safety stop action is also provided, which is operated by the falling of the governor balls; and an improved lubricating arrangement, allows of the admission of a constant stream of oil to the piston and valve.

Fig. 1 is a perspective view of the device, and Fig. 2, a sectional view of the lower and essential portions. Within the steam chamber, A, Fig. 2, is a cylinder pierced with two sets of ports, B B. Within this is the double hollow valve, C, in which is made a row of corresponding perforations. It will be noticed that, in the position shown in the engraving, the apertures in the valve nearly correspond with the upper row of ports in the cylinder, while the lower set of openings in the latter are left unobstructed by the bottom of the valve being above them. No explanation is necessary to show how both sets of ports are closed by suitable placing of the valve, C. The latter is, in fact, in two parts, divided by the row of apertures, and both affixed to the rod, D. This rod is in two portions, the lower of which enters a screw nut, and the nut, in turn, enters a ball, E, secured to the upper part of the rod. By this means the latter may be shortened or lengthened, and the valve, C, raised or lowered, as desired. Upon the upper portion of the rod are placed stops, F, Fig. 1. The balls and levers are suitably connected to the revolving head and actuated by bevel gearing at G. When the governor belt breaks, the balls fall, strike against the stops, F, and thus, by pushing down the rod, D, close the valve, C, and stop the engine. The arrangement of the balls is also such that they fall, fully half the distance between their location while working and when at rest, before acting on the stops and shutting off steam, thus giving a wider opening to the valve when a heavy load is thrown on the engine when operating at low boiler pressure.

A lever and weight, H, is connected with the valve rod by means of the ball, E, for the purpose of balancing the balls and holding the valve in position. A hook lever, I, is adjustably connected with the frame of the governor so as to form a stop for the lever, H, and prevent its weighted end rising, the object being to prevent the valve closing on its seat and shutting the ports.

J is the lubricating and K the condensing chamber, the latter being provided with a suitable valve through which the oil passes to the rod, D, and thence down to the engine cylinder. It is claimed that the supply of oil is perfectly regulated.

Patented through the Scientific American Patent Agency, July 16, 1872, and August 26, 1873, by Mr. A. Matson. For further particulars address Matson and Brothers, Moline, Ill.

Fig. 1

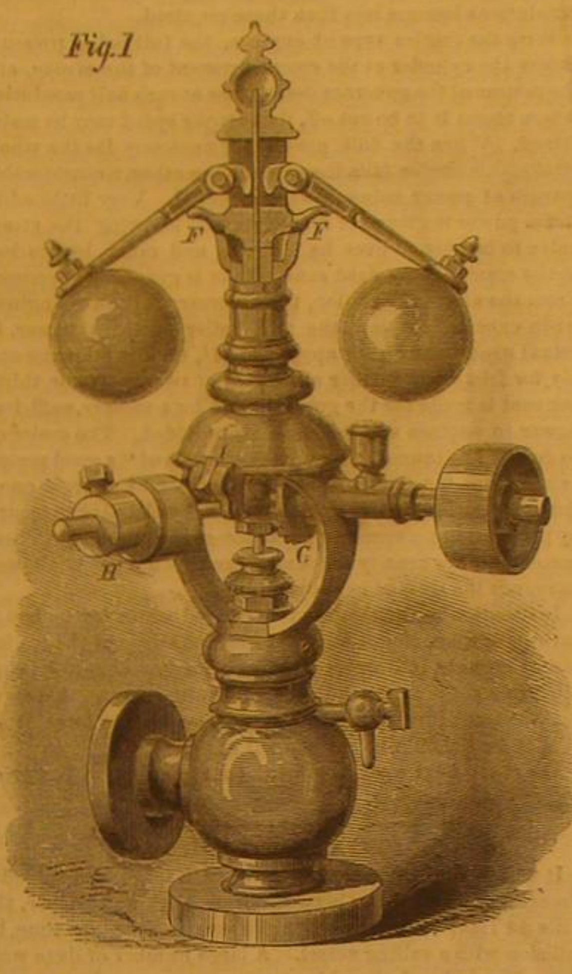
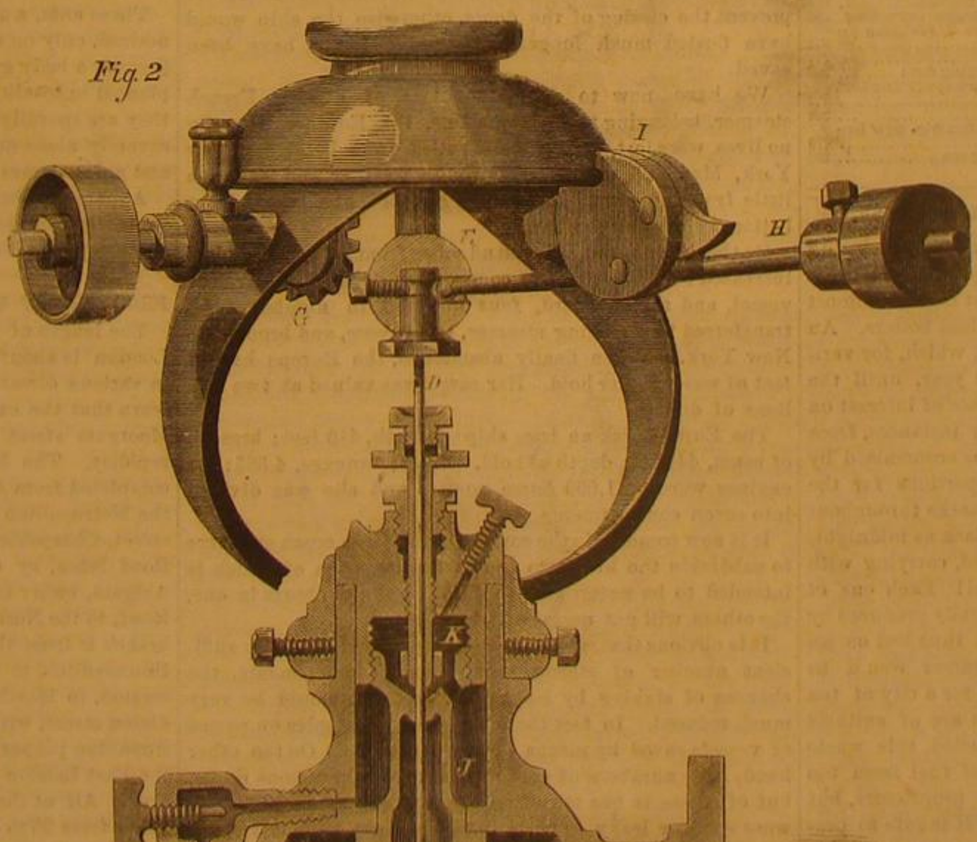


Fig. 2



MATSON'S IMPROVED GOVERNOR.

Seventy-five Miles an Hour by Railroad—Success of the Pullman Palace Cars in England.

In England the passenger cars are short, stumpy things, rarely exceeding thirty feet in length, and a little over six feet high inside. Mr. Pullman has lately built and sent over to London, for trial, a train of his splendid drawing room cars, and our English cousins, among whom were the principal railway magnates, have been riding back and forth in them for some time past, on the Midland Railway. The appearance of these cars in England has made quite a sensation, and they are spoken of in the highest terms of praise. The *English Mechanic* gives the following description of one of the trials, when the cars were run for a distance of one hundred and twenty-nine miles at the rate of over sixty miles an hour, and for a portion of the way at the rate of seventy-five miles an hour. Our cotemporary says: "The fastest speed that has ever been kept up for long together, was run on Tuesday, March 17, 1874, with a party of engineers, etc., and two of the new Pullman cars. The train was timed very fast, so as to see if they shook about; the train stopped twice, as it was thought better to examine the carriage axles; but the tender would carry enough water for the whole distance. The trial was from Derby to London. The two cars are as long as four ordinary five-compartment carriages. The engine had the steam brake, and the cars and tender had the new air brake, which is being fitted to all Midland trains. The air brake will stop a heavy express of twenty-five carriages, running seventy miles an hour, in 290 yards. The distance from Derby to London is 129 miles. It is all on the block system, and all trains were shunted for this special express. The train left Derby at 2:30 P.M., passed Trent at 2:40, 9½ miles; arrived at Wigston at 3:7, 33½ miles; left there at 3:12, stopped at Bedford at 4:0, 79¼ miles; left at 4:3, arrived at London at 5 P.M., 129 miles; running time 142 minutes; but this does not show the speed, as the three stops and three starts took six minutes. Speed was reduced to twenty-five miles an hour over thirteen junctions, which each took a good minute, leaving the time as 123 minutes for 129 miles, which averages over a mile a minute all the way. In one case, on a level piece of line, sixteen miles was run in 13¼ minutes, about 75 miles an hour, and twenty miles was run in 19 minutes. The cars ran as steady as tables at 75 miles an hour.

"Dimensions of the engine that ran: Driving and trailing wheels, 6 feet 8½ inches; leading, 4 feet; barrel of boiler, 11 feet 9½ inches long, 4 feet 4 inches diameter; tubes 1¾ inches across; inside cylinders, 17 by 24 inches; leading wheels outside bearings; driving and trailing wheels inside bearings; steam 140 lbs.; heating surface, 13,000 square feet; blast pipe, 4½ inches. Weight on driving wheels, 15 tuns; the side rods work on the bosses of wheels inside the outside frames; the tender carries 2,050 gallons of water, and three and a half tuns of coal. (Thirty-five lbs. a mile are burnt with an express of 26 carriages.) In this trial trip she burnt 18¾ lbs. a mile."

Speaking of another trial of the Pullman cars, *Iron* says: "Four cars were run, two being drawing room and sleeping cars, and two parlor cars. Each car is 51 feet 6 inches long, 8 feet 10 inches wide, 13 feet in extreme hight from the rails, and 8 feet 6 inches from the floor to the center of the ceiling. It is supported upon two four-wheeled bogies by a double set of springs, half volutes and half elliptical, and by joints which prevent any lateral oscillation being conveyed to the body of the car. The couplings are automatic, being a pair of immense hooks which, when once linked, cannot be loosened, but by operating levers worked from the Miller platform, with which each end of each car is furnished. This platform resembles, in appearance, the platform of an ordinary tramway car. The buffers are central, and brought by the coupling close up to one another, so as to make of the train a complete whole, in which there is no unpleasant jerk when it begins to move. In fact the start was quite imperceptible.

"The greatest novelty to an English passenger is the facility afforded for passage from one end to the other of the train. To accomplish this a central space in each car is left unfurnished with seats, just as in the tramway cars, but here the resemblance ceases. The Pullman parlor cars contain each seventeen comfortable armchairs, in two rows, capable of being turned half round and tilted. Two small compartments, for families or private parties, are at one end, and two more at the other, fitted as lavatories. The drawing room and sleeping cars are fitted with double benches in lieu of armchairs, in the recesses of which, at a minute's notice, can be adjusted small tables, so as to convert the interior into something resembling a coffee room, with the unusual peculiarity of softly cushioned seats. The tables removed, a pulling out of the seats fills up the eight recesses with so many mattresses. A kind of cupboard above each contains bedding, and its door, moreover, forms, when open, the basis for another bed or berth. Partitions and curtains are also furnished, so that the utmost privacy is secured. Private rooms and lavatories form part of the sleeping cars, while in each there is also contained a small room with a stove for warming the car by means of hot air pipes.

The minor details of the cars are too numerous to mention, though their neatness and ingenuity deserve notice. The windows, with convenient blinds and plated bolts to regulate their opening, are a pleasant contrast to those we usually see. The lamps—six in each car—are extremely elegant, as is also the metal work—that which is decorative being bronze, and that which is plain nickel plated. The black walnut woodwork, carved and gilded, and the neat Brussels carpet on the floor, cause the crimson velvet cushions and chairs to stand out perhaps a trifle too prominently, but with excellent effect, while the bright plated metal fittings, occasional looking glass, and the sides (almost all windows) give the interior of the cars not only a luxurious but a comfortable appearance.

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Contents:

(Illustrated articles are marked with an asterisk.)

THE EFFECTIVE POWER OF STEAM ENGINES.

It is rather the exception than the rule that manufacturing establishments have abundance of motive power. In those using steam power, a false economy in first cost is almost universally practised in purchasing insufficient boilers. An increased consumption of fuel is the result, which, for various reasons, becomes greater from year to year, until the losses from this cause aggregate a fearful rate of interest on the amount intended to be saved. In many instances, from one fourth to one half of the fuel would be economized by the introduction of boilers of proper proportions for the power required. From how many smoke stacks throughout the land can great volumes of smoke, as black as midnight, be seen, at almost all times, rolling upward, carrying with them the most valuable portions of the fuel! Each one of these advertises a great waste, which is generally produced by the boilers being too small. The amount thus lost on an average coal-burning Mississippi river steamer would be abundantly sufficient to furnish gas lights for a city of ten thousand inhabitants. When steam boilers are of suitable proportions and furnaces properly constructed, this waste should not occur. A genuine fear of loss of fuel from too much boiler surface is quite common with proprietors, but it is very rarely that such actually occurs. It is safe to provide twenty per cent more boiler than cylinder horse power, while equal power in each will often serve the purpose; and yet it will, in most instances, be found that the cylinder considerably exceeds the boilers in measurement.

Of equal importance is the size and construction of the steam engine cylinder. The naked rule that a certain pressure upon the number of square inches surface of the piston head will give the definite horse power, if followed out, will always cause failure. Omitting, for the present, the amount of friction, let us point out the principal reasons why this is so: It is well established that the economical use of steam forbids that the cylinder should be entirely filled at each half revolution with steam at the full boiler pressure. For this reason the flow of steam into the cylinder should be cut off at some portion of the stroke, and be allowed to exert itself expansively. There are two systems of accomplishing this: In the ordinary engine, by means of the slide or other valve, closing the steam supply port at a fixed point; the other, as in the Corliss type, through a governor acting upon the steam supply valve, cutting off steam when sufficient has been admitted to accomplish the number of revolutions per minute required. With the first named engines, that regular speed may be had, it is necessary to use a governor. The principle upon which this governor always acts is that of securing less than boiler pressure in the cylinder by throttling the steam pipe, and rendering it impossible for the full pressure to reach the piston head. If a pressure gage be connected with the cylinder of an engine using a governor, less pressure will be registered than that shown by the boiler steam gage. When the pressure of steam in the boiler and cylinder becomes the same throughout the stroke, the governor is no longer of service, regularity of speed ceases, and the revolutions become less than those required.

With the Corliss type of engines, the full boiler pressure enters the cylinder at the commencement of the stroke, and the motion of the governor determines at each half revolution where steam is to be cut off, that proper speed may be maintained. When the full pressure is necessary for the whole stroke, this engine fails the same as the other, a considerable margin of power being always essential. Very little additional power is gained in any engine by allowing the steam valve to be open at over half stroke, and much less is lost in the crank and by dead centers than is generally supposed. From the above suggestion, the necessary failure of engines, when expected to yield the full boiler pressure power, in actual use is made quite apparent. If, besides allowing amply for friction, a further allowance of twenty-five or thirty per cent is made for the governor and for a reserve, sufficient power in engines will generally be provided. The omission to do this has caused many advertisements of "a good second hand engine for sale, having been replaced by a larger one." Some engine builders practice deception by claiming to secure, by patented improvements, great accessions in results. These pretensions are usually unfounded, and should not be allowed to reduce the sizes of cylinders.

Inattention to the temperature of feed water for boilers is entirely too common. When the escape steam of the engine can be brought into water heaters, no water should be supplied to boilers at much less than boiling heat. A heater that does not furnish it and a pump that fails to force it in at that heat should be thrown out at once.

We shall next week comment on the effective power of turbine water wheels.

COMPARTMENT SHIPS.

It will be remembered that last year a large and splendid French steamer, plying between New York and Havre, the Ville du Havre, was sunk in mid ocean, in the night time, by collision with a sailing vessel. A large number of lives were lost. The side of the ship was torn open, and the water poured in so rapidly that, in twelve minutes, the vessel went down. It was alleged that the doors in the dividing compartments of the ship were open at the time of the collision, and that influx of water was so rapid and unexpected as to prevent the closing of the doors, otherwise the ship would have floated much longer, and might finally have been saved.

We have now to record the loss of another French steamer, belonging to the same line, the Europe. Happily no lives were lost. This vessel sailed from Brest for New York, March 28, encountering rough weather and leaking a little from the start. It was alleged that she scraped her bottom in passing the bar.

On the fifth day out, a thousand miles from land, the leak had increased so much that the commander decided to leave the vessel, and all on board, four hundred in number, were transferred to a passing steamer, the Greece, and brought to New York. When finally abandoned, the Europe had 17 feet of water in her hold. Her cargo was valued at two millions of dollars.

The Europe was an iron ship: Length, 410 feet; breadth of beam, 44 feet; depth of hold, 37 feet; tunnage, 4,585; her engines were of 1,000 horse power, and she was divided into seven compartments.

It is now common in the construction of iron ocean steamers to subdivide the hull into compartments, each of which is intended to be watertight, so that, if leakage occurs in one, the others will not necessarily be affected.

It is obvious that, if the vessel were divided into a sufficient number of strong independent compartments, the chances of sinking by leakage or collision would be very much reduced. In fact there are many examples on record of vessels saved by means of compartments. On the other hand, large numbers of compartment ships have gone down, but of these it has too often appeared that the partitions were weak or leaky, or ports between them were left open; or the compartments were too large. In a 400 feet ship, it is not customary to have more than seven compartments. But experience seems to show that this is too small a number. The engine and boiler space now required is much smaller than formerly, and there seems to be no good reason why an increased number of compartments should not hereafter be provided.

As an example in this direction, we may refer to the new British war steamer Inflexible, which is to have 127 watertight compartments.

For mercantile service, it would be unnecessary to employ so many compartments as this, but it is plain that the number might be considerably increased and the risks of disaster correspondently diminished.

After the above was written, the sad tidings came of the loss of another ship belonging to the same line, the Amérique. This vessel was almost similar, in size, power, and construction, to the Europe. The Amérique sailed from New York, April 4, and encountered a hurricane, near Brest, April 14, when the captain, acting under the impression that his ship was aleak, signaled another vessel, transferred passengers and crew, and abandoned the Amérique. The next day (April 15) she was found floating in the trough of the sea, by the captain of another steamer, who, on boarding, found 6 feet of water in the middle compartments, all the others being free. The Amérique's pumps were started, and she was then towed to Plymouth, England, vessel and cargo saved in good condition. The value of compartments is well illustrated in this instance. It is now believed that the abandonment of the Europe was unwarranted, and, as in the case of the Amérique, was an act of bad seamanship.

A TREE THAT KEEPS A STANDING ARMY.

Among the varied means of defense developed by plants in their ceaseless struggle for existence, there is perhaps none more wonderful or effective than that of a species of acacia which abounds on the dry savannahs of Central America. It is called the bull's horn thorn, from the strong curved thorns like bulls' horns, set in pairs all over the trunk and branches. These no doubt help to protect the tree from the attacks of browsing animals; but it has more dangerous enemies in the leaf cutting ants and other insects. Against these the tree maintains a numerous standing army, for which it provides snug houses stored with food, nectar to drink, and abundance of luscious fruit for dessert.

When first developed, the thorns are soft and filled with a sweetish pulp, much relished by a species of small springing ants, never found except on these trees. Making a hole near the point of one of each pair of thorns, these ants eat out the interior, then burrow through the thin partition at the base into the other thorn, and treat it in the same manner. The hollow shells thus formed make admirable dwellings, none of which are left untenanted, as any one may discover by disturbing the plant, when the little warriors swarm out in force and attack the aggressor with jaws and stings.

The leaves of the plant are two-winged, and at the base of each pair of leaflets, on the mid rib, is a gland which, when the leaf is young, secretes a honey-like liquid, of which the ants are very fond. This ensures their constant presence on the young leaves, and their most zealous service in driving off other insects.

A still more wonderful provision of solid food is made for a similar purpose. At the end of each of the small divisions of the compound leaflet, there grows a small fruit-like body, which, under the microscope, looks like a golden pear. When the leaf first unfolds, the little pears are not quite ripe, and the ants are continually employed going from one to another to see how they come on. As these fruit-like bodies—which appear to have no other use than as ant food—do not all ripen at once, the ants are kept about the young leaves for a considerable time. When an ant finds one sufficiently advanced, it bites the point of attachment, then, bending down the prize, breaks it off and bears it away in triumph to the nest.

These ants, a species of *pseudomyrma*, are found, as already noticed, only on these trees; and that the trees really keep them as a body guard seems evident from the fact that, when planted in localities where their little protectors do not exist, they are speedily defoliated by leaf cutters, which let them severely alone on the savannahs, while their honey glands and golden pears offer no attractions to the ants of the forest.

Apparently both acacias and *pseudomyrmas* have been mutually modified in the course of time, until they are now quite dependent on each other for support and protection.

PROGRESS OF UNDERGROUND RAILWAYS IN LONDON.

The length of underground railways now in operation in London is about twenty miles, and they are being extended in various directions. From a recent number of *Iron* we learn that the extension of the Metropolitan Railway from Moorgate street under Finsbury circus is proceeding with rapidity. The Metropolitan Inner Circle Railway is to be completed from Aldgate. One new branch is to extend from the Metropolitan Railway, Queen Victoria street, under Friday street, Cheapside, curving northeasterly under Philpot and Rood lanes, by Cullum street, under Fenchurch street to Aldgate, under that street, Whitechapel, Mile End, and Bow Road, to the North London Railway station at Bow. Another branch is from the line just described under Duke street, Houndsditch, to Roper's Building, to the Metropolitan extension, to Meeting house yard, under Petticoat lane, Middlesex street, with a curved junction to unite with the Metropolitan proper. Two more junctions will be made with the East London line at Stepney and the North London at Bow. All of these lines will be underground, the tracks being from 25 to 40 feet below the surface. The total length of the new lines is about five miles.

A NEW COMET.

The discovery of a new bright comet is announced by the Academy of Sciences, Vienna, in 21 hours 23 minutes right ascension south, 6 degrees 56 minutes declension. An observer at Yonkers, N. Y., states that it is nearly globular, about two minutes in diameter, with a decided condensation toward the center. In brightness it is above the average, but it does not in other respects present any notable difference from objects of its class. Its position at 4 o'clock A. M., of April 14, was approximately: Right ascension, 21 hours, 16 minutes, 31 seconds; south declination, 5 degrees, 15 minutes. Its motion is toward the north and east.

An observer in this city states, April 17, that it rises at 2 A. M., east one half south. Half an hour earlier on April 24. It is a telescopic object.

ANOTHER NEW MOTOR.

We have to acknowledge the receipt of a pamphlet containing a description of the "Keely Motor," and a report upon the merits thereof, by Charles Haswell, C. E. This report is addressed to Messrs. Israel Corse and F. W. Foote, Jr., of this city, gentlemen of prominence in commercial circles. The new motor has become the subject of lively discussion among certain wealthy people here, by whom its success is considered certain. Every share of the stock has been taken, the offers of money having been greatly in excess of the supply of shares. The proprietors expect to reap a large harvest by the sale of rights when the invention is more fully developed—an event which is soon expected to take place.

The following account of the invention is given in the pamphlet.

KEELY-MOTOR,

OR HYDRO-PNEUMATIC-PULSATING-VACUO ENGINE.

"Professor Faraday, of England, asserts that a grain of water contains electrical relations equivalent to a very powerful flash of lightning." Knowing that the equilibrium of these relations is sometimes destroyed in the heavens, merely by a change in conditions, resulting in enormous mechanical work: and, as we are constantly discovering means to change natural conditions: the question arises (which seems a legitimate one) why are not our locomotives and steamships propelled with grains of water, instead of tuns? the only answer that can be given is: We have as yet no knowledge of suitable means to destroy the equilibrium of these relations."

"Mr. John W. Keely, of Philadelphia, has discovered a method of destroying this equilibrium, or something analogous to it, and made it the basis of an invention by which these conditions are changed.

DESCRIPTION.

"During a period of about two months, several tests have been made of the Keely-Motor power, at Philadelphia, in the presence of many persons, several of whom were among our ablest civil and mechanical engineers and experts; the main facts connected therewith are thus given:

"By a peculiar *mechanical device* hitherto unknown, a force is generated which can readily be applied to driving all kinds of machinery for which steam or other motive power is generated and applied, *without cost other than the mechanical device or generating machine and the necessary wear of machinery*. The generator is simple and comparatively inexpensive, occupying but a small space, and is light compared with the requirements of steam power; and since this power is produced *without heat, electricity, galvanism, magnetism, or chemicals*, it is destined at an early day to revolutionize completely the present motive powers of the world, by reason of the economy of its cost and space.

"The power, so far as at present evolved and tested, has shown a pressure of fully 10,000 pounds per square inch, as the following explanation will show: The principal part of this power generator, now in use, is made of metal, globular in shape, about fifteen inches in diameter, and hollow, having walls about three fourths of an inch thick, a strong iron tube, an inch in diameter, connecting the generator with a cylinder used as a receiver of the power or force from the generator. This cylinder is made of charcoal iron, forty inches in length, four and one half inches internal diameter, with screw-fitted and welded heads, two inches thick, tested to a pressure of 10,000 pounds per square inch; its capacity is about three and one fourth gallons. This receiver was charged from the generator of the power in five seconds, and the power remained therein at least eight days without any addition, and from it a great number of tests were made without any apparent diminution of its energy or force.

"At the end of the charged cylinder is attached a flexible brass conductor of drawn tubing, one fourth inch in diameter, with a bore of one thirty-second of an inch, passing from cylinder to ceiling, and thence to the other side of the room, for a distance of twenty feet to the test apparatus or force register; this apparatus consists of a thick bed plate of iron, to which was bolted and packed a cylinder four inches in diameter, having a plunger or piston, the area of which was a little less than one square inch in surface. Below this piston is a chamber of about two cubic inches, with which the tubing from the charged cylinder is connected. The plunger or piston, acting perpendicularly, was the point at which the power was applied to a compound lever, which, according to Mr. Haswell's measurement, was as one to fifty-two. The end of the short arm was securely bolted and fastened to the iron bed plate of the apparatus; upon the long arm of the compound lever was suspended an iron weight of 200 pounds. On opening the stopcock of the charged cylinder connecting the tubes, the weight of 200 pounds was at once raised to the limit of the upward movement of the lever; thus, with the weight of the lever and its connections, indicating a pressure power of about 10,400 pounds per square inch, as stated before. The power generator and receiver was supposed to be, when constructed, fully adequate in strength to generate and develop the full power of the invention, but it has been found too weak; the force has proved to be so enormous that Mr. Keely has not dared to apply more than half of the power he can attain. An apparatus is now in process of construction which will be able to generate and sustain a pressure greatly in excess of that already shown, without rupture, though Mr. Keely does not expect he will need one of more than 25,000 pounds to fully develop his power. When the full power is measured and balanced, it will then be comparatively easy to construct an apparatus of the requisite capacity and strength for engines of any desired power. When an apparatus of sufficient strength to allow the generation of the complement or maximum of force is constructed, and the vapor generated is applied to the working of an engine, the exhaust vapor is at once resolved into its original elements, and is easily returned to the generator for a "re-expulsion," thus making the action automatic, and requiring no additional element for continuous working of the power.

"The following named gentlemen have witnessed the exhibition of the above tests, and may be referred to for the correctness of this statement: Charles H. Haswell, civil and marine engineer, New York city, and formerly Engineer-in-Chief, U. S. N.; William W. W. Wood, Chief of Bureau of Steam Engineering, U. S. N., Washington, D. C.; S. Parrish, gas engineer, Jersey City, N. J.; Joseph Patten, engineer, Elizabeth, N. J.; F. Glocker, machinist, Philadelphia, Pa.; William Boeckel, machinist, Philadelphia, Pa."

In connection with the foregoing statement, a professional report is given in the pamphlet, by Mr. Haswell, one of the referees mentioned above. He certifies, as the results of two actual working trials of the invention, as follows:

"Mr. Keely developed a cold vapor of a density that enabled it, when admitted to a cylinder having a piston $1\frac{1}{16}$ inches in diameter, to raise a weight of 150 lbs. suspended from a compound lever, connected as 1 to 42, which, with the weight of the lever and the friction due to the absence of a knife edge or rotating joint, was fully equal to an energy of 7,800 lbs. per square inch."

"That the vapor under the piston had expansive energy. That the temperature of the vapor reservoir and of the vapor itself did not exceed that of the surrounding air. That to operate a 45 horse power engine, a supply of the vapor of $793\frac{1}{2}$ cubic feet per minute, at 7,680 lbs. per square inch, would be required. That the inventor alleges that, by the introduction within the apparatus of a very small volume of water, he can generate a vapor having an expansive energy of from 1 to 20,000 lbs. per square inch in the brief period of a few seconds; the only obstacle to the generation of this vapor in great volume being the capacity of materials to retain it without rupture. That it is proposed to reduce the great pressure above mentioned by allowing the vapor to expand into an intermediate chamber, from which pipes will lead the vapor, which may then be employed in lieu of steam in ordinary steam engines, the use of steam boilers and the consumption of fuel being no longer necessary."

We consider it very kind in Chief Engineer Wood, Mr. Haswell, Mr. Parrish, and their associate mechanicians, to serve as referees for this peculiar invention. In the absence of such capable referees, the public in general, and perhaps the investing capitalists in particular, might have looked upon the scheme in the manner we do, namely, as an arrant humbug from beginning to end.

Jugglery has a bewitching influence upon some minds. The learned Dr. William Crookes, of London, certified that the lever of his weighing machine was raised when the spiritual medium, Home, simply pointed his finger at it. [See engraving, SCIENTIFIC AMERICAN, 1871.] Several of the Doctor's associates, eminent people, corroborated the story. Mr. Haswell certifies that it was cold vapor, having a pressure of 7,860 lbs. to the inch, developed by Keely, that lifted his (Haswell's) lever. Home's trick being simpler we consider it the better of the two.

Among Mr. Keely's most recent predecessors in the "new motor" line was Paine, with his electric engine of 1871–2. Faraday said, you know, that every drop of water contains force elements equal to a streak of lightning. Paine developed this force by means of water, adding, however, a little acid and zinc. With a two quart cup, Paine claimed to be able to generate power enough to drive vessels of the largest class across the ocean at the highest velocity. But he required a brand new engine in every case, whereas Keely will use the existing steam engines.

We have before us the claims of still another aspirant for "new motor" fame. He is an unsophisticated genius from Virginia. He, too, has read about the Faradaic drop of water, and, like Keely, brings out the power by means of a mechanical device—a pendulum. A child may swing a pendulum of great weight. The pendulum works an air pump which compresses air to twenty thousand pounds per square inch if need be. Thereafter a small portion of the air or vapor is used to maintain the swinging of the pendulum, while the remainder of the gigantic power is to be used to drive an engine on the Keely plan.

It is barely possible that the capitalists who have been disappointed in obtaining shares in the "Keely Motor" might meet with better success in applying for the Pendulum stock. But should this likewise prove to be all taken, we are confident that Mr. Paine will be able to supply them. The reason we think so is because he is so kind-hearted, finding it less difficult to make new shares than to refuse to sell those on hand.

THE CREMATION QUESTION.

The question of the disposition of the dead by burning the bodies, after the manner of the ancients, is a subject which has for some years past been under discussion in the scientific circles of Europe. Various processes have been devised as substitutes for inhumation, among others petrifaction and preserving in antiseptic solutions; but in the end, it appears that the total disaggregation of the body by cremation has been considered and announced by many of the ablest foreign savants as the proper and indeed only way of avoiding the noxious effects resulting from the natural changes in the thousands of human remains buried in the neighborhood of thickly populated localities. Taking its origin in Europe, the movement during the last few months has, under the influence of Sir Henry Thompson and other eminent scientific authorities, who have strongly advocated its principles, taken a new life and has rapidly spread over the continent. The people of Switzerland, and Germany especially, have accepted it to no small extent. At Zurich recently, 2,000 persons subscribed to an association having the burning of the dead as its sole object. At Basle, the orthodox clergymen publicly announced their approval of the movement, and in Germany a new apparatus for carrying out the operation of incineration has been invented and advertised. More important than this to us is the wide spread discussion which the subject has evoked at the present time also in this country. A society has already been formed in New York city, including among its members Mr. Henry Bergh, Drs. Sexton, Lorilliard, and J. W. S. Arnold, with many other well known citizens, for the purposes of promoting cremation and securing its practical application, and columns of the daily journals are given up to correspondence and the views of the people upon the advantages and disadvantages of the system.

The reader unversed in the process, which it is proposed to substitute for slow moldering in the grave, will naturally think of the ancient pyre and probably suppose that it is the intention of the advocates of the plan to burn the bodies upon huge piles of variously scented wood, after the Greek or Roman fashion. Little would be gained in an æsthetic or even a sanitary point of view if such were the system, for the gases and fumes evolved would be far from healthy. The body of the poet Shelley was thus destroyed, and his biographer tells us that, so far from being the beautiful and poetic rite intended, the process was a very disagreeable and nauseous operation. Science provides a better plan for reducing "ashes to ashes" in the apparatus especially devised by Professor Brunetti for the purpose, and by that inventor recently described in the French *Revue Scientifique*. After having made several experiments on the human subject, in which the bodies were burned in the retorts of gas manufactories, in closed receptacles, and with free access of air, Professor Brunetti finds that an oblong furnace of fireproof brick is required, having 10 holes below, by means of which the intensity of the fire can be regulated. The upper part of this is hollowed to receive the coffin, over which a domed cover is placed, by which the flames as in a reverbatory furnace, may be directed upon the body. Within the coffin is a metal support or table on which the body rests, fixed by thick iron wire. The operation embraces three periods: the heating of the body, the spontaneous combustion, and the calcination of the bones. During the first period, and about half an hour after the pile of wood in the furnace has been lighted, the combustion of the body commences. If the wood has been well arranged, two hours suffice to produce complete carbonization. During the third period, the air holes being opened, the carbonized mass is collected and placed upon a fresh plate and the heat is urged to the utmost, a fresh supply of wood being inserted. By means of this arrangement, at the expense of about 150 pounds of wood, complete incremation may be effected in two hours. When the furnace has cooled, the cinders and bones are collected and deposited in a funeral urn.

So far as sanitary benefit to the people is concerned, we cannot but think the arguments of the advocates of cremation are cogent and forcible. It is well known that numbers have been rendered ill by water from springs and wells which have become contaminated by the near proximity of graveyards, and it is also a fact that there is a miasm arising from these receptacles which, as is universally recognized, renders their presence in crowded localities dangerous to health. We do not see the ground of the assertion that by burial the fertilizing properties of the bodies are lost to the earth, for it seems to us that they are in as good a condition for absorption as if sprinkled in the form of ashes over the surface. Neither can we incline to the belief, that by adopting cremation, a point of economy will be gained, in avoiding the expensive paraphernalia of modern funerals, since the latter are governed purely by the dictates of fashion, and that fickle individual would speedily make the jeweled urn as costly an affair as the sculptured stone.

Anything which seeks to subvert a settled popular custom strengthened not only by long usage but by a prejudice growing out of a religious feeling, presents, however, at best a doubtful prospect of success. There is not a person, we may safely say, who, when the horrors of possible living burial, the slow decomposition, and the changes of the form of a loved one to a loathsome thing, to poison the health of the living, are laid before him, will not admit that the closed furnace, the pure fire flame, and the final handful of dry clean changeless ashes are much the better of the two means of disposition; but his admission in the end will be found to apply to everybody in the world except himself and his family. It is a question of the heart in the end, not of the mind. Science, cold and passionless, may point out the better way; but if its adoption is to tear wider the wounds caused by separation from those we love, no amount of reasoning will induce us to follow it. A husband may give his wife, a mother her child, into the embraces of the earth, and endure the keenest sufferings as the dirt and stone rattle on the coffin lid; but this act, revolting as it may be, is connected in the imagination with the highest and holiest of thoughts—the hereafter. We may bury those nearest to us in our own bit of ground; we may imagine that their forms remain where we put them, and we may tend the flowers which bloom over their resting places as messengers from them to us. All this we can do: but there are few, we think, who would have the heart to hand his dead child or wife to a public official to be burned, or would care to see the ashes of his ancestors scattered over the earth as manure.

POSTAL CARDS are so extremely popular in this country that, although it is not long since they were introduced, the enormous number of one hundred millions have been printed and issued.

South African Diamonds.

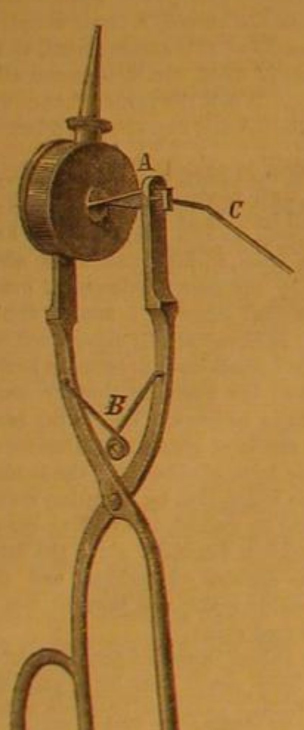
Hon. Theophilus Shepstone has pointed out that Africa, south of the equator, consists of a great central, irregularly shaped basin, the outer edge of which varies in hight from 4,000 to 10,000 feet above the level of sea, and that through this rim the Orange River to the southwest, and the Limpopo River to the northeast, cut their way. It is near the exit of the former, from the enormous basin, that the diamond fields lie, while gold in large quantities is being obtained from the northeastern district. The author of this paper conjectures that this basin is the dry bed of an enormous inland sea, and that the diamonds which are found in it are formed by carbonic acid gas, ejected by the action of subterranean heat through fissures in the earth's surface, into the bed of the dried-up sea, the water of which was sufficiently deep to imprison and liquefy the gas after its evolution. The discovery of the process by which this liquid gas became crystallized, whether by electric or magnetic current, or by the potent influence of iron in some of its numerous forms, must be left to future scientific investigations.

Dr. Robert Mann, late Superintendent of Education in the Colony of Natal, states that, since the serious working of the diamond fields in 1871, large numbers of diamonds had been obtained, and it was estimated that in 1872 there were no less 20,000 miners engaged in searching for them. So large had been the yield that a very material diminution had been brought about in the value of the larger gems in the home market, and the diggers are now leaving the diamond fields for the more profitable northeastern gold fields. The result of the discovery of these fields has been to develop South African commercial enterprize, and to civilize the wild tribes in that part of the continent.

Mr. Sopen, a diamond merchant, states that the number of diamonds of the purest water received from the Cape was very small, not amounting, on the whole, to more than two or three per cent, while of ten carat stones not one in 10,000 was perfect. In consequence of the large quantity of second class stones received from the Cape, such gems were now sixty or seventy per cent cheaper than they were three years ago. Stones which some time since would have realised $7,500 would now only fetch $1,000. The first class diamonds, however, were rather dearer than formerly

IMPROVED PORTABLE OILER.

Our engraving illustrates a novel combination of an oiler with a pair of tongs, in such a manner that, by compressing the tongs, the oiler will be turned so as to bring its spout downward. The handles of the tongs are of sufficient length to enable a person to reach journal boxes overhead without the necessity of a step ladder. In the center of the flat sides of the oil can are secured journals, one of which is simply pivoted in an arm of the tongs, while the other, A, is made long and with a quarter turn twist. This, playing in a slot in the other jaw of the tongs, gives the oiler a quarter turn when the former are compressed. After the jaws are brought together so as to meet the side of the can, further pressure squeezes the latter, forcing out the oil, and this is continued until the handles are freed, when the spring, placed at B, pushes the jaws apart, and thereby causes the oiler to return to its upright position. The wire pin or point, C, is designed for picking out the holes in boxes before oiling. This, when the tongs are compressed, turns around out of the way. This ingenious device was patented by Mr. Gabriel W. Crossley, of Cleveland, Ohio.

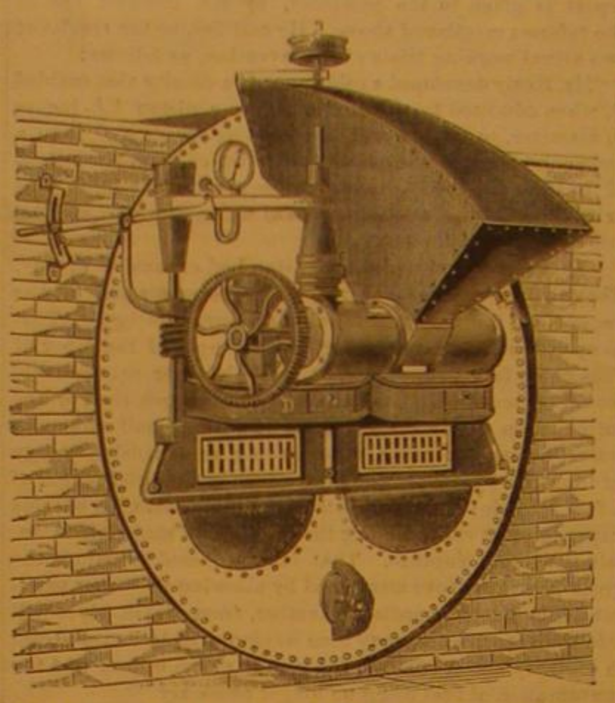


Mechanical Stokers.

Contrivances for mechanical stoking appear to be among the most promising devices for economizing fuel. The attempts to supply an automatic feed for furnaces are usually, and perhaps wisely, imitations of the hand method, which is in the main so good that, whenever volumes of smoke are perceived issuing from a chimney, it may be inferred that the stoker is somewhat in fault.

The patent mechanical stoker of Mr. Dillwyn Smith, illustrated herewith, is, like the others, an attempt to work the hand-stoking method by mechanical means. A hopper machine, known as Standley's, was in use forty years ago, and was considered to act well; but was so complicated in its parts that, owing to the rough nature of the material with which it had to deal, it was liable to continually get out of order. Mr. Smith claims to have entirely overcome these difficulties in his machine. The first object which he seeks to attain is the saving of coal. The first step towards this is by regular distribution of the fuel, which is brought from the hopper by a screw, and falls upon a pair of fans running at a high speed, which project it over the fire and spread it with remarkable evenness. Consequent upon this regular feed, the gases, which are usually lost and go up the chimney as smoke, are consumed. Not the least advantage of improved methods of stoking is the boon of freedom from the dense smoke which now hangs over our manufacturing towns, especially when this now worse than useless substance is turned to profitable account. Another source of economy in fuel is found in the rocking bars supplied with the machine, which so far do away with the opening of the fire doors that, in some boilers, the doors are only opened when the works are stopped for meals.

From experiments with measured coal and water the results on land are stated to be, as contrasted with ordinary Cornish boilers with specially good hand firing, a saving of



from ten to twelve per cent by the use of this machine, apart from the avoidance of the smoke nuisance, and the saving to the boiler, and of labor to the fireman.

But beyond its value upon land, it is even of more importance in its application to steamers, especially those which sail to tropical climates. A strong recommendation of these mechanical appliances is the fact that, by their use, the heat in the stokehole on board the Lisboness, under the equator, was reduced by thirty degrees, and that this steamer made a faster run with six fires then she had ever done previously with eight. The saving in the cost of fuel alone is, in this case, alleged to have been 30 per cent. Anything which promises so favorably as this must be well worthy of the serious consideration of all steamship owners, especially as a decrease of stokers' labor to the extent of 70 per cent is also recorded in favor of the machine.

In mechanical, as in hand stoking, there are three principal points—a regular supply of fuel, its equable distribution over the bars, and a very carefully adjusted supply of air. Each of these is so intimately dependent upon the other two that all three must be effected together if the problem which mechanical stokers attack is to be solved at all. Mr. Smith's seems to be a praiseworthy attempt to deal with it, and the recorded performances of his machine appear to be very satisfactory.—*Iron.*

Labor Legislation in California.

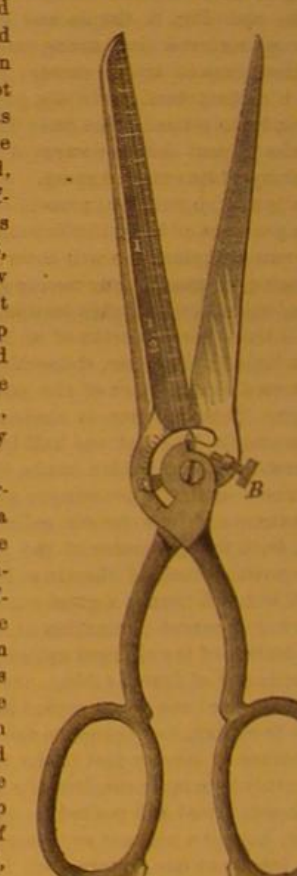
The Legislature of California recently passed a bill providing that no conductor or driver of a street car should be compelled to labor more than twelve hours a day without extra pay. Governor Booth vetoed the bill, giving his reasons in the following language:

"I am clearly of opinion that, under the operation of the inexorable law of supply and demand the wages of labor cannot be fixed by legislative enactment; and that the practical effect of this bill would be to reduce wages in the two instances specified, in the same proportion as the hours are reduced, and compel an additional reduction by the friction it creates. The laborer, too, often has to sell Monday's labor to buy Tuesday's bread, and every artificial obstruction in the sale of Monday's labor only tends to make the bread of Tuesday harder and scantier. The bill in effect says to the man seeking employment as driver or conductor: Whatever may be your necessities or hopes, you shall not labor for one employer more than twelve hours per day. All occupations are equally open to drivers and conductors with all other men. Can the law make a better contract for them than they can make for themselves? If a man prefers to work in his vocation fifteen hours for $2.50, rather than twelve hours for $2, is the law which prevents him a substantial kindness to him? That the necessity which lies behind such a choice, or which induces him to make either contract, is a hardship is too true. If the law could remove that, it would indeed be blessed. But, since it cannot, does not attempt it, cannot even judge of its extent in individual cases, is it wise to prevent the individual from making his own choice in his individual case? No man will accept employment for more than twelve hours per day, except to escape from some greater hardship. Is it right to close this avenue of escape—to cut off his right to choose for himself between want in his family and extreme toil for himself? The classes this bill seeks to benefit would hardly admit that there was anything in the nature of their employment to differentiate it from that of all other free labor, and assimilate it to that of servitude, which the law must of necessity regulate in the absence of free agency. The fact that any man in a land of plenty is compelled to work more than twelve hours a day to procure bread for his family is a sad commentary upon our civilization and society—the more sad when we know there are hundreds of applicants for so poor a boon as the opportunity to do so. The great evil is not that a few men in one employment do this, but that there are so many who would be glad to. If the necessity for laboring for disproportionate pay, or of devoting the natural hours of rest and recreation to severe toil, were peculiar to the classes named, the law might possibly modify the wrong: or, it is more reasonable to think, society itself would soon supply a complete remedy. It is because the same unadjusted conflict between the right and wrong is active and clearly visible, in many other occupations, that legislation, looking only to one feature of a vast system, is of questionable power. To remember the car driver and forget the seamstress; to pity and provide for the conductor and forget the many who have equal claims to consideration; to guard one class against oppression and neglect a larger number, in whose tacit demands for relief precisely the same principle is involved, is to invest the statute with a character which is partial, and is to make the law invidious. Overwork and underpay are common factors in a great problem; they constitute an evil in all countries. This great central evil there is no attempt to reach. In the sharp competitions of society, in the relations between capital and labor, which are the outgrowth of our imperfect civilization, perhaps any attempt to reach it by direct legislation would be futile. It is a part of the theory of our government that its adult citizens are free agents; that they can select their employments and judge of their abilities and necessities to better advantage for themselves than the State can do for them. Deeply convinced that this is in contravention of that theory, and that it, in practical effect, would be an injury to the class it seeks to benefit, I am constrained to return it without approval."

IMPROVED COMBINATION SCISSORS.

Mr. Casper Van Hoosen, of New York city, is the inventor of the novel form of scissors represented in the accompanying engraving, and has provided a device which, we imagine, will be found a quite convenient addition to the work basket.

At the inner edges of the blades, and near the pivot of the same, are formed curved slots, which cause said edges to terminate in sharp corners. The slot on the broad blade is shouldered at A, and the projection thus formed, when the scissors are sufficiently closed, strikes against the stop, B, which is a simple screw readily turned in and out of a nut. C is a stop which slides, and is held by friction upon the edge of one slot, as shown, the latter being suitably graduated.



The object of this arrangement is to enable a number of button hole slits to be cut with uniformity and accuracy after the scissors are once adjusted. The operation is as follows: The blades being widely opened, the cloth is carried between them, and its edge led into the curved slot. The distance from the sharp inner lower corners of the blades to the stop, C, measures the space of the inner end of the button hole from the edge of the cloth, and consequently, by moving the stop, C, along its slot, this space can be altered at will. The length of the button hole is governed by the stop, B, which is screwed in more or less, so that the shoulder, A, takes against it sooner or later. The proper adjustments once made, it is evident that the operator can cut as many slits as rapidly as he chooses, and all will be of the same size; and by noting the position of the stop, C, with reference to the divisions on the slot, and also that of the angle formed by the blades when brought as near together as the stop, B, will allow, with reference to the markings on the broad blade, the same adjustment may accurately be remade at any time. Upon the ends of the handles are formed two jaws, so located that, when the handles are brought together, a pair of pliers or tweezers is formed.

CEMENT FOR AQUARIA.—An adhesive cement for aquaria may be made, according to Klein, by mixing equal parts of flowers of sulphur, pulverized sal ammoniac, and iron filings, with good linseed oil varnish, and then adding enough of pure white lead to form a firm, easily worked mass.

DR. HANBURY SMITH writes to say that our mention of a gallon of water as containing 277·274 cubic inches is an error. The English imperial gallon is 277·274 inches, and is about one fifth more than the American gallon, which is exactly 231 cubic inches capacity.

AN INSTANTANEOUS LIFE PRESERVING RAFT.

The history of recent marine catastrophes, such as those of the Atlantic, Northfleet, and Ville du Havre, prove that vessels, after becoming severely injured, generally sink within half an hour. The unavoidable confusion which follows the occurrence of a sudden disaster renders such means of safety as the boats, which require care and some time to launch, of little value; but, on the other hand, devices which may be instantaneously set afloat, such as light rafts, would, if properly disposed about a vessel, be of the greatest efficiency in saving life. There are certain requirements, however, which such apparatus must meet in order to be of sure utility in the time of need, and which may be summed up as follows: They must be of sufficient capacity to support, say, from 400 to 600 persons, so located as to necessitate no alterations in the vessel or so as to interfere with her management, perfectly accessible, and, finally, so applied to the side of the ship as, when afloat, to be readily reached by the passengers.

In the illustrations herewith given is represented a new form of "instantaneous raft," which appears to be of considerable value, judging from its general design, and which may be arranged in connection with steamers of the largest size. Our engravings are drawn to the proportions of the Ville de Paris and Pereire, both transatlantic steamers of heavy tunnage.

Fig. 1 shows the apparatus hanging from its davits, ready for use, and Fig. 2, the same afloat. A reservoir of strong sheet iron, containing 106 cubic feet of air compressed to 15 atmospheres, is placed in the engine room, and kept always charged by means of the pump ordinarily used by divers in descending to repair the bottom or screw. Tubes pass through an expansion chamber, which is three fourths full of water, and discharge the air into the same through perforations in their sides, the blast finally escaping through a heavy iron pipe. The latter will be seen in the illustrations between the davits, as it extends up through the deck. It is filled with several cleats to allow of access to its outer extremity. This pipe, together with the reservoir and the expansion chamber, are carefully tarred inside or lined with rubber, so as to preclude any possible leakage. The column, D, is united by means of a strong screw sleeve, N, to the insufflation tube of a huge air mattress, M (length 26 feet, width 23 feet, and thickness 20 inches), which is contained rolled up in an envelope, E (Fig. 1), and suspended like a boat above the bulwarks. F F, Fig. 2, are strips of wood secured transversely across the upper side of the mattress, above which, again, is attached a cover or deck, P, of heavy canvas. To the latter is longitudinally secured three flexible tubes, G, Fig. 2.

When the command is given to lower the raft, the crew, of about a dozen men, cast loose the cords, H, thus allowing the mattress to unroll and hang (by the screw sleeve, N,) alongside the ship. While in this position, heavy iron rods are pushed into the tubes, G, thus holding the apparatus extended. A turn or two of the handles on the screw connection, N, admits the air from pipe, D, which speedily inflates the mattress. Another turn closes the connection and confines the air, and one more twist disengages the screws, when the raft drops into the water. Here it is held by wire ropes, J, which are secured to rings which travel on the vertical stationary guys, S, thus retaining the raft close up to the ship's side. In the rail are made two ports, V, which afford access to the Jacob's ladder leading down to the raft. The latter is finally set adrift, after being manned, by removing the pegs, B, which connect it with the cords, T. The *Revue Industrielle*, to which journal we are indebted for our engravings, states that the device has been practically tested with considerable success. At the present day, when losses of ocean steamers are more than usually prevalent, such inventions are of especial and timely importance.

Full investigation of the merits of such devices, and practical trials of the same, are among the most imperative duties of the owners of steamships.

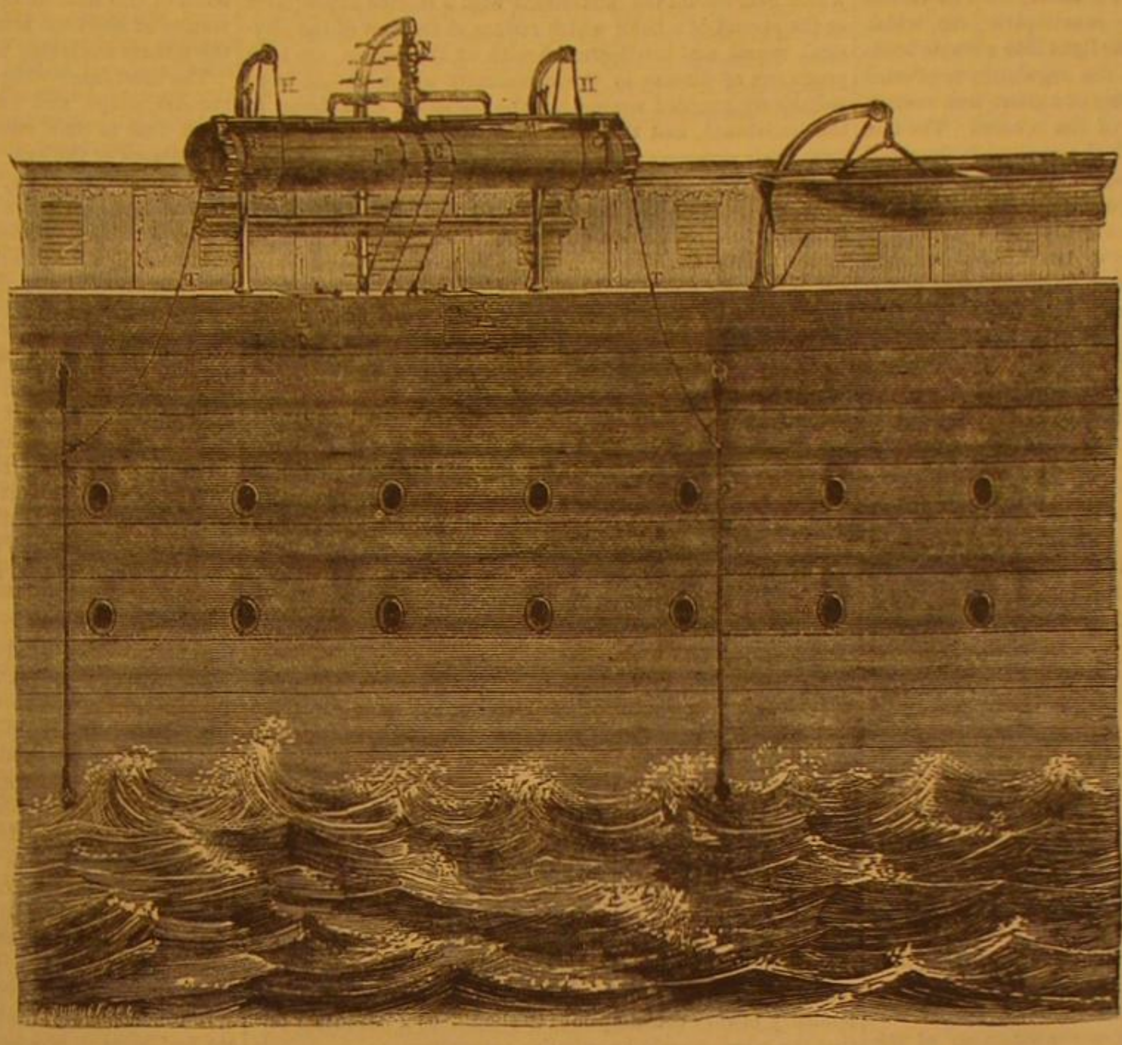
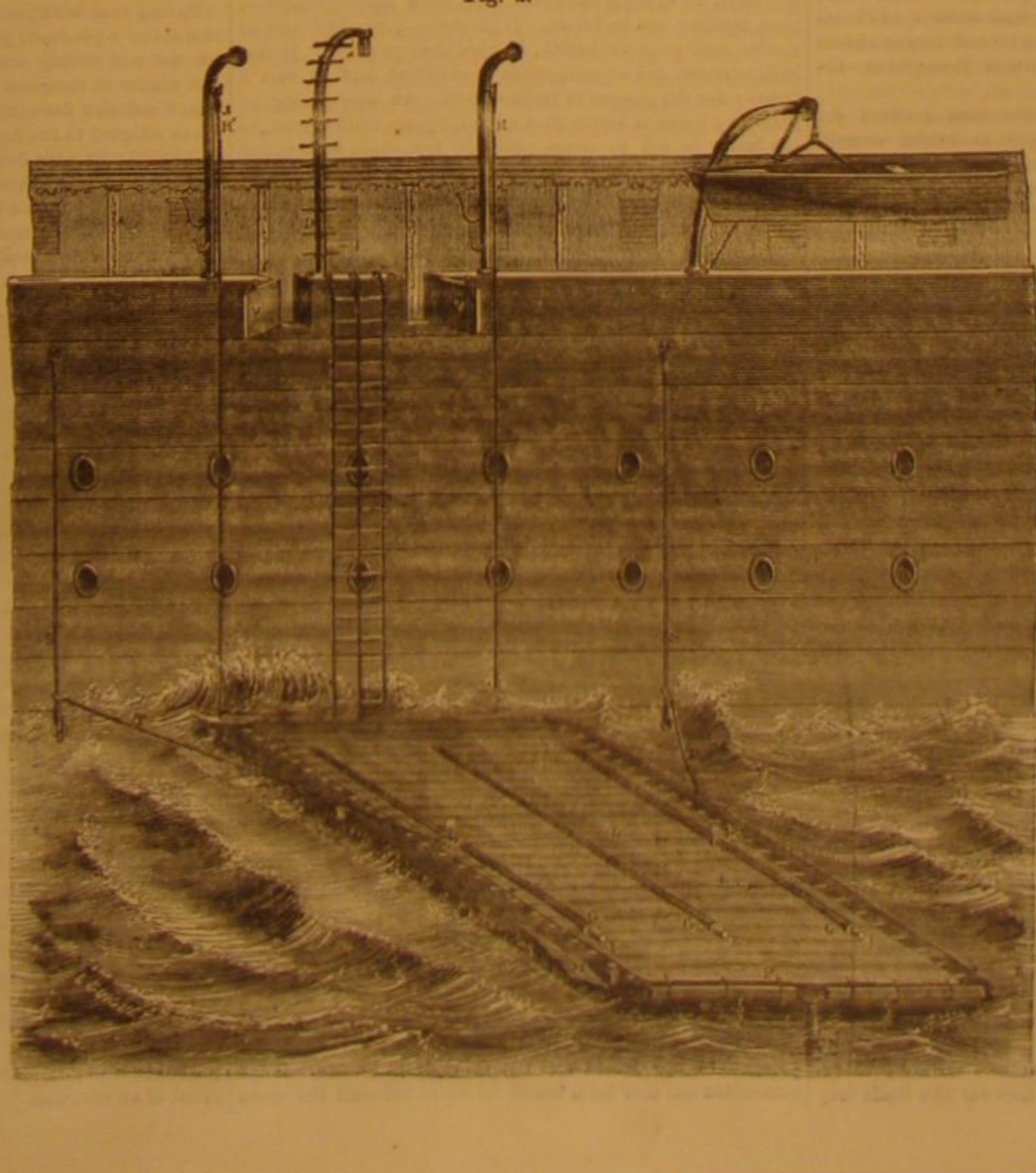


Fig. 1.—INSTANTANEOUS LIFE PRESERVING RAFT.

Fig. 2.



Wilde's Electric Light.

The Comet, a British gunboat, has lately been fitted with one of Wilde's electric lights, which operates with great success. A recent trial showed that its power was immense, and that no boat could approach the light within a mile without being discovered. In a boat at 2,000 yards distance from the Comet, and with the beam of light brought to bear upon the bat, the *Times* newspaper could be read with the greatest ease.

Mr. Wilde's apparatus consists of two parts—an electro-magnetic induction machine for producing the electricity, and an arrangement for regulating the light produced by the current, and projecting it upon distant objects.

The electro-magnetic induction is founded upon a new and somewhat paradoxical principle discovered by Mr. Wilde—that magnets and electric currents indefinitely weak can produce magnets and currents of indefinite strength. The machine consists of a circular or cylindrical framing of cast iron, round the interior of which are arranged a number of electro magnets at equal angular distances from each other. A cast iron disk is mounted on a driving shaft running in bearings fitted to each side of the framing, and carries a number of armatures revolving before the electro-magnets. A slight charge of magnetism is imparted to the electro-magnets before the machine is used for the first time, by transmitting a momentary current through the wires surrounding the iron cores, or by touching their extremities with the poles of a permanent magnet. This initial charge is always retained by the electro-magnets, and is the basis of the augmentations of the electricity and magnetism produced by the rotations of the armatures. As the armatures revolve, they become slightly magnetized in their passages between the poles of the electro-magnets, generating weak currents in the insulated wires surrounding them. These currents are transmitted, by means of a commutator, through the wires surrounding the electro-magnets, so as to increase their magnetism until, by a series of actions and reactions of the armatures and electro-magnets on each other, the magnetism is exalted to the highest degree of intensity, and the most powerful currents of electricity are produced. A small fraction of the current thus produced is sufficient to sustain the power of the electro-magnets, while the major portion of the current produces the light. The machine on board the Comet is 28 inches high 34 inches in length, and 21 inches in diameter. Its weight is 11 cwt. About four horse power is required to drive it at a velocity of 600 revolutions per minute, and this driving power is obtained on board the Comet from the fly wheel of the small engine that raises and lowers the eighteen tun gun and its platform. At this velocity the current will fuse an iron wire 6 feet long and 0 05 inch in diameter, and will burn carbons half an inch square. In this machine the alternating current is used for producing the light, past experience in lighthouse illumination having proved it to be greatly superior to the direct or continuous current, since it has the important advantage of consuming the carbons equally, and thus always retains the luminous point in the focus of the optical apparatus used in connection with the machine. The alternating current also dispenses with commutators, and the destructive spark on the rubbing surfaces is also avoided when the light may be accidentally extinguished, or when the circuit becomes broken from any other cause. Copper wire conductors are laid from the machine along the Comet's deck, from the position of the machine over the engine room to the fore part of the vessel, for the transmission of the electric current to the apparatus where the light is regulated and projected from. All the arrangements on board the Comet, in this respect, have been made to render the light available for naval purposes, whether as a torpedo boat detector or otherwise, and with this view a simple mechanical regulator arrangement, worked by the hand, has been substituted for the delicate mechanism by which the carbon poles have hitherto been automatically adjusted. The carbons, as they consume, are made to approach each other by means of a right and a left handed screw, the screws being made to act independently of each other, so as to allow of the adjustment of the carbons to the focus of the optical apparatus used for projecting the light. The regulator, with its carbon points, is placed in the focus of a catadioptric lens, which parallelizes the divergent rays of the light into a single beam of great intensity. The lens, with the regulator, is pivoted horizontally and vertically on the top of a short iron column fixed on the forecastle bulwarks of the Comet. The box holding the lens and regulator with the carbons is thus well elevated above the bows of the vessel, and the beam of light, by the action of a quick screw adjustment, may be directed to every part of the horizon, and cover any object within the vertical angle of its range. As the carbons only require regulating once in two or three minutes, this is effected by the man in charge without any interruption in the movements for directing the beam of light.

Mr. Wilde, in his official communications with the Admiralty, has estimated the cost of producing the light from his machine on board the Comet, exclusive of the driving power obtained from the vessel's engine room, at only 4d. per hour.

JAMES BOGARDUS.

Mr. James Bogardus, an inventor celebrated both for the multiplicity and variety as well as the value of his productions, recently died in this city in the 75th year of his age. The record of his life is one of continuous labors repeatedly crowned with substantial success, of a versatile genius which devoted itself to the origination of devices in widely differing arts and industries, and finally of unremitting toil in the search for the new and useful, pursued even to the day of his death.

Born in the first year of this century, at Catskill, N. Y., Mr. Bogardus quite early in life developed a strong taste for invention, and while still a young man obtained the highest premium for an eight day, three wheel chronometer clock; subsequently he devised a complicated time piece without dial wheels. In 1828, however, he produced his first generally useful invention, the "ring flyer," still largely employed in cotton-spinning machinery; this was followed by an excellent form of sugar grinding mill, also now in use. The steel die of the first gold medal of the American Institute was cut by an engraving machine invented by Mr. Bogardus in 1831, about the time of his production of the transfer machine, now everywhere employed for printing bank notes from separate dies. In the following year he invented the first dry gas meter, and then modified his plans so as to produce an apparatus, for the same purpose, of totally different construction. In 1833 he patented a pencil case of ingeniously novel design. Being in England in 1836, he answered a challenge in the public prints by inventing an engraving machine which made not only an accurate facsimile of the head of Ariadne on a medal, but also engraved from the medal comic facial expressions. This device was followed by an engine-turning machine, and in 1839 by his winning a prize of $2,000, over 3,000 competitors, for the best machine for making postage stamps. Mr. Bogardus' plan for the erection of iron edifices, as shown in his own factory at the corner of Center and Duane streets in this city, has been largely adopted throughout the country.

The inventions of this remarkable man realized for him a large fortune, but the accession to wealth seemed to offer no inducement for him to remit his exertions. He was devising an apparatus for deep sea sounding at the time of his death.

PREVENTION IN PLACE OF CURE.

President Barnard, in his late address before the Health Association on the occasion of its meeting in this city, intimated that the advance of modern science was such that the physician would eventually find his occupation gone. The people would, it was considered, as they advanced further in knowledge of natural laws, become more and more able to dispense with the doctor, and in brief would learn so to apply the "ounce of prevention" as to obviate the necessity of the "pound of cure." We do not agree in the view that the physician will ever become a useless member of society, for the simple reason that, instead of decreasing the share of his duties, the culture of preventive medicine—of the knowledge of how to prevent diseases as well as to cure them after they are engendered—must tend to amplify and enlarge the same. His will be the task, not merely to recognize the forms of ills and endeavor to combat their effects, but to look into the future and, through the aid of circumstances of the present, predict possible evils and point out means of defense. Add to this the constantly increasing knowledge of drugs and their properties, of the wonderful relations of mind and body, of the nature and habits of disease, which Science is rapidly developing, and the physician of the future has before him not a narrower but a far wider field for the exercise of his skill.

"Preventive medicine," says Dr. Henry Bowditch, in an admirable and exhaustive paper on the subject, which we find in the fifth annual report of the State of Massachusetts, "is the natural outgrowth of modern thought and resources, stimulated by centuries of suffering and by the sacrifice of multitudes of human beings." The various lessons given us by Nature as to the possibility of checking or preventing disease have culminated in the fact that the State uses its moral power and material resources toward preserving the health of its citizens. As to how far the State may thus exercise authority, there is a difference of opinion; but the views expressed in the paper before us (pointing out that the neglect of a city government to provide proper sewerage and the course of a common drunkard, both tending to disturb the public peace and the comfort of individuals, are alike crimes and should be considered as such in law), seem fraught with a deal of sound sense. The existence of vile deposits which overwhelm the inhabitants with a tainted atmosphere or the spread of a habit which strikes at the root of the physical, moral, and intellectual health of the people, are both producers of disease to the community which should be as sedulously guarded against as the visitation of a fever to the individual, and the means used to defend the people from their ravages are striking examples of pure preventive medicine.

In considering the best chances of a person having a tendency to consumption arriving at a good old age after a life of health, Dr. Bowditch discusses a few general topics and lays down a number of plain rules for sanitary guidance, which are mainly generally applicable to every one. Under the subdivision of residence, the first point urged is that the cellar should be always dry. No possibility should exist of drinking water becoming contaminated by refuse; and hence for the latter, closely cemented stone, brick or vitrified tile drains should be used, while the supply for drinking should be brought to the house from some distant spring or pond. The dwelling is best located on an elevated knoll, open to the south and west winds, but somewhat shielded from the north and east. There should be means of allowing sunlight to enter every room. As regards temperature, about 70° as a medium is the best, and this heat should be derived from open fire places connected with well constructed chimneys in every room.

With reference to clothing, the writer condemns sudden changes made in the spring of the year, and points out the well known objections to thin soled shoes, tight lacing, and low dresses. Bathing is recommended in moderation as a check to consumptive tendencies. Surf bathing, however, should be cautiously indulged in by all predisposed to pulmonary difficulties.

Dr. Bowditch condemns very strongly the neglect of recreation common to Americans. Children naturally weak should be compelled to play in the open air, and business men should make it a rule to leave work for a certain period each day and devote the same to exercise or other relaxation. In matters of education among people showing the slightest tendency toward consumption, it should be a steadfast law that the mind should be wholly subservient to the body's welfare.

The various kinds of physical exercise are considered by Dr. Bowditch in some detail. Walking, he believes, is the best form, and most generally applicable. It exercises the body better than any other method. The most favorable time is about midday in winter and in the morning and toward evening in summer. Late in the evening is less useful because of the liability to dampness and coldness in the absence of the sun's rays. Fast running, in the opinion of the writer, is pernicious to consumptives; it produces violent motions of the heart and too rapid breathing, and consequently great tendency of blood to the lungs. As regards dancing, it is said that, at appropriate hours and for a proper length of time, nothing can be better. It promotes grace and ease of motion and positive health, if used thus properly. Horseback exercise for consumptives is excellent, and in fact a remedy for the disease at its inception. An easy pacing or galloping horse is better than a hard, square, solid trotter, as the latter is apt to cause pains in the chest and undue fatigue. Driving for health should be in an open carriage; the back should never be rolled up while the sides are erect, because the draft thereby produced will be liable to cause a cold and consequent injury to the lungs.

Gymnastics, while increasing the power of the muscles, are of little advantage in warding off phthisis. Many stalwart gymnasts have been victims to consumption. The swinging of heavy clubs about the head cannot be recommended. Less exercise than that with the arms causes hœmorrhage in those consumptively inclined. Boxing puts almost too much strain on the heart and lungs, and it is questionable whether severe blows on the chest are ever of use. Bowling should be avoided by consumptives. Rowing tends to expand the chest, and, if no racing be undertaken, may prove of great value. Swimming should be used with great caution, as too long a stop in the water is apt by itself to bring on consumption.

Dr. Bowditch, in conclusion, says that if these recommendations, with others that might be added by any family physician, could be thoroughly carried out by the patient during childhood, and by the man or woman when arrived at adult life, many that will now die of consumption would escape that calamity.

Correspondence.

The Analyzing Power of the Spectroscope.

To the Editor of the Scientific American:

The science of spectrum analysis is not yet a hundred years old, but the results obtained in this short time are surprising. The grandest principle evolved is, the uniformity of the elements composing the universe. The earths, metals, and gases, of which the planet on which we live is made up, have been found to be present in the sun and the fixed stars, and some of them also in nebulæ and comets. By analysis of sunlight, several new metals have been discovered, whose presence in our world was not theretofore known. Some connection has also been found to exist between the spots and glowing gas streams of the sun and electrical phenomena; although the subject has not been sufficiently studied for the laws governing this relation to be definitely established. When we think that, for many thousands of years, Nature has set the rainbow in the heavens, as a constantly recurring hint of the great laws of the light shut up in the tiny globules of water, it seems strange that man did not sooner grasp at some of this half concealed knowledge. But it is not of the results of spectrum analysis of which I wish to speak, but of the minute analyzing powers of the instrument itself.

The most interesting of these is the power of indicating the size, shape, and motion of the gas flames of the sun. From time to time, streams of glowing gas shoot out from the surface of the sun, to the hight sometimes of one hundred thousand miles, and with a rapidity of one hundred miles or more in a second of time. They may have also a lateral motion, and develope into the most fantastic shapes. It is possible to measure with accuracy these swift twistings and turnings, to draw their contours, and to note not only the rate of velocity but also the angles which they make with the surface of the sun.

Another interesting power of this instrument is that of denoting the presence of extremely minute quantities of substances. The most common of all known substances is sodium, the base of common salt. Indeed so universally distributed is it that great difficulty is experienced in obtaining a spectrum without the characteristic lines of this metal. It will not be wondered at when we learn that the spectroscope will demonstrate the presence of so small a quantity as one fourteen millionth of a milligramme, or $\frac{1}{14000000000}$ of a gramme.

There are three other metals of which the spectroscope has the susceptibility of demonstrating even smaller quantities, namely, lithium, thallium, and stronthium, the visible quantities being one forty, eighty, and one hundred millionths of a milligramme respectively.

It must not be supposed that the instrument is employed only in astronomical and chemical science. In many mechanical arts, it has become useful, as for instance in the preparation of dyes. It comes to the assistance of the public analyzer in testing the purity of wine, beer, cheese, butter, etc. It has opened an important field of research to the physician, diagnosing for him the condition of the tissues and fluids of the human body. It is moreover an aid in the administration of justice, in detecting the presence of blood or of poison.

In conclusion, let me give, as an illustration of its accurate and minute power, the examination of human blood. Blood may be burned, treated with acid, dried or washed or kept for an indefinite period of time, and yet this instrument will detect the presence of the constituents of the blood in the substance that remains.

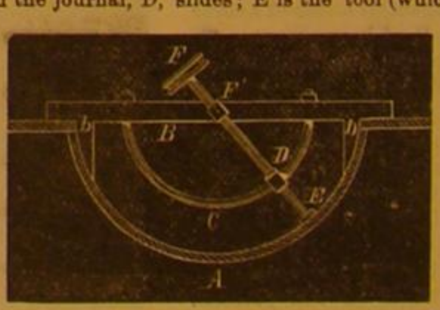
Moreover the fresh blood globules are so minute that, if three thousand of them be placed in a row, they will measure barely an inch in length: yet one half of one of these globules or one six-thousandth of an inch of blood, may be detected by the spectroscope. S. H. C., M. D.

Polishing a Parabolic Mirror.

To the Editor of the Scientific American:

Having read with much interest, in your recent issues, an account of a proposed plan for constructing a mammoth telescope, and having heard it stated that it would be a difficult matter to turn and polish a parabolic mirror of a large size, I inclose a drawing of a device which suggests itself to me as adapted to the requirements of the case; and I think it should be brought to the notice of any parties contemplating the erection of such a telescope:

A is the mirror, B a bar, extending across the top of the mirror and having lugs, *b b*; C is a guide, having the exact curve to which it is designed to turn the mirror, and on which a lug, on the journal, D, slides; E is the tool (which is de-



tachable), from which the shaft extends upwards through the journal, D, above which there is a collar. F is a pulley, from which the shaft receives its motion, the belt running at right angles to the plane of action of the shaft; F' is a journal, turning in a socket in the bar.

It is clear that, by imparting to the shaft a high velocity, and then rocking it slowly from side to side, at the same time slowly revolving the mirror, the whole of the surface will be traversed by the tool, and will have the exact curve of the guide, C. Probably the best mode of imparting the oscillating motion to the shaft would be by extending it above the pulley, attaching a pivoted rod at the top, and operating it by hand. WM. B. COOPER.

Philadelphia, Pa.

WE see, in the London *Building News*, that it is proposed to construct a railway from Naples to the crater of Mount Vesuvius. The journey will be made in an hour and a quarter, and the line is to cost six or eight hundred thousand dollars. One of the promoters is said "to be enabled, by his study of the subject, to guarantee the safety of the passengers in the event of an eruption."

STRAIN DIAGRAMS—WHAT THEY ARE AND WHAT THEY TELL US.

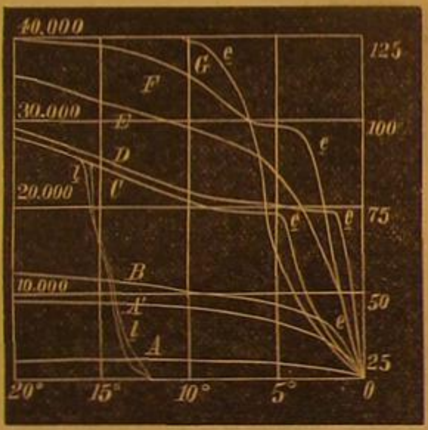
BY PROFESSOR R. H. THURSTON.

A strain diagram is a graphical representation of the variation, of the resistance of a specimen of any material, with the change of form which occurs when it is strained by external forces. It is usually a curve, sometimes of regular form, but generally of an irregular shape. Were the material always perfectly homogeneous, and absolutely uniform throughout, in composition, texture, and in the distribution of the molecular forces, this diagram would be a smooth, graceful, regular curve; but every variation from homogeneousness and uniformity, in any of its properties, must affect the curve, and, as a strain diagram, it becomes a record from which an accomplished observer should be able to deduce the true physical character, and sometimes even the chemical nature, of the material represented.

Strain diagrams of the material of construction are best obtained, where accuracy and completeness of information are desirable, by means of an autographic recording apparatus, attached to a machine for testing by torsion, in the manner adopted by the writer and already several times referred to in the columns of the SCIENTIFIC AMERICAN; but, in the works of Rodman, Captain King, and others, may be found strain diagrams produced by plotting carefully the results of experiments made in the ordinary manner. The finest curves yet published are to be found in the account of the experiments of the Swedish Royal Commission, written by K. Styffe, of the School of Technology at Stockholm.

Referring to the illustrated article published in the SCIENTIFIC AMERICAN of January 17, the reader will readily see how to construct such diagrams for himself. To secure satisfactory results, however, great care must be taken, in observation and record of the first effects of the applied force, since the most valuable indications are often obtained from that part which represents the first six or eight degrees of twist.

Fig. 1 represents this portion of the strain diagrams produced at the Stevens Institute of Technology, by specimens of iron and other metals, of standard size, five eighths inch diameter and one inch long, in the reduced part, by the au-



tographic machine. It will be seen that they are so formed that each point of the curve is so situated that its hight above the base line (that is its ordinate, as it is called), measures the force which strains the piece to a degree which is proportional to the distance of the point from the right hand border of the diagram, that is to say, the latter distance is the abscissa of the given point.

Space will not permit an extended explanation of the methods of determination of the meaning of each peculiarity of the curve, or of the operations of verification, as they are described in sufficient detail in the account of the research published elsewhere.* It is only necessary to state here that an early acquired familiarity with steam engine indicator cards and long practice in their interpretation, probably first prompted the critical examination of these diagrams; and, as with the indicator diagrams, careful observation and comparison led to interesting and useful deductions as to their meaning.

The curves, A A' and E, are the regular lines, parabolic in form, which are given by metals of homogeneous character. A and A' are curved from the start, and are thus known to be the strain diagrams of inelastic as well as homogeneous metals. The line, E, which is at first straight and inclined, is, by that fact, known to be produced by an elastic material, while the regularity and smoothness of the succeeding portion of the curve indicates homogeneousness of structure.

These diagrams are respectively those of forged and cast copper, and of the beautiful specimen of iron described and pictured as No. 22 in the article of January 17. B, in Fig. 1, is similar in its general character to A and A'. It is the beginning of the strain diagram of a soft bronze.

Diagrams C and D are so different from the preceding that the most careless observer notices their peculiarities, and can recognize the distinction, not only between these curves and A, B, and E, but also between themselves. C rises in a curve convex toward the base, turns a sharp corner at *e*, runs nearly horizontally some distance, and finally pursues a course which would be seen to be parabolic, could the remainder be shown. D rises more nearly vertically, but curves slightly to the left, turns a well marked corner also, and then also runs a little way, almost horizontally, before resuming the upward movement.

There is a strong resemblance, and yet an evident difference here. The diagrams are those of two well known brands of iron, good specimens both.

*Trans. Am. Soc. C. E., March, 1874, et seq. Journal Franklin Inst., April, 1874, et seq.

The striking peculiarity of C, its reversed curvature, is supposed to be produced by the existence, in considerable amount, of the internal strain of which the effects were described in the SCIENTIFIC AMERICAN of April 11, and which is there described as a lack of homogeneousness as to strain. Were there not an appreciable amount of internal strain, this portion of the line would present the appearance seen in D and in E, and would be parallel to the elasticity line, *l l*. The degree of this reversed curvature, and the deviation from parallelism with *l l*, shows how much the metal is affected by this strain. It is noticeable that C is evidently weaker than D, which fact is, not improbably, a consequence, and perhaps a measure, of the ill effect of the observed fault.

After the piece has been strained to *l*, and the force-producing distortion is first removed and then renewed, producing the double line, *l l*, just referred to as the elasticity line, much of this internal strain has been relieved by the mere stretching of fibers, and *l l* is thus nearly made a straight line. It is now also seen that the latter line indicates more correctly the real elasticity of the material than does the initial part of the line up to *e*, where these internal forces interfere with elastic properties. We therefore always determine the elasticity of the material by forming lines like *l l*. One of the important discoveries which has followed these investigations is that the elasticity of the metal remains the same, quite up to the point at which rupture commences.

The point, *e*, at which the line turns and becomes pretty nearly horizontal, indicates where the change of form becomes considerable with comparatively small accessions of force, and where the set becomes approximately proportional to the amount of distortion, and it is called the limit of elasticity. In A, A', and B, it is not well marked; in E, it is more readily determined, and, in C, D, F, and G, it is well marked and is easily determined.

This is generally the point which it is considered most important to determine. Many experienced engineers think it more important to know the resistance at the limit of elasticity than even the ultimate strength of the material. It is extremely difficult to determine it accurately by the usual methods of test. Here, it is so well shown that, except with a few hard and, at the same time, very homogeneous materials, the most casual inspection of the strain diagram reveals it.

No materials should ever be subjected, in permanent structures, to stresses nearly approaching this elastic limit. A factor of safety, with reference to this point, of one half, that is straining the material to one half its elastic limit of resistance, is considered good practice.

Passing the elastic limit, the considerable deviation from the parabolic curve, and the consequent approach to the horizontal, which is observed so plainly in the strain diagrams C and D, and is less evident in F, and still less in G, shows a lack of another kind of homogeneousness, a defect of homogeneousness in structure. This is produced in irons, like C and D, by the presence of cinder, which cannot be perfectly expelled by the puddler, or by the subsequent processes of squeezing or hammering and rolling, and which produces the well known appearance of fiber. In E, this cinder has been so perfectly expelled, and the metal, by thorough and careful working, has been so purified, that no cinder is indicated, and the fracture, as already illustrated in an earlier article, shows excellent quality of metal and no fiber.

In the low steels, of which F and G are parts of the strain diagrams, this same want of homogeneousness occurs, but usually in a far less degree, in consequence of the existence of porosity in the ingot. In the rolling mill these pores are drawn out into very minute lines or channels of microscopic dimensions, producing the same effect upon the mechanical properties of the metal as is produced by the fiber in iron.

Comparing the several curves, we see that the line, C, is from a slightly better worked iron than D, although working cold is probably the cause of the internal strain in C; that E is almost perfect in both kinds of homogeneousness; that the Bessemer steel, F, is from a more porous ingot than the higher Siemens-Martin steel, G.

We see that the copper and bronze, of which A, A', and B are strain diagrams, are apparently perfectly homogeneous in structure as well as free from internal strain.

Comparing the angle made with the vertical by the part of each curve lying beneath the elastic limit *e*, we find that, in order of stiffness, they stand: D, F, E, C, and lastly G, B, A', A. In elastic resistance, the order is: C, F. E, D, C, B, A', A. Could we follow the whole extent of each diagram, we should find this last to be also the order of ultimate resistance to rupture. As a general rule, the ultimate strength is pretty nearly proportional to the resistance at the elastic limit.

Thus, by constructing on paper the curves which will represent accurately the results of experiments made in the ways already described, we obtain strain diagrams from which we deduce useful information respecting nearly every valuable property of the material. The length of this article forbids entering upon an explanation of the method of determining the ductility of the material and its power of resisting shock, or describing the way in which the action of time, the effects of tempering, and other interesting subjects have been investigated.

It will be seen, by inspecting the figure, that the horizontal scale is one of degree, or of elongation; the vertical scale at the right is one of moments of torsion; and that on the left is an approximate scale of tension in pounds of stress per square inch of section on those lines of particles which are most strained.

STEVENS INSTITUTE OF TECHNOLOGY.

SCIENTIFIC AND PRACTICAL INFORMATION.

CURIOUS PROPERTY OF TARTARIC ACID.

M. Pasteur, in the course of his investigations, has noted a curious splitting of racemic acid into two tartaric acids, identical as to their composition, but one of which rotates the plane of polarization to the right, and the other to the left. M. Bertholdy has recently made some interesting researches into this subject, with regard to the quantity of heat evolved. He finds that the right acid dissolved in water absorbs 3·275, and the left acid, 3·270 calorific units. Racemic acid, on the other hand, absorbs 5·420 units. The combination of this same acid with two equivalents of water disengages 6·900 units. It results that the solution of this hydrate in water represents a movement of heat equal to the difference of the two preceding numbers, or 1·480 units. Now it is curious to note that this last exactly coincides with the number recently found by M. Desains as representing the heat of melting ice, and hence the odd result may be stated, that if solid tartaric acid were united with solid water, or ice, there would be no disengagement of heat.

TROILITE.

The above name is given to a sulphuret of iron largely found in meteorites. The majority of mineralogists have considered the substance as a protosulphuret of iron, but such, according to a note recently presented to the French Academy of Sciences by M. Daubrée, appears not to be its true constitution. The proper formula is said to be $Fe_7 S_8$. There is a variety of mineral known as magnetic pyrites, or pyrothene, found at Horbach, in Baden, in specimens identical, both in composition and density, with those which fall from interplanetary spaces. This conclusion is strengthened by chemical analysis, as the protosulphurets possess certain properties which render them readily recognized. Under the influence, for example, of bisulphate of potash, the pyrothene gives off sulphuretted hydrogen. This the meteoric mineral does not do.

A FLORAL CHAMELEON.

The French Bishop of Canton has just sent to the *Jardin d'Acclimatation*, at Paris, a plant whose flower changes color three times a day. It is spoken of as another wonderful evidence of Chinese art in leading Nature out of her customary paths. It appears, however, that it is, if not the same, at least not more remarkable than a natural floral freak found in Southern Australia. It is a beautiful flower, similar to our well known morning glory, with five streaks of color on its bell-shaped calyx. In the early morning the color streaks are pale blue. Toward noon they turn to a rich purple tint, which changes to a light pink during the afternoon. As the day declines the color fades, disappearing entirely after sunset, when the flower closes and dies.

How Sea Lions Enjoy Life.

Charles Nordhoff, in the April number of *Harpers'*, has this interesting account of the habits of sea lions:

It is an extraordinary, interesting sight to see the marine monsters, many of them bigger than an ox, at play in the surf, and to watch the superb skill with which they know how to control their own motions when a huge wave seizes them and seems likely to dash them in pieces against the rocks. They love to lie in the sun upon the bare and warm rocks; and here they sleep, crowded together, and lying upon each other in inextricable confusion. The bigger the animal, the greater his ambition appears to be to climb to the highest summit; and when a huge, slimy beast has, with infinite squirming, attained a solitary peak, he does not tire of raising his sharp-pointed, maggot-like head, and complacently looking about him. They are a rough set of brutes—rank bullies, I should say; for I have watched them repeatedly, as a big fellow shouldered his way among his fellows, reared his huge front to intimidate some lesser seal which had secured a favorite spot, and, first with howls, and if these did not suffice, with teeth and main force, expelled the weaker from his lodgment. The smaller sea lions, at least those which have left their mothers, appear to have no rights which any one is bound to respect. They get out of the way with an abject promptness which proves that they live in terror of the stronger members of the community; but they do not give up their places without harsh complaints and piteous groans.

Plastered against the rocks, and with their lithe and apparently boneless shapes conformed to the rude and sharp angles, they are a wonderful, but not a graceful or pleasing sight. At a little distance they look like huge maggots, and their slow, ungainly motions upon land do not lessen this resemblance. Swimming in the ocean, at a distance from the land, they are inconspicuous objects, as nothing but the head shows above water, and that only at intervals. But when the vast surf, which breaks in mountain waves against the weather side of the Farallones with a force which would in a single sweep dash to pieces the biggest Indiaman—when such a surf, vehemently and with apparently irresistible might, lifts its tall white head, and with a deadly roar lashes the rocks half-way to their summit—then it is a magnificent sight to see a dozen or half a hundred great sea lions at play in the very midst and fiercest part of the boiling surge, so completely masters of the situation that they allow themselves to be carried within a foot or two of the rocks, and, at the last and imminent moment, with an adroit twist of their bodies, avoid the shock, and, diving, re-appear beyond the breaker.

WOOD ASHES are stated to be an effective remedy for currant worms. Dust the bushes in the morning with the dry ashes. Three applications, thoroughly done, will be sufficient.

IMPROVED MITERING MACHINE.

The inventor of the device herewith illustrated aims to supply a machine that not only will cut any desired miter, but can also be used for cutting gains and rabbets at any angle, and be used in place of the crosscut saw for light stuff.

Fig. 1 gives a perspective view of the machine, and Fig. 2 a sectional view of one of the guides. Upon the table and upon opposite sides of the saw, are formed two grooves, A, which receive the sliding bars, B. At C are semicircular plates, which are pivoted at their centers to the bars, B, and held in position, when adjusted by the hand screws, D. Upon the curved edge of the plates, C, are formed scales of division marks, as shown in Fig. 1. Corresponding with these scales is a mark or line on blocks which are fitted tightly on the bars, B, though sufficiently movable, very accurately to adjust the scales with the saw. These plates, C, are connected to the guides, E, by a sliding hinge, F, which serves to longitudinally adjust the inner end of the guide closer to or further from the saw, as may be needed, and also enables the face of the guides to be set at any desired angle to the table, as shown by dotted lines (Fig. 2), for mitering moldings that are not fastened upon a solid In the face of the guides, E, are inserted step bars, G, held in position by the set screws shown. These bars are longitudinally movable, and serve to saw pieces to a given length, by pushing the stuff to be sawn against the hook, H, formed on one end of said bars. This hook is made elastic and will, when pressed upon, sink into the groove behind it.

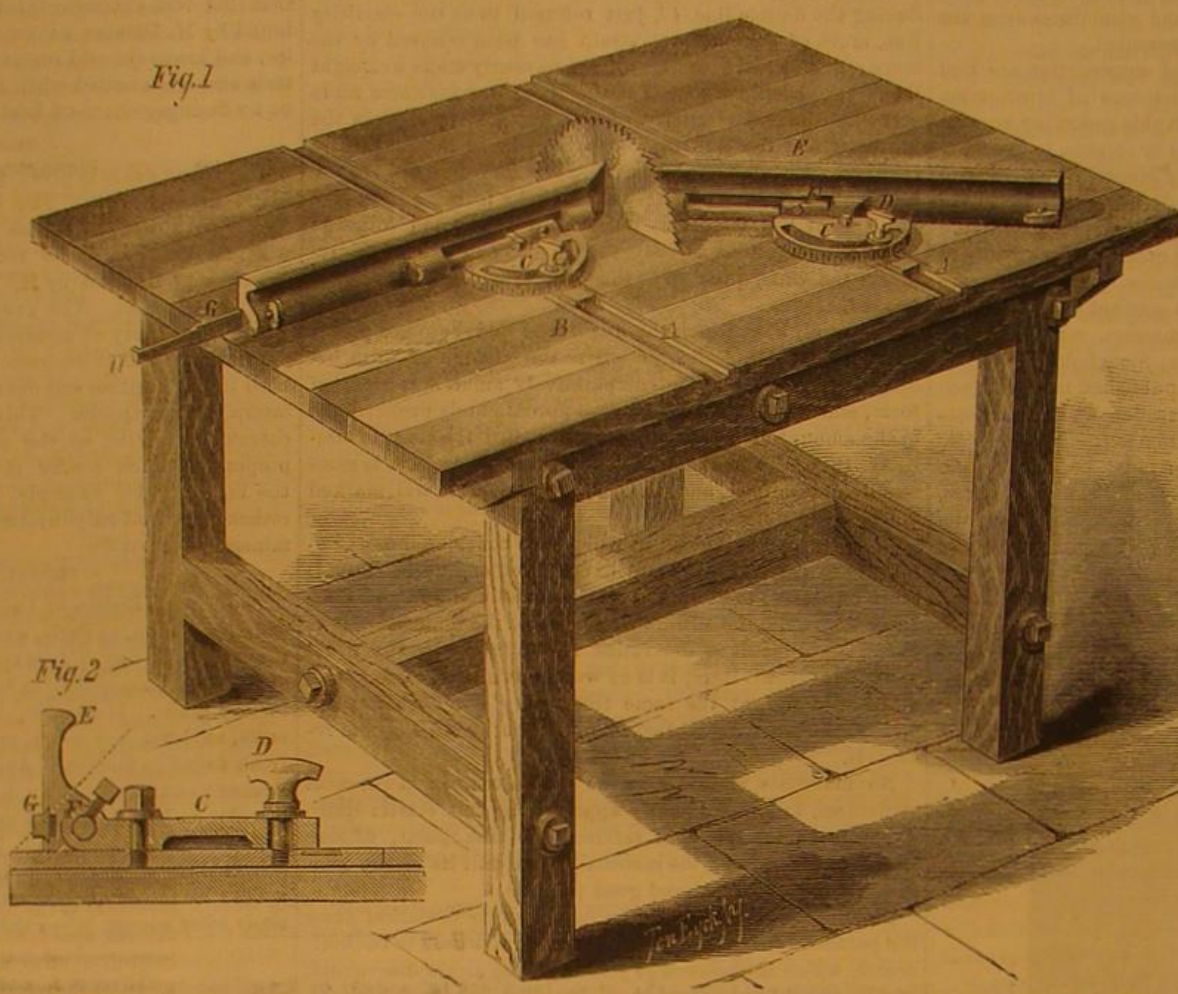
The operation of the machine will be easily understood by any mechanic, and no further explanation is, therefore, necessary.

By having two of these devices the operator is enabled to cut a different angle on each end of a piece of molding, thus saving the time of handling stuff twice. By exchanging them, the guides are made to face in the opposite direction, which is found desirable for many kinds of work. By putting a gaining head in place of the saw, the machine will do all the range of work in that line generally required in a shop. Among the other advantages claimed for this machine are easy and safe handling, susceptibility of accurate adjustment on all points, simplicity, durability, and cheapness.

Patented through the Scientific American Patent Agency, December 9, 1873, by C. Loetscher, 1,238 Jackson street, Dubuque, Iowa, of whom further particulars may be obtained. Patent for sale on reasonable terms.

Fig.1

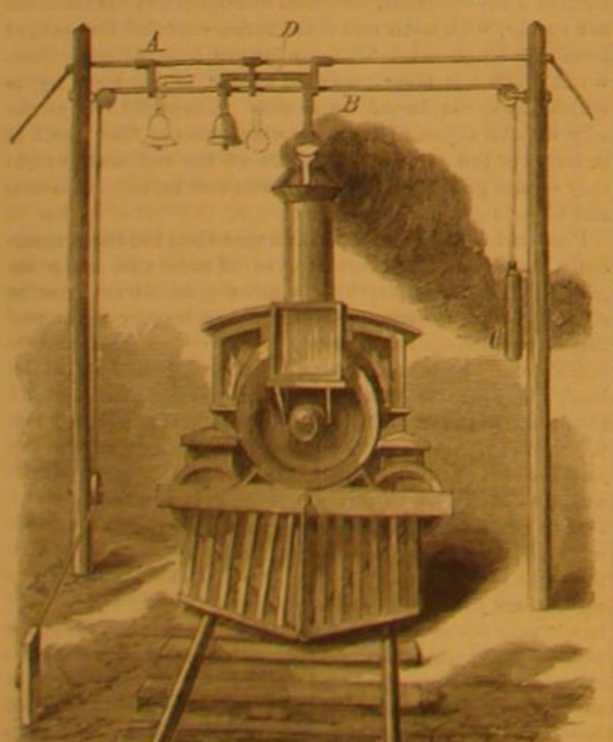
Fig. 2



LOETSCHER'S MITERING MACHINE.

SAFETY BELL SIGNAL FOR RAILWAYS.

At night and especially in times of dense fog, it may happen that a train traveling at high speed may run past a danger signal before the same is noticed by the engineer; or, in



case torpedoes are used, they may fail to explode, and thus not give a timely warning. In order to render the attraction of the engineer a matter of certainty, M. Scheppers, in the *Chronique de l'Industrie*, suggests the simple arrangement represented in the annexed engraving. Two posts are erected on each side of the track, at a suitable distance from the draw, switch, or other point, the connection of which the engine driver must be informed of before proceeding. Between the tops of these is a stout wire, on which are three travelers, A, the lower and vertical portions of which serve for supports for a line, B, which passes over pulleys on the posts, is connected with the switch lever, and carries at its free end a counterpoise, C. Secured to the line, B, which passes through and is secured to its vertical arms, is a double lever, D. One arm carries a bell, the other extends down and has a disk shaped end directly over the middle of the track. When the switch lever is properly adjusted, the counterpoise is raised, and the lever carried by the rope, B, over to the left of the track, as indicated by the dotted lines: should, however, the rails be wrongly placed or left open, the arrangement of the connecting lever is such that the counter weight draws the bell lever into the position shown. As soon as a train comes along, a projection on the smoke stack of the engine strikes the disk arm of the lever and rings the bell, thus warning the engineer. The usual signals for the eye, may, of course, be connected to apparatus in the ordinary manner.

Pressure Forging.

At the State Railway Works, Vienna, Austria, two large hydraulic presses are in use, the largest, with a piston 14 inches in diameter, giving 1,500 tuns pressure, and the second, with an 18 inch piston, giving 600 tuns pressure. The pressure in the pumps is 600 atmospheres. The piston descends upon the work, and for forging ingots it is armed with a hammer-like head. If, for instance, an ingot of soft Bessemer steel, weighing 2,030 pounds, is placed upon the anvil, and the piston brought slowly down, it is crowded into the mass as if it were putty or dough. The piston is then raised, and the ingot is moved forward for a second squeeze, and so on until the first half has been reduced in thickness, when it is turned on edge and the operation repeated. It is then turned end for end, and forged until the whole length has been reduced to the required size. It is cut into masses of the proper length by a chisel forced through the bar by the press. There is no noise or jar in the whole operation, which requires less time than the ordinary method of hammering or rolling, while the pressure affects the very center of the mass; and there is no distribution of the blow by the vibration of the foundation of the anvil and the surrounding objects, as there is with the violent impact of a steam hammer. The masses cut from the forged ingots are taken to a heating furnace and are made nearly white hot, preparatory to the operation of pressing. The molds or dies, made in several parts, if necessary, are securely held together by bands of wrought iron. A plunger head or follower, called the stamp, is attached to the piston and descends into the cavity of the mold. All the parts being properly adjusted, and the inside of the mold and the surface of the plunger being smeared with thick oil, a block of hot steel is thrown into the cavity, the plunger descends and dresses the steel each way into all the angles and recesses of the mold. When the plunger has reached the proper depth, the piston is raised and the mold and contents removed from under the press. A few blows of a sledge liberate the forging, which is thrown aside to cool. If the work is well done, all the angles are full and solid. All pieces of the same kind are alike in dimensions, and there is no great excess at any part to be cut away. The rapidity with which intricate forgings are made is one of the greatest advantages of the method. Of such objects as cross-heads for locomotives, twenty-five or thirty can be made in a day. The molds are made of cast iron, and are used cold. The plungers are generally cast, and duplicates are kept on hand for use in case of breakage. The process is also successfully applied to forming of boiler heads, steam domes, etc., the large plates of Bessemer steel being forced through a ring, while a great number of spokes for locomotive wheels are also manufactured in this way.

The total production of pressed forgings in these works for nine months was 7,830 pieces, weighing 1,071,200 pounds.

Hydrogen a Metal.

M. Dumas has communicated to the French Academy some curious experiments of MM. Troost and Hautefeuille on the hydrates of mercury or combinations of hydrogen with that metal. These combinations, it is said, so strongly resemble those which constitute the amalgams of mercury, with silver and other white metals, that it is hardly possible to doubt that they are themselves amalgams, and hence that hydrogen is a metal, a fact apparently indicated in many other analogies.

CHRISTIE'S RAILROAD DETACHABLE CLAW BAR.

The invention represented in the annexed engraving is an improved railroad bar, provided with a detachable claw which is so applied as to cause the entire strain to be thrown upon a jog and shoulder on the solid portion of the implement. The device, it is stated, will pull spikes straight out of the tie, leaving the bolt ready to be immediately driven again.

The claw piece, the shape of which is plainly set forth in our engraving, fits firmly up against the main portion of the bar, and is secured by a bolt passing through. It will be noticed that the bar has two flat faces, a jog, and an under cut, which fit the corresponding surfaces of the claw so that, as soon as the bolt is set up, the parts are tightly united together. The entire strain comes on the jog and shoulder and not on the bolt, which merely serves as a means of junction.

The trackmen, working on a line of road, may be furnished with a number of claws, and in case one should break a perfect one could be quickly substituted, putting the bar again in working order. The claw is quite cheap; and, according to the inventor, costs about one tenth the price of the ordinary jaw bar. Its appearance from below is shown in Fig.

Fig.1

Fig.2

2. We are informed that the device has been in practical use for two years past with excellent success.

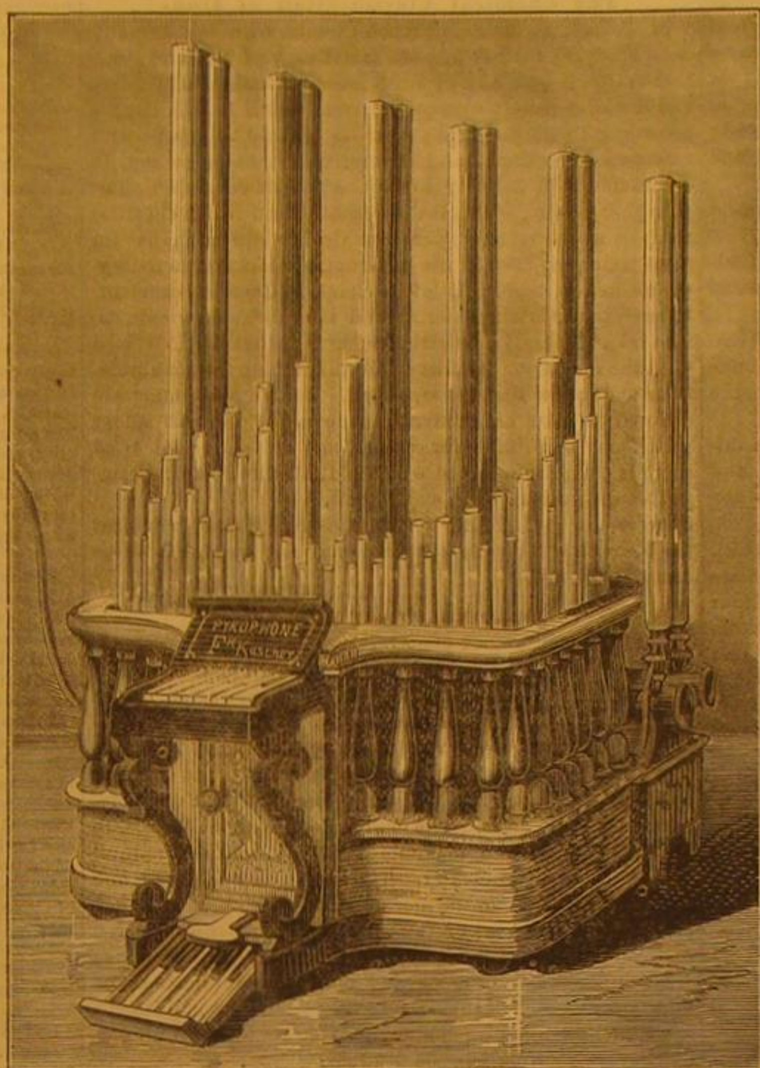
Patented July 18, 1871. For further particulars see advertisement on another page, or address the inventor, Mr. David Christie, Chillicothe, Ohio.

THE PYROPHONE.

M. Frederic Kastner, of Paris, has recently devised a novel and very remarkable musical instrument, which, it is said, produces astonishing effects even in the midst of the largest orchestras. It is termed by its inventor the pyrophone, and we present herewith an engraving of it, taken from *La Nature*. The origin of the device is due to the curious discovery made by M. Kastner in the properties of singing flames. Many scientists have studied these interesting phenomena, but the peculiarities of two flames in conjunction seem to have escaped their notice. As a result of his investigation, M. Kastner finds that if, in a tube of glass or other suitable material, two or more isolated flames of proper size be introduced and located at a point corresponding to one third the length of the tube, reckoning from the base, such flames will vibrate in unison. The phenomenon continues as long as the flames remain separate, but the sound ceases the instant they are brought in contact.

The pyrophone, at first sight, resembles an organ; but instead of being operated by air blown in, it produces its notes by the singing of the flames within the tubes, the quality of the sound, its pitch, and intensity depending of course on the dimensions of the latter. The burners from which the flames emerge are so arranged that the flames run together, but may be separated instantly by pressing down a key on an ordinary key board, seen in front. The position of the key in relation to the sound' is the same as upon the piano or organ. According to the law above cited, as soon as a key is pressed the separated flames, in the corresponding tube, give forth a note, continuing, as in the organ, as long as the key is held down.

It is said that the music thus produced is extremely beautiful, and that the sound closely resembles, in delicacy and purity, that of the human voice.



THE PYROPHONE.

Condensation in Steam Cylinders.

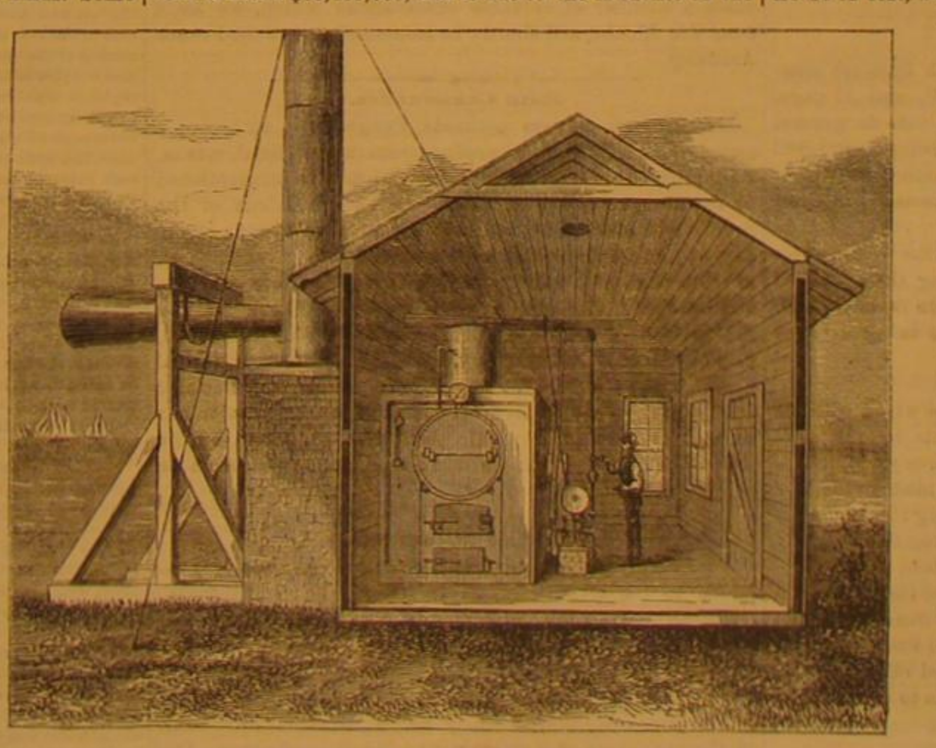
By the use of lead facings to pistons and cylinder lids, a considerable economy in the use of steam may be effected. An iron lid and piston will, other things being equal, condense more than three times as much steam as a lead-faced piston and lid. The thickness of metal heated and cooled at each stroke is not considerable, and not far into the metal, a zone of constant temperature, lower than that of the steam, will be found. The distance from this zone to the inside of the cylinder will depend on the conducting power of the metal, and will be about 9 for lead to 12 for iron. It may be shown that, in any case, the thickness of the lead facing may be kept within very moderate limits. Other materials may be used for the same purpose, as, for instance, tin, the specific heat of which is 0·562, its specific weight being a little less than that of iron. Its conducting power is, however, in excess of that of iron, being as 15 is to 12. Slate or hard pottery ware might also be employed, but on the whole the balance of advantage appears to lie with lead.—*The Engineer*.

THE STEAM SIREN OR FOG HORN.

Fog signals, many of which are required at different points on the Atlantic and Pacific coasts, are of several kinds. Some are steam whistles, the sound of which is made deeper or louder by being sent through a trumpet; but the most effective is probably the siren. This ingenious machine consists of a long trumpet and a steam boiler. The sound is produced by the rapid revolution past each other of two flat disks pierced with a great number of small holes; a jet of steam under high pressure is projected against the disks, which revolve past each other more than a thousand times a minute; as the rows of small holes in the two disks come opposite each other, the steam vehemently rushes through, and makes the singular and piercing noise which a siren gives out. One of these machines, of which we give an illustration, costs about $3,500 complete, with its trumpet, boiler, etc.

Daboll's trumpet is worked by an Ericsson engine, and requires no water for steam.

Congress rightly has great confidence in the scientific skill and integrity of the Lighthouse Board. At the last session, besides the usual appropriation for the maintenance of the lighthouse system, it gave the money needed to build forty new lighthouses and ten steam fog signals. If we ever have a merchant marine of our own again, our seamen will find the stormy and rock-bound coasts of their country well lighted for them.—*Harper's Magazine*.



THE STEAM SIREN OR FOG HORN.

PRODUCTION OF LIGHT IN STONES.—When various kinds of hard stones are pressed by the workmen (with their hands) against quickly revolving grindstones, the transparent stones become pervaded throughout with a yellowish-red light, like that of red hot iron. Opaque stones give a red light, at the place of contact, with halo and sparks. Dr. Nöggerath thinks the phenomenon worth studying by physicists.

India Rubber for Steam Pipes.

As india rubber plates and rings, says the *Journal of the Franklin Institute*, are now used almost exclusively for making connections between steam and other pipes and apparatus much annoyance is often experienced by the impossibility of effecting an airtight connection. This is obviated entirely by employing a cement which holds equally well to rubber and metal or wood. Such cement is prepared by a solution of shellac in ammonia. This is best made by soaking pulverized gum shellac in ten times its weight of strong ammonia, when a shining mass is obtained, which, in three or four weeks, will become liquid, without the use of hot water. This softens the rubber, and becomes, after volatilization of the ammonia, hard and impermeable to gases and fluids.

Mineral Statistics of Great Britain for 1873.

The London *Times* gives the following statistics, showing the metallic and mineral productions of Great Britain for 1873. The total value of metals mined is $110,800,000; of minerals, pottery materials, etc., $9,000,000; of coal $531,400,000. Total, $651.200,000. The excess of value over 1872 is about $66,400,000, and is due to the influence of the combustible element, which has attained exceptionally high prices. The quantity of coal transported by railroads and canals shows an increase of production of 4,305,617 tuns over the previous year. The increase of consumption by the metallurgic industries is but 6,073 tuns, the smallness of which is accounted for by the stricter economy practised in all establishments on account of the high prices. The exports of fuel amount to 450,505 tuns.

The Latest British War Ship, the Inflexible.

(From a paper recently read before the Institution of Naval Architects, by Nathaniel Barnaby, Esq., Chief Naval Architect of the Royal Navy.

This is the ship which the progress of invention in artillery has finally driven us to resort to. Had the manufacture of enormous ordnance been stopped when the 35 tun gun was introduced, we might have been satisfied with the Fury, with her guns of this nature, and her 14 inch armor. But English artillerists were ready to make guns of twice 35 tuns, and foreign powers were known to be building ships to receive such guns.

There could be no question that we could not allow foreign seamen to have guns afloat more powerful than any of our own, however ready we might have been to allow them to defend themselves with thicker armor. Although, therefore, it was known that the ships in which these guns were to be mounted were to be protected by 22 inches of armor, thickness of armor was not made a ruling feature of the design of the first-class ship, which was to mark the next step in advance upon the Fury—but the first of the ruling conditions was that she should be able to mount the heaviest guns which could possibly be made now, and, by some easy modification in her construction hereafter, guns of twice that weight, when they can be manufactured. The other conditions were that she should have a speed of 14 knots at the measured mile, and that she should not exceed the dimensions and cost of preceding ships. It was found to be possible, in conformity with these conditions, to protect the hull by 2 feet of armor.

I may describe the Inflexible to you briefly in the following manner: Imagine a floating castle 110 feet long and 75 wide, rising 10 feet out of the water, and having above that again two round turrets planted diagonally at its opposite corners. Imagine this castle and its turrets to be heavily plated with armor, and that each turret has within it two guns of about 80 tuns each, perhaps in the course of a few years, guns of twice 80 tuns each. Conceive these guns to be capable of firing all four together at an enemy ahead or on either beam, and in pairs towards every point of the compass. Attached to this rectangular armored castle, but completely submerged, every part being 6 feet to 7 feet under water, there is a hull of the ordinary form with a powerful ram bow, with twin screws, and a submerged rudder and helm. This compound structure is the fighting part of the ship. Seaworthiness, speed, and shapeliness would be wanting in such a structure if it had no additions to it; there is, therefore, an unarmored structure lying above the submerged ship, and connected with it, both before and abaft the armored castle; and as this structure rises 20 feet out of the water, from stem to stern, without depriving the guns of that command of the horizon already described, and as it moreover renders a flying deck unnecessary, it gets over the objections which have been raised against the low freeboard and other features in the Devastation, Thunderer, and Fury. These structures furnish also most luxurious accommodations for officers and seamen. The step in advance has, therefore, been from 14 inch armor to 24 inch; from 35 tun guns to 80 tun guns; from two guns ahead to four guns ahead; from a hight of 10 feet for working the anchors to 20 feet; and this is done without an increase of cost, and with a reduction of nearly 3 feet in draft of water.

I cannot attempt to describe the numerous novel and interesting features of such a design, but I may say that no pains have been spared to protect her against under-water attacks, by the isolation of the independent engines, the subdivision of boiler compartments, and such further subdivisions as were possible with due regard to proper facilities for moving about. The result is that the ship is perfectly and easily workable, although she is divided into 127 water-tight compartments. My belief is that in the Inflexible we have reached the extreme limit in thickness of armor for sea-going ships. The temptation is always great to secure more and more power by the expenditure of ever increasing sums of money, but it is my conviction that we shall not, in any future ship, go beyond this expenditure. Some of the ironclads designed ten or twelve years ago cost more than the Inflexible will. In the Inflexible provision has been made both offensively and defensively, for an enormous increase in the powers of artillery without any increase in the cost of the ship.

Iron, published in London in the interest of the metal manufacturers, says: "American hardware and machinery are being imported largely into Germany. The handy shape, the new contrivances, and generally good workmanship, are features in their manufacture which find many friends in Germany and in Russia." This is no new fact to us, but it is the first time we have known an English journal to acknowledge it.

BLACK currant leaf tea is recommended for dyspeptics.

THE ENGLISH TELEGRAPHS.

BY GEORGE B. PRESCOTT.

CONSTRUCTION OF THE LINES.

The construction of the English telegraph lines is uniformly excellent, and reflects great credit upon the Engineering Staff, in whose hands it is placed.

The timber used for poles is generally larch treated with sulphate of copper, or red fir creosoted.

The creosoting is accomplished by the Bethel process. The poles are placed in an iron receiver and the air exhausted from them, after which boiling creosote oil is forced into them by pressure. This process greatly increases the durability of the wood, pine and spruce being thus rendered as lasting as cedar. The odor of creosoted poles in some places is said to be offensive, but no objection is raised against them in England on this account.

The poles are never creosoted until they have been stacked a sufficient length of time to be thoroughly dry.

The cost of creosoting includes a certain margin for loading into trucks, or on board a ship, which is always stipulated for when the contracts are made.

It sometimes happens that a parcel of poles are exceptionally dry, in which case they are given an extra two pounds of oil per cubic foot, costing from six pence to eight pence per pole additional.

When poles are used, which are neither prepared with sulphate of copper nor creosote, they are well seasoned, and then painted, the butt ends being slightly charred from the bottom to a foot above the ground line, and tarred.

The cross-arms are made of English oak, two inches thick and twenty-four and thirty-three inches in length, and are placed alternately on either side of the pole. A twenty-four inch cross arm is placed on the front of the pole a foot from the top, and then a foot lower down a thirty-three inch cross arm is placed on the back of the pole, and so on. In some cases as many as seventeen wires are carried upon a single line of poles of twenty-five feet in length, and no cross arm carries more than two wires, except on the double pole lines, where seven feet cross arms are employed, and four wires are supported upon each cross arm.

All the poles are provided with earth wires, or contact conductors for carrying the wet weather escape directly to the earth, instead of permitting it to leak into the neighboring wires. The earth wire consists a piece of No 8 galvanized iron wire, extending from the top of the pole to the bottom, and terminating in a flat coil attached to the foot of the pole, so as to expose as large a surface as possible to the earth. From the thick earth wire, branches, composed of No 10 galvanized iron wire, are carried in saw grooves sunk in the cross arms, and soldered to the insulator bolts. The work is performed at the factory before the cross arms are carried out on the line. The earth wires sometimes project above the top of the poles, and serve an excellent purpose as lightning arresters.

Great care is taken to keep the poles in a rigidly upright position; and in addition to placing them well in the ground and tamping the earth thoroughly around them, they are well supported with stays made of wire ropes attached to iron rods, which run into the ground about four feet. On straight lines and slight curves, where exposed to the winds, double stays are employed.

INSULATORS.

The insulators on the railway routes are uniformly of the Varley double cone brown ware pattern, and those upon the canals and highways of the single cone white ware, or porcelain. The Varley insulator is regarded as the best, but its greater cost has prevented its exclusive use.

THE CONDUCTORS.

The conductors employed upon the English lines are composed of zinc-coated iron wires of Nos. 4, 8, and 11 gage. The No. 8 gage—0·170 inch diameter—is the size in general use; the No. 4 gage—0·240 inch diameter—being employed upon a few of the long circuits between the more important points, while No. 11—0·125 inch diameter—is used for short lines only.

The method formerly followed of allowing the wires to pass freely through the insulators, and fastening them only at distances of half a mile, has been abandoned in favor of binding them at every pole, No. 16 charcoal wire being used for binding.

JOINTING THE WIRES.

Great care is observed in the jointing of the wires, which is invariably performed upon the line, no joints by the wire makers being permitted. The joint exclusively adopted is that known as the Britannia joint. This is made by slightly bending the ends of the two wires and placing them side by side for a distance of three inches, and binding them tightly together with No. 19 wire, and soldering them thoroughly. All joints are required to be soldered, whether the wire be old or new, galvanized or plain. The leading-in wires at the offices are insulated with gutta percha, covered with linen tape and varnished with a preparation made of linseed oil and Stockholm tar. These wires are re-tarred from time to time to prevent decay.

THE OVER HOUSE WIRES.

The over house wires are erected in spans, supported by iron poles attached to cast iron saddles, which are fitted at the ridge of the roof. The poles are light and well stayed by wire ropes. In London, cables containing 50 insulated wires are suspended by hooks from No. 8 iron wires, carried in the manner described above. The conductors in these cables consist of No. 22 copper wire.

At Newcastle-on-Tyne, a strand composed of seven steel wires, of No. 16 gage and 454 yards long, is suspended over the Tyne, and supports a cable containing fifteen conductors. The cables rest upon ebonite chairs attached to the rope by means of rings placed at distances of 12 feet apart.

The over house wires are used principally for lines which are leased by the Post Office Department to private firms or individuals for the transmission of messages on their own special business between offices, factories, etc., and which make a system of nearly 5,000 miles.—*Journal of the Telegraph.*

The Chemical Classification of Iron.

M. Frémy, an eminent French chemist who has recently been studying further into the metallurgy of iron and steel, thinks that it would be of much more advantage to founders and metallurgists if commercial iron, which is still classed according to its physical properties, should be known with reference to its chemical characteristics, that is to say, in accordance with the very small quantities of carbon, sulphur, phosphorus, etc., which it may contain, and which chemical analysis would reveal. This chemical classification has for some time past been in use in Krupp's celebrated foundery, where, in fact, nothing is left to chance. Chemists constantly analyze the crude materials and the fabricated products. The scientific and industrial element is intimately connected with the military. Artillery officers examine the manipulations and follow their every detail. Considerable sums are devoted to new experiments, made on the different alloys which may be suitable for cannon, and of each metal tried there is compiled a record which indicates its chemical composition, its advantages, and defects.

According to M. Frémy's investigations, it appears that the best metal for guns is neither iron nor steel, but some combination of both.

New Street Railway Locomotive.

A trial recently took place on the Manchester, Sheffield, and Lincolnshire railway, between the Grange Lane and Tinsley stations, of a tramway engine, constructed by the Yorkshire Engine Company, upon L. Perkin's patent system, for the Belgian Street Railway Company, Brussels. The novel features of this engine consist in its not emitting any smoke or steam into the atmosphere, and making comparatively little noise. The engine used steam at 500 lbs. to the square inch, and maintained this pressure by natural draft without any difficulty. The engine is compound, and expands the steam to the most economical limits, and then condenses it by means of two air surface condensers placed one on either side of the machine. The engine can be driven from either end, all the driving gear being duplicate to obviate the necessity of turntables. The engine accomplished a speed of fifteen miles per hour, drawing its full load up gradients varying from 1 in 200 to 1 in 80.—*Iron.*

Ballooning Extraordinary.

We recently published a note of Mr. Croce-Spinelli to the French Academy of Sciences, in which he indicated the belief that existence could be maintained at very high altitudes by aeronauts, if they should provide themselves with cylinders of oxygen, to be breathed in the highly rarefied atmosphere. M. Spinelli and Sivel have lately demonstrated the truth of this view by ascending in the *Etoile Polaire*, a balloon of 98,840 cubic feet capacity, to the immense elevation of 25,841 feet without inconvenience. The barometer level descended 11·7 inches, showing the above altitude, which is higher than that obtained by Gay Lussac and nearly equal to the point reached by Glaisher in his famous ascension. The thermometer at minimum marked 7·6° below zero Fah. The aeronauts, having taken with them all necessary instruments, made a number of valuable observations which, we learn from *Les Mondes*, will shortly be communicated to the French Academy.

Rain Cannonades.

Mr. Edward Powers petitions Congress to authorize a series of experiments to produce rain by artificial means, during dry seasons. This, he points out, may be accomplished by the firing of heavy artillery. In back numbers of the SCIENTIFIC AMERICAN, we have given many specific examples of rain storms which have followed heavy cannonades, in connection with various battles, during the late rebellion and European combats. There is reason to believe that the concussions of artillery, when sufficiently long continued, may have a condensing or aggregating effect upon the aerial vapors, and so induce the fall of rain. When the national debt is paid, or specie payment resumed, we think it might be well to burn some public powder as suggested by the present petitioner. But we move that the experiments be postponed until then.

A Chance for Investors.

The attention of parties desiring to invest in patents is directed to the announcement of Messrs. F. A. Hull & Co., manufacturers of the Danbury drill chuck, published in our advertising columns. This invention was fully described and illustrated on page 214, Vol. XXIX. of the SCIENTIFIC AMERICAN, and is a three jawed lathe chuck so constructed that all the jaws are simultaneously moved, in radial directions, by the revolution of a single right and left hand screw. The action is direct and positive, and, it is claimed, cannot clog, set, or in anywise get out of order.

We are informed that, since the placing of the article upon the market, it has met with a ready sale, and has given general satisfaction. The owner, desiring to dispose of the patent in order to devote his efforts to a more important enterprise, offers the same at quite a moderate price. Judging from the representations of the manufacturers, we presume that any one, having the requisite capital, will find the investment highly profitable.

THE ST. LOUIS BRIDGE.—The iron work is now complete, two weeks in advance of the contract time. A grand banquet has been given by the Keystone Bridge Co., contractors, to their employees, some 200 in number, at the Grand Central Hotel. The approaches will now be hastened to completion, railroad tracks laid, and carriage ways finished as speedily as possible; and the indications are that the bridge will be thrown open to public traffic at a much earlier day than was anticipated.

Recent American and Foreign Patents.

Improved Stone Pavement.

Andreas Eichenberg, Columbus, Ohio.—This invention is an improvement in stone road beds, and consists in arranging an upper vertical layer with a horizontal layer of flat stones. Both break joints to insure a greater degree of stability of the individual pieces in their normal position. Sand or gravel is used to fill the interstices.

Improved Belt Shifter.

Harrison W. Curtis, Philadelphia, Pa., assignor to Joseph L. Ferrell, same place.—This invention consists of an arrangement of the idle pulleys used for turning a driving belt out of a right line for a belt shifter by mounting them on a swinging frame in a line cutting the center of the angle between the two lines in which the belt runs.

Improved Grain Tally.

George P. Fitts, Jacksonville, Oregon.—A carriage moves forward and backward on guide rails between stop pins. A measure is retained in position on the carriage by pegs, and placed under the spout of the threshing machine, passing under cross bars for equalizing the grain in the same. The attendant moves the carriage in one direction, when one measure is filled, and empties the same while the other measure is filled from the spout. He then moves the carriage back, taking off the second measure when full, and repeats this operation, a registering device keeping a correct tally of the grain measured off, forming thus a very convenient self-acting apparatus for counting the number of measures.

Improved Thill Coupling.

J. Russell Little, Jamaica Plains, Mass.—This is an improved coupling for connecting thills or a pole with the axle of a carriage. A retainer, which is a small bar of iron, the ends of which work in slots formed in the yoke of an axle clip, when pushed into the forward ends of its slots, comes so far over the hook head of the thill iron as to prevent the said thill iron from being raised from the bolt. The retainer is held forward by a spring, which will allow it to be pushed back when it is desired to attach or detach the thills or pole.

Improved Bobbin Winder for Sewing Machines.

Moses Cook and Moses G. Cook, Ashfield, Mass.—This invention consists of a traverse mechanism for a bobbin winder for sewing machines, in which a drum with a reversing cam groove for working the traversing guide forward and back along the spool has the necessary slow motion imparted to it by a pawl and a friction griping strap. The pawl is worked by an eccentric on the bobbing turning shaft, which receives motion from the sewing machine wheel by a friction wheel. An adjusting screw regulates the extent of the pawl's movements so as to turn the drum fast or slow, according to the size of the threads, and the drum has a friction strap and spring for holding it when released by the griping spring. The bobbin has a spring on its spindle for fastening the thread to it at the beginning. The spool holder has a tension spring to regulate the unwinding of the thread from it.

Improved Combined Gang Plow, Cultivator, and Chopper.

John J. Watrous, West Point, Ga.—This invention has for its object to furnish an improved machine which may be readily adjusted for breaking up and bedding land, and for cultivating and chopping the crop. By suitable construction no tongue is required, which enables the machine to be turned in a very small space, and the chopper is operated by its advance. The chopping hoes may be conveniently adjusted to work deeper or shallower in the ground, as may be desired. The chopper may be easily raised from the ground, and thus prevented from working, and, when not required for use, may be detached. The plows may be adjusted to work shallower or deeper in the ground. Any desired number of plow beams may be used according to the kind of work to be done. Suitable construction also allows the rear ends of the plow beams to have a free vertical movement.

Improved Pitman.

George L. Jones, Vanville, Wis.—This invention consists in a pitman having a side-notched eye at each end, and a collar bushing combined with a pin secured at both ends by a nut. By this construction, a washer and the eye of the pitman can be forced farther upon the pins to take up the wear, by screwing up the nut.

Improved Machine for Making Animal Shoes.

William Hamilton, Fallsburg, assignor to James L. Lamoree, Grahamville, N. Y.—This invention consists of an anvil, trip hammer, and two side hammers, for hammering the shoe on the sides and edges. The anvil is flat on the top, and the hammer has a face which is the same form in outline as that of one side of the shoe to be made, but wider, so as to insure the hammering of the upper side of the blank over all its surface. The hammer is also beveled or inclined to vary the thickness of the shoe and produce the requisite shape for the top. One of the side hammers is shaped in respect of the contour of its face to correspond with the required shape for the outer edge of the shoe; the other is shaped to correspond with the inner edge, and both rest on the face of the anvil, and work toward and from each other to hammer the edges of the blank. These hammers perform their operation while the trip hammer is raised, and then move out of the way when the trip hammer falls, to give the necessary space for it between them which is required by the greater width of the hammer than that of the blank. The side hammers are operated by the helve of the trip hammer, one being connected directly to an arm projecting from its axis by a rod or shank, so as to be thrown forward when the hammer rises, and the other being connected to the same arm by a similar rod, and an intervening rock lever, by which it is moved toward the other side hammer by the same operation of the trip hammer. A bar is arranged on the trip hammer helve, to be acted on by the tappet wheel for raising the hammer, which said bar is jointed to the shank, and arranged to swing out of the path of the tappets to throw the hammer out of gear, and into their path to put it in gear again.

Improved Adjustable Catch for Latches.

George W. Burr, East Line, N. Y.—This invention is an improvement in the class of catches for door and gate latches, which are made vertically adjustable to accommodate the various positions the door or gate may assume in consequence of shrinkage, swellings, or other cause. The invention consists in combining a T-shaped catch with a slotted holder or guard plate, which is secured to the gate post by screws, so that by means thereof the catch may be clamped and held by friction at any desired point.

Improved Corn Plow.

Jeremiah H. Trout, Kingwood, assignor to himself and Isaac S. Cramer, Sergeantsville, N. J.—The shovel standard is made in two parts and jointed to allow an outward lateral movement to the lower part, with a spring on the outside and a lever on the inside. The draft bars, which are attached to the frame and run along through slots in the plow stocks, are connected to the stock by wooden pins, which are prepared, in respect of their strength, so as to break readily if the plows encounter too great resistance. The stocks are pivoted to the frame, so as to swing back in case the pins break.

Improved Ice Machine.

Thomas F. Peterson, Macon, Ga.—This invention consists of a boiler, condensing coil and cooling tank, receiver, freezing coil and tank, and pumps, all combined and arranged so that the ammoniacal gas expelled from the boiler by heat is compressed and condensed in the condensing coil, and then, after passing through the receiver, is let into the freezing coil, so as to expand therein and freeze the water in the tank by taking up the heat from it. It is then pumped directly into the boiler again for repeating the process, and takes with it the heat obtained in the freezer, and thus utilizes it instead of wasting it.

Improved Tube Welding Machine.

Joseph R. Lemen, Champaign, Ill., assignor to himself and T. G. Lansden, same place.—There is an anvil die and a hammer die for hammering down and reducing the end of the tube to be inserted in the piece to be welded on, or for receiving the ferrule on the end to be fitted in the tube. The anvil die has a part of its concave face made on a circle enough larger to equal the thickness of the metal of which the tube is made, so that the mandrel on which the tube is to be hammered, being entered in the end to be reduced, will hold the tube. When hammered by the die, it will rest thereon, so as to be suitably contracted and reduced, and not stretched or drawn out larger, as it would be if hammered on the mandrel alone. A shoulder on the under part of the anvil die forms the gage for length. The anvil die and hammer die for welding the tubes together are concave like the others, but of uniform size and shape from end to end, except a little convexity in the form of the hammer die, and the anvil die is of considerably greater length than the hammer die, to avoid angular indentations in the surface of the tube. They also have a mandrel. The tubes are presented from the right hand sides, and held by the other end in the hand of the attendant, to be turned and shifted about, as required.

Improved Watchmaker's Tray.

Lyman B. Milliken, Saco, Me.—The object of this invention is to furnish for the use of watchmakers a convenient and handy tray, which enables the workman to take down a watch movement and keep the different wheels, each with its corresponding bridge, pins, and screws, separate, so that there is afterward no trouble or delay in putting the movement together. The invention consists of a concaved tray of suitable shape provided with a series of concave indentations, and a central raised part with similar concavity, on which the plate is placed at different stages of the work, while the detached parts are arranged separately around the same.

Improved Seed Planter.

Simeon Smith, Jr., Newburgh, Tenn.—This invention consists in the combination, with a hopper and seed disk, of a beam having a recess filled with compressible material behind a spring, to keep the space full to exclude the grain, and allow the spring to work forward and back, to allow the grain to pass under the pad freely, and prevent any catching and cutting or breaking of the grain.

Improved Die for Forging Hammers.

James R. Lindsay, Chicago, Ill.—This invention consists in a device for cutting metal formed of two cutter bars connected by straps to a hand lever, and the cutters so shaped that bolts and rods of varying size, shape and configuration may be cut with equal facility.

Improved Knob Latch.

Walter Varah, New Haven, Conn.—A milled head being turned, a sleeve (by its spiral slot, in which is a pin) moves another sleeve inwardly or outwardly, thus throwing a stud into or out of the notch of hub. Thus the spindle may be connected with or disconnected from the hub that operates the bolt.

Improved Game Board.

Jacob Daring Spang, Dayton, O.—This is a toy race track upon which quite an amusing game may be played, serving, according to the inventor, to illustrate, on a small scale, the spirit and excitement of the turf. The race field track or platform is inclined when in use and surrounded by a mimic fence or enclosure. There is a starting station in which representative horses or balls are placed, the horses or balls being severally marked, and the number being optional. A bottom hinged gate is held across the outlet by cords which pass through holes in the platform or track. As soon as this gate is depressed the balls will pass out. They will first encounter posts, arranged in transverse rows, the individual posts of two rows not being opposite or in alignment, but each one occupying a median position between the two nearest posts of the opposite row. The balls will be retarded more or less by the posts, as well as diverted from their course, but will all come to the cross hurdle, which is inclined on the face that is opposite to the starting station. They next will move over this and pass through the three rows of posts to and over a second hurdle. In passing through the next section of the race course, two transverse rows of stables or stops will be met by some of the balls, which will be caught and stopped, while others will escape, though interrupted by another intermediate cross row of posts. They will now pass over another hurdle and more stops and finally reach the goal. Those which succeed in reaching the goal will not, however, arrive simultaneously, but successively, thus enabling the one arriving first to be accounted the winner and to score the highest number or count in the game, while others are allowed a count according to their relative time of arrival.

Improved Gas Stove.

Charles Witteck and William G. Steinmetz, New York city.—The base part of the stove contains four burners, and the draft passages are arranged above the same. The burner nearest the supply pipe produces the main draft through the passages, and is, therefore, allowed to burn continually with a full supply of gas, while the supply of the other burners is regulated by a suitable stopcock. A horizontal partition plate separates the lower part of the base from the upper part, which forms with the top plate the combustion chamber. The partition is vertically adjustable in slots. The admission of air to the combustion chamber is accomplished through the perforations along the upper part of the base. The quantity of air required for the full combustion of the gas is regulated by the higher or lower position of the partition by which the slots are partially opened or closed. The burners connect with the combustion chamber by pipes which open into metallic extension burners which extend along the side walls of the base. The air slots are provided with narrow slots, through which the blue heating flames of the gas issue. A large air hole is arranged in the base for the admission of a stronger current to the larger casing of the main burner.

Improved Ear Tube.

Henry B. Auchincloss, New York city.—This invention consists of a tube arranged in any seat of a hall, church, or similar public building, and having a funnel-shaped mouth, easily adjustable to suit the hight of the ear of the user. The lower end of the tube is designed to pass down through the seat, and be connected with a tin tube passing beneath the seats or floor, and passing up near the speaker's desk, where it should terminate in a funnel-shaped mouth.

Improved Cam Slide for Sewing Machines.

Andrew Aird and William Randel, Troy, N. Y.—This invention consists of a block of steel or other material on the end of the needle arm which works in the cam groove, so constructed as to slide in the groove as a substitute for the roller commonly used. The block is divided into two separate pieces, whose exterior faces are shaped so as to allow them to slide freely along the varying angles of the cam, and the interior faces are made to permit an independent oscillating motion of each part on the stud of the arm. The invention also consists of a spring between the blocks to keep them apart to take up the slack that may occur by wear, and cause them to fill the groove at all times.

Improved Lamp.

Bernard Fasta, Milwaukee, Wis.—This invention is a kerosene or petroleum lamp having a weighted sheet metal base, converging, and provided with a flange having a polygonal periphery suspended above the plane, which supports the base of the lamp. This prevents the effect of an overturn by catching upon the table or other subjacent article. Just after the center of gravity has passed beyond the base. A rebound is created that throws the lamp back, and causes it to regain its equilibrium, or affords the person who has caused the accident time to seize it before damage is done.

Improved Hoof Trimmer.

David Booker and Cornelius N. Tosh, Palmyra, Ill.—This is an improved hoof trimmer, by which the horse's hoof may be neatly pared on the flat part, cleaned from the dirt, and trimmed at the outer edge, so that the hoof is quickly and fully fitted to the shoe. It consists of a main cutting knife at the end of a strong bar, with handle end. The knife is curved outwardly to a point, and serves with its end for paring and cleaning the hoof, while the lower part is used, in connection with a second smaller curved knife, which is pivoted to the larger, and operated by pivoted connecting rods and hand lever, like shears, for trimming the hoof.

Improved Spring Shank for Boots and Shoes.

Emil Briner, New York city.—This is an improved spring shank, which is not only stronger at the point of greatest strain, and more flexible at the fore ends, but which may also be adjusted to various degrees of elasticity, as required. Two spring shanks, of equal length and strength, are spread at the front ends, and are connected by a central pivot. Holes are provided at the heel ends for attaching them to the heel and adjusting their front ends without weakening the heel part.

Improved Plow.

Edward Walter, Salisbury, Mo.—The upper part of the standard is bifurcated, the main arm being pivoted to the beam, while the curved backward extending arm passes up through the beam, and is held thereon by means of a nut and washer. The beam is raised or lowered as the nut is turned, and thereby the share elevated or depressed accordingly. The increased strain which the beam has to bear thereby is met by a metallic strengthening rod, which is pivoted to the main arm of the standard, and extends below the beam.

Improved Bag Holder.

Erasmus D. Hix, Payne's Depot, Ky.—This is a bag holder for filling wheat, corn, and other cereals into sacks in the granary; and it consists of a strong supporting standard, in which slides adjustably the end of the curved steel arms which spread sidewise, and are bent at their front extremities, under suitable angles, into a connecting spring hoop, over which the hem of the bag is attached, and firmly secured by pointed hooks at the front end of the hoop.

Improved Organ Coupler.

Charles W. Fossler, Adeline, Ill., assignor to himself and Christian Fossler, same place.—This improved organ coupling device consists of a pivoted platform, to which the coupling arms are attached, bent in such shape that, on throwing the platform up, the keys will come in contact with the arms when depressed, and thereby couple the corresponding pins to those originally depressed by the keys.

Improved Grading Apparatus.

Ole Matson, Moline, Ill.—This is an improved apparatus for moving earth from one place to another, in grading roads, lawns, etc. The driving shaft revolves in bearings in a frame staked to the ground, and is connected by bevel gearing with a pulley around which passes an endless chain. The chain also passes around a grooved pulley, pivoted to one end of an arm, the other end of which has a hole formed through it to allow it to be placed upon a post. The other part of the chain is held out of the way by passing around a grooved pulley, pivoted to the end of a bar, upon the outer end of which is formed a hook or eye to enable the end of a rope to be conveniently attached to it. The rope passes over a pulley pivoted to a bow, which is passed over the end of a screw post. The line is held in place upon the pulley by a line holder, which consists of a wing pivoted in the fork of a plate, in such a way that the edges of said wing may shut down against the arms of the plate, and thus hold the said line. The line holder thus holds the endless chain in place, and enables any slack to be conveniently taken up. Scrapers, made of a single plate of iron, are provided with holes to receive wooden handles, and with ears to receive the draft chain, which is connected with the endless chain. The scrapers may be filled and emptied at any required points of the circuit of the endless chain, and the position of the said chain may be readily shifted by moving the screw posts from one place to another.

Improved Apparatus for Feeding Steam Boilers with Air.

Martin E. Bollinger, Littlestown, Pa.—An air pipe leads directly from the feed pump to the boiler through a heating coil surrounding the fire, to be used when a steam heater cannot be used, as on locomotive engines. This, with the air feed pipe, is provided with a check valve and stopcock, to let off the pressure for a short time when starting. The steam pipe enters the steam dome above the water line. The pipe for the circulation of the water is tapped into the boiler shell, near the smoke stack, below the water level, and into it again at the front above the water level.

Improved Variable Exhaust Valve.

David H. Seamon, New London, Conn.—The valve is in the form of a hollow truncated cone reversed, and is seated on the upper end of a tube. Guide rods, rigidly connected with the valve by means of arms, pass through ears of the tube, and are connected with a semicircle on the end of a lever which extends back to the engine room, so that the valve may be operated by the engineer or fireman, as occasion may require. For producing what is known as a "sharp" exhaust of steam into the chimney, the valve is kept closed, so that all the steam passes through the valve. For a less sharp exhaust, the valve is raised so as to make an annular opening between it and the seat. By raising the valve in this manner, the annular opening is graduated in size to suit the exigencies of the case, the lever being arranged so that the valve may be set and held in any desired position.

Improved Seal Lock.

Daniel T. Casement, Painesville, O., at present residing at the Fifth Avenue Hotel, New York city.—This invention consists in connecting a push pin and seal punch by a rock lever, so that, when the former is forced in to disengage the hasp, the other will be thrust out through the seal; also in constructing the end of the hasp with a notch of peculiar form, corresponding to that of one end of the locking bolt. The fastening is attached to the door by means of a screw bolt, and has a lip fitting over the open end of the card-holding frame. The bolt passes through a slot in the sliding hasp. The frame for confining the seal is provided with rough and jagged notches and points to make it impossible to cut out the card and then fit in another. A glass seal may be used as well as the paper card, if preferred, and, when used, the seal punch may be dispensed with, as the glass will have to be broken to work the push pin; and when the lock is adjusted for the use of the swinging hasp, the mouth will be suitably arranged for allowing the broken pieces of glass to fall out.

Improved Device for Checking Horses.

Edwin R. Ray, Columbus, Ky.—Two bridle check rein pulleys and a pulley for a hand rein are made in one piece, having through their center a shaft. The ends of the shafts are made fast to the hames, reaching from one side to the other, with the pulleys revolving thereon. The check reins of the bridle are attached, in any suitable manner, to the first pulleys. To the other pulley a hand strap or rein is attached, and is wound around it. The difference in the diameter of the bridle and strap pulleys gives the driver a purchase on the bit, which controls the horse.

Improved Machine for Upsetting Tyres.

Mathias Schon, Englishtown, N. J.—This is a machine for upsetting or shortening wagon tyre or iron bars of other descriptions that may be operated by one man. A stand has on each side a bar. These bars support a stationary head and guide a hinged head. The stationary head is also attached to the edge of the stand. These heads are placed crosswise of the bars, each having a flange, against which the adjusting blocks are placed. Gripe jaws, one on each of the heads, have levers, and are connected by the jointed bar which is attached to an operating jaw. By working the latter, power is applied to one of the gripe jaws which first strikes the tyre, when the other jaws are also caused to gripe the tyre. The tyre is in a heated state, between the two jaws, and is firmly held, so that it can have no longitudinal motion, by the operator, while, with his left hand, he grasps a cam lever, and forces the movable jaw and head toward the other jaw. This movement causes the jointed bar to turn outward on its hinge and upsets the tyre. The anvil is fastened between the two bars, and the tyre rests thereon. In case it bends upward, it may be forced down with a hammer.

Improved Door Bell.

David Mosman, West Meriden, Conn.—A gong is screwed upon the end of a standard attached to the door. The standard is made with an offset, and to its angle is pivoted the hammer. The short arm of the hammer projects down into a slot in the shank of the standard, and to its end is pivoted a rod which passes out through the door and has a knob. Upon the inner part of the rod is a nut, which strikes against the base of the bracket to limit the movement of the rod, and thus regulate the force with which the hammer strikes the gong. A washer prevents the said nut from being turned upon the rod, and thus moved out of place by the concussion.

Improved Gate.

George C. Crum, Barr's Store, Ill.—This invention consists in a novel and very simple mode of opening a gate from the back of a horse or the inside of a vehicle without alighting or indeed any personal inconvenience.

Improved Carriage Curtain Fastening.

John Bannihr and Daniel H. Rhodes, Hempstead, N. Y.—This invention is a fastening for carriage curtains which will hold securely, and is not liable to become accidentally unfastened. Small slotted metallic plates are attached to the curtain at suitable points on the sides and bottom. These slip over buttons which are pivoted to the frame. The latter has a concave outer edge into which the inner rounded edges of the buttons fit, so as to press the curtain down in its place. Securing the button, after the slotted plate is slipped over it, holds the curtain securely.

Improved Universal Joint.

Hiram Pitcher, Fond du Lac, Wis.—This invention relates to apparatus used for conveying power and motion by means of rods from the motor to the machinery driven; and it consists in a universal joint formed of a cup piece and a head piece, with intervening rollers. The outer ends of the rollers are made conical, to prevent undue friction. The rollers revolve independently of each other as they are touched by the head, and this allows the two coupling rods to be placed at an angle with each other without increasing the friction. The purpose for which this joint is more especially designed is for connecting horse powers with thrashing machines.

Improved Vehicle Wheel.

Benjamin Pearson and Horace W. Pearson, Newburyport, Mass.—The joint is made so far from the middle of the space between two of the spokes that the end of one segment will be supported by the spoke, and by cutting the ends or making the joint on a bevel, the other segment is caused to act as the key of an arch on the other segment, and be thus supported. While the joint is made beveling, the bolt is passed through at a right angle with the felly, and through the center of the bevel joint. This position of the bolt prevents lateral movement of the ends, and obviates the necessity of doweling the ends together.

Improved Shoemaker's Shoulder Tool.

William L. Peters, Oxford, Mass., assignor to Charles I. Rawsen, of same place.—This invention consists of a shoulder tool for smoothing and finishing the edges of the sole and the ball edges of the heel, in which file-cut faced disks of hardened steel are combined with the rubbing blade, so as to scrape, smooth, and finish the edges at the same time the rubber is used. The disks are adjustably attached to be shifted around as they wear dull, and several disks of different thicknesses are constructed alike, so as to be interchangeable for soles of different thicknesses.

Improved Mechanism for Actuating Punches.

Warren Lyon, Mamaroneck, N. Y.—This invention consists in a wheel provided with radial notches in the side of its rim, a lever provided with a projection upon its side, fitting into said notches, and a loose collar, in combination with the gearing by which the machine is operated. By operating the lever the wheel is turned in either direction, which gives motion to the gearing. The peculiar construction of the lever and notched wheel enables the said lever to be readily shifted at the end of a stroke to obtain a new purchase, so that immense power may be applied by a series of successive efforts until the desired effect has been accomplished. This power, when applied to a punching press, enables the punch to be readily forced through a bar five eighths inch thick, or even thicker.

Improved Operating Mechanism for Hatches.

William S. Harris, Brooklyn, N.Y.—This invention relates to the hoisting and lowering apparatus employed for simultaneous opening and closing a series of hatch covers by a windlass or other power; and it consists of the rope, chain, rods, or other device employed for connecting the hatch covers to the power apparatus, extended directly from one cover to another, from the topmost downward, and passing through a notch or eye in them, of peculiar construction. There is a knot above and below the covers, to prevent the rope from running through the eye without effect, said knots being placed such a distance apart as to allow of such little play of the rope as may be needed to each cover. The object is to simplify the arrangement and cheapen the cost of such apparatus.

Improved Log Turner.

William E. Hill, Erie, Pa.—This is an improved log turner, which is applied to the log, and the rolling motion of the log is produced by the continuous motion of the spur wheels without tearing or injuring the same, while allowing at the same time the immediate interruption of the rolling, and the placing in position of the log for sawing; the rolling mechanism is then carried back to rest on the supporting frame out of the way of the saw. Wheels with pivoted spurs are provided for simultaneously raising and rolling the log, which wheels are keyed fast to a shaft turning in bearings of a shield-like frame, which incloses the gear wheels and brake mechanism of the log turner. The casing, with its spurred wheels, is supported on a supplementary cushioned frame and thrown into gear with the driving power by suitable lever mechanism, which carries the wheel up toward the log. The brake is applied by a yoke with eccentric, band, and lever connection to the upper wheel, its lever serving the twofold purpose of operating the brake and forcing the log into exact position for the saw on the carriage, and throwing the log turner into gear.

Improved Music Leaf Turner.

George Sweatt, Lebanon, N. H.—This invention consists of fingers, for turning the sheets, provided with a circular toothed base, and arranged, one above another, on a vertical pivot in a chamber, in or below the music board, along which a toothed bar is made to slide for throwing the fingers, said bar having a row of teeth for each finger arranged to operate them successively. There are foot treadles, for sliding the toothed bar forward and backward with pulleys, to be turned by them, and cords connecting said pulleys with the bar to move it by being pressed on them, one treadle and pulley being to pull the bar to the right, for turning the leaves from right to left, and the other being to turn them back again, when it may be required to do so. The music rack is adjustable forward and backward relatively to the fingers, for turning the leaves, and is held up to them by springs, so that the leaves between are always held in the proper relation to the fingers, whether the book be thick or thin.

Improved Portable Fence.

James M. Wallis, Rocky Comfort, Mo.—This is an improved stay for fences. One brace is set in an inclined position and extends to the top of the fence. The foot brace, the lower end of which rests upon the ground, is attached to the other brace, near its middle point. To the braces are attached vertical bars. When the stays are applied to a rail fence, the foot brace is attached in such a position that it may support the bottom rails of the fence at the proper distance from the ground. In this case two vertical bars are used, and the ends of the rails of the adjacent panels are placed upon each other alternately. The top rails are placed above the brace first mentioned, a block being notched and fitted into the space between the brace and vertical bar for the ends of the top rails to rest upon.

Improved Dumping Wagon.

Charles Campbell, Cambridge, Wis.—The hind part of the bottom is attached to a roller, suspended under the box sides. The front end rests on a cross bar fastened to the box sides, and the rear end is held up by a hook. The hounds of the hind truck are fastened to the cross bar. The fore part of the bottom is attached to another roller suspended under the box sides, and rests at the rear end on the reach. This reach is connected to the cross bar, so as to be detached when the load is to be discharged to let the hind end of the fore part of the bottom down. The connection is made by a staple which passes up through the bar so as to be fastened by a long rod which slides in from the side of the wagon box, so that it can readily be put in and taken out.

Improved Apparatus for Puddling Iron.

Joseph Davies, Knoxville, Tenn.—This invention consists of two puddling tools, one revolving and the other having a reciprocating motion within a rotary furnace. It is believed that, by the rotation of the hearth in this manner, the puddling tools can be worked by power in a simple way, because the iron is brought to them by the hearth; and by using power driven tools, the puddler's labor is much lessened.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Models made to order. H.B.Morris,Ithaca,N.Y.

A thorough Machinist and Draughtsman, who is an experienced foreman, desires employment. E. L. Johnson, Philadelphia, Pa.

Microscopes, Spy Glasses, Lenses. Price List Free. McAllister, Optician, 49 Nassau St., N. Y.

The recently discovered Evergreen, Frugiferous,Creeping Pine. For particulars, address (stamp enclosed) J. F. Lewis, Wyoming, Luzerne Co., Pa.

A Machine to cut the edges of Band Iron, making them straight, is wanted by the Wheeling Hinge Co. See advertisement in this column.

Bradley's Croquet has the Patent Socket Bridges. Examine this improvement.

For Sale—Several Screw Machines of different Sizes, cheap; also, a second hand Press. Write, for particulars, to A. Davis, Lowell, Mass.

To Iron Founders—State Rights for Sale of a Valuable Patent, an Attachment for Boilers. Has been in use several years, and saves from 15 to 30 per cent of fuel. Circulars, with testimonials, sent free. Address P. O. Box 4312, Boston, Mass.

Nail Maker's Bead and Face Stones—Best in use. J. E. Mitchell, Philadelphia, Pa.

The Catechism of the Locomotive (which is now being published weekly) in the Railroad Gazette of April 18, will contain engravings and descriptions of the Steam Whistle, Throttle Valve and Grates, and accurate engravings, made to a scale of ¾ in. to 1 ft., of 8-wheeled locomotive by the Grant Works, 8-wheeled, 10-wheeled, and Mogul Locomotive by the Baldwin Works. Single copies 10 cts. $4 a year; $2 for 6 months. Address The Railroad Gazette, 73 Broadway, New York.

A practical Machinist, competent by experience, would travel and sell machinery for some responsible company. Address F.S.Williams, Binghamton,N.Y.

Removal—L. & J. W. Feuchtwanger, of 55 Cedar St., have removed to 180 Fulton St., two doors above Church St., New York.

Position Wanted—To Teach Chemistry and Physics. Salary $1500. Address A. M., Station H, N.Y.

Furniture Men and others—A new patent convertible cradle and crib; also two other patents in a wood article. The whole or parts will be sold for a small amount in either patent. Reed & Co., 335 Broadway, New York.

Chemicals, Drugs, and Minerals imported by L. & J. W. Feuchtwanger, No.180 Fulton St., removed from 55 Cedar St., New York.

Burglar Alarm wanted by N. W. Ader, Bainbridge, Ind.

Forges—(Fan Blast), Portable and Stationary. Keystone Portable Forge Co., Philadelphia, Pa.

Patent for Sale—The best Burglarproof Door Lock in the world. F. Gyss, 126 Greene St., N.Y.

Small turning in metals done to order by Hendey Brothers, Wolcottville, Conn.

Steam Whistles, Valves, and Cocks. Send to Bailey, Farrell & Co., Pittsburgh, Pa., for Catalogue.

For Sale—A "Burdict" Bolt heading Machine, improved—perfect order—at a low price. Address C. E. Hunter, Hinsdale, N. H.

Patent for Sale—Patent Knife, Pen and Penholder Combined. Has paid, and will pay, large profits. Address Patentee, Box 143, Hinsdale, N. H.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $5. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

The most Perfect Power Hammer—Exclusive Right for sale, or built on Royalty. Particulars of Samuel Pennock, Kennett Square, Pa.

Engines 2 to 8 H.P. N.Twiss,New Haven,Ct.

Steptoe, McFarlan & Co., No. 212 to 220 West 2d St., Cincinnati, Ohio, manufacturers of Woodworking Machinery and Machinists' Tools. Send for circulars.

Steam Boiler and Pipe Covering—Economy, Safety, and Durability. Saves from ten to twenty per cent. Chalmers Spence Company, foot East 9th St., N.Y.

Pattern Letters and Figures, to put on patterns of castings, all sizes. H.W.Knight,Seneca Falls,N.Y.

For best Presses, Dies and Fruit Can Tools, Bliss & Williams, cor. of Plymouth & Jay,Brooklyn,N.Y.

All Fruit-can Tools,Ferracute,Bridgeton,N.J.

Brown's Coalyard Quarry & Contractor's Apparatus for hoisting and conveying materials by iron cable. W. D. Andrews & Bro., 414 Water St., New York.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

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

Temples & Oilcans. Draper, Hopedale, Mass.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

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For descriptive circulars, and terms to Agents of new and saleable mechanical novelties, address James H. White, Newark, N. J., Manufacturer of Sheet and Cast Metal Small Wares.

Paragon Gold Quill-Pens—The best in use. C. M. Fisher & Co., 102 Fulton Street, New York.

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Spools, Button Molds, and all small turned goods made by H. H. Frary, Jonesville, Vt.

Answers to Correspondents

T. D. W. can best adjust the pea of a scale by experiment with a known weight.—J.G.P. will find an explanation of the wire rope and sheave mystery on p. 191, vol. 29.—J. H. will find directions for waterproofing canvas on p. 122, vol. 27. Varnish for chromos is described on p. 154, vol. 27. A solution of gum dextrin is sometimes used on postage stamps.—E. H. will find directions for galvanizing wrought iron on p. 202, vol. 30.—K. will find a recipe for fine shoe polish on p. 73, vol. 26.—W. W. P. will find that marine glue, described on p. 262, vol. 28, will answer his purpose.

A. R. B. asks: What elements are removed from the soil by the growth of cabbage? A. The outer leaves of perfectly ripe cabbage are composed of albuminous substances, 1·16 per cent, woody fiber, gum, and sugar, 5·0 per cent, ash, 2·2 per cent, water, 91·1 per cent. The heart leaves contain a little more water, and a little less of the other constituents. It removes potash, lime, phosphoric and sulphuric acids principally from the soil. These acids are in combination with the various bases which are absorbed by the growing plant.

A. L. C. asks: 1. If I take a tube of suitable length and diameter, and on one end put a double convex lens of about 6 inches focus, and in front of this end a mirror, at the other end a triangle, is there any way by which I can project that triangle on to the mirror, so that I may be able to see it from the outside? A. Not when arranged in the manner stated. 2. Can you give me any information in relation to the different species and character of the marine vegetation of the Great Banks of Newfoundland? A. See the reports of the exploring expeditions sent out by England and the United States Government. 3. What is the best theory on the physical constitution of the sun? A. The sun is supposed to consist of a central solid or liquid mass, which is surrounded by two or more shells or envelopes, which consist of the vapors of the various metallic and other bodies constituting the sun, and of gases, especially hydrogen in a state of intense ignition.

F. T. H. asks: 1. Can I prepare ammonia arsenite as a reagent? A. Ammonia arsenite, $(NH^4)^2O,As^2O^3$, is produced, according to Pasteur, when very strong aqueous ammonia is poured upon arsenious oxide. It exists only in contact with ammonia, quickly giving off ammonia in contact with the air. It forms a yellow precipitate with silver salts. 2. What degree of heat can I obtain in an evaporating dish on an oval copper water bath over a Bunsen burner? A. You cannot obtain a heat of over 212° Fah. in an ordinary water bath, whatever the containing vessel and the source of heat may be. 3. What are the specific gravity, hardness, and other mineralogical properties of borate of lime? A. The specific gravity of borate of lime is between 2·81 and 2·98. It is sufficiently hard to scratch fluate of lime, or calcium fluoride. Its color is white, shaded with gray or green, and sometimes milk white and translucent or nearly transparent. One variety is gray, white, and reddish in concentric stripes. Before the blowpipe it swells into a milk-white mass and then melts into a transparent glass, colorless, or sometimes pale rose colored. It is composed of lime, silex, boracic acid, and water.

J. T. asks: 1. What will dissolve ultramarine to make writing fluid? A. Ultramarine can be suspended in a mucilaginous liquid, like ordinary mucilage, for the purpose you mention. 2. Will soluble glass dry on an iron surface exposed to friction? A. We do not advise the application of soluble glass where metallic surfaces rub together. 3. Will a long belt transmit more power than a short one? A. No.

S. B. says: 1. We have a cellar heater, with three hot air pipes heating five rooms; one of the pipes runs into a flue which heats two rooms on the first floor and one on the second floor. There are no dampers in the hot air pipes or in the flue. When we want all the heat in the two rooms on the first floor, we close the registers on the other pipes and the upper part of the flue, which leaves a vacuum in those pipes and the flue. I think that, if we had dampers in pipes in the cellar by the heater, and one in the flue right above the register on the first floor, we should get more heat. A. It is usual to provide dampers in the hot air pipes near the furnace in the cellar; and you would save some heat by having them, namely, that portion which escapes from the pipe not used, by radiation from it, and by the register in the room not heated, which seldom or never closes tight. 2. Can you inform me what the sizing that plumbers put on the pipes, preparatory to wiping the joints, is made of? A. It is prepared with lampblack and glue boiled in water, with sometimes a little lager beer put into it.

A. B. asks: What is the value of antimony, what is its use, and where is it mostly found? A. Alloys of antimony, with lead and tin, are largely used for type metal. An alloy of 90 parts of copper, 5 of zinc, and 5 of antimony is used for sockets in which the steel or iron pivots of machinery are at work. The gray antimony ore is found in the Hartz mountains in Germany, and also in Cornwall, Auvergne, Hungary, and Borneo. The oxide of antimony is found in Algeria and is smelted in France. Red antimony, which is a compound of oxide and sulphide of antimony, is found in Tuscany. The mode of working the ores is too long to be given here.

A. E. F. asks: Will you give me a recipe for making a good quick dryer for oil paint? A. Linseed oil 1 gallon, powdered litharge ¼ lb.; simmer with frequent stirring until a pellicle begins to form, remove the scum; and when it has become cold and has settled, decant the clear portion. This is used by house painters.

E. L. D. asks: How can I remove enamel from gold without heating? The enamel is the blue kind used for ornamenting jewelry. A. The enamel to which you refer, being a species of glass, can be removed without heat by the action of hydrofluoric acid. This is most easily applied by wetting the enamel with sulphuric acid and then sprinkling over it some finely pulverized fluor spar (calcium fluoride), by which means hydrofluoric acid is set free and attacks the glass, the gold not being affected by either acid. The sulphuric acid should be slightly warm, and care taken to avoid the fumes and getting the acids on the hands, as hydrofluoric acid is very corrosive to the skin. Several applications may be necessary. Wash off and dry after each application.

P. H. W. says: To heat water I placed a copper tube in a coal stove; the tube is 13 inches deep, 5½ inches diameter, with a ball made on the circle of same diameter. It was filled nearly full; and while boiling rapidly, I attempted to take it out, but the steam was rising so fast that I could not place my hand near to it. I then poured a little cold water into it, which checked the steam entirely, so that there was no visible steam arising from it. I took it and set it on a cold plate of iron, where it stood 6 or 8 minutes, then took it by the ball again, holding it two minutes. There was no sign of steam arising from the water, but as soon as I attempted to pour it out, the steam burst forth in such volume that it was only with the greatest effort that I succeeded in keeping it from scalding my hand. Did the cold water remain on the top, and at a lower temperature, condensing the steam, until poured off? A. The explosion was caused by the power which water in a quiescent state has of retaining a large amount of steam, and setting it free when shaken or suddenly agitated.

F. M. B. says: 1. While on the roof of my house, watching the chimney burning out, I noticed a stream of electrical fire or light passing on to the point of the platinum arrow or weather vane attached to the lightning rod and passing off from the opposite end. I touched the point of the arrow with my hand and the light ceased; on removing my hand, the electrical current was again established. I reversed the arrow in direction, putting the point opposite to the wind; again the light ceased. On letting go of the arrow, the point turned toward the wind and the electrical light was resumed again. At the time the wind was blowing from southeast, rain and sleet were falling, and the barometer was low. The following questions arise: Does electricity go with the wind? A. Atmospheric electricity is caused by the advancing clouds. 2. No lightning being seen, was this voltaic electricity? And if so why did not the current pass from the arrow to the lightning rod, and thence pass to the ground instead of passing off from the reverse end of the arrow? All the connections of the copper rod are good and the lower end is nine feet in the ground, which is moist. The rod near to and below the arrow is coated with soot from the chimney: would this prevent the flow of electricity to the earth? A. It was not voltaic electricity.

J. D. S. says: I am informed that there is a method by which tracings made on tracing muslin can be reproduced on prepared white paper. I believe a negative is prepared directly from the tracing, and afterwards printed on the prepared paper by exposure to the sun. What solution is used, or how is the negative obtained? A. The drawing is properly mounted in front of the camera, and a photograph is taken in the usual manner. This negative is then employed for solar printing by direct contact with sensitized paper.

W. says: In Dr. Hayes' "Open Polar Sea," he states that he procured sufficient fresh water for the crew of his schooner by boiling sea water in a common tea kettle, using a cask as a condenser. Is it so easy a process to purify sea water? If so, what is the use of the expensive apparatus sold in Europe for this purpose? We hear of the crews of vessels perishing of thirst. Surely, if there is a simple process of purifying sea water, it should be made widely known. A. There is no difficulty in procuring water free from saline matter in the manner described. But water, so distilled, differs from natural water by containing no air and being free from certain small amounts of mineral matter, which make spring water lively and palatable. The aeration and filtration of distilled water complicate the apparatus and render it expensive.

G. W. asks: Can wood be petrified, and how is it done? A. One method is: After the tree is felled, place the root end in a solution of sulphate of copper and acetate of iron. After remaining for a few days, the wood is completely saturated. Another method is to place the wood in a vessel from which the air is exhausted; sulphate of iron or alum solution is then let in and pressure applied. The wood is then partially dry, and afterwards it is treated with a solution of chloride of calcium in the same manner. Or the wood can be impregnated with water glass, and then treated with an acid.

C. E. Y. asks: Can metallic zinc be obtained from the muriate of zinc, or can a coating of zinc be deposited on iron or other metal from the muriate of zinc? A. The muriate of zinc has been employed, but is said to possess no peculiar advantage.

G. C. H. says, in reply to J. N. W.'s query as to the excrescence on the plank: The board was recently brought to Utica and shown to the scientific men of the place, among others to Mr. S. W. Chubbuck. He immediately said that it was the result of compression; and to convince the others, he selected a piece of clear pine, laid it upon a block of iron, and struck it one blow with a hammer. It was then placed in a vise and sawn down through the edge; immediately the compressed wood bulged out and assumed the shape it now has. I enclose you the piece. I think that the original one can be accounted for in the same manner. The tree either struck a stone or other substance in falling, and was thus indented at that spot, or the board has been prepared for a joke. A. Mr. Chubbuck has certainly succeeded in producing an appearance similar to that of J. N. W.'s board, and his explanation is correct.

S. asks: How thick is the earth's surface or crust? At what depth in the earth will it be hot enough to fuse all known substances? A. It is ascertained that at a depth of a very small proportion of the earth's diameter, all known substances would be in a state of fusion. Experiments made at Creuzot, France, led the observers to believe that, at a depth of 50 miles, the heat would reach 4,000° Fah., more than sufficient to melt platinum. As to artesian wells, see p. 241, vol. 29.

E. E. asks: What can I use to make a joint steam tight? A. Use equal parts of white lead and red lead, and add as much boiled linseed oil as is required to make a putty.

G. N.—Animal vaccine virus can be obtained at all times and in any quantity from Frank P. Foster, M.D., Director of Vaccine Department, New York Dispensary, 137 Center street, New York city. It is furnished in three ways: On slips of quill, costing each 25 cents; in capillary tubes, costing $2 each; and in entire crusts, costing $3 each. The first is the most handy to use. The method of using it is so simple that it is within the power of every one to vaccinate: Bare the arm to be vaccinated to the shoulder, and, taking a large needle, scratch the skin two inches below the shoulder in cross lines until a place the size of a three cent piece looks watery; then dip the quill into warm water for a second, and rub the smaller end upon this spot for a few seconds. Allow the arm to remain bare for some minutes until the spot seems dry. Each quill is sufficient for one person; but the capillary tube contains sufficient virus, in a liquid form, to vaccinate ten or twelve persons. It is necessary to blow the lymph out of the tube upon a knife blade in minute quantities at a time, and rub the knife blade upon the spot prepared as before described. The crust may be macerated in water and then applied. Virus is prepared for use in this way: When the pustule upon the cow is full of matter, the small quills are dipped into it, allowed to dry, and rolled in tin foil. The capillary tube is simply a very fine glass tube, one end of which is dipped into the matter; the matter will nearly fill the tube, by what is called capillary action of the tube. Then the portion of the tube not filled with matter is broken off, the two ends sealed up with sealing wax, and the tube is now ready for transportation. Vaccine virus from the cow is the purest and most efficient known, first, because young and healthy heifers are the only animals from which the virus is taken, and, secondly, because it can always be obtained fresh from the physician above mentioned. A letter, addressed to him enclosing 25 cents or $2, will be answered by return post by a letter containing the quill or tube.—S. H. C., M.D.

W. H. J. asks: Will a siphon draw water 100 feet high, if it had 150 feet fall? A. No. The rise of water would be less than 34 feet.

M. C. asks: Is there any machinery for utilizing the power of water, as it is ordinarily laid on in dwelling houses? A. Yes. Water engines and small turbine wheels, for driving sewing machines and other purposes, are in the market.

E. L. S. asks: 1. Is it possible for gas to escape from a burner when lighted, unconsumed? A. No. 2. Is it the revolution of our earth which produces the atmosphere? A. It does not produce the atmosphere, but causes certain great movements in the atmosphere, such as the trade winds.

D. C. S. asks: Has heating with hot water been adopted in this country? A. There are several firms in this city who make heating by hot water a specialty, as also some in the other principal seaboard cities, and who have put their apparatus in a great many buildings, both public and private. The expense, however, of heating by this method is fully as great as that of steam.

E. M. B. asks: 1. What are the most powerfully explosive substances or compounds known, that can be obtained in large or inexhaustible quantities? A. Gun cotton, nitro-glycerin, dynamite, and dualin. One part by weight of gun cotton is equal in projectile power to 5 parts of gunpowder; 1 part of nitro-glycerin to 8 parts of gunpowder. 2. Which of said explosives are the cheapest per unit of explosive power? A. Nitro-glycerin. 3. Which of said explosives burns or explodes with the least smoke or ashes? A. Gun cotton should leave no residue. 4. Is there any treatise upon explosives that will give me all the known properties of the principal explosives? A. See our advertising columns for booksellers' addresses.

G. S. R., H. B. G., and others question the accuracy of our answer to W. L. N., in which we stated that it is not a fact that all matters that form scale in a boiler float on the water as scum. A. Compounds of lime are precipitated from solution in water as the temperature increases, and the carbonate of lime, being light, rises to the surface of the water, if there is a good circulation in the boiler. The sulphate of lime, which is heavier, sinks almost immediately after precipitation. Both of these substances can be most readily removed by a surface blow, since they are formed more rapidly as the temperature of the water increases. When the boiler is not in use, the particles of carbonate of lime no longer rise to the surface, but settle down upon different parts of the boiler.

O. P. H. asks: How many pounds of nitrate of ammonia would be required to freeze a gallon of water? A. Theoretically, nearly 4 lbs. when the temperature of the water is 68° Fah., but in practice a larger quantity, owing to the absorption of heat from the containing vessels.

J. G. H. asks: 1. Can sugar be kept liquid by any chemical process? A. No. 2. How can copying ink be made from common writing ink? A. By the addition of a little sugar. 3. Can water colors be made to copy, the same as copying ink? A. This can be easily tried.

L. says: 1. I want to make a heat governor for a hot air furnace. If I enclose, in a tube exposed to the heat, quicksilver, or simply the air in the tube, from which can I get the most expansion or pressure to act on the damper? A. Quicksilver expands the 0·01543 times its volume on being heated from the freezing to the boiling point, and air 0·3665 times, so that the expansion of air is much greater. 2. Can you suggest a way by which this pressure may best act on a lever? Pure rubber would answer the purpose if perfectly airtight. A. By means of an airtight piston.

M. asks: Is the mineral found with lead ore and known to miners as mundic the same as iron pyrites? A. Mundic is the name of copper pyrites among English miners.

C. H. S. asks: Had eighteen hundred and seventy-four full years of the Christian era passed on January 1, 1874? A. Not exactly. The years as reckoned by the calendar do not agree perfectly with those calculated on astronomical data.

F. C. C. asks: What can I apply to the back of sheet copper to prevent gold adhering, while I am electro-gilding the face? It must not come off into or injure the solution. A. Use a thin coating of varnish.

E. S. asks: What is the proper temper for a magnet, and how much of it should be tempered? A. It should be tempered at as high a degree of heat as possible, and the temper should be drawn to a violet-straw color.

S. S. S. asks: 1. Would a silver rod used for an anode (as in the illustration in your issue of January 31) be as good for plating a dozen forks or spoons as an anode of sheet silver? A. Some electroplaters use anodes of pieces or rods of silver. The general practice is to employ sheet silver; and while the former plan answers, the latter is on some accounts to be preferred. 2. How much silver by weight is calculated to be deposited upon a dozen forks, for single, double, and triple plate? A. Tablespoons are single plated when they are plated with 4 ozs. of silver to the gross, double plated with 8 ozs., and triple plated with 12 ozs. Forks in proportion, according to size. 3. What book do you recommend for traveling electroplaters? A. Roseleur's "Galvanoplastic Manipulations" is a standard authority.

G. P. L. asks: Is there any chemical or other way to remove hair from any part of the face without marring the face or leaving any injurious marks on it? A. Hydrosulphate of sodium can be used, but care must be taken, lest the skin be attacked. See *Science Record* for 1874, p. 20.

N. A. M. asks: Can you give me a recipe for making nitro-glycerin? A. To prepare nitro-glycerin, very strong nitric acid, density 49° to 90° Baumé, is mixed with twice its weight of concentrated sulphuric acid: 6 lbs. of this mixture, thoroughly cooled, are poured into a glazed earthenware jar, placed in a pan of cold water, and there is next added gradually 1 lb. of concentrated and purified glycerin, having a density of at least 30° to 31° Baumé, care being taken to stir constantly. The mixture is left to stand for some time, and afterwards poured into five or six times its bulk of very cold water to which a rotatory motion has been imparted. The nitro-glycerin sinks to the bottom as an oily liquid.

C. S. D. asks: I. Where it the largest refracting telescope in the world, and what is the size of its object lens? A. At the National Observatory, Washington, D. C.; diameter of lens, 26 inches. 2. I wish to connect another boy's home with mine by a telegraph wire, and (as it is not convenient to have it suspended from the one house to the other) I want to know if I tar copper wire and put it under the sidewalk (fastened by staples), if the tarred wire will answer the same purpose as insulated wire? And if not, what can I put on the wire that will? A. Use an ordinary insulated gutta percha telegraph wire. 3. I have a blackboard on which it is difficult to leave any mark. What substance shall I put on it to remove that difficulty? A. Put on the blackboard liquid sold by most stationers.

R. E. W. asks: Is there any way of making oxygen gas, cheaper than the common method of using potash and manganese? Nitrate of soda is much cheaper: cannot its oxygen be driven off? A. Nitrate of soda is readily decomposed at a red heat, and yields oxygen, which at first is tolerably pure, but becomes contaminated with increasing quantities of nitrogen.

A. B. asks: Is the white soft matter in the center of a corn kernel pure starch? A. It consists of more than 50 per cent of starch. The remainder is water, fat, cellulose, and nitrogenous substances.

K. K. K. asks: By what means can nitrogen be prepared in large quantities, cheaply, rapidly, and with simple apparatus, similar to a hydrogen generator, so as to be instantly ready? A. By heating nitrite of ammonia.

F. H. M. asks: Is there any sure way of ridding an old house of bedbugs, cockroaches, etc.? A. As to bedbugs, if you can locate their dwelling places, use strong mercurial ointment, soft soap, and oil of turpentine, in equal parts, triturated together. If they are secreted in the timbers, fumigation by burning sulphur is the best method. For cockroaches, make poison wafers of flour, red lead, and sugar, rubbed up with a little mucilage; spread out thin to dry.

W. S. X. asks: 1. How can I make lard oil in small quantities? A. Lard oil is chiefly obtained as a secondary product in the manufacture of stearin. It is purified first by agitation with sulphuric acid, and afterwards by steaming it or washing it by water. 2. Is there a polish that will adhere to such articles as a tin lantern of which the tin is worn off? If so, how is it made? A. See p. 315, vol. 29.

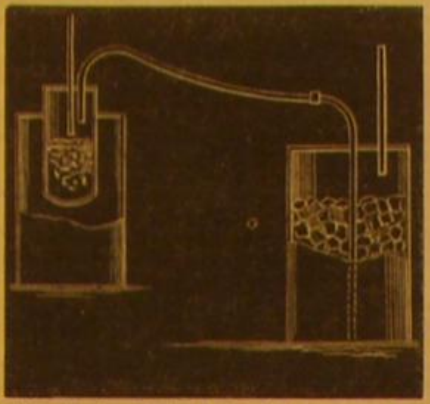
G. W. W. asks: How can canvas be prepared for oil painting? A. The canvas must be strained on a frame of thoroughly seasoned wood, so as not to shrink, and a thin oil filling must be put on till the texture of the canvas is completely hidden. All seams and projections must be avoided.

J. A. M. asks: How can I smooth and polish a piece of rough marble? A. Use (1) wet sandstone (2) a piece of unglazed pottery (also wet), (3) pumice-stone, (4) lead filings and rouge, (5) a little powder of calcined tin, rubbed on with a linen rag.

Z. P. B. asks: 1. What is the best substance with which to clean common and undressed kid and dogskin gloves with, and how is it applied? A. Damp them slightly, stretch them gently over wooden hands, and clean them with a sponge dipped in benzole. As soon as they are dry, withdraw the hands, and suspend in the air till the smell has passed off. 2. What is the best to clean ivory with? A. Ivory can be bleached by exposing it to the fumes of burning sulphur or to chlorine gas. In answer to your other question, consult a cyclopædia of manufactures.

C. W. H. Jr. asks: How can cloth or velvet be made to stick to cast iron? A. Try painting the iron with oil paint, letting it dry, and then attaching the cloth with glue.

A. A. W. asks: How can I make bisulphide of carbon? A. You can probably buy bisulphide of carbon more cheaply than you can make it, as it is now manufactured on the large scale. The following apparatus, however, may be sufficiently simple and cheap for your purpose: Bore two holes in the top of an iron bottle, such as mercury is imported in, and into these holes fix two copper pipes, one straight, as on the figure



and the other bent. The bent tube is connected with another tube leading to the bottom of a bottle filled with ice. The iron bottle is fitted into the top of a furnace, so that about two thirds is exposed to the action of the flame. The furnace should have a hole in its top so that the bottle may fit snugly into it, and the top be protected from the fire. The bottle is filled two thirds full of pieces of fresh charcoal; and when hot, a few fragments of sulphur dropped at intervals into the straight tube, which is immediately closed with a plug. The bisulphide of carbon is condensed in the bottom of the ice bottle, and sinks to the bottom of the water. It should afterwards be rectified by carefully distilling in a hot water bath, in contact with chloride of calcium, and condensed as before. Bisulphide of carbon is very volatile and inflammable, so that care must be used in making and handling.

N. H. F. says that J. P., who asked how to prevent a wooden screw from checking, should boil it in water with a little salt in it. It will then never check or crack.

H. G. B. says, to M. B. C., who asked how to increase the rapidity of the drying in his lumber kiln: You need no air at all, and consequently have too much already. Air is good for respiration, but was not made for a drying agent, although it is well adapted to prevent too rapid desiccation. And air-dried lumber has a crust of dried wood on the outside, which retards the internal drying and prevents the thorough shrinking of the wood, leaving it liable to swell or shrink with every change of the weather. Again, air cannot season lumber, which operation is a chemical change of its albumen, preventing its future shrinkage, swelling, and decay. Even eggs can be so coagulated as to keep for 10 years, and I have some, thus prepared, which are thus old, as perfect as ever they were as, far as decay is concerned. It was (and still is) thought that the best way of preserving lumber was to extract the albumen, by soaking the lumber in water for 6 or 12 months, or by boiling or steaming. These processes kill the lumber for good work and good finish. The albumen should be coagulated and retained in the pores of the wood, and it will keep out water or damp air as well as if the pores were filled with shellac or other gum, evidently fitting the wood for a very superior finish. This operation is readily accomplished by the well known means of dry steam, requiring fewer days for its completion than the soaking and subsequent drying does months. In fact, it pays well to subject all lumber, no matter by what process it has been seasoned, to dry steam, by the use of which a black walnut tree may be cut in the forest on Monday morning, and worked into furniture by Saturday night, and be better fortified against any tendency to shrink, swell, warp, or decay, and it will show a better finish.

H. P. says: If W. D. B., who asked as to flow of oil from a wick, will lower the wick, when not lighted, below the top of the wick tube, the oil will not spread over the outside of the lamp, which is the case with some, if not all, oils when the wicks protrude out of the tubes.

J. E. D. says, in reply to several correspondents who ask how to gild on glass: First I see that the glass is free from dirt and grease; then with my tongue, I lick the place where I desire the figure or letter to be, and then press the dampened surface upon a piece of gold leaf of sufficient size, taking care to have it smooth and unbroken. After it has dried (which is indicated by its assuming a polished appearance), I place it over a marked board, and with a sharp instrument and ruler scratch lines for the top and bottom of the letters, and then (with quickly drying material) paint the letters, taking care to reverse them so that they will show right from the other side. When the paint is dry, I rub off the superfluous leaf and the job is done. If the work is to be done on large glass, like store windows, it is better to paint the letters first on the outside, as they are to appear, and this will show where to apply the leaf, and also how to paint on the inside, as the paint will show plainly through the leaf. When the job is done, the outside letters can be easily cleaned off. It will help most persons to paint the letters backwards, to mark them with pen and ink on paper, and, after oiling the paper, look at them from the other side.

P. H. B. says, in answer to W. E. S., who asked how a 20 horse power engine can be started and stopped by telegraph: If it be a single engine, it would have to be seen that the crank was in a position to start and the steam pipe and the steam chest would have to be well provided with drip exits; and the throttle valve must be easily worked and well balanced. The throttle lever could be actuated by a magnet, or by weights and mechanism similar to that employed to trip the hammer in apparatus for striking the fire alarm telegraph bells in cities. A double engine could be so arranged as to be stopped or started, at any time, by the same arrangement.

K. L. H. says, in reply to J. J. G., who asks if there is any compound that will make the beard grow faster than it naturally would: The following recipe is perfectly harmless, and will make the beard grow like mushrooms in a hotbed: Cologne 2 ozs., liquid hartshorn 1 dram, tincture of cantharides 2 drams, oil of rosemary 12 drops, oil of nutmeg 12 drops, lavender 12 drops. Apply to the face daily and wait for the result.

T. A. C. says, in an answer to J. P., whose query about seasoning wooden screws is answered on p. 219, vol. 30: Bore a hole longitudinally through the center of the screw: it will not be apt to crack so badly in seasoning, because then the air can get to the center of the wood, the sap escapes therefrom, the center of the wood contracts, and the strain on the outside is lessened. Of course, the larger the hole, the better for the seasoning process; but it should not, and need not, be large enough to materially weaken the screw. If in addition, you can boil the screw in water, the job will be bettered; if boiled in oil, it will be complete.

J. H. P. says: Tell G. C. B. that cracks and holes in cast iron kettles can frequently be filled by cement composed of glycerin and litharge made into a stiff putty. It requires 3 or 4 days to harden. I have filled holes in kettles an inch or more in diameter with this cement, and used the kettles for years afterwards.

C. D. S. says that R. H. F. can test squares with the dividers by drawing two circles one within the other, from the same center, of 16 and 12 inches diameter respectively; then set the dividers to 10 inches, insert on point in any part of the outer circle, and mark the point exactly where a circle (drawn with the dividers in this position) would intersect the inner circle; now draw a straight line through the center of the circles and through the point marked in the inner circle; and through the outer one, another line starting from the point where the dividers were inserted in the outer circle through the center of the circles until the outer circle is reached. If this is done exactly, the points where those lines intersect the outer circle will form the corners of a perfect square whose side is 11·3137+ inches. If the square is correct, it will fit the square thus formed and also the lines in the center, which divide the circle into 4 equal parts, and the angles must be 90 degrees. This is based on the rule for finding the hypothenuse of a right angled triangle, thus: $6^2=36$ and $8^2=64$, sum 100, the square root of which is 10. This is sometimes called the 6, 8, and 10 rule for squaring buildings.

Minerals, etc.—Specimens have been received from the following correspondents, and examined with the results stated:

D. H. E.—This mineral is compact soapstone.

D. B.—The mineral resembling gold, which is inclosed in the quartz, is iron pyrites.

J. K.—The crystal is garnet; it is a silicate of alumina and iron. The red stone is quartz rock, colored by a little oxide of iron. The gray one is silex.

E. L. F.—Your specimen consists of cubical crystals of iron pyrites, inclosed in gray quartz rock.

B. B. S.—Crystals of iron pyrites, inclosed in talcose schist.

H. S. B.—Your specimen consists of a solid mineral portion, and of volatile substances, the latter amounting to 17·76 per cent. Gives off water and oils on heating. The residue left after heating consists of siliceous grains, colored with oxide of iron. Contains a small amount of soda but no potash. We do not know of any use for it other than that of soap, and we can assign no value to it.

O. K.—Your sample of safety powder for use in petroleum oils consists of salts, mostly common salt, which have been dyed yellow, blue, and red in order to disguise their true nature. It is worse than valueless. It does not diminish the explosive nature of the oils, and should be exposed as a fraud calculated to do great injury.

R. S. asks: How can I remove the inside bark of the cocoa-nut, otherwise than by shaving it off?—V. V. V. asks: What must I use to paint show cards with? The oil in ordinary paint discolors the card around the letters. I want something that paints very black, also white and light tints for dark grounds?—G. S. asks: What is the process of ferrotyping?—M. B. A. asks: What is the best way of removing tallow and white lead that has been applied to polished parts of machinery to prevent rust?—W. H. D. asks: Does powder of a coarse grain shoot more strongly than one of a fine grain?—M. F. B. asks: 1. Which will shoot the greater distance, a breech or a muzzle loading shot gun? 2. Is 30 inches long enough for a gun of 10 gage? 3. What are the different strengths of the materials used for gun barrels? 4. Is Damascus twist as good as laminated steel for gun barrels?—P. J. F. asks: 1. What is the proper charge of powder for a No. 12 caliber shot gun? 2. How much powder will the same caliber consume without waste?

COMMUNICATIONS RECEIVED.

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

On Kepler's Third Law. By A. L.

On the Elasticity and Slipping of Belts. By J. T. H.

On a Scientific Toy. By E. L.

On Ascertaining the Width of Streams. By J. C.

On the Manufacture of Leather. By D. S.

On Car Building. By N. E.

On Light. By T. H. C.

On the Attraction of the Sun and the Earth. By H. K.

On Ventilation. By E. H. S.

On the Canal Problem. By J. H.

On Foaming in Boilers. By G. C. P.

On Shellac as a Dressing for Wounds. By W. W.

On Squares. By M. T. C.

On Spiders' Webs. By C. T.

Also enquiries and answers from the following:

P. T. F.—F. H.—J. R. P.—W. H. C.—T. H. F.—J. W.—T. C. H.—E. W. H.—P. S.—J. L.—F. H. E.

Correspondents in different parts of the country ask: Who sells a machines for testing the strength of the arm by striking a flat surface? Who makes jig saws for cutting out ship timbers? Makers of the above articles will probably promote their interests by advertising, in reply, in the Scientific American.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

March 31, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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APPLICATIONS FOR EXTENSION.

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:

29,012.—Horse Rake.—F. Seidle *et al.* June 17.
29,035.—Sewing Machine.—J. First. June 17.
29,271.—Steam Engine Valve.—J. F. Hamilton. July 8.
29,785.—Sewing Machine.—D. Haskell. August 12.
29,790.—Cattle Tie.—G. Hull. August 12.

EXTENSIONS GRANTED.

27,678.—Fastening Artificial Teeth.—A. M. Asay *et al.*
27,735.—Grinding Mill.—E. Munson.
27,743.—Boiler Feed.—T. Snowdon.

DISCLAIMER.

27,678.—Fastening Artificial Teeth.—A. M. Asay *et al.*

DESIGNS PATENTED.

7,261.—Carpet.—R. Allan, Yonkers, N. Y.
7,262 to 7,282.—Carpets.—O. Heinigke, New York city.
7,283 to 7,299.—Carpets.—H. Horan, East Orange, N. J.
7,300 to 7,302.—Carpets.—H. S. Kerr, Philadelphia, Pa.
7,303.—Label.—J. Lippincott *et al.*, Pittsburgh, Pa.
7,304 to 7,308.—Carpets.—L. G. Malkin, New York city.
7,309 to 7,313.—Oil Cloths and Carpets.—C. T. Meyer *et al.*, Bergen, N. J.
7,314.—Flower Stand.—J. E. Morris, Minneapolis, Minn.
7,315 to 7,332.—Carpets.—E. J. Ney, Dracut, Mass.
7,333 to 7,339.—Carpets.—H. Nordmann, New York city.
7,340 and 7,341.—Carpets.—J. H. Smith, Enfield, Conn.
7,342.—Beer Mug.—B. Bakewell, Jr., Pittsburgh, Pa.
7,343 and 7,344.—Carpets.—J. M. Christie, Kidderminster, England.
7,345.—Carpet.—J. Fisher, Philadelphia, Pa.
7,346.—Carpet.—A. Heald, Philadelphia, Pa.
7,347.—Buckle Plate.—W. F. Osborne, Ansonia, Conn.
7,348 and 7,349.—Types.—R. Smith, Philadelphia, Pa.

TRADE MARKS REGISTERED.

1,694.—Plows.—B. F. Avery & Sons, Louisville, Ky.
1,695.—Oysters.—T. H. Carmine, Baltimore, Md.
1,696.—Wrenches.—L. Coes & Co., Worcester, Mass.
1,697.—Boots, etc.—T. H. Dodge, Worcester, Mass.
1,698.—Yeast.—Flack Brothers, Baltimore, Md.
1,699.—Bitters.—Flint & Goldthwait, Salem, Mass.
1,700.—Axle Grease.—J. J. Hucks *et al.*, S. Francisco, Cal.
1,701.—Shirts, etc.—Johnston & Sutphen, Newark, N. J.
1,702.—Thrashing Machine.—Nichols & Co., Battle Creek, Mich.
1,703.—Draw Frame Rollers.—E. Page, Lawrence, Mass.
1,704.—Belting.—E. Page, Lawrence, Mass.
1,705.—Plows.—J. L. Reed & Co., Dayton, O.
1,706.—Hats, etc.—Thompson *et al.*, New York city.
1,707.—Shirts.—B. Wechsler, New York city.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

List of Patents Granted in Canada.

March 28 to April 4, 1874.

3,257.—I. H. Thorp, Chicago, Cook county, Ill. Improvements on brick machines, called "Thorp's Brick Machine." March 28, 1874.

3,258.—G. H. E. Dubelle, Montreal, P. Q. Art or process for the manufacture of butter, called "The Dominion Dairy Butter." March 31, 1874.

3,259.—T. S. Seabury, St. James, Suffolk county, N. Y. Improvements in wagon jacks, called "Seabury's Improved Wagon Jack." March 31, 1874.

3,260.—F. Nichols, New London, Conn., U. S. Useful acid pump and siphon, called "The Nichols Acid Pump and Siphon." March 31, 1874.

3,261.—D. Davison, New York city, U. S. Improvements on the construction, setting, and operation of retorts for the manufacture of coal gas, called "Davison's Improvements on the Construction, Setting, and Operation of Gas Retorts." March 31, 1874.

3,262.—D. Davison, New York city, U. S. Improvement on the manufacture of illuminating gas from coal and other substances, called "Davison's Improved Process of Manufacturing Illuminating Gas." March 31, 1874.

3,263.—G. Sweet, Dansville, Livingston county, N. Y. Improvement on wheelwright machine, called "Sweet's Wheelwright Machine." March 31, 1874.

3,264.—G. Sweet, Dansville, Livingston county, N. Y., U. S. Improvement on horse rake, called "Sweet's Improved Horse Rake." March 31, 1874.

3,265.—G. Sweet, Dansville, Livingston county, N. Y., U. S. Improvement on plaster sowers, called "Sweet's Plaster Sower." March 31, 1874.

3,266.—S. T. Lamb, New Albany, Ind., and B. F. Avery, Louisville, Ky., U. S. Improvements in self car couplers, called "Lamb's Self Car Coupler." April 4, 1874.

3,267.—D. E. Fletcher, Lindsay, Ontario county, N. Y. Improvements on a machine for churning, called "Fletcher's Dairy Maid's Friend." April 4, 1874.

3,268.—William A. Lewis, Springfield, Windsor county, Vt. Improvements on churn powers, called "Lewis' Churn Power." April 4, 1874.

3,269.—T. Mathias and J. A. Coons, New Berlin, Sagamon county, Ill. Improvements in churns, called "Mathias' Improved Churn." April 4, 1874.

3,270.—O. F. Cook, Grant Island, Colusa county, Cal. Improvement on process of preparing grain for the manufacture of flour, called "Cook's Process of Preparing Grain for Manufacture of Flour." April 4, 1874.

3,271.—W. R. Macaulay, Hamilton, Wentworth county, Ont. Improvement in railway car couplers, called "Macaulay's Self Car Coupler." April 4, 1874.

3,272.—F. Green, Montreal, assignee of T. Holland, New York city, U. S. Improved combination steam, water, and gage cock, called "Holland's Combination Safety Gage." April 4, 1874.

3,273.—S. Rodgers, Toronto, Ont. Improvements in tobacco cutters, called "Rodgers' Improved Tobacco Cutter." April 4, 1874.

3,274.—I. O'Brien, Quebec. Improvements on cards for photographic pictures, called "O'Brien's Papyrus Photograph Card." April 4, 1874.

3,275.—D. Larer and S. R. Griscom, Borough of Pottsville, Schuylkill county, Pa., U. S. Improvements on diamond millstone dressing machines, called "Larer's Diamond Millstone Dressing Machine." April 4, 1874.

3,276.—R. Smith, Sherbrooke, P. Q. Improvements on a machine or apparatus for the purposes of navigation, called "Smith's Improved Aquapede." April 4, 1874.

3,277.—S. Mills, Madison, Dane county, Wis. Improvements in toilet tabourets, called "Mill's Improved Toilet Tabouret." April 4, 1874.

3,278.—R. J. Campbell, Toronto, Ont. Curtain ring and hook, called "Campbell's Imperial Curtain Ring and Hook." April 4, 1874.

3,279.—J. Horton, Philadelphia, Philadelphia county, Pa. Process for massing and combining granulated iron ore into lumps, called "Process for Utilizing Granulated Iron Ore." April 4, 1874.

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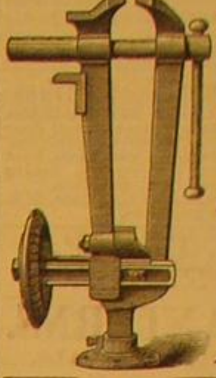

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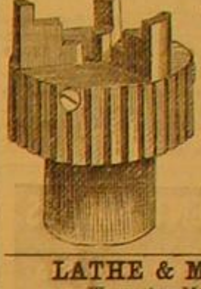

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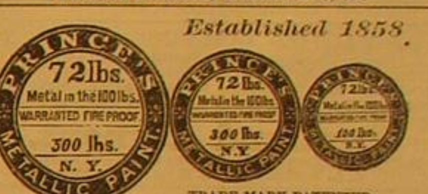

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