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Improved Steam Engine.

The cut-off patented by Noble T. Greene has been favorably known for many years, its simplicity and durability, its economy and sensitive regularity ranking it among those improvements which are conceded to represent the highest state of the art. In March, 1869, the patent was extended and passed into possession of the Providence Steam Engine Company, who, it is stated, are now unable to build the engines fast enough to supply the demand.

The following improvements have been made: A new bed plate has been designed; access is had to the exhaust valves by removing the cylinder heads, as shown in Fig. 1; an intermittent movement allows these valves to remain at rest through nearly seven eighths of the stroke, and the mechanism actuating both steam and exhaust valves is now placed outside of the steam chest. The principle of the original Greene engine is not changed, but the parts retained, after reconstruction, are more durable, have larger bearing surfaces, and are made easy of access to the engineer.

The engine is of that class which does not require a throttle valve. The steam enters the cylinder at boiler pressure, and the governor fixes the period of time during which the steam valves shall remain open, allowing more or less steam to flow into the cylinder as there is more or less load to be driven. There are four flat slide valves, one (as shown in Fig. 3) at each end on the top to let in the steam, and one (as shown in Fig. 4) at each end on the bottom to let out the exhaust, and with as little clearance as the thickness of metal in the cylinder will allow.

While one valve is admitting and cutting off the steam, the other three are entirely at rest until just before the completion of the stroke, when the exhaust valves instantly rearrange themselves, opening the exhaust on one side of the piston and closing it on the other. The return stroke then commences, and the operation is repeated.

The short space of time during which the exhaust valves are moving is when the pressure upon them is the least, and, by an arrangement of cushioning the steam, the induction valve is at all times nearly balanced.

Fig. 3

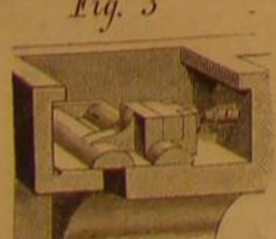
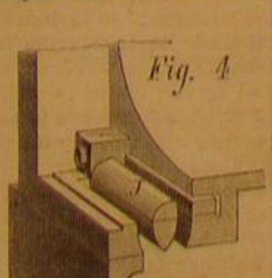
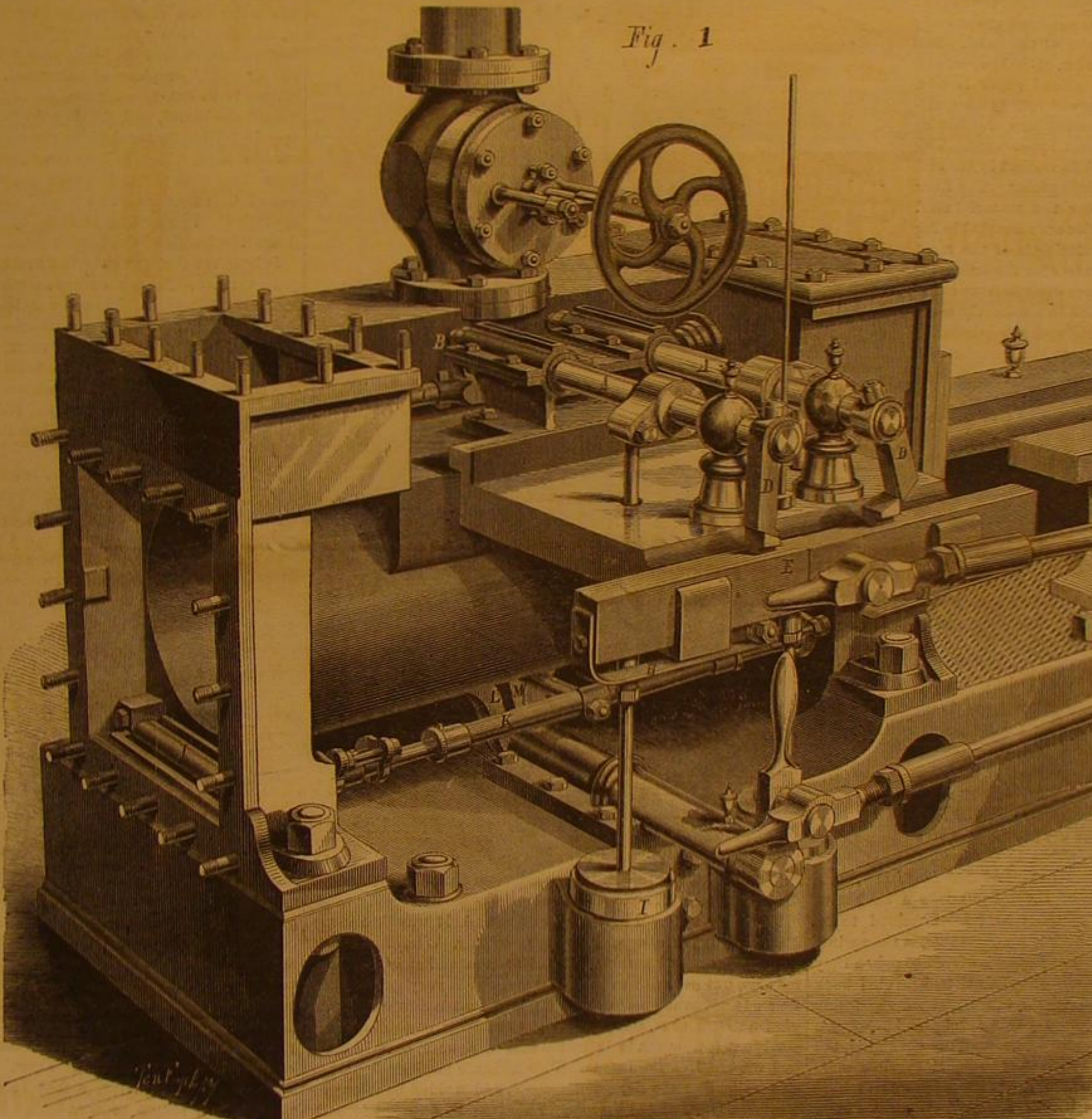


Fig. 4



The power which moves the valves is applied parallel to, and nearly in line with, their seats, so that they cannot rock or twist, thus greatly reducing any tendency to wear. One end of each valve stem being in the steam chest, the whole boiler pressure acts upon it to aid the weight in closing the valve when tripped, and the valve stem is made large in diameter to obtain the full benefit derived from cut-off valves closed by steam pressure. The governor can adjust the point of cut-off over a range of three fourths the entire stroke.

The working of the valve gear will be understood by reference to the engravings. Figs. 1 and 2 are perspective views of the cylinder and valve gear, Fig. 1 having certain parts removed. Figs. 3, 4, and 5 are sectional details.



THE GREENE ENGINE.

The induction valves, Fig. 3, are connected with the rock lever shafts, A, Fig. 1, arms, B, working in slots in the valve stems, C. Below the rock levers, D, is a sliding bar, E, receiving a reciprocating motion from an eccentric on the main shaft. Behind the sliding bar is a gage bar, F, Fig. 5, connected with the governor, which bar receives an up and down motion from a corresponding movement of the governor balls. The adjustable tappets, G, Fig. 5, in the sliding bar, are kept up in contact with the gage bar, F, and are made to move up and down in unison with it by the springs, H, Figs. 1 and 5.

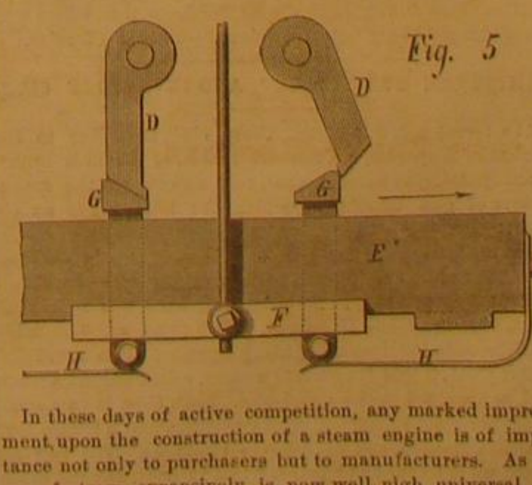
It will be seen from this description that, as the sliding bar moves in the direction of the arrow, Fig. 5, one of the tappets is brought in contact with the inner face of the toe on the rock lever, causing it to turn on its axis, thereby opening the steam valve at one end of the cylinder, the other tappet meanwhile passing under the other rock lever without moving it, the toe and tappet being so beveled that the tappet will be forced down against the action of this spring until it has passed by the toe, when the spring causes it to fly up to its original position, ready to open the induction valve at the opposite end. As a result of this motion, the two tappets always open the steam valves at the same period, but, the tappets moving in a straight line while the toe describes the arc of a circle, the tappet will pass by, liberating the toe, which is brought back to its original position by a weight, I, Fig. 2, and the steam pressure on the valve stem, thus closing the valve and cutting off the steam. This liberation will take place sooner or later, according to the elevation of the tappets; that is, the lower the tappets are, the sooner the toes will be liberated, and *vice versâ*; and so, by simply elevating or depressing the gage bar, F, Fig. 5, the period of closing the valves can be changed, while the period of opening them remains the same. The adjustment of the gage bar is effected by the governor, and the steam is cut off sooner or later according to the amount of load.

The exhaust valves, J, Figs. 1 and 4, which lie in the bottom of the cylinder, are connected at their outer ends by parallel rods, K, which are tied together by a crossbar in the inside.

The exhaust rock shaft arm, L, is a jaw, as shown in Fig. 1, just under the cylinder. One side of this jaw comes in contact with a lug, M, on the crossbar, and moves both the exhaust valves simultaneously opening one and closing the other. While the exhaust eccentric is taking up the lost motion, between the sides of the jaw, the exhaust valves remain at rest. The other side of the jaw coming in contact with the crossbar, the exhaust valves receive a reverse motion. The lug on the crossbar is so shaped that it receives no blow from the jaw, L, but takes a gradually accelerated motion.

The strength, simplicity, and durability of this engine is very noticeable, and it embodies all the advanced views in stationary engineering which have stood the test of actual practice. Its finish is also neat and tasty, and, with the improvements described, it thus embodies all the essentials necessary to extend the wide popularity the original engine enjoyed.

Fig. 5



In these days of active competition, any marked improvement, upon the construction of a steam engine is of importance not only to purchasers but to manufacturers. As the use of steam expansively is now well nigh universal, the value of a variable cut off that combines, in so great a degree as this does, delicacy of action with strength and durability, is sufficiently obvious.

For circulars and other information, address Providence Steam Engine Company, Providence, R. I.

Japanese Textile Art.

Some years ago, there existed a law in Japan forbidding the exportation of high class textile fabrics, and judging by the few examples of any sort one sees at the present time, it is likely that the restriction still remains in force. The first time Europeans had an opportunity of forming definite ideas, regarding the state of the textile arts of Japan, was during the Paris Exhibition of 1867, where a remarkable series of samples was shown, and for the exportation of which, no doubt, special license was given to the Japanese Commissioners. At a recent meeting in London, Mr. Audsley was enabled to show several of the best fabrics from the Paris collection. The finest silks of Japan are manufactured on a small barren island, by high-born exiles who adopt the art of silk weaving as their means of procuring the necessaries of life. Ships convey provisions and raw materials to the island, and return with the product of its looms. There is little doubt that the fabrics so produced and protected are used exclusively by the Mikado and princes of the land. The materials employed are silk, gilded paper, and some strong fiber. The gilded paper is of a very tough nature, and is cut into narrow ribbons: in this state it is woven into the fabrics and presents a most brilliant appearance. The silk is of rich quality, and is worked in cut and terry velvets, satins, and dead grains. The fiber is only introduced to render the material stiff. The designs of these fabrics are remarkable for their boldness, and the coloring is of the most vigorous character. The ideas for the ornamentation are in nearly all cases derived from natural objects, and are handled in a masterly manner, and in strict accordance with the principles of decorative art. Turning to the lowest grade of the scale of textile fabrics, the common towels used by the peasantry of Japan (worth about a penny each in Japan) show more clearly than the costly silk fabrics do that the appreciation of and love for art is inherent in the Japanese mind, and that it is cultivated by all classes of the people, and carried into even the smallest and commonest articles of daily use. We can never correctly estimate a people by its great works, or the true wealth of a nation by the luxury of its princes. The towels are poor in material, and very trifling in cost, but they are ornamented in a most artistic and thoroughly original manner.

Preserving Nuts.

H. J. S. is one of our tree enthusiasts. His is an enthusiasm that never wanes; he never wearies of experiments to find out the best methods of culture. For years he has been at work on the problem. How can chestnuts, hickory nuts, and hazel nuts be kept over winter in the best condition? His experiment the past winter was quite satisfactory, and is given by him as follows;

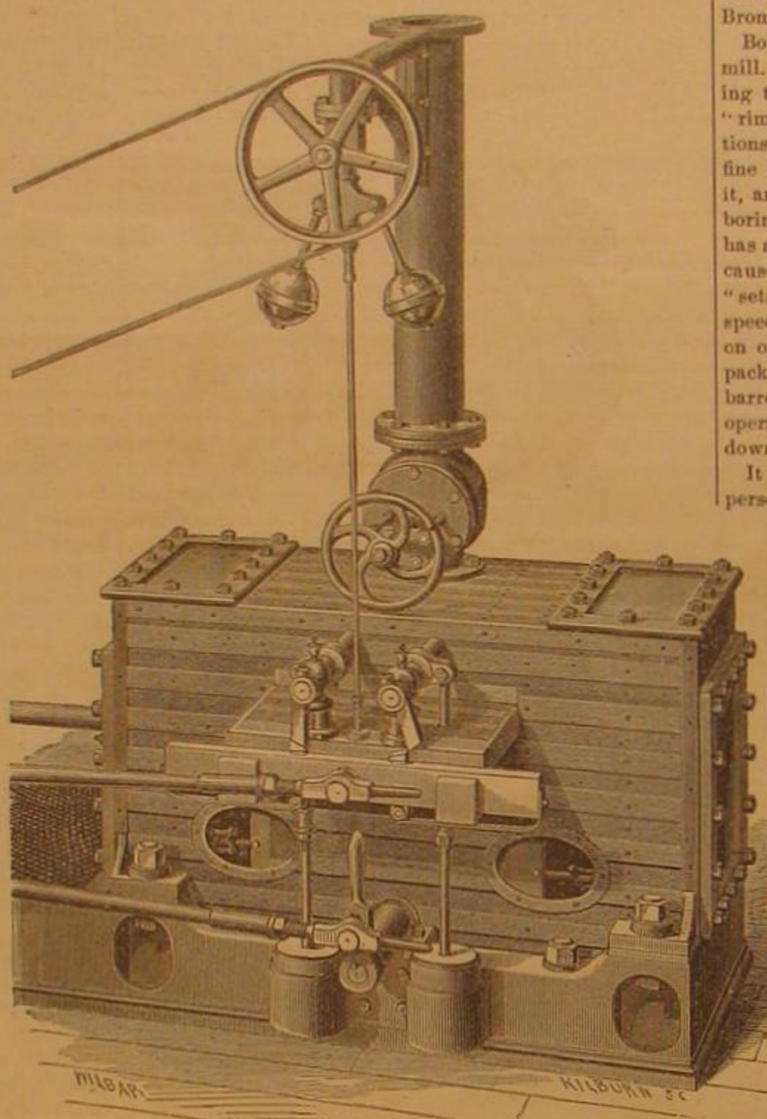
"Last fall I had about six quarts of fine large chestnuts and a few walnuts. Half of them I put into a bucket of moist sand as usual, but the other half I determined to experiment with. I had often picked up chestnuts, in the spring, from among the leaves, that appeared as fresh as when they dropped from the trees. Following this clue, I leveled back the earth on a plowed field where there was no vegetation or covert to attract the mice. On this level plot I strewed a quantity of leaves. On these I deposited my chestnuts, not so close as to touch one another. On these I deposited more leaves, and, top of the whole, I put some boards to hold them down. Around the border I threw up some dirt to discourage any vagabond mouse that might chance to stray that way, and then left them with my blessing. The result was that when I examined my treasures, about the twentieth of April, I found those in the bucket of sand were soft, brown, moldy and lifeless, as usual, while those under the leaves were as fresh and hard as ever; and where the spring warmth had come near them, they were already sprouted. I mention these circumstances with the hope that others will be encouraged to try the experiment."—*Oneida Circular.*

BIRMINGHAM GUN MAKERS' AND INVENTORS' CLUB.

At a recent meeting of the above club, according to the *Mechanics' Magazine*, Mr. Samuel Smith, of Weaman street, Birmingham, gun barrel maker, read a paper on the manufacture of gun barrels, of which the following is an abstract:

The material used for gun barrels was mostly charcoal iron. For plain and figured barrels, at the date of which I am speaking—namely, 1793—the iron used was stub, stub twist, wire twist, and Damascus. Stub twist was first made as plain stub, but, instead of being hammered into a "skelp" or flat plate, it was drawn into a strip, coiled around a mandrel, and welded in the usual way. Stub twist is now made of old horse shoe nails and steel cuttings, about 2 inches long ½ inch in breadth, and the same in thickness. The two are mixed up together and "balled" in a furnace, and the bloom drawn out under the forge hammer. It is then rolled into a strip, coiled round a mandrel, and welded as before. If the balls are very large, or the stubs or steel of inferior quality, the iron will not be good. Plain stub barrels were made of the same iron, forged into a skelp, and welded longitudinally.

Damascus and wire twist are now made by "piling" plates of iron and steel alternately. The plates are about three inches broad and a quarter of an inch thick. From sixteen to twenty are piled on top of each other; they are then placed in a furnace and raised to a welding heat, drawn down under a forge hammer, and rolled into square rods, 3-8 7-16, 1-2 and 9-16 inch, according to the size of the barrels required. The wire twist is rolled so as to show the edges of the different plates on the flat of the strip, so that when it is welded together it looks like a coil of wire from one end of the barrel to the other. The Damascus is rolled into square rods; these are cut into suitable lengths, heated white hot, and twisted until they become round like a screw. Two or



THE GREENE ENGINE.—Fig. 2. (See Preceding Page.)

three of these are welded together, and then rolled down to rods of the size required. These are then coiled round a mandrel, and welded in the usual way.

There is another iron, called silver steel. It was first made about forty years ago, I believe, by Mr. Whitehouse, of Wednesbury, by laminating Swedish iron and steel, like Damascus, but not with so many layers. It is very good. The figure is not much better than the iron that is now called single iron Damascus, but it was a very strong iron. The silver steel that is now made is rolled into a square of .7-16 inch, and worked like Damascus. Two rods are welded together and rolled down to the size required, and welded in the same way as other twisted barrels. This iron is now made both at Adams' and J. Clive's. There is not so much used as formerly.

About 45 years ago, J. Clive began to make iron for gun barrels, and the best iron is now made by Mr. G. Adams and J. Clive, who may be said to be indeed the only makers of "best twist" gun iron. The iron now in use is of six qualities—1st, skelp twist, price 2d. per lb.; 2d., iron twist, 3d. per lb.; 3d, fourpenny stub, 4d. per lb.; 4th, fivepenny stub, 5d. per lb.; 5th, silver steel, 7d. per lb.; 6th, Damascus, 7d. per lb. No. 2 is twisted into a screw, like Damascus, and is called iron Damascus. This is worked in single rod and double rod—that is, two rods put together and rolled into a strip. The same is done with fourpenny and fivepenny stub and the result is called stub Damascus, but cheap guns are chiefly made of the iron Damascus. This is the cheapest figured iron. It contains no steel, being generally made of waste screws mixed with other scrap. It requires experience to distinguish it from the true steel Damascus.

Welding: Best barrels are welded by coiling the strip round a mandrel, and then heating it to a welding heat in a smith's fire; it is then taken out and jumped up on an iron plate on the floor, then put in a swage with a "stamp" or mandrel inside, and hammered down. About three inches are welded at a time. Here I may observe that there are very few welders who use the "stamp" except for a few inches at each end; but best barrels ought to be welded on a stamp throughout.

History of gun iron: Mr. R. Adams began to make twist iron about the year 1815. He was before that time a tilter of barrel skelps or plates for making plain iron barrels. At that time a great deal of iron was made from swaff or filings, which were first washed and then mixed with scrap, made into a ball, and welded in a smith's forge; this was called "swaff ball drawing." It made very good iron, and was used by lock forgers, breech forgers, and occasionally made into barrels for fowling pieces. In the early time of the barrel trade, there were a number of small forges for making barrel skelps by tilting; one in particular was at Wednesbury Bridge, and here Mr. R. Adams, above mentioned, worked; and there is no doubt that he saw what the trade required. At the close of the French war, he began to make twist iron as a trade. Before this time, it had been made at various forges, but no one made a specialty of this kind of iron. Mr. Adams continued working at Wednesbury till unfortunately killed by the bursting of a boiler, after which Mr. G. Adams took up the business, and continues to make twist gun iron at his new works, in Church lane, West Bromwich, up to the present day.

Boring: After the barrels are welded, they go to the mill. They are first rough bored. This is done by fastening them in a socket or holder; the "bit" is a square steel "rimer," of suitable length, running at about 500 revolutions per minute, which is forced through the barrel. The fine borer then examines the barrel, "sets" or straightens it, and then it is "spilled up," a process the same as rough boring, except that the bit does not cut on all the edges; it has a "spill," or piece of oak wood, put on one side, which causes it to cut much more evenly. The workman then "sets" the barrel, and finishes the boring, which is done at a speed of 70 to 80 revolutions per minute. The bit only cuts on one edge, which is left sharp, and a deal spill is used, packed up with strips of paper as the boring proceeds. The barrel is examined, and "set" several times during the operation. The setting is done by the shade or reflection, down the inside of the barrel, from the top of the window.

It is an art that can only be acquired by long practice and perseverance. Some men have worked at the trade all their lives, and have never learned to set a barrel correctly. The same process is used for sporting and military barrels up to the fine boring. After fine boring, the military barrels are turned, or stripped as it is called, which is done by a self-acting slide lathe, which takes off the thick side, if they have any. The grinder then finishes them to the gage. The history of boring and setting I cannot attempt to state, but setting, I think, does not go back much more than 100 years. My father began to work as a fine borer in the year 1793. Setting was known then, but not generally. He had to pay for the secret. According to my father, a man named P. Parsons was the first to set barrels that he had heard of. He worked at Duddeston Mill, being what was called a "best workman" at sporting barrels. This Mr. Parsons used at first, for the purpose of setting, a string or wire which was drawn tight by a bow, or otherwise, and applied to the inside of the barrel. By this means he discovered the crooks, and then corrected them with a hammer. The process of fine boring is the same now as it was in 1793; that is, it is done with a square bit, but only two edges cut, and only one at a time. The advantage of taking off the edges was said to be discovered about 1790, by Mr. Beesley, and this was kept a secret among good workmen for a long time. I think we may be sure that boring and setting had not attained their present perfection until the beginning of the present century.

In the year 1787, there were 27 gunmakers in Birmingham, and barrels were made, bored, and ground at water mills all round the town. Such mills still exist, chiefly in the neighborhood of Hales Owen, where large numbers of barrels are now made. I have not touched on the subject of rolled barrels, which are chiefly used for military firearms and the commoner sort of sporting guns. The rolling of barrels from short taper skelps, a foot or more in length, is comparatively a recent process. The barrel is drawn over an oval headed mandrel, so fixed that its head is immediately between the grooves of the upper and under roll. These grooves are of a shape corresponding to the outline of the barrel. Of late years, steel barrels have come very much into use for rifles, but to a very small extent for sporting guns as well, the want of "figure" operating much against them. Steel rifle barrels are sometimes drilled out of a solid bar, which must be "set" from time to time, as the drill is certain to run out. As there is usually more to turn off one side, they are generally of unequal hardness, and is a difficult matter to keep them straight. Steel barrels are now usually rolled from 12 to 15 inch drilled blanks, the hole in which is much larger than the intended bore. The punching of shorter blanks, which were afterwards rolled out into a barrel by two rollings, constituting the patent of Deakin and Johnson, appears now to be discontinued, though very good barrels were made by the process.

The reading of Mr. Smith's paper was accompanied by practical illustrations of the method of "shading" barrels, or detecting internal or external irregularities. Barrels, straight and bent, were supported at each end, and Mr. Smith explained the entire process, which has been kept very much as a secret by the very few who really understand it. So delicate is this test that the distortion, produced by warming one side of the barrel with a common candle, was distinctly perceptible. Independently of its practical utility, the "shading" of a gun barrel is an exceedingly interesting optical problem, which has never yet been investigated.

How Genuine Pearls are Prepared in China.

Imperfect and contradictory accounts of the mode of producing pearls in mussels having at different times appeared, and as the only place of culture is within a few days' journey from Ningpo, Mr. Consul Hague and myself, says Dr. Macgowan, despatched an intelligent native to make enquiries on the spot concerning the art, and to procure specimens in different stages of growth. The following result of these investigations, made on two successive journeys, may be relied on as authentic:

The practice of the art is confined to two conterminous villages near the district of Teh-sing, in the northern part of Chih-kiang, in a silk producing region. In the month of May or June large quantities of the mussels (*mytilus cygnus*) are brought in baskets from the Tahu, a lake in Kiang-su about thirty miles distant, the largest among the full grown being specially selected. As their health suffers on the journey, they are allowed a few days' respite in bamboo cages in the water before tortured for the sake of human vanity, when they are taken out to receive the matrices. These are various in form and material, the most common being pellets made of mud taken from the bottom of water courses, dried, powdered with the juice of camphor tree seeds, and formed into pills which, when dry, are fit for introduction into the unfortunate subject. Molds which best exhibit the nacreous deposit are brought from Canton, and appear to be made from the shell of the pearl oyster; the irregular fragments thus produced are triturated with sand in an iron mortar, until they become smooth and globular. Another class of molds consists of small images, generally of Buddha in the usual sitting posture, or sometimes of fish; they are made of lead, cast very thin by pouring on a board having the impression. Pearls having these forms have excited much surprise since they first attracted the attention of foreigners a few years back.

The introduction of the pearl nuclei is an operation of considerable delicacy. The shell is gently opened with a spatula of mother of pearl, and the free portion of mollusc carefully separated from one surface of the shell with an iron probe; the foreign bodies are then successively introduced, at the point of bifurcated bamboo sticks, and placed in two parallel rows upon the mantled or fleshy surface of the animal; a sufficient number having been placed on one side, the operation is repeated on the other. Stimulated by the irritating bodies, the suffering animal spasmodically presses against both sides of its testaceous skeleton, keeping the matrices in place. This being done, the mussels are deposited one by one in canals or streams, or pools connected therewith, five or six inches apart, at depths of from two to five feet, in lots of from five thousand to fifty thousand.

If taken up a few days after the introduction of the mold these will be found attached to the shell by a membranous section, which at a later period appears as if impregnated with calcareous matter; and finally, layers of nacre are deposited around each nucleus, the process being analogous to the formation of calculary concretions in animals of a higher development. A ridge of nacre generally extends from one pearly tumor to another, connecting them all together.

About six times in the course of the season, several tubs of night soil are thrown into the reservoir for the nourishment of the animals. Great care is taken to prevent goat manure falling in, as it is highly detrimental to the mussels, preventing the secretion of good nacre or killing them, as the quantity may be great or small.

In November, the shells are carefully collected by the hand, the muscular portion removed and the pearls detached by a sharp knife. If the basis of the pearl be of nacre, it is not removed, but the earthen and metallic matrices are cut away, melted yellow resin poured into the cavity and the orifice artfully covered by a piece of mother of pearl. In this state, these more than semi-orbicular pearly pellicles have much of the luster and beauty of the solid gem, and are furnished at a rate so cheap as to be procurable by all who care to possess them. They are generally purchased by jewellers and others, who set them in tiaras, circlets and various ornaments of female attire. Those formed on the image of Buddha are finished in the same manner, and are used as ornaments and amulets on the caps of young children. A few shells are retained with their adhering pearls, for sale to the curious and superstitious, specimens of which have by this time found their way into the principal public and private cabinets of Europe and America. They are generally about seven inches long and five broad, containing a double or triple row of pearls or images, as many as twenty-five of the former and sixteen of the latter to each valve! That the animals should survive the introduction of so many irritating bodies, and in such a brief period secrete a covering of nacre over them all, is certainly a striking physiological fact. Some naturalists, indeed, have expressed strong doubts as to its possibility, supposing the pearls were made to adhere to the shell by some composition; but the examination of living specimens in different stages of growth, having both valves studded with pearls, has fully demonstrated its truth. A tinge of yellow is found over the whole inner surface of some shells, showing that the more recent secretion of nacre by the suffering animals was unnatural. The flesh of all, however, is eaten.

About five thousand families are represented as being engaged in this singular branch of industry in the villages of Chung-kwan and Sian-Chang-Ngan; they, however, mainly derive their support from cultivating the mulberry and in rearing silkworms and other agricultural occupations. Those who are not expert in the management of the shells lose 10 or 15 per cent by deaths; others, none in the whole season.

BIBORATE OF SODA dissolved in water, used as a lotion, will remove prickly heat.

The Sun a Probable Cause of Terrestrial Magnetism.

If an electrified body were placed near a moving conductor so as to induce an opposite charge in the moving body, this charge would move on the surface of the conductor so as to remain opposite the electrified body, whatever the motion might be. Suppose the moving conductor to be an endless metal band running past a body negatively charged, the positive charge would be on the surface of the band opposite to the negative body, and here it would remain whatever might be the velocity of the band. Now the effect of the motion of this negative electricity on the conductor would be the same as that of an electric current in the opposite direction to the motion of the band.

If instead of a band the moving body consists of a steel or iron top spinning near the charged body, the effect of the electricity on the top would be the same as that of a current round it in the opposite direction to that in which it was spinning.

It might be that the electricity in the inducing body would produce an opposite magnetic effect on the top; but even if this were so, its effect, owing to its distance, would be much less than that of the electricity on the very surface of the top. If we take no account of the effect of the inducing body, the current round the top would be of such strength that it would carry all the electricity induced in the top once round every revolution. And if the top were spinning from west to east by south, it would be rendered magnetic with positive pole uppermost, that is, the pole corresponding to the north pole in the earth or the south pole of the needle.

In order to show that such a current might be produced, a glass cylinder, twelve inches long and four across, was covered with strips of tinfoil, parallel to the axis, with very small intervals between them. These strips were about six inches long and one half inch wide, and the intervals between them the two hundredth of an inch. In one place there was a wider interval, and from the strips adjacent to this, wires were connected by means of a commutator with the wires of a very delicate galvanometer. This cylinder was mounted so that it could be turned twelve hundred revolutions in a minute, and brought near the conductor of an electrical machine. This apparatus, after it had been thoroughly tested, was found to give very decided results. As much as 20° deflection was obtained in the needle, and the direction of this deflection depended on the direction in which the cylinder was turned, and on the nature of the charge in the conductor. When this was negative, the current was in the opposite direction to that of rotation. It may be objected that the measurement was not actually made on the cylinder. It must, however, be remembered that it was made in the circuit of metal round the cylinder, and that my object was to find the relative motion of the cylinder and the electricity. Altogether, no doubt it may be taken as experimental proof, of the fact previously stated, that if a steel top were spinning under the inductive influence of a body charged with negative electricity, the effect would be that of a current round the top such as would render it magnetic.

The cause of terrestrial magnetism has not been the subject of so much speculation as many much less important phenomena. It seems to have been regarded as part of the original nature of things, like gravity and the heat of the the sun, as a cause from which other phenomena might result, but not as itself the result of other causes.

Yet, when we come to think of it, it has none of the characteristics of a fundamental fact; it appears intimately connected with other things, and when two phenomena have a relation to each other, there is good reason for believing them to be connected, either as parent and child, or else as brother and sister—the one to be derived from the other, or else both to spring from the same cause.

Now the direction of the earth's magnetism bears a marked relation to the earth's figure, and yet it can have had no hand in giving the earth its shape, which is fully explained as the result of other causes; therefore, we must assume that the figure of the earth has something to do with its magnetism, or what is more likely, that the rotation which causes the earth to keep its shape also causes it to be magnetic.

If this is the case, then there must be some influence at work with which we are as yet unacquainted—some cause which, coupled with the rotation of the earth, results in magnetism. From the influence which the sun exerts on this magnetism, we are at once lead to associate it with the cause. Yet the cause itself cannot be the result of either the sun's heat, light, or attraction. What other influence then can the sun exert on the earth?

The analogy, between the magnetism produced in a spinning top, by the inductive action of a distant body charged with electricity, and the magnetism in the rotating earth, probably caused by the influence of the sun, which influence is not its mass or heat, seems to suggest what the influence which the sun exerts is. If the sun were charged with negative electricity, it seems to follow, from what the experiments described establish, that its inductive effect on the earth would be to render it magnetic, the poles being as they are.

The only other way in which the sun could act to produce or influence terrestrial magnetism would be by its own magnetism. If the sun is a magnet, it would magnetise the earth. If this is the cause, the sun's poles must be opposite to those of the earth. Now, it follows that such a condition of magnetism would or might, if its materials are magnetic, be caused by the rotation of the sun under the inductive action of the earth and planets in exactly the same way as that caused in the earth by the inductive action of the sun. As the direction of rotation is the same in both bodies and the electricities are of the opposite kind, the magnetism would be of the opposite kind also. So that on this hypothesis it is probable the sun would act by both causes.—*Professor Osborne Reynolds, in the Mechanics' Magazine.*

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the month of March, 1872:

During the month 896 visits of inspection were made, and 1,870 boilers were examined—1,794 externally, and 589 internally—while 174 were tested by hydraulic pressure. The number of defects in all discovered was 1,113, of which 271 were regarded as dangerous. These defects, in detail, are as follows:

Furnaces in bad condition, 45—12 dangerous; fractures of plates, 122—63 dangerous; burned plates, 78—30 dangerous; blistered plates, 130—13 dangerous; sediment and deposit, 110—18 in dangerous condition; incrustation and scale, 193—17 dangerous; external corrosion, 73—17 dangerous; internal corrosion, 25—7 dangerous; internal grooving, 15—3 dangerous; water gages defective, 59—8 dangerous; blow out defective, 19—5 dangerous; safety valves overloaded and in dangerous condition, 32; pressure gages defective, 147—19 dangerous; these varying from — 20 to + 10. Boilers without gages, 9; deficiency of water, 16—4 dangerous; broken braces and stays, 60—30 dangerous; boilers condemned, 12.

When such an array of defects and defective fittings as the above is presented, we are aware that some will inquire, "What proof have we that they are correct?" All we can say is that each inspector employed by the company is required to make report of every defect coming under his notice, and to sign his name to the same. These reports are kept on file in the company's office, and can be referred to at any time, and each individual defect can be traced out. It will be noticed, by reference to these reports, that fractured plates and blistered plates usually figure high. This can only be accounted for on the ground that much of the iron used in the construction of boilers is of inferior quality. In a recent number of the "Locomotive," we remarked at some length on the subject of laminated iron, showing that, in consequence of that condition, blisters and other weaknesses were developed in the plates of boilers. If care is not used in piling the bars preparatory to rolling, or if the bars are not free from rust and scoria, there will be imperfect welding of the parts, and consequent weakness. It is true that boilers constructed of the best of iron are frequently fractured, and nearly or quite ruined from injudicious management. Requiring more work from a boiler than it is constructed to bear is a fruitful source of trouble. The only safe rule to follow is. "Get the best, both in material and workmanship, and take good care of it."

Gas Meters.

Wet gas meters are the most convenient and generally used in France, but for many years the introduction of dry meters has been attempted.

The comparative merits of both systems have been often discussed; one thing is certain, that neither assures a perfect registration. The opponents of wet meters argue that the water level should be kept constant, and that the meters must be periodically filled. If too much water is introduced, the flow of gas is checked, and by letting these become too dry the gas does not flow at all.

Between these two limits moreover, the meters vary three or five per cent from the actual consumption. On the other hand, it is urged against the dry meters that their action is irregular, and that still greater uncertainty is inseparable from them than is found with the wet meters.

The Parisian Gas Company has undertaken a series of comparative experiments on both classes of meter. At the conclusion of these trials, which have lasted over several years, the company applied to the municipal authorities of the city definitively to suppress the use of the dry meter.

This demand has been complied with, and the Prefect of the Seine has recently issued a decree forbidding the employment of dry meters amongst the gas consumers of the city.

AT the Victoria Institute, recently, Dr. Bateman having called attention to Mr. Darwin's statement that the difference between man and the higher animals was only one of degree, and not of kind, he proceeded to show that such could not be the fact, and instanced the faculty of articulate language, a distinctive attribute of which there was no trace in the ape or other animals. After defining articulate language, he demonstrated that it was exclusively man's prerogative, and there was no analogy between it and the forms of expression common to the lower animals. He then stated that it had been thought that a particular part of the brain was the seat of language, and, if it were so, the Darwinian might contend that, as there was a certain similarity between the brain of man and of the ape and other animals, that the latter had the germs of the faculty. He then cited many cases, which had been brought under the notice of German, French, American, English and other surgeons, to show that even where various portions of the brain had been injured or destroyed, the faculty of speech remained. He concluded by stating that the faculty of articulate speech seemed to be an attribute, the comprehension of which was at present beyond us.

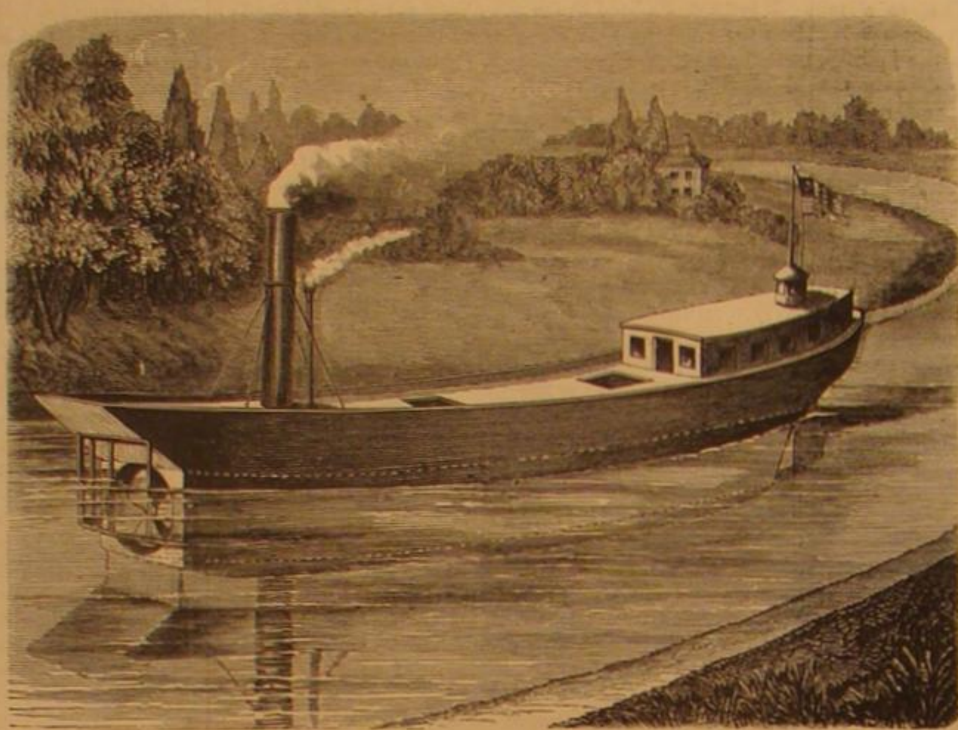
THE *Adriatic* is the name of a new and splendid screw steamship plying between New York, Cork, and Liverpool. She belongs to the White Star line. On her first passage to this city, recently, the time made was 8 days 14 hours. The *Adriatic* is believed to be the fastest ocean steamer afloat.

New Method of Propelling Canal Boats.

Notwithstanding the numerous attempts to substitute something better for canal boat propulsion than the wheel or screw, it may be safely said that the majority of mechanics and engineers still adhere to these time honored devices as being superior to anything else yet produced or likely to be produced for the purpose. The question of position is, however, still a moot-point. Side, bow, and stern have each their advocates, and arguments *pro* and *con* are not wanting for either of these positions. Resort to practical experiment can only determine which is the best, and this will, no doubt, soon be brought about, by the action of the New York State Commission and the alluring prize it has at its disposal for the successful competitor.

The inventor of the method illustrated in the accompanying engraving believes the bow is the position for either a propelling wheel or screw, and in order to produce direct longitudinal displacement and obviate side swells, he proposes to combine one or other of the devices referred to with a tube or passage from bow to stern of the boat through which the displaced water shall pass, while the boat is made to advance correspondingly.

Although we have shown in our engraving only the screw thus applied, the application of a paddle wheel instead will easily be comprehended. No special peculiarity in the engine or construction of the boat is involved, with the exception of the longitudinal tube or passage. The most approved practice in steam engineering can, therefore, be applied in the construction of the engine, and its application to driving the propelling wheel or screw. There can be no doubt that the displacement taking place through the tube will obviate side swells. How far power can be economically applied to propulsion in this way can only be settled by actual trial. The inventor desires to enlist capital to enable him to make such a trial and to compete for the prize offered. Those who would like further information or to correspond with the inventor, Dr. L. Heins, can address him till the 20th May at 36 Platt street, New York, care of Sprague and Close, or, after that date, at his residence, Brunswick, Ga.



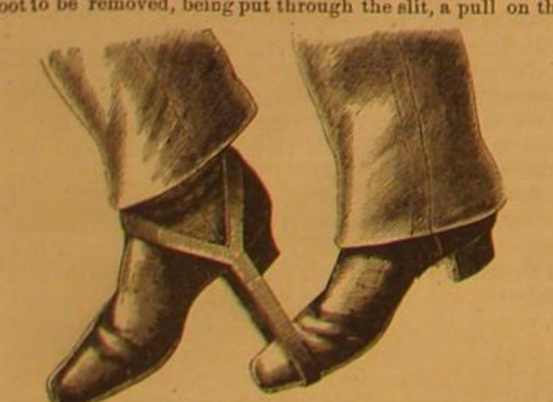
HEINS' METHOD OF PROPELLING CANAL BOATS.

Chinese by Telegraph.

The managers of a telegraph company in China have recently solved the problem of how to transmit telegraphic messages in Chinese. At first sight the difficulty of an alphabet which is made up of about fifty thousand distinct characters appears almost insurmountable, but the obstacles have been overcome, and A-Fat at Hong Kong encounters no more difficulty, in communicating with A-Chum at Shanghai, than does Brown with Jones under similar circumstances. The plan adopted is this: Some few thousands of the more common Chinese characters are cut on wooden blocks after the manner of type, and on the reverse end of each is a number cut in the same way. Now A-Fat, having handed in his message written in Chinese, the native clerk selects in order the corresponding blocks from the case, and prints off the numbers on their reverse. This he hands to his English colleague, who telegraphs the numbers to the destination desired. Here the reverse process is gone through, and, the numbers having been taken from the cases, the characters are stamped on paper, and thus A-Chum is put in possession of the cherished wishes of A-Fat through the medium of his native language.

POCKET BOOTJACK.

This device consists simply of a leather strap about an inch in width and eighteen inches in length, which is united at its ends, and slit as shown. The foot, upon which is the boot to be removed, being put through the slit, a pull on the



part, B, by the other foot, is claimed to readily remove the boot. If this invention is effective, there will be a large demand for it from travelers and others, who desire an article of this kind which occupies only a small space. Patented Feb. 8, 1870, by Charles Brown, Charlotteville, Va.

Iron Telegraph Pole.

A galvanized iron pole comprising two sections jointed together where the upper one, which is the smallest, screws into the top of the other, has its base set in a box and packed in with cement, concrete, etc. The box is to be planted in the ground for holding the pole erect. At the top of the box is provided a hub, with arms, extending laterally to the edges of the box; and at the upper end of this section is a ring or collar, for the connection of the upper ends of guys whose lower ends are connected to the lower end of the lower section; while near the center the said guys are stretched over the two ends of a cross tree used for bracing the section. Below the collar is a screw threaded ring or collar, employed for forcing the collar upward for straining the guys; and below this ring is another hub, with arms for straining another set of guys, which are connected at the lower ends of the hub and at the top of the upper section. These guys may be tightened like the others by an adjustable collar, or they may have swivels for tightening them. Any number and lengths of sections may be used, and the tube constituting the body of the pole may be made round, square, or otherwise, or of any size. One or more tubes in each section may be used side by side, and confined together by a band or hoop for strengthening one by the other. If the pole is not to be more than fifteen or twenty feet high, one section of tube will do, with one set of guys; but if higher, it will be better to have two sets. The box may have a bottom, as shown in the drawing, for holding the lower end of the pole resting on and connected to it, and the lower hub and arms may be attached to the top of the box by straps of iron bent over and nailed to it. But instead of having the box for holding the pole, it may be mounted on a stone or other suitable base or planted in the ground. The arms at the top of the pole for holding the insulators may be insulated by means of an inverted cap, mounted on the top of a wood, glass, india rubber, or other block, placed in the top of the upper tube. In the top of this cap is placed a composition point to which a copper rod or wire is attached with its lower end anchored in the ground to convey away the electricity and prevent the pole from becoming a conductor. This copper conductor may be placed inside of the pole, if preferred. If, however, it be desired to use the pole as a conductor, the insulators at the top will be dispensed with, and in this case the hub at the top of the pole will serve both as a support for the message wires and for tightening the guy rods, which may then be connected to it.

The message wire supporter and cap which cover the insulators may be made of malleable cast iron or other suitable material. The cap is made larger than the cup, at the top of the pole, which holds the insulators and fits over it so as to shed rain.

Mr. Alfred Homer Trego, of Philadelphia, Pa., is the inventor.

Substitute for Lithographic Stone.

A substitute for lithographic stone has been introduced. For the purpose in question, the inventor takes a block or slab of slate, or other material, which is to be made perfectly smooth and true, and then coated with glue or other gelatinous matter. In some instances he adds a solution of silicate of soda and bichromate of potash, or uses this solution alone. The coated block is exposed to sunlight, and then washed to remove the superfluous coating; and after being dried, it is ready for drawing or writing upon. The ink or pigment is prepared with albumen or other gelatinous matter, dissolved in a saturated solution of bichromate of potash, either with or without chrome alum, and with a small quantity of ivory black, to render the ink visible. The picture is drawn upon the prepared block with this ink, and exposed to sunlight, and afterwards the surface is covered with gum or glycerin. The block is then ready for the printer. Another method consists in using, as substitutes, metallic substances, as tin, brass or zinc, preparing them first by rubbing with a solution formed of one ounce of hydrochloric acid, one fourth of an ounce of zinc, and one dram of glacial acetic acid. After the plate has received the impression from the stone or wood in an ordinary lithographic press, or by means of a "transfer," the ink thereon is dried by heating the plate, which is afterwards plunged while still hot into cold water; this latter operation being supposed to confer permanency upon the impression. The ordinary ink is used in this process, which appears to consist, in reality, of "soldering" the design on the plate and burning it in.

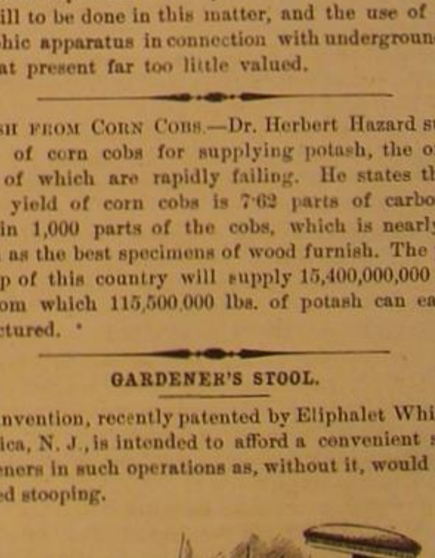
Underground Rope Tramways in Germany.

The coal mines of the Saar are situated in a hilly district, and this configuration of the country, and the circumstance that the coal measures come up to the surface over a large area of the district, is singularly favorable for adits and levels, instead of shafts; and although a great part of the coal beds above these adits is already exhausted, they are still used to bring the coal on the surface to the smaller valleys. The wagons or tubs used to be drawn by horses in trains of 15 to 20; but this system is now abandoned, and the wagons are drawn by stationary steam engines, after being fastened to long ropes or chains. There are now three different systems of rope tramways in use. The counter rope system has been adopted in one mine, in an adit 1,024 fathoms long, and in another, 1,420 fathoms; it is also used at a third mine for a length of 800 fathoms. This system consists of two engines—one in the mine, one outside, alternately pulling a train of 30 to 36 wagons out or in, when the end rope runs freely off the winding drum, which is for a time disconnected from its engine. The tail rope system, used also at some collieries near Newcastle and Durham, has been adopted in two other places, for 1,400 and 1,020 fathoms of length respectively. With this system a single steam engine is required, which drives two drums in opposite directions—one hauling in the rope, the other paying it out, when the rope at each end of the tramway is carried round a sheave back to the engine. The train being connected to one branch of the rope, and the empty wagons to the other branch, the engine pulls the loaded train out, and drags the empty one into the mine, and is reversed after every journey. The endless rope system is in use elsewhere, and consists in one engine driving a rope continuously round in the same direction, when loaded trains are fastened to it on the way out, and empty trains on the way in. This system is adapted to short distances. Instead of attaching the wagons in trains, it is now found more useful to fasten them singly at certain intervals, so that the tipmen have time to empty one wagon over the screen before the next arrives. The advantages of the single wagon system are too conspicuous to be overlooked, but it is only in connection with the endless system they can be fully developed. The difficulty of the increasing dead weight of the rope for great distances must be overcome by the adoption of auxiliary engines, and the regulation of their speed can be effected by the use of telegraphs and self acting brakes and governors. The underground transport through the road ways has always been a heavy item in collieries. There is much still to be done in this matter, and the use of electric telegraphic apparatus in connection with underground transport is at present far too little valued.

Potash from Corn Cobs.—Dr. Herbert Hazard suggests the use of corn cobs for supplying potash, the ordinary sources of which are rapidly failing. He states that the average yield of corn cobs is 7·62 parts of carbonate of potash in 1,000 parts of the cobs, which is nearly twice as much as the best specimens of wood furnish. The present corn crop of this country will supply 15,400,000,000 lbs. of cobs, from which 115,500,000 lbs. of potash can easily be manufactured.

GARDENER'S STOOL.

This invention, recently patented by Eliphalet Whittlesey of Mullica, N. J., is intended to afford a convenient support to gardeners in such operations as, without it, would require continued stooping.



The stool is strapped to, and carried by, the foot, leaving the hands free, so that whenever the operator desires he may sit upon the pad or seat. The same device is applicable as a milking stool, and perhaps for other purposes where it is desirable to avoid the fatigue of continued or often repeated stooping.

The safety of Dr. Livingstone, the celebrated African traveller, is now assured. Recent accounts state that he has arrived at Zanzibar, from the interior of Africa.

Narrow Gage in the United States.

Engineering, in an editorial on "Narrow Gage Progress," says: "It is less than a year since the advantages of narrow gage became firmly fixed in the Western American mind; yet to-day nearly all the new lines being constructed or projected in the West are narrow gage."

It is, of course, not to be expected that an English journal should have complete and minute information concerning American railroads; still this extraordinary statement is quite unaccountable.

We make it our business to obtain (and give) information concerning the progress of all new lines whatsoever, and we are very sure that not one twentieth—and probably not one fiftieth—of the lines in progress are narrow gage roads.* We are likely to lay track on six or seven and perhaps eight thousand miles of new railroad during the year 1872, three fourths of it in the West. Of this probably not more than from two to three hundred miles will be narrow gage.

That there are projected narrow gage railroads to the amount of several thousand miles is not improbable; but then there are probably a million or two miles of standard gage railroads projected, there being not many townships in the United States which have not a projected railroad. We are accustomed, however, to count the railroad only when the rails are laid, the organization of a company signifying little; the letting of a contract, not much; the completion of considerable grading, even, only a probability (as hundreds of miles of old road beds testify). The slips between the cup and the lip are increased in the case of a narrow gage railroad by the possibility that after all it may be made of the standard gage—a fate that has befallen several promising narrow gage projects.

As for the history of the narrow gage movement in this country, not nearly so many lines of that gage are being projected now as were a year ago. Then most of the narrow gage companies were organized by men with no knowledge either of engineering or railroad operation. When these companies have come into the control of experienced railroad men, as they have occasionally, their first step frequently has been to adopt the standard gage.—*Railroad Gazette.*

Improvement of the Steam Engine.

In a paper read before the Polytechnic Association of the American Institute by Professor Thurston, on the above subject, he summed up his conclusions in the following statements:

The direction which improvement seems now to be taking, and the proper direction, as indicated by an examination of the principles of science, as well as by our review of the steps already taken, would seem to be:

Steam must enter the machine at the highest possible temperature, must be protected from waste and must retain, at the moment before exhaust, the least possible amount of heat. He whose inventive genius, or mechanical skill, contributes to effect either the use of higher steam with safety and without waste, or the reduction of the temperature of discharge, confers a boon upon mankind.

In detail: *In the engine*, the tendency is, and may probably be expected to continue, in the near future at least, toward higher steam pressure, greater expansion in more than one cylinder, steam jacketing, superheating, a careful use of nonconducting protectors against waste, and the adoption of higher piston speeds.

In the boiler, more complete combustion without excess of air passing through the furnace, and more thorough absorption of heat from the furnace gases. The latter, I am inclined to suppose, will be ultimately effected by the use of a mechanically produced draught, in place of the far more wasteful method of obtaining it by the expenditure of heat in the chimney.

In construction, we may anticipate the use of better materials and more careful workmanship, especially in the the boiler, and much improvement in forms and proportions of details.

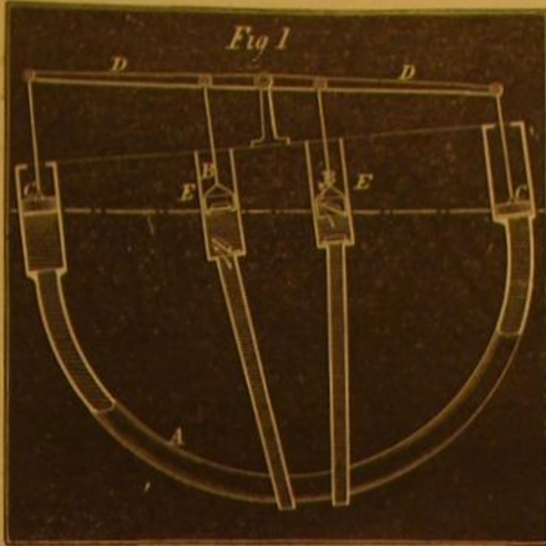
In management, there is a wide field for improvement, which improvement, we may feel assured will rapidly take place, as it has now become well understood that great care skill and intelligence are important essentials to the economical management of the steam engine, and that they repay liberally all of the expense in time and money that are requisite to secure them.

A correspondent of the Birmingham *Post* writes that recently one of the trains from Liverpool, "which usually stops at Northwich, did not stop there; but on arriving at a point on the line between Northwich and Middlewich, it slackened speed and finally stopped. After some delay the passengers felt uneasy, and one gentleman walked up to the engine to ascertain the cause of the stoppage, when he found both driver and fireman drunk and lying asleep on the foot plates of the locomotive, the steam exhausted, and the fire out." The correspondent added that the driver and fireman have both been suspended. Most readers will feel that if they had received their deserts, their suspension would have been by their necks.

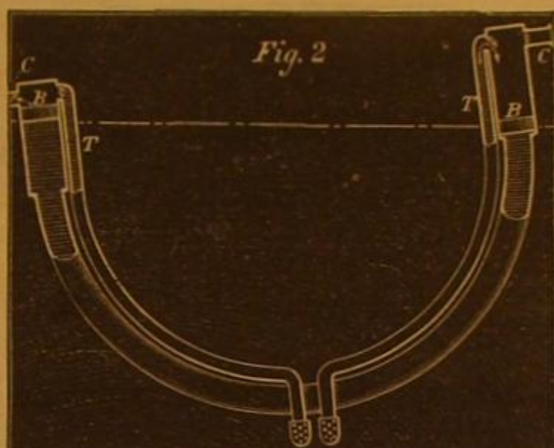
THE Western and Southern Railway Association, at its recent session in Atlanta, Ga., discussed the questions appointed for the meeting and adjourned to meet at the Kennard House, Cleveland, July 9. Among the questions discussed were: The best means of preventing accidents; responsibility of railroads for injuries to employees; interchange of cars, mileage and demurrage; the maintenance of agreed rates and contracts; sleeping cars and express contracts; brakes and platforms; hight of car buffers; breakage of rails and axles; national time; repairs of foreign cars, etc.

Hydromotor for Ships, Pumps, and other Purposes.

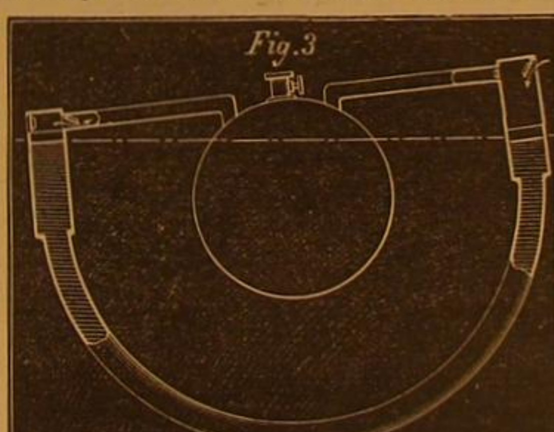
The following system, for utilizing the motion of rocking vessels for the pumping and ventilation of ships, is communicated by Mr. Henry Baudouin, of Grass Valley, Cal. In many respects, it is analogous to the system published and il-



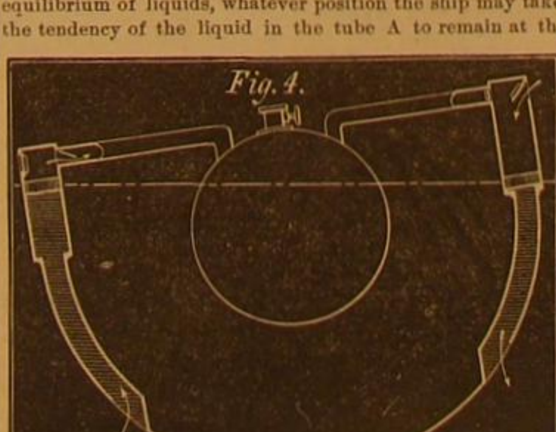
lustrated on page 15, current volume of this journal; but it differs considerably in detail, and, in the employment of compressed air as an intermediate motor for pumps, adds a new feature which seems valuable. Mr. Baudouin thus describes his method:



In Fig. 1, A is a curved tube, containing a certain quantity of liquid, water or mercury. The two branches of the tube are terminated by two cylinders, of which the upper part is open. In these cylinders are placed two pistons, C, resting on the liquid. The rods of these pistons are fixed to the arms,



B, D, of two pumps, P. Below each pump cylinder, E, are placed two valves, B. According to the principle of the equilibrium of liquids, whatever position the ship may take, the tendency of the liquid in the tube A to remain at the



same level, whether the ship roll to one side or the other, will cause the pistons to move in the cylinders, E, and so to work the pumps.

The pressure of the liquid can be directly employed to work the pumps by terminating the rod of the piston in the cylinder by a T, to the two arms of which are fixed the rods of the pumps placed one on each side. By this means a longer stroke of the pump piston is obtained, but the power is diminished.

In Fig. 2, the cylinders, 1 and 2, perform the functions of exhaustion and force pumps. The pistons, B, have no rods; and to the upper part of each cylinder is attached a tube, T, descending to the bottom of the vessel. Two other tubes, C, communicate with the external air; these tubes are furnished with valves, as shown. Supposing the ship to be resting on the keel, with one piston, B, at the bottom and the other at the top of its course: when the ship's side lifts and she rolls to the starboard, the pressure of the liquid will cause the piston in one cylinder to rise, the compressed air between the piston and the upper part of the cylinder will open the outer valve and will close the inner one, while in the cylinder opposite the contrary will take place. When the ship returns on to the port side, the action is reversed; and this will take place at each rolling motion until the water comes into the cylinders, whence it will flow out. We thus have two exhaustion and force pumps, to the pistons of which we can give long strokes.

Fig. 3. As the movements of a ship are far from being regular, the power of the liquid can be used to compress the air in a receiver, and this compressed air can be used, as steam is, to work the pumps with regularity. In this case, each cylinder acts as a machine for compression, the pistons have no rods, and the valves act as represented in Fig. 3. The air which flows into the reservoir performs the office of the boiler of a steam engine, the pressure of the compressed air on the inner valves forcing them to remain closed, and the air being led to the engines through a pipe from the top of the reservoir.

Fig. 4. In place of a tube full of liquid, the lower part of the cylinders can be made to open into the sea; placing two cylinders on each side of the ship, in front and behind, a considerable force for compression can be obtained, and at the same time the rolling and pitching of the vessel can be utilized. With several cylinders on each side, all along the ship, a larger force can be obtained.

I leave to those who have the necessary time and money the work of carrying out this problem. Awaiting this, I suggest the compressed air: 1st, for improving the ventilation; 2d, for working the pumps; 3d, in substitution of steam for the fog whistles on board of sailing ships.

Vesuvius and other Volcanoes.

The volcano of Mount Vesuvius, near Naples, in Italy, has lately broken out with violent eruptions of lava, the molten streams of which had, at the latest accounts, completely destroyed some of the mountain villages, while others were threatened. The lava streams advanced at the rate of three fifths of a mile per hour.

The eruption was accompanied by fearful electrical phenomena. Lightning darted incessantly from the summit of the volcano, the quakings of the mountain were violent and frequent, and thunder continuous. Burning cinders, stones, and scoriæ fell fast and thick in the surrounding towns.

At Naples, ten miles distant from the volcano, dense clouds of smoke and ashes covered the city. The ashes fell in the streets like snow, and reached a depth of two or three inches. The people made use of umbrellas to protect themselves from the ashes. The Bourse was closed and business generally suspended.

The present is the most destructive eruption that has taken place since 1631. The town of Torre del Greco, which is now mentioned as threatened, was, in 1794, utterly overwhelmed by a stream of lava which contained upwards of 46,000,000 of cubic feet. Thick sulphurous smoke, white as snow, resembling the fumes of gunpowder, at that time enveloped the side of the burning mountain, and sometimes rose up in solid masses to an altitude of 14,000 feet, presenting at night time, when lighted up by the lurid columns of fire from the crater, a spectacle of extraordinary magnificence.

The phenomena of volcanic eruptions seem to be chiefly limited to certain regions of the earth whose area is well defined. In some of these, there are continual burstings forth of flame and smoke, scoriæ and lava, like Stromboli in the Mediterranean, on the coast of Sicily.

Stromboli discharges lava every hour with unceasing regularity, and has done so for the last 2,000 years. Mauna Loa, in the island of Hawaii, is famous for the enormous size of its crater and the incalculable quantities of lava it discharges at irregular intervals.

Sangay, a volcano in Chili, 17,000 feet high, has an eruption every quarter of an hour, belching out scoriæ and lava with a hideous roar.

In the island of Java, there are some forty-six volcanoes, and eruptions are constantly going on.

IRON shipbuilding appears to be rapidly becoming an important branch of industry in Denmark. Although for the last fifteen years small iron vessels, designed for trading between the various Baltic ports, have been built at Copenhagen, it is only recently that the construction of large steamers has been attempted. At present several of 1,000 tuns are being built, and one of these, it is stated, will be employed in laying down the telegraph cable between China and Japan. Two steamers, each of nearly 900 tuns—the *Rolfe* and the *Thorwaldsen*—have just made the passage to New York.

M. Champouillon avers that putrefaction is much more rapid in the dead bodies of alcoholized subjects than in those of comparatively sober individuals.

Correspondence.

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

A New Astronomical Instrument.

To the Editor of the Scientific American:

At the last meeting of the Natural History Society in this city, Professor Bushee exhibited a new instrument, of his invention, for illustrating the precession of the equinoxes, or in other words, the deviation of the axis of the earth from an exact parallelism with itself; this deviation is about 50" a year, hence the equinoctial points will make (as is well known) an entire revolution in about 25,000 years; and hence also the circuit of our North star is gradually widening and will, in the course of distant future, cease to be our North star; and, in about 12,000 years, will appear to move in a circle of more than 45° radius.

The instrument is a skeleton model of our celestial sphere, about 18 inches diameter, composed of several light brass rings arranged as meridians and parallels, and one flat ring, with its signs and divisions representing the ecliptic or celestial equator; within this skeleton sphere, a model sun is adjusted, around which a model earth, with its extended north pole, is made to move by means of appropriate gearing; so that, by the turning of a crank, the principle or *modus operandi* of this immense sweep of the terrestrial around the celestial pole is clearly made manifest to the observer. Of course no degree of accuracy as to time or proportion can be expected in a model of this kind, yet such instruments are a great help to our comprehension of the vast movements going on in the universe.

While listening to the lucid explanation and lecture of the Professor, it occurred to me that, to say nothing of our ignorance of celestial things, mankind generally have but a vague conception of the comparative significance or importance of various matters upon the earth. For instance, a model earth 21 feet diameter gives us only one thirty-second of an inch to a mile; on such a globe, one hundred acre farms would of course be utterly invisible to the naked eye, and the loftiest ranges of mountains might be represented by a few grains of rifle powder; and the entire human family, estimated at one thousand millions, might be gathered without uncomfortable crowding, upon a spot less than one twelfth of a superficial inch. And the greatest depths which man has yet been able to reach, in the way of mining or otherwise, would not exceed the thickness of thin card board, and the entire animal portion of the earth now living would scarcely fill a child's thimble. The extent of the sensible atmosphere would not exceed one inch and a quarter; and if man shall ever be able to penetrate the earth to the depth of ten miles, it would be but little more than a quarter of an inch on this 21 feet model; hence the model earth must be many times 21 feet in diameter in order to show to the naked eye any of the great works of mankind on a like scale.

Boston, Mass. F. G. W.

Governor Evans on Sea Sickness.---Practical Working of his New Patent Swing Berth.

To the Editor of the Scientific American:

Your favor notifying me that a patent had been allowed on my plan for a ship's berth and chair to prevent sea sickness is received, and I am daily expecting the documents from the Patent Office.

It may be of interest to you to have its history.

A remarkable fact is that my residence is as far removed from the sea and from all connections with navigation as any place on the continent. And although, while Governor of Colorado, in reply to Secretary Stanton's complaint that I, being simply a civilian, had no right to press my views, of our defences against the Indians, on the War Department, I claimed to be "Commander in Chief of the Army and Navy of Colorado," no sail vessel or steamer ever comes within four hundred miles of the Territory. So you see that it was not familiarity with the sea that directed my attention to the means of avoiding sea sickness.

In June, 1869, my wife sailed from New York to Liverpool, in the Cunard ship *China*, in good health. Though the voyage was by no means a stormy one, she suffered so much from sea sickness that before landing she was greatly prostrated, and for a month after was confined to bed, and a considerable part of the time was unconscious and not expected to live. After eighteen months of the best care and medical attention, she remained so feeble that I was satisfied that for her to return home across the ocean, without some efficient means of preventing sea sickness, would be fatal—it would have been little short of suicide. I therefore instituted a general enquiry for some means of avoiding the influence of the motion of the ship in producing sea sickness. To this enquiry, I got uniformly the assurance that it could not be done, as everything had been tried and failed. The question with me had resolved itself into this shape: I must either leave my wife permanently on the other side of the Atlantic Ocean, or procure some apparatus to prevent sea sickness. And finding that no reliable means had been devised, I had no hope except in my own ingenuity. In November last I went to an ingenious mechanic in London and described to him the berth for which you have secured me letters patent. He told me it would not answer the purpose, and declined to make one on that account. But from my observation of the sickness on ship board being increased, by the rolling and pitching of the vessel and its subsidence when the sea became calm, I was satisfied that sea sickness was caused entirely by the deviations from a horizontal position of the support of the patient, caused by the rolling and pitching of the ship—and that the berth I proposed, by keeping the patient, or his or her support, constantly in a horizontal position, would prevent the sickness. I therefore, with the permission of the mechanic, went to his workmen and had a berth constructed as represented in the application made to you for a patent. I had it put in the place of one of the ordinary berths on the steamship *Russia*, and my wife came over on it last December. Although the passage was a very stormy one and a large number of the passengers suffered greatly from sea sickness, she came over without suffering the slightest effects of the malady. That this result was not on account of any change in her predisposition to suffer from sea sickness was proved by the fact that her head would immediately commence swimming when she would get out of her berth, if the ship was rolling, and it would only cease when she returned to her berth. The berth kept her supported in a horizontal position during all the varied motions of the ship, and saved her from any sickness, and I have no doubt saved her life. Necessity was, emphatically, the mother of this invention, and I doubt not it will prove a great blessing to all who suffer sickness from crossing the ocean. Its successful operation, during the voyage, was witnessed by a large part of the passengers and officers of the ship, Senator Stewart of Nevada, Governor Ward of New Jersey, Governor McCook of Colorado, and other prominent persons being among the number. It has already been patented in Great Britain, France, Italy, and the United States.

As the berth takes little more room than those in ordinary use, and can easily be put in all vessels of ordinary construction at a moderate expense, I feel confident of its early introduction into general use. I have already the offer of the officers, of one of the popular lines of steamships plying between New York and Liverpool, to put the berths in their ships.

Denver, Col. JOHN EVANS.

Sewing Machines and their Effect upon Health.

To the Editor of the Scientific American:

Reading your article, in No. 16 of the current volume, with the above title induced me to write the following, in the hope that it may benefit those interested. My objections, after an experience of five years, to some machines, are these:

1st. Many makers place the machines too far back from the front of the table, causing the operator to lean toward it, particularly when near sighted.

2d. In many machines, the fly wheels are too light for the power required to keep up the momentum, making it a continual effort to keep the machine in motion.

3d. Any machine in which the work runs across the front of the table, instead of from the operator, is very objectionable, as persons unconsciously lean over the machine to direct their work, producing a pain in the back or neck; besides which, having to pass large articles over the lap is very uncomfortable and fatiguing in warm weather.

These objections can be remedied by makers who will leave the old beaten track and construct machines on more physiological principles.

Until such changes are made, I would suggest that some one invent a sewing machine chair, to be made inexpensively with cane seat, which can be raised or lowered with a screw like a piano stool, and with a moderately low back, like a school chair. This would permit one to lean well backward to rest while basting, etc. The revolving seat allows a person to turn to or from the machine, avoiding lifting the chair each time, and the seat should be raised until the lap inclines downward to the knees, which position allows the lower muscles their full action. A chair of this kind can be set much closer to a machine than any other, if the base is made like a tripod.

Persons who use a piano stool find it preferable to an ordinary chair. By carefully cleaning and oiling both the motive and operative parts of the machine regularly, and using this improved chair, keeping the body erect, almost any one would be able to sew continuously with little fatigue.

Three to five minutes, each morning, spent in cleaning the machine will give an operator an advantage of an hour or more in a day by economizing strength. Sewing will thus be more beneficial than otherwise.

A TEXAS SUBSCRIBER.

American Silk Manufacturing, Silk Throwing and Weaving, and Locomotive Building, at Paterson, N. J.

To the Editor of the Scientific American:

During the last few years, rapid advances have been made in this country in the manufacture of silk goods. While stopping for a day at Paterson, N. J., accompanied and guided by Mr. Frederic Baare, of the Baare Silk Manufacturing Company, I saw more of this manufacture going on than I had supposed could be seen in the whole United States.

We first entered a room, where girls were engaged in assorting the skeins of raw silk, taken from the sacks in which it was imported from Japan, China, Italy or France. The raw silk differs as much as wool in size and quality of thread. Before it can be wound, it is necessary to remove the gum which is left on it by the silkworm. This is done by soaking it in soap and water. To remove the soapy water without injuring the silk has, until recently, been a very difficult matter. This difficulty has been entirely overcome by a machine, the invention of a member of the French Academy, lately deceased. The essential portion of the machine is a tub, similar in shape to a large wash tub, the sides of which are a series of rings one above another with open spaces between. The skeins are carefully lifted from the vats and laid into this tub around the edge. The tub is then made to revolve rapidly around a vertical shaft, and the water is driven out, by centrifugal force, through the chinks in the sides. To keep the water within bounds, the revolving tub is cased with another having close sides and a perforated bottom. By this means the silk is quickly made sufficiently dry for winding. A similar application of the centrifugal force I lately saw at Herkimer, N. Y., in a contrivance for extracting honey from the comb without breaking the latter, thus enabling the bees to "gather honey all the day" without the loss of six days in seven in making wax. In the winding room, the skeins are put upon reels from which the silk is wound off upon bobbins. In the room visited were nearly 5,000 reels, arranged in rows on long frames, 224 on a frame, two persons attending to one frame. From the winding room, the bobbins are taken to the doubling room, where the silk from two, three, or four bobbins is wound together upon one. The spinning follows, which is done on what are called three deckers, or three story spinners, on which 12,000 spindles made music enough for a Boston jubilee, and not less melodious, perhaps, if rightly heard, than the harmony of which the Rev. Robert Collyer speaks as resulting from 2,000 discords. The processes above mentioned, by which the silk is prepared for the loom, form a distinct branch of the silk business; those engaged in it are called throwsters. In this instance, the feminine termination, *ster*, has not, as in many cases, lost its significance, the employees being mostly females. The establishment visited was that of the Ryle Silk Manufacturing Company.

We next visited the works of the Baare Manufacturing Company, where we witnessed the operations of warping and weaving broad silks. They have some forty looms, and are now engaged in making plaid silks of various patterns for ladies' scarfs. Mr. Baare is one of the pioneers in the silk business in this country. Several years ago, he started a factory in Schoharie county, N. Y.; but afterwards, in order to secure better facilities, he removed his machinery to Paterson, N. J. He showed me some pieces of beautiful dress silk of his own manufacture.

In the same mill is the ribbon factory of John Day & Co. Here are 46 long looms, on each of which from 10 to 40 ribbons are woven at once, the exact number depending upon the width of the ribbon. There is a distinct shuttle for each ribbon, but they all move simultaneously. Ten yards is about the average daily product per shuttle, and the entire weight of silk used per day, about 100 pounds. In one loom was the warp for 14 six inch ribbons, each 240 yards long. Mr. Day has lately patented an improvement in ribbon looms, by which all strain on the thread of the warp is obviated.

Mr. Strange, of the firm of William Strange & Co., Secretary of the American Silk Manufacturers' Association, took me through his factory, and gave me some interesting facts. This factory employs about 500 operatives, and combines the throwing of silk and the making of ribbons, trams, and organzines, running 100 looms. It is estimated that 6,000 persons are employed, that $2,000,000 wages are annually paid, and that some $10,000,000 capital is invested in the Paterson silk factories.

Paterson has other extensive manufacturing establishments. I spent half an hour in a hasty walk through the Rogers locomotive works, where I saw the various pieces which form the "iron horse" being shaped and fitted for their places.

The Falls of the Passaic, the water works, and the hights which overlook the busy, thriving city occupied our attention for an hour, in pleasant contrast to the din and bustle of the factories.

Paterson, N. J. C. H. DANN.

Concentration of Tannin.

To the Editor of the Scientific American:

A short time since, I noticed an article in your paper relative to the production of a concentrated extract of hemlock or oak bark. Every chemist knows that the reduction of tannin into gallic acid is due to the action of oxygen. Without going into a detailed discussion on the *modus operandi*, allow me to say that if a suitable vessel (not iron) is used, and the tan liquor is placed therein, covered with a deep layer of hydrocarbon oil or paraffin (sufficient to protect it from the action of air), and heat applied, a superior extract is procured. Heavy oils that have a high boiling point only are to be used, and any degree of concentration may be secured. I have repeatedly carried out this experiment, and now give it to the public, having no facilities for engaging in the manufacture, and believing it to be valuable to those who have. GEORGE VINING, M.D.

Troy, N. Y.

FROZEN BEEF ESSENCE.—Dr. H. B. Hare (*Philadelphia Medical Journal*) writes that, in a case of scarlet fever in a child, the patient could not be induced to swallow the beef tea which his condition required. As he took ice with avidity, the father suggested that if the beef tea were frozen he might then be induced to take it in that form. The suggestion was carried out, and the child took the frozen beef tea readily. This expedient may, in many cases, be advantageously adopted.

AT some of the English works, slag is now broken up by Blake's stone breaker, and sold for road making; and we are told that the Bessemer slags, from the iron ore known as hematite, make excellent concrete, because of the large quantity of lime they contain; for which reason, and for the silica which they also contain, they make excellent manure for potatoes and barley. In the fields, the broken slag crumbles to powder.

BISCUIT MANUFACTURE.

Civilization and biscuits go together; indeed, it is only in very highly civilized countries that biscuits are made, although we are unable to call to mind the name of any nation, civilized or savage, by which they are not more or less highly appreciated. Messrs. Huntley and Palmer, of Reading, England, are perhaps the largest producers of biscuits in the world. Their buildings cover a very extensive area; at present not less than 1,800 persons find full occupation, while in busy seasons—as, for example, about Christmas—as many as 2,000 have been at work.

About 100 different varieties of biscuit are made by Huntley and Palmer; and they are continually inventing new biscuits and cakes. Speaking of cakes, we may add here that the firm turn out fabulous quantities of tea cakes, forty tuns being no uncommon order, Bristol cakes, sponge and supper cakes, with which they supply confectioners' shops all over England. With one or two exceptions all biscuits are produced in the same way. A dough is first made, and this is then stamped into biscuits, which are subsequently baked, *boiled*, and variously manipulated, according to the species.

We first enter the mixing room, in which are five or six machines used for making fancy doughs, and about as many used for plain biscuits. The "fancy" machines consist each of a miniature mortar mill, the cast iron pan of which is about 4 feet 6 inches diameter, and a foot deep. This revolves at some fifty revolutions per minute under a single heavy roller, nearly as wide as the semi diameter of the pan. In some cases the rollers are smooth, in others grooved. An attendant stands by each pan, and is supplied with the requisite proportions of treacle, sugar, butter, lard, whipped eggs, milk, etc., in large round iron buckets or drums. Over each pan is a canvas shoot, down which the requisite quantity of flour for one batch descends when required. The attendant is armed with a great wooden spatula or shovel, with which he turns over and mixes the materials, which are quickly reduced to a smooth homogeneous mass by the roller. From the pan the mass is transferred to barrows, where we shall leave it for a moment.

The "plain" mixers are horizontal cylinders, about 3 feet diameter and 4 feet long, traversed by a horizontal shaft armed with knives, by the rotation of which the body of materials is quickly reduced to the condition of dough. The bottom of the cylinder is then allowed to fall down by a very ingenious piece of mechanism, and the contents put in barrows.

The next process consists in converting the dough into sheets and stamping it into biscuits. The machinery used is ingenious and perfect.

The dough is passed between a pair of breaking rollers, under which runs an endless web of pure white felt. As it passes through the rollers it falls on the web, and is carried back to the attendant, who, again seizing the end of the sheet of paste, puts it between the rollers. This operation is repeated twice. The third time, after the dough—now in a sheet some 8 feet long, and 2 feet 6 inches wide—has just begun to issue from the breaking rollers, it is laid hold of by a boy and placed on a second endless band running up an incline and lying at a higher level than the endless belt just named. This second belt is of a very thick pure white felt. It travels round a roller, about 12 inches in diameter, 8 feet or 9 feet—measured horizontally—from the breaking roller. Round the belt roller the sheet of dough, clinging closely to the felt, is carried. Opposite the roller is a vertical frame oscillating on pins at the lower end. The upper end of this frame carries a set of swing stamps. The frame, set in motion by the gearing, alternately approaches to and recedes from the roller. As it approaches, the swing stamps assume a horizontal position and strike the sheet of dough, which is caught between the stamps and the roller. The former each cut out a complete biscuit of the required form. As the swing frame retreats, the stamps assume a vertical position and deposit the biscuits on a third endless band, by which they are carried to a set of open wire trays on which to be baked. They are quickly arranged on these by a boy. It is obvious that, as the biscuits are of various irregular shapes, much of the dough is left between the stamps. This falls on a short endless web under the machine, by which it is carried to an attendant who takes it away to be worked up again. The next process is the baking of the biscuits, but before proceeding to the ovens we must describe the extremely curious way in which some of the smaller biscuits, such as "ratafias," "cocoa nut," and one or two others, are made by hand.

The dough for such biscuits is incorporated in special mixers, simply large wooden boxes within which a horizontal shaft armed with paddles or spades rotates slowly, thoroughly incorporating the ingredients. The resulting dough, unlike that used for ordinary biscuit—which is very hard and leathery in consistence, the smallest possible quantity of fluid being used in its preparation in order to insure crispness—is, in the case of "ratafias," "cocoa nuts," etc., semifluid. In other words, it is a thick paste. Proceeding to another department but a few yards off, we find eight or ten white capped, white aproned men hard at work making the dough into biscuits in the following way: Each man is provided with a kind of waterproof bag, capable of holding a pound or so of dough. The bag has at the lower end two tin orifices, jets, or tubes. The bag being supplied with the proper quantity of dough, the upper end or mouth is twisted up to close it. The bag is then grasped by the workman in a way impossible to describe. By squeezing the bag, the dough can be made to flow out of the tubular orifices. Opposite each man is a sheet of that peculiarly thin paper with which everybody who eats sweet biscuits is, no doubt, familiar. Holding the dough bag over this sheet of paper, the workman, beginning at the left hand side of the sheet of paper, squeezes the bag gently, and thereby forces out two big gouts or drops of dough; a jerk detaches these from the bag, and behold two ratafias on the paper ready to be baked. A slight motion of the hand to the right, another squeeze and a jerk, and two more biscuits lie in a line with the first, and so the operative proceeds line after line till his paper is filled. The operation is very simple to look at, but it requires great sleight of hand, to work at a high speed and yet make all the biscuits as nearly as possible of the same size. The rapidity with which a man will cover a large sheet of paper with little dabs of biscuit dough is really remarkable. The whole operation constitutes one of those feats of manipulation, perfection in which can only result from long and careful practice.

We may now proceed to consider the means by which the biscuits are baked. On the ground floor are eight or ten ovens of very large dimensions. These are all heated by hot air flues from separate furnaces. The general principle consists in depositing the unbaked biscuits on an endless web of wire or of flat bars of iron, which, continually moving through the oven at a velocity regulated by the size and nature of the biscuits to be baked, carries them through in from five to ten minutes. The biscuits are continually fed in at one end, and are continuously delivered into hoppers or boxes placed to receive them at the other. The delivery ends of the ovens open into the sides of a long and rather dark passage. No machinery is to be seen here, nor any trace of fire—nothing, in short, but a series of long, narrow, horizontal openings, like that of a gigantic letter box, in the walls, and beneath these the boxes to receive the biscuits. These last come tumbling through the wall without visible cause, at short intervals, in ten or a dozen at a time, just as though the street ran outside the wall and a great public, who used biscuits instead of letters as a means of corresponding with their friends, kept on posting biscuits all day. The incautious visitor who picks up one of these incoming morsels is likely to feel sensations of keen regret immediately afterwards, the biscuits being quite hot enough to inflict a mild burn.

A very large proportion of the biscuits thus made are finished as soon as they are baked, but this is not true of all—some require to be ornamented. This ornamenting is effected in various ways. In some cases a glaze of sugar properly colored is put on before they are baked; in others the biscuits proceed to the fine art department. Here we have a light, airy studio, in which we find four or five artists—we can find no more suitable title—some engaged in decorating supper cakes, others building up a magnificent wedding cake, carefully preserved, during such time as the builder is not at work, under a glass shade; others again are at work on biscuits—pretty little things for dessert; some of these have a bright red sugar glaze on them; these are being decorated with ships, swans, roses, branches, or geometrical patterns. The pencil used by the artist is simply a bag, similar to that used in making ratafias and already described, with the exception that it is very much smaller, and fitted with but one small nozzle, the hole in which is less than a sixteenth of an inch in diameter. The white thick pigment used by the artist is simply a preparation of white sugar, and with this pencil he turns out all manner of dainty devices, with a skill, taste, artistic feeling, and endless powers of invention which must be seen to be appreciated as they deserve.

We have stated already that biscuits are sometimes *boiled*. Two or three sorts are thus treated; of these we may particularise the very light crisp cracknels, triangular in shape with the corners turned up. The boiling process is one of the most curious conducted by Messrs. Huntley and Palmer. At the top of the house, in a little out of the way room, we find a large cauldron, heated by steam and nearly full of water boiling away merrily. Into this cauldron the cracknels are thrown just as they come from the stamping machines. They sink at once to the bottom, where they remain for about five minutes. The moment they are sufficiently cooked, they float up to the top, and are skimmed off with a wire skimmer. They are then sent down stairs to be baked.

A very large portion of Messrs. Huntley and Palmer's works is devoted to the operations of sorting, packing, and sending out goods to all parts of the world. We cannot give a better idea of the magnitude of the trade than by stating that the average output of biscuits suffices to occupy no fewer than thirty railway trucks per day.—*Engineer.*

Soap a Source of Skin Diseases.

Obscure affections of the skin, of the face of men especially, are well known to specialists to be widely spread. They are commonly classed as *ekzema*, and, while causing great discomfort, especially at night, show nothing, or almost nothing to the eye, if the patient be otherwise in good health. Skin specialists frequently ask patients whether they have been using any new sort of soap, but no one seems hitherto to have traced any distinct communication between soap and this troublesome disease.

It is a fact, but very little known to the multitude of both sexes who use the "Prime Old Brown Windsor Soap" of the perfumers' shops, that by far the largest proportion of it is manufactured from "bone grease." Few more beautiful examples of chemical transformation are to be found in the whole range of chemical manufacture than this one. At one end of a long range of buildings, we find a huge shed heaped up with bones, usually such as are of little value to the bone turner or brush maker, in all stages of putrefaction as to the adherent or inherent portions of softer animal matter attached to them, the odor of which is insupportable.

These are crushed and ground to a coarse powder, exposed to the action of boiling water under pressure, sometimes of steam, until the grease and marrow are extracted.

We need not here pursue the subsequent treatment of the rest of the material from which bone glue and "patent isinglass" are prepared, the latter of which we often eat in the soups and jellies of the pastrycooks, and finally to the "bone dust" or phosphate of lime, nearly free from animal matter, which is produced for the use of the assayer and the china manufacturer, etc., as well as for other purposes in the arts.

But let us follow up the bone grease, which is of a dark tarry brown color, and of an abominable odor.

By various processes it is more or less defæcated, bleached and deodorized, and is separated into two or three different qualities, the most inferior of which goes to the formation of railway or other machinery greases, and the latter is saponified, and becomes, when well manufactured, a hard brown soap, still, however, retaining an unpleasant smell. It is now, after being remelted, strongly perfumed, so that, like the clothes and persons of the magnates of the Middle Ages, its own evil odor is hidden by the artificial perfume.

This is the "Fine Old Brown Windsor Soap" of most of our shops. The natural brown color of the grease gives it the right tint in the cheapest way, without the coloring by caramel, which was the original method of the manufacturer.

Like all other things, there are cheap and dear Windsor soaps; and for the production of the former, little is done beyond saponifying and casting into blocks or bars. Were we to rely upon the many experiments that have been made as to the degree of elevation of temperature at which putrescent or other contagious matter is deprived of its morbific power, we might conclude that boiling and saponifying had made this hitherto putrescent grease innocuous.

It seems, however, more than doubtful that such is the fact in this case, for the soap thus made seems to be capable of communicating skin diseases when rubbed on the face for use in shaving.

But another promoter of irritation is not unfrequently also found. Whether it be that it is more profitable to the soapmaker to have a liberal proportion of the finer particles of the ground bone made up with the soap, or that these are difficult to separate completely, the fact is that bars of this "Brown Windsor" soap are to be bought containing a rich mixture of those small sharp angular fragments of bone which before boiling was putrid. When a piece of such soap is rubbed hard to a man's face, the skin is more or less cut and scored by these bony particles held in the soap like emery in a head "lap," and thus the skin is placed in the most favorable state to absorb whatever there may be of irritant, or contagious, or putrid in the soap itself. The existence of the bone fragments is easily verified by solution of the soap in water or alcohol, and examination of the undissolved particles with a lens; and I can readily, if need be, send you a piece of such soap for examination.

Now, without occupying too much of your space, I may just state that I have, while using such shaving soap, thrice suffered from ekzema of the face. On the first occasion, I derived no benefit from treatment by the two most celebrated dermal surgeons in London, and at last the disease went away of itself after giving up shaving for a time. I had by me a quantity of this brown soap, and through inadvertence took to using it again, for a time without effect; but when dry and hot weather came, with it came a recurrence of the skin disease, which also again, after some months of discomfort, went away. Curious to make sure whether or not the soap was the real cause, I a third time employed the soap deliberately to see if the ekzema was due to it. I was in excellent health, and in about three weeks I found the disease re-established, so that I think the soap must be viewed as found guilty. Good white unscented curd soap is now my resource, and with no ill effects.

Ekzema is always a distressing complaint even when affecting those in the most robust health. With those of bad constitution or lowered health, however, it seems to degenerate into bad or intractable skin diseases, so that probably this notice may not be deemed useless or uncalled for. —*R. M., in Nature.*

TEST FOR SULPHUR AND PHOSPHORUS IN IRON.—M. K. Meincke recommends the use of chloride of copper in place of that of iron, the former presenting the advantages of much greater facility in filtering the various solutions and liquids, and of producing more precise results. The method employed differs little from that in use by metallurgical chemists. The iron, finely divided, is dissolved in the chloride of copper, then the metallic copper is separated by means of an excess of chloride of copper and common salt the solution is then filtered through asbestos, which detains the insoluble particles, and the latter are then oxidized by means of concentrated nitric acid and chlorate of potash, and set to evaporate with hydrochloric acid; lastly, the sulphur is precipitated by barytes in the form of sulphate, and the phosphorus by molybdic acid according to the ordinary method.

A MUSEUM OF WORKING MODELS.—A correspondent, E. J. O., suggests, as an addition to the art museums the erection of which we have lately advocated, the formation of collections of working models of machinery. He maintains that such an exhibition would be a popular sight and a pecuniary success; and he believes that profits would be realized sufficient to make a dividend among the exhibitors. This scheme has been frequently proposed, and in a few instances tried, with pecuniary loss. There is so much working machinery to be seen in every town and village that it is doubtful whether a permanent exhibition, such as proposed, would pay expenses.

Improved Water Gate.

Our engraving illustrates the construction of an improved water gate, which comprises valuable and new features and to which we call the attention of hydraulic engineers as probably being, for some purposes, superior to others which have preceded it. The water flows through a straight passage, and the construction is such that, with minimum size a large proportional flow is obtained. The parts are accessible and easy of adjustment, and the whole combination will, we think, commend itself to those competent to judge of such matters. The valve can be used for gas or steam, and has much to recommend it for these purposes. The gate, as will be seen by the description of details below, is easily operated, even under great pressures. The extreme compactness of this gate, its automatic drain, and the peculiarly constructed resting place of the double wedge, whereby an unobstructed recess for sediment is secured, are also features which will impress those of our readers who are familiar with the requirements of a good water gate. The stem packing is remarkable for its compactness, durability, and effectiveness.

A, Figs. 1 and 2, denotes the shell or case of the valve through which a straight passage for the flow of water or steam is made. Two seats, *a*, Fig. 1, are formed on the internal opposite sides of the passage, against which the two valve disks, *b*, close. B is the bonnet, the flanged base of which is connected with the flanged top of the shell by means of bolts or screws, *c*, passing through the two flanges. C is the stem, which extends down through the neck of the bonnet and carries on its lower end a flanged traversing nut, D, to which the valve disks, *b*, Fig. 1, are affixed. On the stem is an annular collar, *d*, which is disposed within the neck, *e*, of the bonnet and rests upon a brass or metallic washer, *f*, which, in turn, rests upon the bottom of the chamber, *g*, of the neck. I is a screw nut, which screws into the neck and down upon the collar, *d*, serving to prevent any longitudinal movement of the stem, while it allows it to rotate upon its axis. For the purpose of perfectly packing the stem there is formed on the lower surface of the screw, I, a circular V shaped rib, *i*, which fits into a correspondingly formed depression or groove made in the upper surface of the collar, *d*. A similar shaped annulus or rib, *k*, and a corresponding channel are formed respectively on the under surface of the collar and the top surface of the washer, *f*.

Another and similar annular rib, *r*, and follow groove are formed respectively on the under surface of the washer and the bottom of the chamber, *g*. All the series of annular ribs are ground and so formed that the apices of their angles shall not impinge against the bottom of the grooves, but so made that each shall have two bearing surfaces upon opposite walls thereof, whereby a double protection is afforded at each joint. These ribs being forced down upon their seats by means of the screw, I, with any desirable degree of force, a most perfect steam or water tight connection is insured.

The disks, *b*, are guided in their vertical movements by means of channels, formed respectively on the opposite sides of the disks, operating in conjunction with vertical ribs, *m*, disposed on opposite walls of the shell, as shown in Fig. 2. Each of the disks is connected independently and loosely with the flanged traversing nut, D, and each has two inclined recesses, *o*, Figs. 1 and 2, formed in its inner face to receive two wedges, *n*, disposed near the ends of a wedge-carrying plate, E, through which the stem slides, this plate being stopped in its downward movement by means of projections or lugs, *l*, disposed on the inner surface of the valve shell, as shown in Fig. 2. G is a recess or chamber, formed underneath the disks when at their lowest position, which receives any sediment which may be in the water or which may be removed from the valve seats by the closing of the disks.

The employment of the double wedges is designed for large sized water gates, they being especially useful when the valve plates used are more than a foot in diameter, as a single wedge arranged centrally between the two disks would admit of too great oscillation of the disks while being opened and closed.

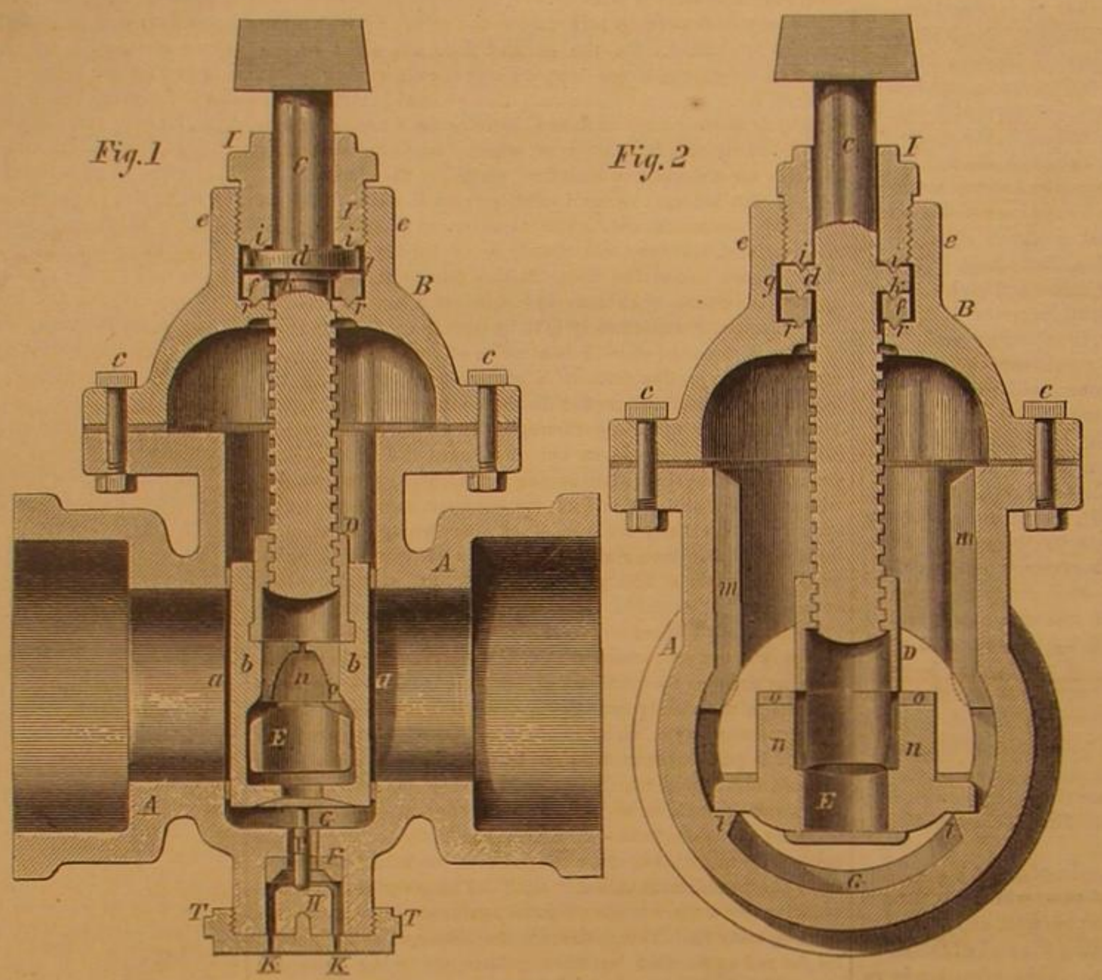
The operation of the disks and wedges is as follows:

To close the valve or the disks upon their seats, we have simply to rotate the screw stem in the proper direction. The disks being hung to the traversing nut, D, and carrying the wedge plate and wedges between them, will be forced downward until the projecting ends of the wedge plate strike upon the lugs, when the wedges become stationary and, by their action against the inclines on the inner faces of the disks, the latter will be forced in close contact with their seats. To open the disks, the stem is to be rotated in the opposite direction to that used in closing them. As soon as the disks begin to start, they are instantaneously relieved from their pressure against their seats, so as to produce but little friction or wear of either the disks or their seats. The employment of the two wedges, arranged as described, serves to preserve the disks from too great lateral play under the pressure of the water or steam while being operated.

The automatic drain is constructed as follows:

H represents a rubber spring fitted into a boss cast on the bottom of the shell; this spring is enough smaller than the hole in the boss to leave the drain, K. F is a white metal washer with a conical shaped seat fitted to the size and shape of the upper end of the rubber spring. P is an iron pin firmly fitted into the top of the spring; this pin is of sufficient length to reach up three eighths of an inch into the water way when the valve is open or the disks sufficiently raised. This spring is forced into position by means of the screw nut, T.

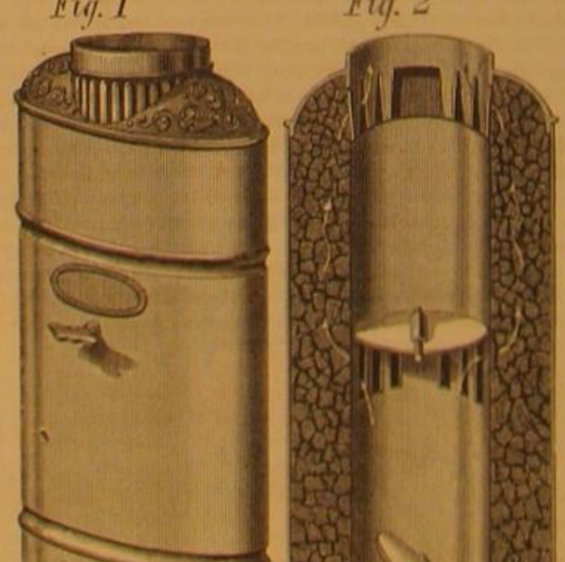
This invention was patented March 19, 1872, and further information may be had by addressing the Peet Valve Co., 152 Hampden street, Boston, Mass.



PEET'S IMPROVED WATER GATE.

TWITCHELL'S DRAFT REGULATOR AND HEAT ECONOMIZER.

The accompanying engraving illustrates an attachment applicable to any kind of stove or range, the object being to



regulate the draft and more fully extract the heat from the gases of combustion than is done by the ordinary dampers in use.

The attachment is neat in design, while, we judge, the principle on which it operates must lead to the desirable results claimed for it. These claims are sustained by a large number of testimonials from those who have used the invention, and who have thereby made a notable reduction in their coal bills.

It is claimed that, while one third or more of the fuel ordinarily used for heating or cooking may be saved, other conveniences, such as the perfect control of the heat and the easy preservation of the fire during the night, etc., are secured by the device, which costs little and requires very little attention to operate it.

Fig. 1 is a perspective view, and Fig. 2, a section of the apparatus. It consists of an external and internal sheet iron case, the annular space between which is filled with some solid material in lumps, hard coal being the handiest and most preferable substance for the purpose. There are two dampers, as shown. When both are open, the gases of combustion escape through the center of the regulator directly to the chimney. When the upper one is closed and the lower one opened, the gases take the direction of the arrows, passing into the annular space through slots in the inner shell and traversing the interstices between the lumps of coal, and are retarded in their course, thus being rendered less sensitive to external winds and currents than would be the case if they passed directly to the chimney. The draft thus produced is steady instead of fitful, and the coal, becoming heated, radiates its heat into the apartment. The radiating surface is large, owing to the fragmentary state of the material, and the extraction of the heat from the gases can be carried to the utmost extent consistent with the continuation of the draft.

The lower damper, when used, lengthens the distance which the gases must traverse through the interstices; and by the proper adjustment of the two, the consumption of fuel is controlled without danger of extinguishing the fire.

Patented Feb. 7, 1871. For further information address S. H. Twitchell, 27 Bedford avenue, Williamsburgh, N. Y.

[See advertisement on another page.]

COMPRESSED AIR LOCOMOTIVES.

In a recent article on the use of compressed air engines, the editor of *Engineering* expresses the opinion that the proper way, to prevent the great reduction of temperature which necessarily attends the expansion of air, through the engine, from its compressed state, is to apply heat to the main reservoir and to the engine cylinders; and that the best way to do this is by means of a jacket supplied with hot water. On a street car, weighing with load six tuns, it is estimated that 318 pounds of hot water would furnish the necessary temperature. It is also estimated that to drive such a car, for a distance of four miles at the rate of eight miles per hour, will require the employment of 170 cubic feet of air, condensed to an initial pressure of 300 pounds to the square inch. This supply of air could be packed into thirty-four wrought iron tubes 10 feet each in length and 9⅝ inches interior diameter. Such a locomotive would not be an economical method of using power as compared with steam, but might be highly advantageous where steam cannot be used, as, for example, on street railways or city railway tunnels.

Manufacture of American Sewing Machines in Scotland.

The Howe Sewing Machine Company of Glasgow, Scotland, has recently held in that city the first annual social meeting of the employees. Mr. F. M. Tower, the chairman of the meeting, informed the audience that the manufactory in Glasgow was only an offshoot from the American one, which has been in operation for many years. One of the chief motives of the Company in transferring a portion of their production to that country was the conviction that it was needed. Within less than five years the Company's production had increased from 50 to 500 per day. After giving an account of the Company's great works at Bridgeport, Connecticut, and at Peru, in one of the western States, Mr. Tower mentioned that the demands now are for 50,000 machines per annum, and that ground extending to 8,000 or 9,000 square yards has been secured in the east end of Glasgow, on which very extensive works are to be erected forthwith. The Company sell their machines in England at half the price they charge for them here, and still make immense profits. In this country, under the cover of the Wilson and other patent monopolies, they are enabled to charge extortionate rates. It is to be hoped that Congress will refuse to extend the Wilson patent.

IT is found, in Canada, that 100 lbs. of peat will last longer than half a cord of wood, for locomotive fuel.

Scientific American.

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VOL. XXVI., No. 20. [NEW SERIES.] *Twenty-seventh Year.*

NEW YORK, SATURDAY, MAY 11, 1872.

Contents:

(Illustrated articles are marked with an asterisk.)

OPENING THE PUBLIC LIBRARIES ON SUNDAY.

For some time there has been a growing popular opinion in favor of opening the public libraries on Sunday. It is a just inference that there were and are grounds on which to base argument in support of such a movement. As people have had their attention called to the subject, they see that, instead of tending to greater violation of sabbatarian observance, the opening of the libraries will in all probability prevent many from spending the day in a manner injurious to themselves, and totally out of keeping with the character of the Sabbath. The public libraries are all of them free from any associations tending to vice or immorality. They are retired resting places, where silence, comfort, and order reign. In these respects they are far more desirable places, for clerks, mechanics, and others, than the cramped, ill ventilated lodgings so many are compelled to occupy.

No one, we suppose, will at the present day declare it a violation of the Sabbath day to read good books, even of a secular character. If this be admitted, it is clear that the provision of good books, and a comfortable place to read them in, cannot be objectionable in either a moral or religious point of view.

A primary effect would be that the cheap and often filthy trash, sold in such large quantities at the news stands, would be less sought after, and a general elevation of taste in reading would commence. It needs no argument to show that this must exert a salutary influence on morals. Another scarcely less desirable result would be the attraction of youth from evil associations, found in suburban places to which, by their unpleasant and unsocial surroundings, they are almost driven on the Sabbath.

It may be asked if the luxuriant seats, the excellent music, and the pulpit ability of the churches do not draw young men from such associations as are hurtful, how is it to be expected the opening of the libraries will accomplish it? We reply, that neither libraries nor churches will attract all. The churches will attract some whom the libraries will not, and *vice versâ*; but both together will do more towards purifying the morals of the community than either working separately.

The recent lecture of the Rev. Henry Ward Beecher, at the Cooper Institute, placed this point in an admirable light, and we are glad to see that not only this prominent divine, but others scarcely less influential, are strenuously advocating the measure.

It is announced that the Cooper Institute reading room and library will be opened on Sunday in the Fall. The Mercantile Library will undoubtedly soon follow, and this action will, for the most part, undoubtedly be imitated by the trustees of public libraries throughout the country. We can see no probability or possibility of evil effects resulting from this movement, while its advantages seem obvious. The present state of morals in this country demands that no means of improvement should be neglected.

In an educational point of view, the opening of the libraries is certainly very desirable. It will afford opportunities, for the acquisition of knowledge and for self discipline, now wholly denied to a large class of our city population. Mechanics, clerks, and others, confined at labor almost constantly during the week, will, it is believed, gladly avail themselves of the facilities thus offered, and the usefulness of the libraries will thus be largely extended.

DRYING BY CHEMICAL ACTION.

Having already penned several articles upon various methods of drying substances, we propose to conclude with some remarks upon drying by chemical action. That wonderful property, called by chemists affinity, which exists between different substances, exerts a force so much greater that any which is practicable to the resources of mechanics, that it may be made one of the most effective means known whereby the desiccation of substances can be accomplished. Sometimes it may be employed singly. In other instances, it may be used in connection with heat or mechanical action, or all three may be used together. There are few substances that have no affinity for water, but there are some which seize upon it and hold it with such intense force as almost to defy separation. The strongest chemical reagents, such as sulphuric acid and the other strong acids, the alkaline bases, potassa, soda, lime, etc., owe much of their usefulness in the arts to their affinity for water. There are few substances that have so strong an attraction for water that some one of the alkaline bases will not seize upon it and hold the whole of it.

Of course, when water is an essential ingredient of a compound, and not an extraneous substance, its removal effects decomposition; and in all such cases, the use of chemicals for drying, as it not only removes the superfluous water but injures what remains, is, of course, inapplicable. One of the most important processes in which chemical drying is employed, and one of the best illustrations of the principles upon which it is based, is that of *separation*, as it is called in the soap manufacture. The fats or oils used for soda soaps are first saponified by an excess of the solution of caustic soda, technically called "ley." The soap thus formed contains glycerin, excess of water, and soda, which it is desired to remove. Now, although the soap has a strong affinity for water, it could be dried sufficiently by the slow and careful application of heat, but to do this would require a long time, and, besides being very tedious, would be a very expensive process. Soda, or chloride of sodium (common salt), has a much stronger attraction for water than soap. If either of these substances in strong solution should be added to the soap in sufficient quantity, and heat be applied, the following actions are set up: The soap floats upon a strong solution, "ley," of soda or salt (sometimes both are used). The heat applied to the bottom of the kettle drives off a portion of the water in the solution, which is replaced by water attracted to the salt or soda from the soap; this is in turn converted into steam by the heat, and so on, the soda or salt taking water constantly from the soap, which the heat expels until the soap has been sufficiently freed from water. Meanwhile the soda ley has dissolved out all of the glycerin, and the water in departing from the soap has carried with it the excess of alkali, adding it to the solution at the bottom of the kettle, and so the purified soap floats in hard grains or lumps upon the ley. The soap being then drained is ready for the subsequent operations, which fit it for sale and use.

This is a fine example of chemical action combined with heat to eliminate water. Another illustration is the production of absolute alcohol by distilling it in contact with quicklime, the latter seizing and holding all the water contained in the alcohol, which then passes over and is condensed in the receiver.

Chemists pass gases through quicklime, chloride of calcium, calcined potash, or soda, to rid them of watery vapor. Polished metallic articles, liable to tarnish through the action of watery vapor, may be protected by placing them in a case in which is also placed a little quicklime. Whenever the lime falls into fine powder, it is an indication that it has absorbed all the water it can hold, and that a new supply of quicklime is required.

Very rapid drying without heat can be accomplished by the use of quicklime and a fan blower, using the same air over and over, first passing over or through the substance to be dried, and then over quicklime in lumps. The process can be accelerated greatly by heating the air on its passage from the lime to the substance to be dried (the heating greatly increasing the absorbing power of the air) and keeping the lime cold by means of tubes through which cold water passes. By regulating the heat properly, very delicate substances may be thoroughly desiccated without injury. The writer has applied this process in certain operations with great success. Where an operation of this kind is conducted on a large scale, the lime can be renewed over and over again by calcination, which drives off the moisture (and perhaps carbonic acid) it has absorbed.

The hints thus thrown out may serve as a guide to inventors who are devising means for the desiccation of fruits, vegetables, meats, etc., and for the concentration of milk, etc. Processes of this kind are being extended rapidly at the present time, and the preparation of articles of food, in a palatable form and in a condition to keep a long time, is daily becoming of greater industrial and commercial importance.

FIREPROOF BUILDING.---THE LESSON OF CHICAGO.

A disaster is partially compensated for when from it is derived the knowledge necessary to avoid similar catastrophes. The lesson of the great Chicago conflagration was a severe one, yet full of instruction which, we regret to say, appears not to be fully heeded in the haste to reconstruct that devastated city. In the first tide of excitement that spread over the country, as the news of the terrible conflagration was received, the press teemed with theories hastily devised to account for the magnitude of the fire and the rapidity with which it devoured the richest part of the Garden City. Statements equally baseless, as subsequent developments have proved, were circulated far and wide about the influence, of the wood and tar pavements and the bituminous stone largely employed in some of the buildings, upon the spread of the flames. It was to be expected that many conflicting accounts would be promulgated and much false theorizing be indulged in, and that some months would elapse before the opinions of calm and dispassionate observers would be listened to. It is the purpose of this article to give in condensed form the opinions of such an observer, and to make such brief comments upon them as may suggest themselves.

The gentleman referred to is Mr. P. B. Wight, Secretary of the American Institute of Architects, whose remarks upon the subject of fireproof building in connection with the Chicago fire constituted the most interesting and valuable part part of the "Proceedings" of the above named association at its fifth annual convention, a copy of which proceedings now lies before us.* The views of this able architect and engineer, and the facts stated at the convention will correct many erroneous impressions.

Red brick and Milwaukee buff brick are the kinds chiefly used in Chicago. The buff brick endured the trial much better than the red, but both yielded in many instances under the heat. Mr. Wight attributes the great destruction of brick buildings to the extreme thinness of their walls, and to the use in them of soft brick fillers. This latter practice, Mr. Wight says, is yet in some instances indulged in, notwithstanding the evident inefficiency of such walls to withstand excessive heat as demonstrated by the fire. These walls were cracked and warped, in fact "all shattered to pieces" by the heat. The bricks were "all burned white, even the red ones." Some of the bricks were rent in pieces, others were rounded off at the corners, and some softened instead of being vitrified.

The Illinois limestone was the worst to withstand the heat, being in many instances entirely calcined. Some of the fronts of this material were burned off entirely, leaving one or two stories of brick backing standing after the fire. In other instances, this stone was so rounded at the corners as to appear like "boulders." The Lockport limestone proved better, but still was badly damaged. The two sandstones which withstood the heat the best were the Cleveland stone and the Lake Superior stone. Little granite was used in the burned district, but such of it as was exposed to the heat was cracked badly and rounded at the corners.

The Illinois stone exploded where the heat was very intense. "It seemed," says Mr. Wight, "to calcine with great rapidity, and I suppose the effect was very much like that seen in the manufacture of pop corn." No observations of marble were made. One building, in which a great deal of artificial stone was used, stood the heat remarkably well. Mr. Wight says: "I do not know whose patent stone it was, but it was used from the second story up to the top in pilasters, cornices, and sills. In many places, this stone was scarcely injured at all." We deem this fact of importance as proof of the part which artificial stone is destined to fill in future building.

A correlative fact is that all kinds of mortar were less affected by the heat than natural stone. This might be inferred from the statement relative to artificial stone, since mortar, strictly speaking, is an artificial stone. This point has much significance, showing that, when the real constitution of stone which will withstand destructive influences is thoroughly comprehended, chemical science will be able to supply the requisite conditions for its artificial formation.

The petroleum stone, of which so much was said in the newspapers and which was charged with having greatly assisted the spread of the fire, is spoken of as follows:

"There was one church in Chicago built of what they call prairie boulders, which ten years ago were supposed to contain tar, but really contained petroleum. The amount of petroleum in the church was so great that the heat of the sun would draw it out, soon after being set up in a wall, and it would run down in black streaks. The effect of the heat on the inside of the walls threw out upon the exterior all the oil it contained, which formed a thick hard coating about a quarter of an inch in thickness; and though the interior of the church was exposed to great heat, and every particle of wood in it was burned up, so that there was not a scrap left in it, the interior sides of its walls were not greatly injured. In some places the stone had flaked off, and yet this stone stood the test better than any other natural stone used in the city."

* Proceedings of the Fifth Annual Convention of the American Institute of Architects held in Boston, November 14th and 15th, 1871. Published by the Committee on Library and Publications of the American Institute of Architects, and sold by D. Van Nostrand, Nos. 23 Murray street and 27 Warren street.

He also says that the Nicholson pavement, contrary to many statements, stood the test remarkably well.

"In some places the upper part was charred off, especially where it was new; but the curbstones were in some places actually destroyed, while the Nicholson pavement remained intact. I would suggest as to whether the presence of tar in the wood was not similar in its effects to the presence of the oil in the stone. We may possibly discover a valuable property in tar or oil, from this experience."

Iron structures and parts of structures were badly injured, with the exception of corrugated iron floors supporting concrete arches of masonry, the iron being simply a basis for the masonry.

Vaults built in the tower form, from the cellar up, proved the most efficacious; heavy brick vaults built upon floors are severely deprecated.

The importance of fireproof shutters is earnestly dwelt upon. Mr. Wight says:

"No matter how they are made, so long as they are strong enough; make them double or treble or quadruple, with air spaces between, but by all means keep out the fire from neighboring buildings, even if you have nothing in your own house to burn. Every fireproof building should have fireproof shutters on every window, whether on the front or on the rear. It is the habit with us to put them on the rear, and very often to leave them off the front. We say "Our building is fireproof; there is nothing in it to burn." But there is something in it to burn, and the very books, papers, furniture and carpets used have proved—as in some of these buildings in Chicago—sufficient to soften an iron beam, and destroy the best constructed floors."

Great emphasis is also laid upon the proper construction of roofs. They should "be made the best part of the building." In a great fire fanned by a hurricane, the current of heated air comes directly down on the tops of the buildings, instead of the fire communicating from house to house. This fact is shown by numerous examples, adduced by the speaker, which we have not space to reproduce, having already exceeded our prescribed limits.

We have seldom read a more instructive discussion, and if Mr. Wight fulfils his intention of writing an elaborate paper upon the subject, he will confer a great benefit upon the public.

POWER PRODUCED BY STEAM, UNDER DIFFERENT TEMPERATURES AND PRESSURES.

At the present stage of our knowledge in regard to the conversion of heat into motion, the steam engine stands foremost as the least expensive and most convenient apparatus to accomplish this transformation. Being founded on the increase in volume of water, when changed by heat into steam, it is easy to calculate the amount of heat required to produce a given power, for the reasons that the amount of the increase in volume of water when becoming steam, and the amount of heat required to accomplish this, are both well known.

To simplify our calculation, let us suppose that we have a long vertical tube 6 inches in diameter, or of 27 square inches, or $\frac{1}{5}$ of a square foot, sectional area. The whole length we suppose to be 144 feet; then the whole contents of the tube would be $\frac{1}{5}\times144$, or 27 cubic feet. Suppose now we have, at the bottom of this tube, water one inch high; then we shall have 27 cubic inches, or one pound of water. Let us finally assume that we give this water heat enough to convert it all into steam. Then, as it expands 1,700 times, it will just fill the tube, which is 144 feet, or 1,728 inches long. The heat required to change one pound of water into steam is 965 units, and the power produced we may easily estimate by considering that the steam will possess one atmosphere's pressure and be just able to remove the atmosphere from the tube, as this has a pressure of 15 pounds per square inch, or $15\times27=405$ lb. for the whole sectional surface of the tube, in which a piston might separate the steam from the air. This piston will, by the expansion of the steam, be moved through a distance of 144 feet, and, being subject to the atmospheric pressure of 405 pounds, the force produced by the evaporation of one pound of water will be $144\times405=58{,}320$ foot pounds.

If this result is accomplished in one minute, we shall have one and two thirds horse power, as 33,000 foot pounds per minute has been adopted for the amount of one horse power. We see, therefore, that the evaporation of one pound of water per minute, or 60 pounds per hour, gives us one and two thirds horse power, and this agrees tolerably well with experience, which has taught that the evaporation of one cubic foot—that is, 63 pounds of water per hour—is amply sufficient for one and a half horse power. As we have seen (p. 184) that one pound of coal is able to evaporate 13 lbs. of water, the evaporation of $5\times13=65$ lbs. water requires 5 lbs. of coal (producing one and two thirds horse power), or three pounds of coal per hour for one horse power. And this is indeed the ordinary estimate for economical engines with Cornish boilers; locomotives consume double that amount, and even more.

The question now arises: Is it not more economical to raise the temperature of the water higher than only 212°, which only obtains one atmosphere's pressure? Is it not more advantageous to work with a pressure of several atmospheres?

The answer to these questions is affirmative; but it must be remembered that the rule, usually given, that water expands 1,700 times so that one cubic inch of water makes one cubic foot of steam, is only applicable to steam of 212°; at higher temperatures there is a lesser bulk of steam. At 250° Fah, we have increased every inch of water only to 900 inches of steam and a pressure of 30 lb.; at 293°, the volume is 475 inches and the pressure, 60 lb.; at 340°, the volume is 250 inches, and the pressure, 120 lb.

In regard to the heat required: Steam of 212° consumes 965 units of latent heat; steam of 250°, or 38° more, does not require 38 more units, but only 11, as the specific heat of this denser steam is less. At 293°, or 43° more heat than the latter and 4 atmospheres' pressure, we require only an addition of $12\frac{1}{2}$ units of heat; at 340°, or 47° more heat and 8 atmospheres' pressure, we require only an addition of 14 units of heat.

It is thus seen that every additional atmosphere's pressure requires the addition of a lesser amount of heat, while the capacity for heat or specific heat of the steam decreases by an increase of the heat and pressure. Therefore, the same addition of heat has more effect, when applied after a high temperature and pressure have already been obtained, than at a lower temperature and pressure. The figures here given have been obtained, by Régnault, by the most careful methods of research.

If we apply the same reasoning as before to our tube, with steam of 250° Fah. and two atmospheres' pressure we find that the piston is lifted, by a force of $2\times27\times15$ lbs., or 810 lbs., through a space of 900 inches, or 75 feet, producing 810×75, or 46,170 foot pounds, for $965+38=1{,}003$ units of heat. When heating the water to 293°, we have 4 atmospheres' pressure, and thus $4\times27\times15=1{,}620$ lbs.; and as the water expands only 475 times, it will raise the steam of this pressure to the hight of 475 inches, or nearly 40 feet, and will lift the 1,620 lb. that distance, which is equivalent to 64,800 foot pounds, for $965+81=1{,}046$ units of heat. Finally, for 340°, the steam expands 250 times, fills the tube to the hight of 250 inches, or nearly 21 feet, at a pressure of 8 atmospheres, or $8\times15\times27=3{,}240$ lbs.; this, lifted 21 feet, gives 68,040 foot pounds, for $965+128=1{,}093$ units of heat employed.

It is seen that there is an advantage gained, but it is not as great as supposed by many. The pressure of one atmosphere gives 58 foot pounds per unit of heat; 2 atmospheres, 60 foot pounds; 4 atmospheres, 63·5; and a steam engine of 8 atmospheres, 65·5 foot pounds for every unit of heat consumed. But if we take into consideration that, at high temperatures, there is more loss of heat by waste of fuel, radiation, etc., it is evident that the advantages gained may be overbalanced by disadvantages.

In practice, it is customary not to consider the first atmosphere, or 15 lb. pressure, but to call steam of 250° Fah. and two atmospheres, or 30 lb. pressure, one atmosphere, considering only the 15 lb. above the ordinary atmospheric pressure; one atmosphere has, therefore, to be subtracted from our theoretical figures, in order to make them agree with the customary terms used in practice.

A LONG FELT WANT.

There has been a long felt want for a transparent material, which could take the place of glass for many purposes, without the fragility of the latter substance. The substance which comes nearest to these requirements is mica, but in many respects this fails to meet the want. It would seem that the present resources of chemistry might be adequate to furnish to the world such a material as we have named. So far as we are aware, but little experiment has been made toward the attainment of less brittleness in glass. The ancient process of annealing is still solely relied upon; with how much success, let the myriads of broken lamp chimneys globes and mirrors testify.

It would not be necessary, to render a non-brittle transparent and easily molded material valuable, that it should be insoluble in water, but it would be very desirable that it should withstand the effects of considerable heat. Gelatin, of which beautifully transparent plates can be made, is not only soluble but is decomposed by high temperatures. Are the two properties of transparency and brittleness in solids inseparable? We have no general reason, except the fact that most transparent materials are brittle, to justify such a belief.

Chemistry may yet render glass as little liable to breakage as hard rubber. Could this be done without change in its other characteristics, the utility of glass for general purposes would be increased a thousand fold. The man who can do this cheaply would supply a process of incalculable value.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line, If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Facts for the Ladies.—Dr. A. K. Gardner, of New York, says there is not the slightest foundation for the vague and interested statements that the light Wheeler & Wilson Lock-Stitch Sewing Machine is injurious to feminine health. We speak advisedly when we deny most positively that any form of disease is traceable to its proper use by any woman in health. For twenty years we have carefully watched the progress of the Sewing Machine, visited the large factories where it is used by the hundred, questioned the makers, the foremen in the workshops, the girls daily working them, and never yet have been able to trace a single disease as having originated from the use of this domestic implement. See the new Improvements and Woods' Lock-Stitch Ripper.

Notes & Queries.

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

1.—COATING CAST IRON WITH COPPER.—I wish to know of a good process for coppering cast iron by dipping.—F. M.

2.—SIGNAL LIGHT.—What composition is used for the white (Bengal) Indian light?—H. M. L.

3.—INDIAN INK STAINS.—Will some reader inform me how to entirely obliterate Indian ink marks from the skin?—H. W. B.

4.—WATER TELEGRAPH.—How can I construct a water telegraph such as is used in most mountainous districts? Any information will be highly appreciated.—W. M. R.

5.—PAINTING INSIDE OF WATER TANK.—Please inform me what kind of paint I should use for the inside of a wrought iron water tank? The water is to be used for domestic purposes.—P. R.

6.—KEEPING IRON CONTINUOUSLY MELTED.—Will some of your correspondents inform me if there is any way of running a cupola continuously, day and night, so that one or two tuns of iron could be drawn from it per hour, and if so, how?—B. A.

7.—KEY WAYS AND KEYS.—Will some of your many machinist readers please inform me the correct taper of keys, for connecting rods for engines, also the average taper of key seats of pulleys, etc.?—A. P.

8.—LINING CAST IRON VESSELS.—I have a number of cast iron porcelain lined soda water fountains, with part of the porcelain broken off, exposing the iron. Is there any cement or other preparation, which I could apply, that would be durable and not color the soda water or make it taste?—C.

9.—PRESERVING TELEGRAPH POLES.—Will some of your readers inform me the best way to preserve butt ends of chestnut telegraph poles, that they may be made to last as long as their tops? Will gas tar or charing the ends help to preserve them?—H. R. B.

10.—GROVE'S BATTERY.—I am constructing a Grove's battery, and I understand that the amalgamated plate is a mixture of zinc and mercury. Am I right, and will some one give me the right proportions of the two metals? What proportion should the surface of the amalgam have to that of the platina? What should be the dimensions of the porous cup? My zinc cylinder is open at one end; it is a quarter of an inch thick, and eight inches high by four inches internal diameter. How should the amalgam be prepared?—J. C. G.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal.

ALL reference to back numbers must be by volume and page.

PAINT FOR IRON.—In reply to enquiry No. 6, April 27th, about paint for iron, etc., we have received letters from various makers, stating that their article is the best, and asking us to publish an account of their goods. We would suggest to these manufacturers that they insert short advertisements of their goods in the column of "Business and Personal," and in this way they will be able to place the merits of the r articles before all our readers.

C. B., of N. C.—The specimen you send is pulverized quartz containing a little iron.

LEAKY BOAT.—A. B.. of Pa, should caulk his boat with oakum and pitch.

NEST OF BOILERS.—T. E. W., of Md., is referred to pages 356, 388, 394 of Vol. XXV. of the SCIENTIFIC AMERICAN for a full discussion of the question he proposes.

B. F. B., of R. I.—An advertiseme: t in our "Business and Personal" columns will doubtless obtain you the information required.

B. C., of Ohio.—Artificial stone is either run into molds while in a fluid state, or is, while plastic, pounded into the molds by an instrument similar to that used by iron molders.

J. S., of Col. Ter.—We shall be glad to hear from you as proposed.

A. H. A., of Mich.—Upon examination of the description and drawings sent, we do not find anything to account for the anomalous working of the boilers described. An examination on the spot by an expert might perhaps lead to the discovery of the cause.

L. P. L.—We do not think you incur danger from the use of a galvanized iron chain in your pump.

J. W. G.—We do not know of a reliable meter for measuring the flow of steam through pipes. Measuring the water supplied to the boiler is a good way of determining the quantity of steam used in a given time. Or you may condense the steam, and by ascertaining the weight of the condensed water, determine it in that way.

F. J. L., of Ohio.—There is no solvent of scale in boilers that can be universally used with good results. We have published much upon this subject; consult back numbers. Also see recent editorial for answers to queries about asbestos packing.

G. A. B., of Ohio.—Glass could, we think, be easily molded as you require. Consult some manufacturer.

J. R. W., of N. Y.—The salts used in England for street watering are the chlorides of calcium and sodium. Chloralum has also been used, it is said, with good results.

A. W. C., of Iowa.—The specimen of rock which you send is a limestone, with disseminated particles of iron pyrites or "fool's gold."

A. V. P., of Mich.—The specimen you send appears to consist mainly of alumina and some alkali, either lime or potash. An analysis will be needed to determine exactly, which will cost $10.

CEMENT FOR RUBBER BOOTS.—P. H. W. can find the required information on page 153, current volume IENTIFIC AMERICAN.

DEPOSIT IN LOCOMOTIVE CYLINDERS.—The enclosed is a sample of a substance which gets into some of the cylinders of locomotives. It accumulates so as to fill up the clearance space in a short time. We are all using the same tallow, yet some engines of the same class do not form it, although all use about the same quantity of tallow. What is your opinion of it, and what is the stuff composed of? When first taken out it is like soft pitch. Some of the engineers blame the stacks; these are nearly all self cleaners. All the engines burn wood.—J. R. M. Answer: It is the result of the distillation of some hydrocarbon, probably derived from the tallow. The engineer should be able to tell why it gets into some cylinders and not into others.

SEPARATION OF MERCURY IN THERMOMETER TUBE.—To F. D. H., query 1, page 281.—Heating the thermometer bulb until the mercury fills the whole length of the tube will unite the separated parts of the column. The separating of mercury in a barometer tube is caused by air entering; it is rather difficult to remedy. You had better take it to a maker of those instruments and get him to refill the tube.—L. T. Y., of Pa.

MERCURIAL COLUMN.—Query 11, page 217.—The chamber containing the mercury should be of sufficient size to hold more mercury than the column, so that water from the pump will not get into the latter. The pipe leading to the column should be let into the bottom of the chamber. The pipe from the pump should be let into the top of the same. One atmosphere, or 14·71 pounds pressure per square inch, equals a column of mercury 29·22 inches in hight, nearly two inches mercury for every pound pressure per square inch. This is near enough for all practical purposes; therefore a column, to indicate 60 pounds per square inch, should be 120 inches in hight from the zero or starting point to the last mark. The columns in different cities ought to agree if they are spaced off with equal care, and the board upon which the spaces are marked does not shrink or expand.—F. J., of N. J.

TEMPERING SPRINGS.—Query 26, page 169.—Harden the spring in linseed oil, then heat it gradually over the fire until it becomes hot enough to burn a small shaving, scraped off, on the sharp edges of the spring, from a piece of hickory wood. At first the shaving will lie on the spring a few moments before it will burn, but as the spring becomes hotter, the shavings will burn as soon as they are scraped from the wood. At a point between these two extremes, I have been able to give a spring temper to different qualities of steel.—L. V. B., of N. C.

TINNING CAST IRON.—On page 212, current volume, Mr. Charles Thompson gives a method to tin cast iron. It will not do at all. I have tried the same thing before. If he ever had occasion to tin cast iron, he certainly could not have done it by the method he describes. I use muriatic acid with zinc dissolved and diluted with water, and a small quantity of sal ammoniac; but it is not what is wanted. There must be some other preparation which is better.—W. S. M.

TIMBER FOR WATER PIPES.—Query No. 8, page 249.—Spring water can be conveyed in pipes, during one generation, made as follows: Take "tamrack," or, as it is called in Massachusetts, "hackmatack" logs, with the bark on or off, from six to eight inches diameter and ten feet long. Bore these, beginning at the small end with a gimlet pointed pod bit. Get three quarter inch band iron, and make some hoops thus: Bend a piece to make a circle say of four inches diameter, then bend back each end making a semicircle or a little more; then, with a hammer, drive this into the end of the log around the hole edgewise. This will secure the log from splitting when the thimble is driven in to connect the logs. Dip the iron thimbles in boiling tar. The holes, o course, must be reamed to fit the slant of the thimbles.—R. S. B., of Mass.

ADHESION OF RUBBER BELTS.—Query 2, page 233.—Use castor oil; it will keep the gum soft and prevent its becoming glossy.—J. H.

ADHESION OF RUBBER BELTS TO PULLEYS.—Query 2, April 6.—Linseed oil will prevent rubber belts from slipping, and will make them last longer.—J. H. G., of Tenn.

FIREPROOF WOOD.—H. S., query 9, February 24, should immerse his wood in nitric acid. The surface of the wood corroded by the acid is incombustible.—G. H., of Mo.

PRESERVING BIRD SKINS.—To W. J. L., query 15, April 20.—The cheapest and most successful process is to rub the skins with equal parts of alum and arsenic.—H. W. U., of Wis.

DRIVING ELEVATOR.—To C. W. W., query 9, page 333.—You can drive your elevator from the lower pulley with fair success, yet I would much prefer driving from the upper pulley. I am using one, elevating all kinds of grain and mill feed, driving from the bottom, with 13 inch belt, 12 inch buckets (12 inches apart), 73 feet high. The lower pulley is 2 feet and the upper 3 feet in diameter. The larger the lower pulley the better it will work.—R. G. S., of Ill.

FINISHING FURNITURE.—Query 6, page 265.—The cheapest and quickest way to finish cheap furniture is, for black walnut color, to use asphaltum varnish for a stain; when dry, rub smooth with curled hair, then coat it with shellac and alcohol varnish; rub that with fine cane shavings, and lastly use furniture varnish. Other colors may be obtained by using a combination of cheap colors mixed with japan and spirits of turpentine.—A. B.

PRESERVING BIRD SKINS.—Query 15, page 265.—I have used powdered white arsenic for four years with good success. It keeps out moth, and cures the skins perfectly. It is applied dry. I have also used an arsenical soap for heavy skins and large birds. It is made of the following ingredients: Arsenious acid, 2 pounds; carbonate of potassa, 72 ounces; camphor, 5 ounces; white soap, 2 pounds; powdered lime, 8 ounces; reduce each to powder and mix.—A., of N. Y.

TEMPERING SPRINGS.—To W. R. H.—Tempering is only one, and that the last, condition essential to a good spring. The first is good material, and this should be the best refined cast steel. The next is that the material must be carefully and properly worked into the proper shape and proportions throughout; lastly, heat the spring evenly to a bright blood color, cool or chill it in melted lard or lard oil, free from salt, acids, or other chemicals (home made lard is the sure thing), hold it over the fire, blowing a little heat slowly and evenly, till the lard begins to blaze; then hold it away from the fire till it is entirely blazed off, and lay it down to cool. If appearance is an object, now carefully polish your spring and it will improve in elasticity. A strict compliance with all the above conditions will make good springs for all purposes, for traps set under water not excepted. A spring trap set under water is the greatest test that I know of. Many good springs will stand severe frost that water will break in fifteen minutes.—S. P., of Mo.

GATE FOR GANG SAWS.—Mr. J. V. Walter states, in his comments on E. F. J.'s communication about gang saws, etc., in your issue of March 24, "that a less number of pounds of cast iron makes a better and stiffer gate than wrought iron." We build wrought gates very light, some as light as 600 pounds, to carry 32 four and a half feet saws; and 750 pounds is plenty heavy enough for a gate to carry 40 saws. Now if Mr. Walter will inform us how to make a lighter gate of cast iron (or any other metal no more expensive) which will bear the strain and labor required of a gang, he will do not only us but the milling public a great favor. I heartily concur with him in regard to the source of trouble with E. F. J.'s gate. I think that 3,500 pounds is too heavy a load to be jerked about at the speed a gang should run.—P. H. W.

PIN POINTS IN STEEL.—To H. M. H.—When the forging is done, heat the article to a dark blood color, just such as can be distinctly seen in a dark place; then cool it in soft water. The exact degree of heat can be ascertained by experimenting; a little too hot or a little too cold will harden it. It must be heated evenly throughout.—S. P., of Mo.

TO COLOR CASTOR OIL.—Take two ounces of annatto and form it into a paste with a little water; add half a pint of alcohol, shake occasionally for a day or two, and filter. To one quart of castor oil, add the above tincture until the desired color is obtained.—H. W. B., of N. J.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

BOILER EXPLOSIONS.—B. C T.—J. B.
COTTON WOOD TREE.—H. G. M.
ELECTRICAL MACHINE.—J. C. W.
RAPID TRANSIT FOR NEW YORK.—A. M. W
STEAM PROPULSION ON CANALS.—C. B.
NOTES AND QUERIES.—F. X. F.—W. C.—T. C.—H. W. B.—J. L. R.—J. T. C.—N. F. O.

Recent American and Foreign Patents.

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

HARNESS SADDLE.—Samuel E. Tompkins, of Sing Sing, N. Y.—This invention relates to improvements in the coach pads particularly intended for double harness, and which have heretofore been, for cheapness, made with a metal top plate and leather under pad, and finished on the end with a metal extension of the top plate instead of a leather pad, inclosing a metal stiffening plate, as in the better class. The invention consists of separate and attachable metal or leather extensions, either of which may be used at will, as preferred; and it also consists of a construction of the top plate by which it is adapted for said extensions, whereby greater beauty of design and finish are combined with a form of top plate that can be cast cheaper, and that insures more perfect and uniform castings than can be had with the top plates as at present arranged. In the better class of harness the top plate is inclosed between the leather, and the bindings are formed on the cushion, which is the most desirable way, except for the cost. The object of this invention is to approximate the advantages of the method named and yet economize considerably in the cost. The top plate is made with ends in separate pieces, to be attached as heretofore described, so that either leather or metal ends may be used, as desirable. Another advantage in the use of the attachable iron end is that the cushion part is fitted to the plate, and the space between it and said plate for the side strap is preserved much easier than in the old way, in which it is necessary to insert leather pieces temporarily, over which the leather cushion is fitted, and then the pieces are withdrawn and the side straps put in, which requires experienced workmen; whereas in this case, the metal extension being put on, it remains and becomes the form or part to which the cushion is fashioned.

STAND FOR TESTING FIRE ARMS.—Julius Lehnert, of Louisville, Ky.—This invention provides convenient and reliable means for holding firearms, such as rifles, pistols, etc., to be loaded and fired without danger of displacement, in order to ascertain the accuracy of the bore and adjust the sights. The invention consists in the use of a table, provided with a hinged leaf to which a clasp for holding the arm is applied. When the leaf is in a vertical position it holds the arm convenient for loading, while when horizontal the same is in a position for firing. The arm to be tested can be conveniently loaded in the vertical position, and fired as often as necessary in the horizontal position, and will, as long as the table is not shifted, remain in the position for firing, thus giving good opportunity for accurate tests. The leaf is locked in the horizontal position by pins or catches, applied to or through its front part.

METALLIC TELEGRAPH POLES.—Francis Boyd, of Newburgh, N. Y.—This improvement in metallic telegraph poles consists in constructing such a pole with collars for supporting horizontal arms which carry the insulators, in the means of connecting it with the base piece, and in the arrangement of a lightning rod or conductor. The cast metal tube has a suitable step, with arms for bedding in the earth to support the pole. Braces extend from the extremities of the arms to ears cast on the pole, the braces being fitted through them, with screen nuts above for straining them to adjust the pole to a vertical position. A collar or ring is cast on the pole for holding the lowermost insulator arms; and shoulders for the other arms are formed by successive reductions of the size of the pole. The arms may be made of metal bars, with a large hole at the center to fit on the pole snugly above the shoulders, each arm having its hole corresponding in size to that of the pole above the particular shoulder whereon it is to rest, said arm either being made in one piece and put on over the top of the pole, or it may be divided in two parts, longitudinally and vertically, and bolted together. The lightning rod passes down through an insulating tube, and projects above the top of the pole, being insulated by an india rubber cap fitted watertight on the top of the pole, the hole through which the rod passes being packed tightly to prevent the water leaking out. The insulated arms have holes for holding wood pins or india rubber insulators which may screw into the arms or be attached in any other suitable manner. The arms are galvanized; the parts below ground are coated with coal tar and the parts of the pole above ground are scaled and primed with red lead.

BOOT STRAP MACHINES.—Aaron F. Stowe, of Worcester, Mass.—This invention has for its object to furnish an improved machine for cutting the draw straps for boot legs, which shall be so constructed as to adjust itself to the varying thickness of the doubled leather, and which will feed the leather steadily to the knives, so that the straps may be cut straight. It consists in a combination of a grooved or channeled feed roller, with circular knives, a knife roller, and top roller of the machine. If desired, part of the knives may be placed at a distance apart different from the others, so that straps of different widths may be cut by the same machine and at the same time. This construction is particularly advantageous in shops where different sizes of boots are made, as, for in stance, men's, youths' and boys'.

WAGON WRENCH.—Roland J. North, assignor to himself and B. B. North, of Cornwall, Conn.—This invention furnishes an improved wrench for removing the axle nuts of wagons and other vehicles, so constructed that, when applied to the nut, the nut will be screwed from or upon the axle by simply revolving the wheel. The body of the wrench is made with two arms which are curved, so that the body may enter the hub band and receive the nut. The arms are made of such a length that they may extend along the sides of the hub and pass between the spokes, so that the wheel, when revolved, will carry the wrench with it, and thus screw the nut off or on, according to the direction in which the wheel is revolved. The wrench has a square hole sufficiently large to receive any axle nut, which may be made to fit smaller nuts by a bushing or block having a hole of the proper form and size to fit the desired nut. Coiled springs, the ends of which are attached to the outer parts of the arms, and the other ends of which have hooks formed upon them to hook upon the spokes of the wheel, hold the wrench securely in place while allowing the nut to move out or in as it is screwed off or on the axle. If desired, the wrench may be secured in place by screws, wedges, or other suitable and convenient devices.

COMBINED PROPELLER AND FIRE EXTINGUISHER.—Allen Turner, of Bronson, Mich.—In this invention a screw works in a cylinder closed at the forward end, but having a pipe descending through which air passes into the cylinder and is forced out against the water to propel the boat. The reversing of the screw draws in water and forces it out of the pipe for the extinguishing of a fire should it occur upon the vessel carrying the device. Two or three screws are employed, one on each side of the rudder.

BRIDLE.—Martin A. Penn, Sumter, S. C.—The invention consists in making the headstall of a bridle of metallic plates which can be made more cheaply and more durable than leather; in the mode of adjusting the blinds by means of a projecting and adjustable spring to which they are each attached; in holding the side plates at any adjustment by means of a catch and sliding sleeve; and in attaching the headstall and reins to bit by hooks.

Attaching Shoes to Sleigh Runners.—Gilbert Budd and Gabriel T. Daved, of Phillipsport, N. Y.—This invention consists in constructing the main portion of the shoe with oblique tenons to fit into corresponding mortises in the under sides of the runner. The main portion of the shoe may be made in two or more parts, connected by oblique V shaped joints, and secured firmly in position by the front part of the shoe or banger, as it is technically termed; or the main part of the shoe may be made in one piece. By this construction neither the shoe nor runner will be weakened by bolt holes. There will be no bolt heads to wear off, and the wearing surface of the shoe will be perfectly smooth. This construction strengthens both the shoe and runner, and enables the shoe to be easily detached when required.

Glass Globes or Reservoirs for Lamps.—Adolph Otto, of New Braunfels, Texas.—The object of this invention is to prevent the breaking of glass globes used in kerosene lamps as reservoirs for the burning fluid; and the invention consists in the application around the reservoir of a rubber ring let into a groove, but projecting sufficiently to receive the concussion in case the lamp is overthrown. An oil reservoir of suitable shape is made of glass and arranged to form part of a lamp in ordinary or suitable manner. The globe or reservoir is provided with a continuous groove around it, at the point where, without such groove, the globe would have the largest diameter. Into this groove is fitted a ring of india rubber, which projects beyond the surface of the globe to constitute a protective cushion on every side of the lamp. Whenever the lamp is overthrown, the rubber ring will receive the concussion and prevent the breakage of the globe and consequent concussion.

Forming Screw Threads in the Necks of Bottles.—Goveneur M. Keeffer, of East Birmingham, Pa.—This tool consists substantially of a revolving plug having a screw thread cut upon it, provided with a notched circular flange, and pivoted to the forward end of a stationary rod, to adapt it to be conveniently locked and released, also of a stationary plate, provided with a countersink and a sleeve to adapt it to receive the flanged base of the plug and the stationary rod to which it is attached, also of combination of a lever catch with the elastic handle, stationary rod, plate and pivoted flanged plug. The tool seems a very excellent one for the purpose intended.

Tool for Removing the Roller and Replacing it upon the Balance Shaft of Watches.—James Ingram, of Troy, N. Y.—To the upper end of screw is attached a handle. In the lower or forward end of the screw is formed a small hole, to receive the fine pivot of the staff. A U shaped piece, having a screw hole formed in its middle part or bend, receives the screw. Upon the lower ends of the arms of the U shaped piece is formed a disk, having a hole formed in one side and extending to the center of said disk to receive the roller, so that, by screwing down upon the shoulder, the roller may be raised from the staff without any danger of breaking the pivot or putting the balance out of shape. Another U shaped piece is designed for replacing the roller upon the balance staff, and is constructed the same as the first named U shaped piece, except that, instead of a slotted disk, it has two inwardly projecting hooks, beveled upon the upper sides of their inner edges.

Animal Power.—James R. Deyo, of Sterling, Ill.—This is a new mode of combining means to form a small power, which may be operated by a dog or other animal. A combination of an inclined tread wheel and shaft, a friction wheel, crank shaft, and crank wheel, pitman, beam, and posts, arranged in a frame, constitute the claim on which a patent has issued; the principal novelty being the means of adjusting the inclined shaft to any degree of inclination, to adapt it to the amount of work required.

Folding Table.—Joseph Quevedo, of Brooklyn, N. Y.—This invention is a dining or other table so constructed that the legs thereof may be readily folded down onto the rails, and so that the table may be extended in length and suitably supported in the middle. A novel arrangement of drops and recesses in combination with the top and leg frames and a combination of a cross piece hung at journals or pivots, a center leg, rod, and drops, with the folding table, having hinges, is employed and covered in the claims by letters patent.

Apparatus for mixing Soap.—Horace N. Humiston, of Troy, N. Y.—This invention has for its object to furnish an improved apparatus for mixing, soap so constructed as to raise the heavy insoluble materials to be incorporated with the soap and distribute them thoroughly through all parts of the mass, and keep them from settling into the lower parts of the mass before the mass has become sufficiently stiff to hold said materials.

Spittoon Chair.—Antonio Quirolo, of New York city.—This is an improvement in chairs, by the connection with them of spittoons that can be swung out of the way under the seats, or made to project from the sides for use. It also consists in hinging the chair back and operating it with rod springs and catches. To invalids and others a chair thus arranged will be a great convenience, as well as to those not requiring its comfort, from whom the spittoons will be concealed the greater part of the time.

Charges for Shot Pouches.—Joseph T. Capewell, of Woodbury, Conn.—This invention relates to a newarrangement of the inner cut-off of a lever shot charger attachment to a shot pouch or belt; and consists more particularly in applying said inner cut-off to work within the enlarged shank of the discharge tube close to the inner end of said tube, and in hinging it so that it may have a slight play on its pivot. The object is to prevent the inner cut-off from crowding against the shot and preventing its discharge, and also to facilitate the filling of the pouch or belt without requiring the removal of the tube or the constant manipulation of the ever. The invention is applicable to all kinds of shot flasks, pouches or belts, of whatever construction, and is, in our opinion, a decided improvement on the chargers hitherto used.

Saw Mill.—John J. Reinhart and William Houghton, of Loogootee, Ind.—The saw is rigidly attached to the crank pin by means of iron straps or otherwise. No pitman is employed, but the saw itself partakes of the character and receives the motion of a pitman. Adjustable muley boards guide the saw. The frame work which supports the feed and gigging gearing of the mill has an adjustable frame connected with it by means of which the upper end of the saw is supported and adjusted. A bar or arm, slotted at one end to receive the saw, is attached to it by a pin. The other end of the bar is hinged or pivoted, or so connected with the adjustable frame that it allows the opposite end to vibrate with the saw and describe the arc of a circle. As the log is fed up to the saw, the saw will make its cut as it descends, and will be carried back to its kerf by the crank, thus preventing the sawdust or fibers of wood from wedging or retarding the upward or back movement of the saw. The points of the teeth of the saw are preferably of chisel form. The cut of the saw should be at right angles with the grain of the wood, so that the fibers or dust will be as short as possible. The driving crank wheel is so constructed that the saw and the parts connected thereto are balanced or nearly balanced. The upper end of the saw can be properly adjusted to the center without difficulty. A feeding apparatus of peculiar construction also constitutes a feature of the invention.

Mitering Machine.—Harry Malin, George W. Malin, and Albert D. Malin, of Pleasantville, Pa.—The invention relates to mitering machines for cutting picture frame and box joints, and consists in a combination of a table, plane, guide and plate arranged in a peculiar manner for the purpose specified.

Oscillating Engine.—John W. Van Sant, of Perth Amboy, N. J.—An adjustable sliding plate provided with slots and holes for the entering steam, and holes for the exhaust steam, in combination with a stationary plate provided with holes for the passage of the steam, and with a pivoted or oscillating cylinder provided with holes for the same purpose, are the features of this invention.

Clothes Beater.—Alden Jameson, Boston, Mass.—This is a new implement for use in washing clothes and other articles with boiling hot suds, in common wash tubs, barrels, boxes, boilers, etc., and consists in the arrangement of an inverted funnel on a tubular handle, and provided with radial and other beating edges at its large end. The instrument is, by hand or machinery, moved forcibly up and down, beating the clothes in its descent. It should be brought upon a new part of the clothes at every stroke. It beats and squeezes the clothes under the beating edges, and also compresses the air in the inverted funnel, and forces the hot suds and the air through the pores of the fabric in descending. When slightly lifted it creates a momentary vacuum, somewhat lifting the clothes and keeping them light and prepared in the best manner for the next blow. It also keeps a fine lather on the suds, and thereby retains the same in best condition for the process of washing. The implement is adapted to fine as well as coarse fabrics.

Organ.—George Woods, Cambridgeport, Mass.—This invention consists, first, of a peculiar form of the case, which is very simply and economically formed of the reed board for the bottom, with moldings for the sides, and a cover, the instrument not being inclosed below the reed board, the said moldings forming such inclines that a large reed board, and also a large sound board, with a small top surface, is secured, suitable for a card table and the like, on which is arranged a chess board. The case is, by this construction, adapted for the arrangement of the stops in a row along the front of it under the keys. Also, the invention consists of an arrangement of the blow pedals and their supports in connection with the stand or frame supporting the case, two pedals being used to equalize the action of the wind and to divide the labor between the two feet. The invention also consists of a box arranged in a vacant space behind the keys and below the cover, for storing away chess men when not in use, and in a peculiar construction of the valves, claimed to improve their action.

Propeller Wheel for Fluid Meters.—William Van Anden, Poughkeepsie, N. Y.—This is a propeller wheel for fluid meters made from a plate of metal of even thickness, and stamped up and pressed into shape by means of dies, in the ordinary way of shaping metal, for the purpose of stretching the outer edge and giving additional length to the blades or wings made therefrom. This method of producing a wheel without adding to it additional parts insures accuracy and uniformity, also a light and well balanced wheel, the lack of which has been a great defect in the construction of meters. The wheel varies in speed according to the amount of water or fluid which passes through it; thus, when a large quantity passes through, the wheel moves swiftly; therefore, it should be equally balanced to prevent vibration and wear. When a small quantity of water passes through, the wheel moves slowly; and unless it is light and properly balanced, and very sensitive to the slow movement of the water, a portion will pass through without its revolving. The utility of a meter depends on registering the smallest quantity of water that passes through it without the flow being obstructed. By this method of stretching the metal, it is claimed, the most water surface and the greatest degree of pitch to the blades is secured, which makes the wheel more accurate and more sensitive to the varying flow or quantity of water that passes through it.

Plug for Leaky Boiler Tubes.—John M. Spiegle, Philadelphia, Pa.—This invention consists of a long rod with a plug on one end small enough to allow of being pushed through the tube to the rear end; and at the inner end of said plug is a leather or other flexible disk, which follows the plug through the tube and there expands, so that, being pressed against the end of the tube by the plug being pulled forward, the plug and leather disk will stop the end of the tube tight, and the other end of the tube is packed by a cap forced against it by the nut and rod, which draws the packing of both ends against the tube; and another wood plug or a metal disk is applied to the rod near each end to fit snugly in the tube, to center the binding rod.

Baling Cotton, etc.—Benjamin W. Collier, Oxford, assignor to himself and W. H. Ford, Valden, Miss.—This invention has for its object to furnish an improvement in baling cotton, hay, and other substances suitable to be put up in bales, simple, inexpensive, and secure, protecting the substance baled better, from thieves, fire, animals, etc., than when baled in the ordinary manner, and which shall be equally applicable to loose and compressed bales. It consists in the use of wire baling cloth, and in the manner of securing it upon the bales. The baling cloth is made of fine wire of sufficient strength to hold the cotton or other substance securely without ties. In the wire cloth, at suitable distances apart, are larger wires. The wire cloth may be secured upon the bale by locking the ends of the coarser wires into each other; but in the case of compressed bales this will not answer. In this case, metallic hooks or buckles are used, which are secured to one end of the coarser wires and hooked upon them.

Cough Mixture.—Matthew Connell, Jersey City, N. J.—This remedy, for coughs, colds, and kindred diseases, consists in a combination of ingredients solidified as sugar candy, in the form of tablets, or in any other form convenient for use. The compound consists of sugar, phosphate of soda, oil of peppermint, and water, combined, poured, in a semi-fluid state, after the combination has been made, into molds, where it solidifies, thereby forming cakes or tablets of about two inches diameter and one fourth (more or less) inch in thickness.

Grinding Machines.—William Battell and Milton E. Worrell, Quincy, Ill.—This invention consists in the improvement of grinding machines, for grinding the revolving cutters of plows, and other revolving cutters, by which improved arrangement of adjusting devices the disk, which sustains the cutters, may be supported so as to present the cutters to be ground to an edge, or thicker at the edge than at the center, or to the same thickness, as may be required.

Clod Fender.—Robert T. Gillespie, Millport, Ohio.—This invention consists in a fender connected with a plow or cultivator for protecting growing plants from clods of turf and from stones in the process of working between the rows of plants, the construction and arrangement of parts constituting a fender shoe and scraper combined together, which is broadly claimed in the patent which has issued.

Reversible Axle Skeins.—Andrew F. Smith, Aiken, Texas.—This invention consists of cast metal axle skeins fitted on the axles, whether of wood or iron, so that they can be turned from time to time, as they wear away, to remove the worn place from the wearing position and bring a part not worn thereto. The invention also consists in pinning the skein to the axle, to relieve the linch pin or nut from the end thrusts of the skeins. The axle skein is polygonal in form and diagonally apertured, so that the bearing surface can be changed and the wear taken on different parts of its perimeter.

Clothes Dryer.—George W. Ainsworth, Waterbury, Vt.—This invention furnishes a simple and convenient clothes dryer, which may be compactly folded, and securely held when expanded to any desired extent. It consists in the construction and combination of standards, rounds, bars, and lock bars, arranged together in a peculiar manner for the purpose set forth.

Head Block for Saw Mill.—Henry C. McEwen, Oakdale Station, Pa.—The object of this invention is to facilitate the operation of setting logs to the saw in the process of sawing lumber, so that the thickness of the lumber sawn may be determined with greater accuracy than it is by the usual method. The invention consists in a new mode of arranging the parts which operate the knee on a head block, whereby the sawyer can reach the setting apparatus from the side of the log, and can set the log with the greatest precision while standing erect. This invention is more especially designed for the circular saw mill, but may be applied to other kinds of saw mills.

Pneumatic Springs.—Matthew F. Maury, of Richmond, Va.—Pneumatic springs have long been used in machinery, but the great obstacle to their general employment has been the inability to secure a packing sufficiently tight to prevent the escape of air when under pressure. The inventor thinks that he has accomplished this object in a perfect and economical manner as follows: He constructs the lower section with a central and upward convexity which produces a narrow channel between it and the wall of said section. He fills this channel with oil or other equivalent substance, while into the upper part of the chamber, formed by the two sections, is forced the proper quantity of air or other gas. The lower edge of the upper section rests in the oil, and hence the joint between the two sections is hermetically sealed, and with but a comparatively small quantity of oil.

Composition Stone.—John W. Hopkins, of Fayetteville, N. C.—This invention relates to an artificial stone made under pressure in the usual manner. The elements of which this stone is composed are common sand and rosin, the first in the proportion of 10 parts by measure to the hundred, and the rosin in the proportion of 90 parts. These materials, when thoroughly mixed, the rosin being, of course, in a melted state, and pressed and dried in the ordinary manner of manufacturing artificial stone, constitute a durable article of an agreeable dark brown color and very cheap. The sand forms the body of the artificial stone, the rosin serving to hold it together.

Fence.—William Post Rollo, of Holland Patent, New York.—This invention furnishes an improved farm fence, designed for line and other permanent fences, claimed to be strong and durable, and at the same time neat, tasteful, and substantial in appearance. The foundation or base of the post is built of common stone upon a level or prepared surface, and from one and a half to four feet square, as the firmness of the soil and the required hight of the post may require. The foundation is leveled up to the bottom board or picket rail, allowance being made for the settling of the post, and it is then banked up. The bottom board or rail is then arranged upon the foundation, and the upper part of the post is then built up to the required hight with selected blocks of stone, the bottom board or lower picket rail being thus anchored in the center of the post. The top boards or upper picket rails are placed end to end in grooves formed in the top of the posts, to receive them, and are connected by ties with a grip. In the case of a board fence the top boards are covered and strengthened by a board nailed to their top edges. The top and bottom boards are connected and strengthened between the posts by ties or cross bars, one or more of which, when the distance between the posts is long, may extend to the ground. The intermediate boards are attached to the ties. When a high fence is required the ties may be extended upward, and may have additional boards attached to them. When bar posts are required their upper ends may be sustained in place by being attached to the top board or picket rail. When a picket fence or a close board fence is required, the pickets or boards are attached to the bottom or top boards or rails, the ties serving as a part of the boards or pickets.

Medical or Phosphated Candies.—Charles S. Allen, of New York city.—This invention consists in combining any of the salts and acids of phosphorus with candles, sugars, and saccharine compounds in a solid form for medicinal purposes. One method of carrying out the invention is as follows: To one ounce, avoirdupois, of any candy drops—preferably ordinary small lemon drops—use eighty minims of officinal dilute phosphoric acid evaporated to one sixteenth its bulk, in which acid dissolve double its weight of best white sugar. Allow this phosphoric acid sirup to cool, then stir in the lemon drops so that they are evenly covered with the acid sirup; now roll the wet lemon drops in pulverized sugar and throw them on a sieve to separate any excess of sugar not properly adhering to the drops. Three of these drops represent one dose of the officinal phosphoric acid dilute. By varying the proportions of acid, any required number of lemon drops may represent a dose. In order to make cordial drops containing phosphoric acid, hollow confectionery drops are made in the usual manner, and the interior is filled with the above described sirup of phosphoric acid. In order to make a compound containing phosphate of iron, two ounces of white sugar are dissolved in as small a quantity of boiling water as possible, twenty-six grains of phosphate of protoxide of iron are added, and mixed thoroughly. The heating is continued until a portion dropped in cold water becomes hard, but not brittle. The candy is then poured into molds of the usual form. The proportions of sugar and iron can be made to vary if necessary. The above method can be adopted for any phosphate which is insoluble in water. The exact quantities of the ingredients herein mentioned and the specific forms of phosphorus may be varied at the will of the manufacturer.

Top Prop for Carriages.—David M. Valentine, of New York city.—This is a new detachable carriage top prop, and has for its object, by being detachable, to permit the ready and neat application of the covering and to avoid the cutting of too large or misplaced holes. The ordinary props now in use have to be fastened in place before the cover can be stretched, and project, therefore, against the latter. The cover must be perforated to fit the prop and permit it to protrude. This necessitates the preparatory perforation, which frequently turns out to be misplaced. From this cause unsightly holes often appear through carriage tops in the vicinity of the props, and often the holes do not insure a proper fit. Another form of prop is that whose plate is fastened on the outside of the cover subsequent to the latter's application, and which greatly mars the appearance of the carriage. The fastening plate of this improved top prop is, by screws or other means, secured to the supporting frame or seat. The prop is screwed into the plate through the cover. The cover is or need not be perforated for the admission of the prop until after it has been properly stretched over the carriage top. The prop is then applied, receiving afterward the thimble, the bows, and the head nut. In order to prevent the prop from working loose by spontaneously unscrewing, it can be locked to the plate by a pin, key, or other means after having been put to its place, or else a prismatic flanged washer, having prongs that pierce the plate, may be placed upon the cover and around the prop to receive a prismatic sleeve that slides on a portion o. the prop, which is also made prismatic.

Steam Boiler Furnace Door Ways.—William S. Wood, of Newtown N. Y.—This invention has special reference to the door ways of steam boiler furnaces; and it consists of a hollow arch partially surrounding the doorway, which separates the doorway from the front "uptake" of the boiler. The arch is divided by one or more partition plates. Through a tube a current of water or air is forced into one of the compartments of the arch, and through another tube the water is conducted from the arch. As steam boilers were formerly "set," the end of the boiler was supported by the front plate, or was flush therewith; and the uptake from the boiler flues was made of sheet iron, and attached to the outside of the front plate or end of the boiler. The present mode of setting a steam boiler is to support it on stands, and drop it back from the arch plate, thus leaving the uptake inside the front plate, thereby greatly improving the appearance of the whole arrangement without contracting the smoke channels or interfering with the draft of the furnace. The fuel doorway must, of course, be separated from the uptake, and it has hitherto been arched with brick; but, as the heat from the furnace is intense at this point, such arches are soon destroyed, making almost constant repairs or renewals necessary, which it is claimed is obviated by the present method.

Center Bit.—William H. Richards, of Deerfield Corners, N. Y.—This is an improved center bit, so constructed as to bore the hole and countersink it for the screw head and plug at one operation, and which may be used for many different sized screws. It consists in the combination of a countersink lip or wing with the center bit. With this bit the hole is left, with a shoulder above the countersink. The hole thus formed allows the plug to rest upon the bottom or shoulder of the first or plug countersink, which gives the glue a much better hold than when the hole is bored with an ordinary bit.

Ventilator for Windows.—George W. Pell, of New York city.—This is an improvement in that class of ventilators which are adapted to be introduced into a space under the lower sash, which is raised up a short distance for the purpose, and which takes the air in under the sash and discharges it upward in a direct course to the ceiling. It consists of a long tin or other sheet metal case constructed in two parts, telescoped together so as to be lengthened or shortened to adapt it to windows of any width, shaped on the bottom and at the ends to fit the window sill and sides, and provided with a ledge on the upper and outer side for the sash, and adapted to make a symmetrical apparatus extending across the whole breadth of the window, and affording all the capacity required without projecting into the room in such manner as to be objectionable in appearance. The air passages, being extended the whole breadth of the window, afford all the capacity required, and yet are quite narrow transversely, so as not to project into the room so far as to be objectionable. The case being made of sheet metal or other thin substance, there is no material offset at the point where the two sections meet, as in the case of the use of two thick boards of wood. The air passages may be provided with fine wire gauze partitions to exclude insects and the like.

Carriage Wheel.—Charles W. Fillmore, of Marengo, Ill.—The invention consists, first, of a retainer or metallic plate sustained in recesses of the hub and serving at intervals to reinforce the spokes, and admit of driving them home tightly and firmly. It consists, secondly, in the construction of the metallic band on each side of the spokes with a vertical flange, perforated horizontally so as to enable it to be held by pins on the retainer.

Fire Kindler.—David W. Thompson, of St. Joseph, Mo.—This invention relates to a sheet metal, cylindrical or otherwise shaped, case, to be filled with brick dust or other porous absorbent of combustible liquids, the case being perforated so as to allow the liquid to pass in as it is absorbed and pass out as it is burned, and the case being also provided with a handle, secured therein in a novel manner.

HEDGE TRIMMER.—Joseph S. Crum, Scottville, Ill.—The invention consists in a hedge trimmer so constructed as to allow the relation of the several parts to be readily changed and the hedge to be thereby turned and formed into any preferred shape.

PETROLEUM FORGE.—Herrman S. Saroni, of Cincinnati, Ohio.—The invention consists in impinging a constant flame from a gas burner against non-combustible material, to form a forge fire, and in providing means, connected therewith, for generating the gas as it is wanted.

ROTARY PUMP.—David L. Jones, of Nebraska City, Neb.—The invention consists in forcing water upward through a tube by means of one cylinder, having a diametrical slide valve rotating eccentrically within a second cylinder, each provided with apertures and combined with a discharge tube having a stationary valve. This forms a very cheap, simple, and effective water elevator.

SASH LOCK AND STOP.—John E. Scott, Baltimore, Md.—The invention consists in forming a sash lock by means of a spring pressed rod, which can be drawn back and reversed so as to lock the sash at any point of elevation and also when closed.

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DESIGNS PATENTED.

5,819.—COOKING RANGE.—J. Beesley, Philadelphia, Pa.
5,820.—BROOM HANDLE.—J. Dion, Chicago, Ill.
5,821.—CAR LINING, ETC.—C. Husband, Taunton, Mass.
5,822.—HAT RACK, ETC.—I. H. Kinch, Pleasantville, N. Y.
5,823 to 5,825.—CARPETS.—A. M. King, Kidderminster, Edgland.
5,826.—SODA WATER APPARATUS.—C. Lippincott, Philadelphia, Pa.
5,827.—REVOLVING PICTURE CASE.—R. R. Marsh, Detroit, Mich.
5,828.—CARPET.—C. T. Meyer, Lyon's Farms, N. J.
5,829.—FLOOR CLOTH.—J. Meyer, Lansingburgh, N. J.
5,830 to 5,832.—GARDEN CHAIRS.—W. and R. Mushet, Dalkeith, Scotland.
5,833.—JEWEL BOX.—G. Schoenemann, New York city.
5,834.—MILITARY CAP.—J. Schuller, Brooklyn, N. Y.
5,835.—BADGE.—T. W. Sweney, Reading, Pa.
5,836.—PLATE FOR LOCK.—G. W. White, New York city.

TRADE MARKS REGISTERED.

790.—MUSTARD AND SPICES.—G. S. Adams, New York city.
791.—HORSE BLANKETS.—S. W. Baker, Providence, R. I.
792.—TWINES, ETC.—Cable Flax Mills, Schaghticoke, N. Y.
793.—BAKING APPARATUS, ETC.—T. J. T. Cummings, Fort Wayne, Ind.
794.—CATTLE FOOD.—G. Gordon, New York city, and Montreal, Canada.
795.—PIANOS.—Ohio Valley Piano Company, Ripley, Ohio.
796.—SILVER WARE.—Rogers & Brother, Waterbury, Conn.
797.—MEDICINE.—N. Smith, Syracuse, N. Y.
798.—ICE.—Swett & Crouch, Chicago, Ill.

APPLICATIONS FOR EXTENSIONS.

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

21,029.—CLOTHES WRINGER.—I. A. Sergeant. July 10, 1872.
21,603.—TEMPERING STEEL.—P. G. Gardiner. September 11, 1872.
21,077.—SEPARATING WOOD FIBER.—A. S. Lyman. July 17, 1872.
20,999.—STOCK FOR HOLDING CUTTERS.—I. Gibbs. July 10, 1872.
21,036.—GRAIN SEPARATOR.—B. T. Trimmer. July 10, 1872.
21,026.—CAR COUPLING.—B. C. Sampson. July 10, 1872.

EXTENSIONS GRANTED.

19,979.—SEWING MACHINE.—C. F. Bosworth.
19,984.—COOLING AND DRYING MEAL.—J. Deuchfield.

EXTENSIONS REFUSED.

Lewis Miller.—Harvester.—Divisions No. 767, 768, 769, and 770 of the reissue, dated July 19, 1859, of original patent dated May 4, 1858.
William H. Seymour and Henry Pease.—Harvester.—Dated May 25, 1858.

Inventions Patented in England by Americans.

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