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Improved Method of Propelling Canal boats.

We have heretofore expressed the opinion that screws or paddle wheels at the bows, of boats designed to run in narrow channels, when properly applied would be most likely to effect the propulsion of such boats with economy of power, and without the liability of producing injurious side swells. Our opinion is based partly upon general principles, and partly on experiments performed with the method of propulsion herewith illustrated, which we witnessed some two years since, and which have been recently repeated in our presence. These experiments have confirmed us in what before was merely a theoretical view, derived from the consideration of the nature of the problem.

The boats experimented with were placed first in a channel so narrow that just sufficient space was allowed for their passage without binding at the sides, and subsequently in a wider channel, which gave ample room for the generation of side swells, as these would have been produced by any of the ordinary modes of propulsion.

The propeller is a hollow, water tight drum, with paddles upon its outer surface, as shown in Fig. 1. The paddles are bent or inclined from the ends of the drum to the middle, where they form an obtuse angle, as shown, being obtusely V shaped, the outer ends coming in contact with the water first, and the immersion of the blade taking place gradually and without shock. A little space is left between their inner edges and the periphery of the d.um. This construction inclines the water moved by the paddles toward the center, and aids the wings, which extend from the bow to each side of the paddle wheel,in collecting and displacing the water longitudinally under the bottom of the bcat, as shown in Fig. 2.

Another effect produced by this shape of the paddles is that they rise from the water without lifting it,as the straight paddle or bucket does, the easy inclination of the paddle giving the water more time to escape.

The boat is a flat bottomed scow, the bow turning up in circular form, as shown in Fig. 2. It has a rudder at the stern; and it is proposed to put one also at the bow, in order that the boat may be made to move laterally and obliquely, while its longitudinal axis shall remain parallel to itself, which will be a great convenience in getting close to docks, etc. The bow rudder will also be very convenient in turning sharp bends in canals.

Before describing the experiments referred to, we will make some general remarks on the propulsion of boats, which will render the results of the experiments more intelligible.

Fig. 2

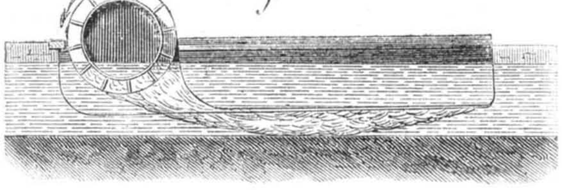
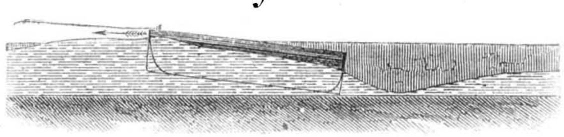


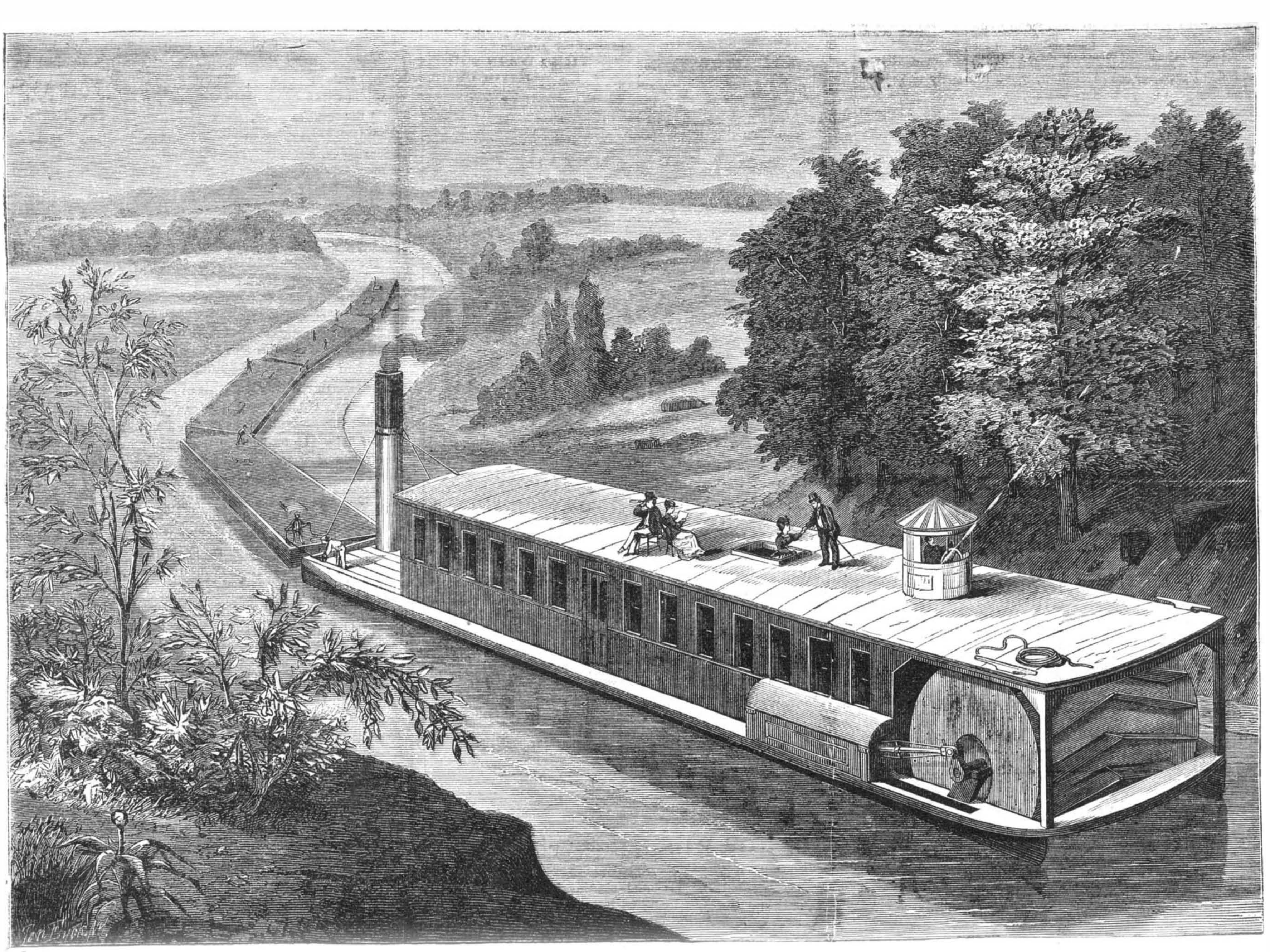
Fig. 3



Let the reader bear in mind that the combined weight of a boat and its cargo is just equal to that of the water it displaces in floating. If the boat weighs, say, fifty tuns and carries a cargo of two hundred tuns, then there is a displacement of two hundred and fifty tuns of water. Theoretically, this weight of water must be displaced from the front to the rear of the boat, or a horizontal distance equal to the boat's length, for every time the boat advances its length, and the power required to do this and to overcome the friction on the sides of the boat (skin friction) is the very minimum required for its propulsion. But as power is force expended through distance in time, it follows that, as the velocity of advance increases, not only must the amount of water displaced increase in the same ratio, but the velocity with which the displacement is effected also increases in the same ratio. The forces required to impart different velocities to a body is as the squares of these velocities; so that to move the same amount of water the same distance with twice a given velocity would require four times the expenditure of force necessary to move it at the given lesser velocity. But as in the advance of a boat the amount of water displaced increases also directly with the velocity, we have velocity again entering as a factor in the product of force expended, so that the latter is as the cube of the velocity. This principle is enunciated, in books on physics, as follows: "The resistance of any medium, to the motion of a body moving therein, will be as the cube of the velocity with which the body moves."

This law holding good for displacement of water laterally, which displacement does not aid the boat's advance, we may say that the waste of power in propelling boats also increases as the cube of the velocity. It is well known that, with steamboats or locomotives, a given number of miles can be accomplished at low speed with a consumption of much less fuel than would be the case were the same distance passed over at high speed, the variation confirming the law laid down.

As the boat can only advance by the longitudinal displacement of water, it has been the study of naval constructors to eliminate, as far as possible, all other displacement; and to this end, the modeling of vessels and the construction of screws and paddle wheels have received the most profound attention, and all the aids which science affords have been brought to bear upon the subject. The inventor of the method of propulsion under consideration does practically remove lateral displacement. With a propeller wheel or screw at the



GOODWIN'S METHOD OF PROPELLING CANAL BOATS.

stern, with side wheels, or with a tow line, the displacement of water in front of a vessel takes place more or less laterally, and it flows by the action of gravity into the chasm made by the advancing vessel. With blunt bowed vessels, a certain portion is displaced in the direction of the advance of the vessel. The action of these displacements is to produce an inclined plane, up which the boat must, so to speak, climb, so that gravity acts constantly against progress. The stern is lowered, as shown in Fig. 3 while the bow is raised. This effect increases as the channel narrows, so that, if the latter be only wide enough for the boat to pass, the water would be heaped up in front; and if the channel be only deep enough to float the vessel, the water would be caused to overflow the banks in front, while the stern of the boat would ground on the bottom.

The water only being able to reach the stern and get behind by flowing under the bottom, and doing this only by virtue of its own gravity, the speed of the boat would be limited to that at which a volume equal to the displacement of the boat can find its way from the bow to the stern under the bottom, when acted upon by gravity. Thus if, in a channel seven feet deep, the boat draws six feet of water, the water must flow through under the boat by the action of gravity with a velocity six times as great as that at which the boat is advancing. But the action of gravity, which is uniform, cannot be hurried. A body falling one second moves sixteen and one twelfth feet and no more. The velocity of flow under the boat will be that due to the difference in depth of water before and after the boat; and as this can be much increased only by an enormous expenditure of power, to attempt to tow a boat in such a channel as we have described, or to propel it at the stern, is a practical impossibility. Widening the channel, we can force it along, but as the displacement now takes place by the sides of the boat instead of under it, side swells result, with waste of power and other attendant evils. These swells are the result of the manner in which the displacement takes place; and sharp models may lessen, but cannot wholly obviate them.

With the Goodwin bow propeller, illustrated herewith, all these effects are reversed; the displacement is under the bottom, and is caused not by gravity, but by the power of the propeller. An inclined plane is created which is the highest at the stern, so that gravity acts with instead of against progress. There are no side swells, and the boat runs as well or even better in a channel just wide enough for it to pass as in one wider.

Experiment 1.—The boat was placed in such a narrow channel as described, and a tow line attached. Result—the water was heaped up in front, overflowing the banks, and the boat only moved fast enough to create the overflow.

Experiment 2.—Power applied to the stern with same effect.

Experiment 3.—Propeller wheel in front. The boat made rapid progress, the water bubbling up at the stern but making no side swells.

Experiment 4.—Boat loaded down at the stern till it grounded. Propeller set in motion, when instantly the stern rose and the boat moved on as before.

Experiment 5.—The boat was placed in a wider channel, when it moved as before without side swells. When propelled from the stern, or drawn by a tow line, it gave heavy side swells, and moved much more slowly with an expenditure of the same power.

Experiment 6.—The boat was heavily grounded from bow to stern. Upon starting the propeller, she gradually rose and moved forward slowly, grounding again, alternately grounding and rising, but still making a fair rate of progress.

Experiment 7.—The narrow channel was filled to the brim, when the boat, moderately loaded, traversed it at high speed, producing scarcely a perceptible overflow of the banks.

Experiment 8.—A precisely similar boat, with three screws, propelled by the same power, at the bow instead of the propeller wheel, moved at less velocity through the channel, producing head and side swells. Grounded like the boat with the propeller wheel in experiment 6, she was powerless to move.

Experiment 9.—The boat with propeller wheel at the bow was attached to the stern of the boat with the screws at the bow. Both having the same power applied, and carrying equal loads, the propeller wheel boat towed the screw propeller boat stern foremost nearly as fast as the screw propeller boat could advance singly by the action of her screws.

The reason for this lies in the fact that the screws throw the water from the upper half of their reacting surface directly against the breast of the boat, and that the water tangentially displaced by them avails nothing in propelling the boat. These two sources of waste are not found in the bow paddle wheel, since it displaces all the water, except that carried about by friction, tangentially and in just the right direction for propelling the boat. A very large percentage of its power is therefore utilized for propulsion, while a large proportion of the power applied to the screws is lost. Indeed, the first experiments of Mr. Goodwin were with bow screws, but the decided superiority of the bow paddle wheel was so evident upon comparison of the two systems as to lead to an abandonment of the idea of propelling boats in narrow channels by screws at either bow or stern.

Another advantage of the drum paddle wheel is that its buoyancy and the increased buoyancy it imparts, to the boat when in motion, compensate for the room it occupies, while the screws are additional load to be carried.

Captain Goodwin is an experienced navigator of the Ohio river, on which, as well as on other western rivers, stern propeller wheels are largely used. He found that, in attempting to cross bars, he could get over by turning the boat and running stern foremost, when he would ground with the bow on, and also that in narrow channels he could make better speed by running stern foremost. This having been confirmed by trials on the part of others, we are told the practice has been adopted by many, and is gaining in favor.

As we have remarked, we are confident that for narrow channels and shallow water this system of propulsion offers advantages possessed by no other yet produced. Arrangements are now on foot to test the principle by practical working on canals with full sized boats, the inventor being confident that under such circumstances he will be able to prove the value of his invention to the most incredulous. Captain W. F. Goodwin's address is 91 Liberty street, New York, of whom further information may be had on application. See advertisement in another column.

THE REMINGTON WORKS, ILION, N. Y.

The Remington armory comprises twenty-five different buildings, which occupy twenty-three acres of land in the heart of the town of Ilion. Two races, running from States Creek to the Erie Canal, pass through the works and furnish them with a valuable amount of water power. Not so very long ago the works, for a whole month together, turned out on an average 1,400 rifles and 300 revolver pistols a day. This was, of course, exceptional; but the average capacity of the works is rated by the firm at 1,100 rifles and 200 pistols a day. The firm have now contracts on hand which compel them to produce over 1,000 rifles a day. But in addition to this great production, the Remingtons make any number of rifles, guns or pistols to special patterns; and send shot guns and fowling pieces all over the world.

The Remington rifle is a breech loader, of apparent simplicity but demanding the most skillful construction. This arm has been introduced in most of the armies of the world.

HOW THE BARRELS ARE MADE.

When I was at Ilion yesterday, a short, thick bar of steel, about six inches long and four inches in diameter, was placed in my hand. It was bored. "From Sheffield in England; that is the embryo gun barrel," I was told.

A workman produced one of these same bars, red hot from a heating furnace, ran a rod with a shoulder to it through the bore, and hurried with it to a rolling mill. Through it went, coming out longer, but preserving the bore, the rod left behind by reason of the shoulder preventing its passing through the rollers. Another rod was put in, again the growing barrel went through, and the process was repeated sixteen times, till there was the gun barrel in the rough.

The boring of it, after the quality of the metal, is the great thing. This and rifling are the most important features. The making of the locks, triggers, stocks, etc. is, in these days, purely a matter of mechanical operation; unless the automatic machinery goes wrong, they must be according to pattern. But in boring and rifling, mechanical skill is the one desideratum; if either be untrue, the barrel may burst, or the shot fail the truest aim. The rifling is done by a very small cold steel chisel inserted in a long rod firmly attached to a rapidly revolving wheel, which also moves up and down a platform. The barrel is run over this rod and placed firmly in position. As the wheel revolves, the chisel in the rod cuts the rifling in the barrel; and as the wheel advances and retires very rapidly, the twist of the rifling is very elongated. The appearance of the rifling on looking through a barrel is very much like a long piece of apple paring. The next process is the polishing. This is done by a simple contrivance which polishes any number at one time. Several guns are attached to a machine which works up and down, each barrel passing through an expanding and contracting band of leather, well covered with emery powder, and outside a rod which simultaneously polishes the inside. From the polishing room the barrels are taken to the testing room, where they are put to the severest test. Two men work this department. They load forty barrels at a time, with 280 grains of powder and 500 grains of lead in each, and carry them into a small room, arranged for the purpose, to be all discharged at once. They are placed in position, wedged, and held down by a heavy beam. A train of powder is then laid to all the touch holes, every one hurrying out, and all is ready. The whole thing looks like an improvised mitrailleuse. The double doors having been carefully closed, the tester strikes a small rod of iron, protruding through the wooden partition, with a hammer. The rod is driven into a percussion cap at the end of the train of powder and the explosion of the charges in all the rifles immediately occurs. The value of this test is very great, the ordinary charge being seventy grains of lead. The barrels are afterward tested with 150 grains of powder to see if they have been strained by the first test. The roof and walls of the testing room show that gun barrels can burst. The barrels are then steeped in boiling acids, which give them the peculiar shade of color they generally have. The mottled appearance is produced by heating them in boxes filled with charcoal, and then dashing them, while red hot, into a solution of ammonia.

MAKING THE BAYONETS.

In other buildings, the rolling, tempering and polishing of the bayonets is carried on. The steel bar to be converted into a bayonet is passed through a succession of rollers with dies on them, each successive die being longer and smaller, and approaching more nearly in shape to the bayonet, as it leaves the last roller. The whole operation is similar, to a great extent, to rolling angle or bridge iron; with the exception that the shape is given by a pattern die, on the rollers, instead of by pattern of the rollers themselves. The slots in the shoulder of the bayonet, for fixing it on the barrel of the rifle, are all cut by punches. The polishing is done on the emery wheels.

STEAM STREET CARS.

One of the prominent features in the Remington character is restless activity. If business flags a little in the gun trade, they immediately turn the use of some of their innumerable machine shops to the production of other manufactures. After the close of the French war, they converted one of their buildings into a sewing machine factory, and are now able to turn out 500 machines a week, their gun lathes and drills being particularly suitable for working the smaller parts of a sewing machine. They have also quite lately taken up the construction of Mr. Baxter's new steam cars for street railroads, and have contracted to build 100 of them. Two will be completed within a month. The advocates of these cars, in summing up their advantages over the ordinary horse car, say that the boilers are entirely safe, and burn the smoke perfectly. There is no noise or puffing of steam, and the car can be stopped and started in half the time required by the horse cars, and can be run as slow or fast as may be desired; while the cost of fuel is less than half (in proportion to power) of that for any locomotive or dummy ever made. But the great point in the invention is its being able to ascend grades up to 400 feet to the mile, (1 in 13) without any complication of gearing or machinery, but having a simple direct connection similar to a locomotive. It does not do this by the force of momentum, but can be stopped and started on any part of the grade without difficulty. In fact, it can do all that the horse car can, and do it much better, and at a small fraction of the expense, both in first cost and in the running, and will actually save more than all the cost of the horses and their keeping.

THE REMINGTON AGRICULTURAL WORKS.

Here you see mowers, reapers, plows, hoes and rakes being made by thousands, all the work being done by machinery. I saw a lump of steel converted into a square hoe, and another into a heart shaped one, in what an Irishman would call "no time." I saw them tempered and polished. I saw them tested, and they were almost as pliable as a Damascus blade. I stood for several minutes in solemn contemplation of about 500 plow shares, and my respect for plow shares has increased immeasurably.

These Remington agricultural works sold last year, 2,500 mowers and reapers, 5,000 plows, 500 cultivators, 30,000 cultivator teeth, and a large number of hoes and rakes. The last item is always an exceedingly variable one. During the six years the works have been in full operation, they have made as few as 10,000, and as many as 23,000 hoes in one year.

But, even here, the Remington restless activity displays itself. I saw some cotton gins being put together, and inquired what they were doing there. The reply was: "Oh, we make cotton gins of a superior kind here. We often make two hundred or three hundred gins a year." In the foundery, I saw men at work on heavy iron beams. "What are they for?" I asked. "Oh, we build bridges about here and in other parts of the State, railroad and other bridges." The fact is these Remingtons inherit a mechanical spirit and a restless activity. They cannot be otherwise than busy. If guns are not in demand, they make pistols; if pistols are not wanted, they make cartridges; should cartridges become a drug in the market, they burst out in sewing machines, horse cars, cotton gins, bridges, plows, mowers and reapers, or anything else that strikes their fancy, or that Col. Squire, their able and energetic director in New York, may suggest. They have created Ilion; they are bound to see that Ilion gets along, and they attend to their own and Ilion's business. They build churches and homes; they give $100,000 or more to colleges, they treat their workmen like fellow creatures, and Ilion shies its cap in the air for the Remingtons and the Remington works.—*Correspondence New York Times.*

Bromine Water as a Test for Phenol (Carbolic Acid).

If we add bromine water in excess to a dilute aqueous solution of phenol, a yellowish white precipitate of tribromophenol appears. If the amount of bromine water added is insufficient, the precipitate disappears again. The reaction is very delicate. If one part of carbolic acid be present in 43,700 parts of water, or 0.0229 gramme in a litre, there appears, on adding the bromine water, a distinct turbidity. No other re-agent hitherto known is capable of detecting such minute traces of phenol. The method may be advantageously applied for detecting the presence of coal tar contaminations in potable waters. Acid liquids, before the application of this re-agent, must be nearly neutralized. To ascertain, in doubtful cases, whether the precipitate thus produced really contains phenol, it is filtered, washed, and put in a test glass, heated slightly with sodium amalgam, and shaken. If the liquid is then poured out into a small basin, and mixed with dilute sulphuric acid, the characteristic odor of phenol appears, and the acid itself separates out in minute oily drops. If phenol is suspected in urine or sewage, it is advisable to distil, when the phenol will be found concentrated in the first portion which passes over.

AUSTRALIAN LOCOMOTIVES.—Australia is making very rapid progress in the arts, and is destined ultimately to become a great center of civilization. The latest advance is the manufacture of locomotives. Three locomotives have been built at Ballarat, and three at Melbourne. They were constructed for the North Eastern Railway line, and are said, to have demonstrated the economy of hereafter building rather than importing locomotives.

THE very best way to clean a stained steel knife is to cut a solid potato in two, dip one of the pieces in brick dust (such as is usually used for knife cleaning), and rub the blade with it.

DIAMOND CUTTING IN NEW YORK.

According the *American Watchmaker's, Jeweler's, and Silversmith's Journal*, the New York Diamond Company has commenced the business of cutting and polishing diamonds, and the promise is good for its success. The premises are in 15th street, near Broadway.

The business is divided into three entirely distinct and separate branches. First, there is the cleaver or splitter, called the *klover*; then the cutter, or *snyder*; and, lastly, the polisher, or *slyper*. So much skill is required of each that it is hardly possible to imagine that any one could combine the three trades perfectly. The splitter or cleaver must be a person of the quickest possible perception. Seizing a stone, he looks at it quickly, and decides instantly in his mind how the stone must be cut, so as to give it the greatest weight and brilliancy. Instantly he detects any flaws, or *striæ* or streaks in it; judges in a moment what minute fragments must be cut off in order to get rid of these flaws, and must be so thoroughly acquainted with his subject as to be able to tell whether the imperfection is at the surface or in the heart of the stone. As to color, he knows at once whether it will turn out of pure water or not. He must be both bold and cautious. Having decided in his own mind what that stone of a carat or more will turn out—having even calculated to a nicety how much the clippings of the rough diamond will be worth, whether they will make little brilliants or flat rose diamonds—he secures the stone in a wooden stick, the gem being held by a cement made of rosin and pounded brick dust. Taking another diamond, or a fragment of one before split, having a sharp edge, he secures it in another stick precisely in the same way. Steadying his two hands over a small wooden box, lined with brass, which has at the bottom a sieve to secure the precious dust, he applies the knife edge of one diamond to the face of the other. It cuts rapidly—there is a distinct notch made. Showing us the stone he is about to cut (in this instance a fine one of about two carats), he points out to us a minute flaw on its surface, which he proposes to remove. It might be ground off. But if this slow process was employed, it would take two or three days, may be a week, and that portion of the diamond capable of being turned into a pretty little rose diamond be lost. Now he takes something like a steel ruler, with a perfectly flat, square edge, about six inches long and say a sixteenth thick, places first this rule, not on the stone, but on the line where the cleavage ought to be; considers a moment, then, having as it were taken his aim, he deftly, with an instantaneous movement, places it in the little notch cut in the diamond, with the other hand seizes a small steel rod, something like the pestle to a mortar, gives the ruler or knife one, two quick taps, and, showing us the stone, there is a distinct, perfectly straight split. Now, warming his cement, he takes the stone out, now divided into two parts; he has taken off a piece which, it is true, is very small, but in looking at it closely we see he has cut right through a fault, and has so got rid of an imperfection. It is not difficult to describe, but the skill, accuracy, judgment and coolness required is wonderful. The stone might be worth in the rough $100 or $10,000; the process is the same. A single error on the part of the cleaver, an ignorance of the nature of the stone, or of what it ought to be like when perfect, might spoil for his employers more in one minute than they could make up in months.

The cleaver having determined what shape the diamond shall have, it is handed over to the cutter. The diamonds are secured precisely in the same sticks, and held over exactly the same kind of box. The stone to be shaped is held in the left hand, though both stones are in process of cutting. The thumbs are closely braced, the left hand being protected by a leather glove The process is a very slow one; the cleavage had a *presto* quick artistic slight of hand in it, but this has a dull plodding look. Slowly the faces are abraded as the two diamonds are ground together. In this condition they have not the least appearance of beauty; if, when split up by the *klover*, they still retained some little sheen and glitter, here they look like bits of very poor smoky glass, about as brilliant as a cinder. The shape required is approximated. Stones we saw, ready for the polishers, were rather more roughened out, apparently, than conforming to the required forms. It is a long and tedious process, requiring no end of patience and judgment.

After this, we visited the polishing rooms. Seated, before revolving steel disks running parallel with the floor, sat a number of men all intent at their tasks, the tables turning noiselessly with a speed of 2,000 revolutions to the minute. They were begrimed with oil. Each man held in his mouth something that looked like a tooth pick, which he complacently chewed. This they would dip occasionally into a little glass vessel containing an olive colored mixture, made of oil and diamond powder. A drop of this they would apply to the diamond they were polishing. The first process was that of soldering the stone into a brass cup, the solder rising above it until it looked like a big acorn, the stone being as the apex. To do this properly, to follow each workman through his work, and to present each facet in its proper position, seemed to us the acme of skill. Taking a tiny stone, the fractional part of a carat, but, minute little thing as it was, having no less than sixty-four distinct surfaces to be smoothed, a workman who does nothing else but fix the stones seized it between his forceps, placed it in its proper position in the solder, now in a plastic state, and heedless of burnt fingers, shaped the yielding mass of metal around it until it was thoroughly secured; then taking it, still hot, he plunged it into water, where the metal hissed; and we thought this workman must be endowed with salamander qualities. Taking the precious acorn with its diamond point, the polisher now commenced his work. First he touched the point with the olive oil and diamond dust, and felt with the end of his finger the exact position. It seems to us that in this process the senses have to play entirely novel functions. The polisher's eyes are apparently of little use, but the sense of touch has been so exquisitely educated that it supplies the other faculty. Placing the stone in the acorn with its point downward, he clamps it in a wooden rest, the diamond just touching the revolving wheel. To produce pressure, he puts on the wooden rest pieces of lead, weighing perhaps four or five pounds; sometimes he has the weight of three or four on it. One diamond at a time is not sufficient to absorb his attention: he has three, all mounted at the same time, going together. Occasionally he takes one of the rests off, and plunges the acorn into some water to cool it, looks at it a moment, feels it with his finger, and puts it down again. Sometimes he seems to be paying a certain slight amount of attention to the plate, looking at the streak the stone makes on the revolving disk. This seems to be all the process, only this and nothing more. Little does the observer imagine the years of assiduous and patient toil it has required to acquire this proficiency. All the workmen are Israelites, all from Holland. Those who understand the business inform us that from generation to generation they have carried on this trade, and that the persistency of this remarkable people, the dogged perseverance which they are famous for, has alone made them proficient in this branch of art. It may take months of this patient, monotonous toil to perfect a single stone of any size. Sometimes it happens that a surface is presented to them which defies even the mordant qualities of any other diamond powder. They may grind and grind away for months, and the smooth, glittering surface will not come. They have come across a bit of the poetical adamant. Still they work on with it; they will make it brilliant. It passes from hand to hand, from wheel to wheel. Everybody has tried it, and everybody has given it up. But still they keep on trying. Suddenly a bright little speck appears—you could cover it with the point of a cambric needle. The obdurate hide is getting worked off, and human patience is triumphant, and a magnificent luster rewards their labors.

African stones are particularly hard and obstinate, and give much more trouble than South American ones. The company have already a large proportion of the business of repairing diamonds. It happens frequently, even with the most skillful workmen, that in setting a stone an edge is chipped off or roughened, and requires some slight remodeling Again, when soldering and plunging into water a piece of jewelry containing a diamond, from the too sudden change of temperature, a film appears, on the surface of the diamond, which dims its luster. It then requires repolishing. Fires may occur, and diamonds subjected to a long heat lose their sparkle, and want retouching. All these accidents give constant employment; but it is rather with the idea of taking stones in the rough, making a market in New York for rough diamonds, and of bringing these productions to the utmost pitch of skilled perfection we would treat—and this has been fully accomplished by the New York Diamond Company.

Walking.

Walking briskly, with an exciting object of pleasant interest ahead, is the most healthful of all forms of exercise except that of encouragingly remunerative, steady labor in the open air; and yet multitudes in the city, whose health urgently requires exercise, seldom walk when they can ride if the distance is a mile or more. It is very common in the country, especially with the well-to-do; a horse or carriage must be brought to the door even if less distances have to be passed. Under the conditions first named, walking is a bliss; it gives animation to the mind, it vivifies the circulation, it paints the cheek and sparkles the eye, and wakes up the whole being, physical, mental, and moral.

We know a family of children in this city who, from the age of seven, had to walk nearly two miles to school, winter and summer; whether sleet, or storm, or rain, or burning sun, they made it an ambition never to stay away from school on account of the weather, and never to be "late;" and one of them was heard to boast that in seven years it had never been necessary to give an "excuse" for being one minute behind the time, even although in winter it was necessary to dress by gaslight. They did not average two days' sickness in a year, and later they thought nothing of walking twelve miles at a time in the Swiss mountains. Sometimes they would be caught in drenching rains, and wet to the skin; on such occasions they made it a point to do one thing—let it rain,—and trudged on more vigorously until every thread was dry before they reached home.

There is no unmedicinal remedy known to men of more value in the prevention of constipation than a few miles' joyous walking; let one follow it up a week—a walk of two or three miles in the forenoon, and as much in the afternoon—and, except in rare cases, when a longer continuance may be made, the result will be triumphant; and yet nine persons out of ten would rather give a dollar a bottle for some nauseous drops or poisonous pills than take the trouble to put in practice the natural remedy of walking. Nor is there an anodyne among all the drugs in the world which is the hundredth part so efficacious, in securing refreshing, healthful, delicious, glorious sleep, as a judicious walk.—*Hall's Journal of Health.*

Stopping Pinholes in Lead Pipe.

A correspondent in the *Industrial Monthly* writes: "The supply water pipe which extends from the street, along the top of our cellar to the sink in the kitchen, had a very small hole in one side, so that a stream of water spun out, not so large as a cambric needle. If I had known that the difficulty could have been remedied by placing the square end of a tenpenny nail on the hole and hitting it two or three light blows with a hammer, the knowledge would have saved me much trouble and expense. But I did not know that a small hole in a lead pipe can be stopped by battering the metal just enough to close the orifice, therefore I went and called a plumber. Of course he was employed by the day. He knew how to stop the issue in less than one minute; but he preferred to make a good job for himself and for his employer. He was too proud to be seen carrying his solder and tools along the street; hence a helper must be detailed to carry these appliances. His employer paid him twenty cents per hour, but charged sixty cents per hour for his services. He paid the helper ten cents per hour, and charged forty cents, whether they were loitering along the streets, or at work. They looked around, lit their pipes, smoked and chatted, and used about four ounces of solder, for which the charge was fifty cents, as they reported they had used one pound. The plumber reported one hour each for himself and helper. Thus the cost of stopping one pinhole cost me $1.50, when any one who can handle a hammer could have closed the issue in half a minute if he had thought of how to do it."

Bones and Bone Meal.

The complaint of fraud in the manufacture of commercial manures gives rise to many questions concerning the manufacture of bones into some available form by the farmer himself. This is a very important subject and yet it is one beset by many difficulties. To a majority of farmers in this country, bones are the only reliable source of supply to replace the phosphates carried away by the annual exportation of grain, beef and pork. But bones broken into fragments of not more than an ounce in weight each will, under ordinary circumstances, remain in the soil undecomposed for half a century, and consequently but little benefit will be derived from their use. Bones, to be of immediate value, must be ground fine; but this with "raw bones" is a very difficult process. Bones subjected to the action of high steam lose all their oil, and a large portion of the gelatin which so obstructs the grinding, and thus become brittle, and are quite easily ground in a common mill. The same end can be reached more directly by burning the bones, the waste being merely the animal matter contained in them. The phosphate of lime is unaffected by either steaming or burning.

The mineral part of the bones, thus separated, will be found to consist substantially of 45 per cent of phosphoric acid and 55 of lime. This compound is insoluble in pure water, and but very sparingly soluble in rain water charged with carbonic acid. If we take this "bone phosphate" and add to it a little more than half its weight of sulphuric acid (commercial oil of vitriol), we will in a few days produce a new compound, in which the sulphuric acid has removed two thirds of the lime from the bones, combining with it to form gypsum, supplying the place of the lime thus removed with water. This is a true soluble superphosphate. Its elements are:

Phosphoric acid	60·39
Lime (calcium)	23·93
Water	15·38
	100.00

This mass will be found very tenacious, and somewhat difficult to handle. To remedy this it should be mixed, in sufficient quantities to render it dry, with some good absorbent, such as dry swamp muck reduced to a powder, or with ground charcoal, or even with road dust. Lime or ashes should never be used for this purpose.

Several farmers can co-operate in the construction of a mill, and thus produce the bone meal which they use at prime cost. From this, they can make their own superphosphate, and use it either by itself or mixed with composted manure.

But bones may be reduced to a very fine state of division by use of strong wood ashes, and thus, presenting a large surface to the solvent action of water and carbonic acid in the soil, may be of great value in maintaining fertility. We suggest the following formula for using bones with ashes:

Ground bones	100 pounds.
Strong wood ashes	400 pounds.
Soda saltpeter	70 pounds.
Epsom salts	10 pounds.

Dissolve the soda saltpeter and Epsom salts in sufficient water to thoroughly moisten the ashes and bone meal. Mix well, and let it stand ten days, stirring it daily. Use some absorbent, such as dry muck pulverized, to dry the mass and reduce it to powder.

German potash (150 pounds) may be substituted for the ashes, in whole or in part. This amount used on an acre will have a marked effect on the crop.—*R. T. Brown.*

Fastening Loose Window Sashes.

The most convenient way to prevent loose window sashes from rattling when the wind blows is to make four one sided buttons of wood, and screw them to the stops which are nailed to the face casings of the window, making each button of proper length to press the side of the sash outwards when the end of the button is turned down horizontally. The buttons operate like a cam. By having them of the correct length to crowd the stiles of the sash outwards against the outer stop of the window frame, the sash will not only be held so firmly that it cannot rattle, but the crack which admitted dust and a current of cold air will be closed so tightly that no window strips will be required. The buttons should be placed about half way from the upper to the lower end of each stile of the sashes.—*Industrial Monthly.*

Adjustable Spring Bed Bottom.

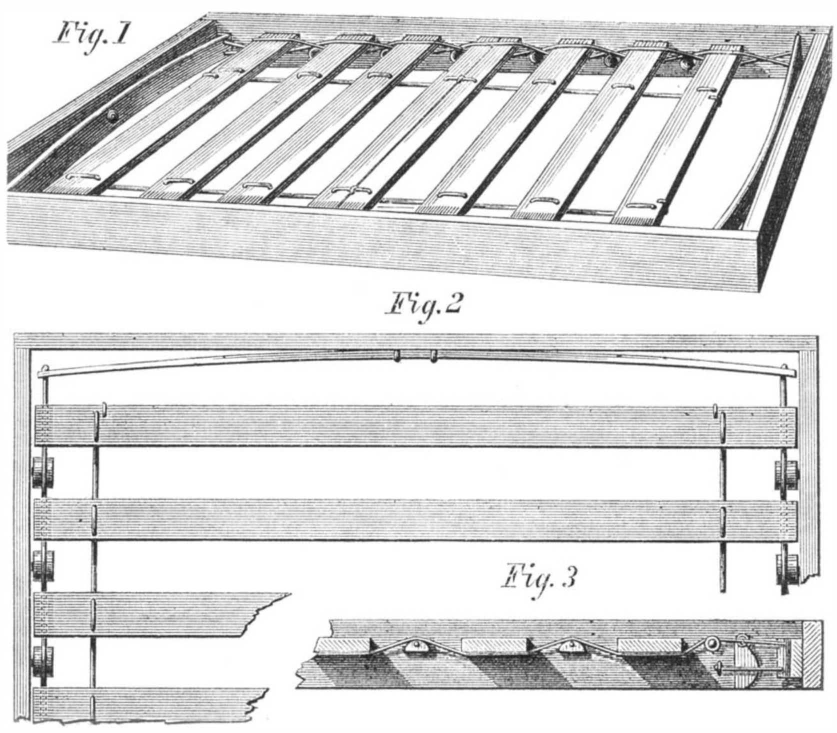
The principal object of this invention is to make the slat bottoms, of the common slat bedstead, elastic, so that it may be used in place of the cumbrous spring bed bottom frame now in use, with the additional advantage that it may be made hard or soft at pleasure, to suit the season. It is claimed that it can be put up or taken down as quick, and will occupy as little space, as any other bedstead bottom, and that it can be made of cheap materials.

The engraving represents two styles of bedstead. Fig. 1 is a view of a bed bottom employing the double or endless bearing cord used for crosswise slats. Figs. 2 and 3 are detail views of a bed bottom having a single bearing cord used for the lengthwise slats. Two spring bars with grooved ends (one may be used), made fast at their centers to opposite sides of the bedstead, on the rails, communicate their motions by means of the bearing cord or cords passing over pins or rollers between the ends of the slats on the inside of rails, the bar acting like an archer's bow. In the double or endless cord for the crosswise arrangement, both cords rest in two grooves or pins, but divide and pass on each side of the slats and around the end of the spring bars, in such a way that the end strain bears up alternate slats. The adjacent slats, then resting on different cords, do not interfere with each other's vibration. The cord never touches the upper surface of the slats, for the weight of the mattrass depresses the slats between the pins, and keeps them in the centers of the spaces. The web of slats need not be fast in any way to the bedstead, as represented, but can be lifted off and rolled up. With lengthwise slats, the single cords will answer, for the reason that the weight of the occupant comes on but few slats. The cord is not attached to the spring bar, but passes around the end, and is brought back a few inches and made fast to a screw in the bed rail. As the bearing cord always slips on the end of the spring bars, the motion is multiplied, so that a little spring in the spring bars gives great elasticity to the slats, and the bars and slats can be made of the cheapest material, pine, spruce, or fir answering perfectly for this purpose.

There is a groove on the under side of the slats, which are held in position by two small stay cords passing through two converging holes in such a way that, although loose in the holes, there will be no slipping if the cord is made taut, as it should be. At each corner of the bedstead there is, on the rail, an oblong button, nearly in front of the end of the spring bar, and by turning this up against the end of the bar, the bearing cord is made taut, thus rendering the bed hard for hot weather.

When no spring bars are used, the double bearing cord is passed around rollers placed on screws in the bed posts. This makes a very cheap spring bed. The reciprocating motions of the slats allow them to adjust themselves to the varying shapes of occupants of the bed. The slats can also be used, divided, the halves being held apart by a piece of cord to make them more elastic.

This invention is covered by two patents, dated August 15, 1871, and Feb. 27, 1872, taken out through the Scientific American Patent Agency. The patentee, being a disabled soldier and not able to attend to active business, would like to correspond with parties for the sale of rights, at moderate prices. For further information address Geo. Brownlee, Princeton, Ind.



ADJUSTABLE SPRING BED BOTTOM.

THE BALTIMORE BOILER INSPECTION LAW.

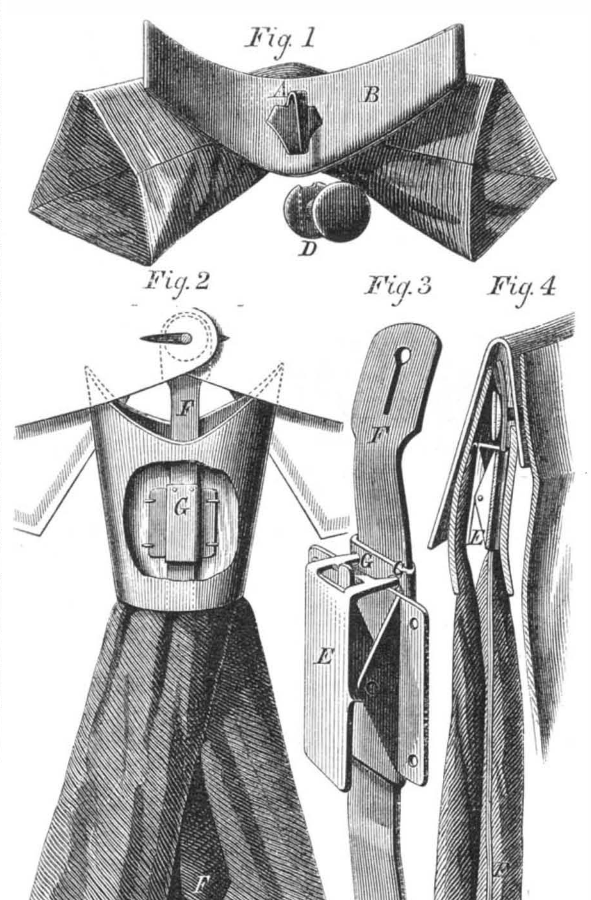
At the last session of the Maryland Legislature, a bill was passed authorizing the appointment, by the governor, of two inspectors of boilers for the city of Baltimore. It names, as the qualifications of these inspectors, that they shall be well skilled in the construction and use of steam engines and boilers, and fixes their salary at fifteen hundred dollars per annum. With this munificent provision for their support they are to be content, and not to engage in the manufacture of steam boilers, engines or machinery applicable thereto, and are not to receive any money, gift, gratuity or consideration from any person or persons. With the kind of inspectors and inspection likely to be obtained from any ability such salaries will secure, the Baltimoreans might, in our opinion, about as well be without any. The other features of the bill are not objectionable.

Blood Crystals.

An interesting volume has just been published by M. W. Preyer, on blood crystals. Though blood crystals were first observed by Hünefeld, the merit of discovering them is due to Reichert, who first recognized their nature. The fact of the crystallization of a complex organic substance like blood was first received with some amount of incredulity, but the corroborative testimony of many microscopists soon cleared away all doubt, and a variety of methods were suggested by which the crystals could be obtained. The best plan for obtaining them is thus given by M. Preyer: The blood is received into a cup, allowed to coagulate, and placed in a cool room for twenty-four hours. The serum is then poured off, and a gentle current of cold distilled water passed over the finely divided clot placed upon a filter, until the filtrate gives scarcely any precipitate with bichloride of mercury. A current of warm water (30°—40° Cent.) is now poured on the clot, and the filtrate received in a large cylinder standing in ice. Of this a small quantity is taken, and alcohol added, drop by drop, till a precipitate falls from which an estimate may be made of the quantity required to be added to the whole without producing a precipitate. The mixture, still placed in ice, after the lapse of a few hours, furnishes a rich crop of crystals. The forms of the crystals obtained from the blood of different animals do not vary to any great extent, and are all reducible to the rhombic and hexagonal systems. The vast majority are rhombic prisms, more or less resembling that of man. The squirrel, however, with several of the rodentia, as the mouse and rat, and the hamster, are hexagonal. The hæmoglobin of several corpuscles is required to form a single crystal. All blood crystals are double refracting. The animals whose blood has been hitherto examined and found to crystallize are—man, monkey, bat, hedgehog, mole, cat, lion, puma, fox, dog, guinea pig, squirrel, mouse, rat, rabbit, hamster, marmot, ox, sheep, horse, pig, owl, raven, crow, lark, sparrow, pigeon, goose, lizard, tortoise, serpent, frog, dobule, carp, barbel, bream, rudd, perch, herring, flounder, pike, garpike, earthworm, and nephelis. The spectrum of blood-coloring matter when oxidized, with its two absorption *striæ* between D and E of Fraunhofer's lines or in the yellow part of the ordinary spectrum, and the single band of deoxidized hæmoglobin, are now well known. Preyer states he has not been able to obtain a spectrum from a single blood corpuscle, but that the characteristic bands are visible where certainly only a very few are present.

FASTENINGS FOR NECK TIES, SCARFS, ETC.

Much annoyance is often experienced through the inefficiency and unsatisfactory character of the fastening used for



attaching these to the button or stud of the neck band. If at first they answer the purpose, they soon get out of order so as to need constant adjustment, which soils the ties and, in addition to the inconvenience caused by it, renders these articles much less serviceable than they would be with a more positive and reliable fastening which it is the object of the present invention to provide.

A, Fig. 1, is a fastening for all that class of neck wear known as bows, ties, etc., and consists of the sheet metal hook, A, securely fixed to the shield, B, by clinching. To provide a suitable hold for the hook, and at the same time prevent the metal from soiling the linen, a stud, Fig. 2, is provided, having a slot or dovetailed slit passing through or across the head, at right angles to the shank, as shown at D The hook, fitting the slot neatly, forms a durable, cheap, and easily adjusted fastening. E, Fig. 3, is a fastening for all that class of neck wear that furnishes a hiding place for the clasp, and tape, as shown in Fig. 4. The clasp, E, Fig. 3, is firmly fixed inside the shell of the scarf. The tape, F, Figs. 2 and 3, with button hole in one end, passes through the clasp, E, Fig. 3, in such manner that when the spring, concealed within said clasp, is allowed to assert its force, the sharp points, G, penetrate the tape and hold it fast. By pressing open the clasp, as shown in Fig. 3, the scarf may be passed freely up and down the tape, and stopped and retained at any desired point thereon. In use the tape is pulled out)Fig. 4) and fixed to the shirt collar button. Then, by pressing open the clasp with one hand and grasping the lower end of the tape with the other, the scarf is passed to its place; the clasp being then released, the spring forces the points into the tape and holds it fast. In use this arrangement has been found to answer the purpose admirably. Patented December 13, 1870.

For further information address the patentee, Wm. A. Wicks, 129 Jefferson street, Baltimore, Md.

Dyeing Leather.

Picric acid gives a good yellow without any mordant; it must be used in very dilute solution, and not warmer than 70° Fah. so as not to penetrate the leather. Anilin blue modifies this color to a fine green. In dyeing the leather, the temperature of 85° Fah. must never be exceeded.

Anilin green is well adapted to dyeing leather, and its application is quite simple. Whether used in paste or as powder, we must make a concentrated aqueous solution.

The leather is brushed over with a solution of sulphate of ammonia, mixed with water, the dye solution applied at 95° Fah., and it must be endeavored, by rapid manipulation, to prevent the dye from penetrating through the leather. By the addition of picric acid, the blueish shade of this dye stuff is modified to leaf green, and it becomes faster; but the picric acid must not be added to the color solution; it must be applied to the leather before or after the dyeing with anilin green.—*F. Springmuhl.*

MEASURING THE VELOCITY OF ROTATION.

Professor A. E. Dolbear suggests, in the *American Journal of Science*, a simple and effective method of determining the velocity of rotation of wheels and shafts. Upon the face or upon the periphery of the rotating object, he fastens smoked paper, and this he touches with a point of rubber which is attached to one branch of a vibrating tuning fork, having a known rate of vibration. The fork is to be so held that the direction of its vibrations will be at right angles to the line of motion of the shaft. By counting the number of undulations made on a given extent of the smoked paper the speed of rotation is at once indicated. Thus if the fork makes 100 vibrations in a second and one vibration is recorded on the smoked paper in a space covering one half the circumference of the wheel or shaft, or two vibrations within the entire circumference, it is evident that the rate of rotation is 50 revolutions per second. By this simple and easy method, the velocity of rotation of gyroscope disks and of all kinds of shafts and wheels may be readily ascertained.

CHIMNEY MOVING.—The Cabot Company, of Brunswick, Maine, in order to enlarge their cotton mill, moved their large smoke stack chimney—78 feet high, 7 feet 9 inches square at base, and 5 feet square at top—containing more than 40,000 bricks and weighing more than 100 tuns—twenty feet, without rollers or balls, or guys or braces to steady it—one of the greatest feats ever performed in the State. It was planned and carried out by Superintendent Benjamin Greenes, not one of those engaged having ever witnessed the moving of such a body. It was accomplished by building such ways as are used in launching ships, surfaces planed, and greased, chimney wedged up, and moved by two jack screws in four and a half hours. The flues were disconnected from the boiler at 1 o'clock P. M., and at 9½ o'clock the same evening the flues were again connected, fires going, and steam up.

BEES are exceedingly susceptible of atmospheric changes; even the passage of a heavy cloud over the sun will drive them home; and if an easterly wind prevails, however fine the weather may otherwise be, they have a sort of rheumatic abhorrence of its influence and abide at home.

OUR next eclipse of the sun will take place soon after sunrise on Wednesday, Sept. 29th, 1875. Visible north of North Carolina and east of the Mississippi.

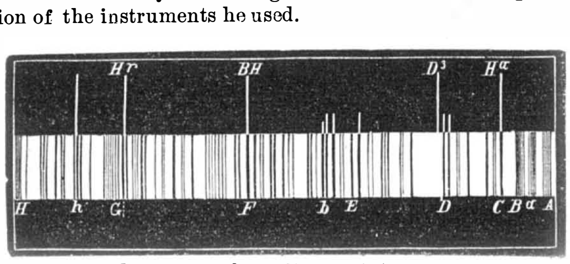
AT Denver, Colorado, on the 29th of July, 1878, at 3½ P. M. there will be a total eclipse of the sun lasting nearly three minutes.

[For the Scientific American.]

THE DISCOVERY AND HISTORY OF THE CHROMOSPHERE.

BY J. H. LEACH, OF DARTMOUTH COLLEGE.

Extensive preparations had been made to observe the chromosphere and prominences during the eclipse of 1868. The spectroscope, for the first time, was directed toward these mysterious flames about which there had been so much discussion. They were about to disclose the secret of their composition. The observers, stationed at different points along the path of the eclipse, met with general success. A spectrum of bright lines was found to be given by the chromosphere and prominences, although at this time the word chromosphere had not been invented, and that envelope which now bears the name had not, in reality, been distinguished as an envelope or atmosphere separate from the photosphere; yet a red light had been seen around the sun, and it was this which gave the bright lines. The spectrum of bright lines seen at once showed that this envelope must be gaseous and existing at a very high temperature. To M. Janssen, the well known astronomer, belongs the honor of succeeding in seeing the bright lines when the sun was shining in full splendor; Mr. Lockyer attempted, independently, to discern these lines, but failed, owing to defective instruments. The difficulty to be surmounted was this: the brightness of full sunlight eclipsed the comparatively feeble light given off by the prominences and chromosphere; how to get rid of this intense light was the problem. If a beam of sunlight be passed through a prism of glass, it will be dispersed, giving a spectrum of a certain length and brightness. Now if instead of one, two or more prisms be used, there will be an increase in the length of the spectrum and a corresponding diminution of its brightness. Now, as the spectrum of the chromosphere and its appendages is not a continuous spectrum but a spectrum of bright lines, the only effect which an increase in the number of prisms used could have would be that of more widely separating the lines, not to any great extent diminishing their brilliancy. Mr. Lockyer hoped, by using a sufficient number of prisms, to be able to see the prominences; for after toning down the glare of the solar spectrum, as given by one prism, he expected to see a monochromatic image, of the prominences he should examine, in each of the lines given by the prominences. As stated above, he failed, not because his theory was wrong, but because of the imperfection of the instruments he used.



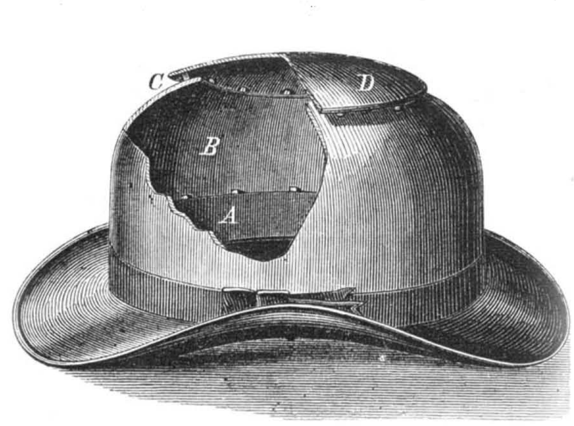
The next day after the eclipse of August 19, 1868, M Janssen tried the experiment and succeeded. There were the bright lines. Astronomers could now examine the prominences at their leisure. That which could be investigated heretofore only during an eclipse would now become a subject of daily study; in fact, M. Janssen had proved that it was possible to produce in effect a total eclipse whenever desired, providing the sun shone clear of clouds.

The next question which engaged astronomers was that of the coincidence of the lines seen with those given by some known gas or gases. Sodium and other metals had been proved to exist in the sun long before. Kirchoff had discovered the law that every body has the power of absorbing such light as it emits. The coincidence of the bright lines given by the vapor of sodium with the *D* lines in the solar spectrum had been announced. The coincidence of the chromospheric lines with certain dark lines in the solar spectrum was soon established. The line, marked *Hα* in the engraving, was found to coincide with the *C* line of Kirchoff's map. *BH* with *F*, and *Hγ* with a line near *G*. These lines were coincident with those given by glowing hydrogen, and as they were the most prominent and the brightest, hydrogen was announced as being the chief constituent of the prominences and chromosphere. Another line was seen in the orange part of the spectrum, which at first was thought to be the sodium line *D*; but this was a mistake, and the line was soon found to be more refrangible than D. This line has been called the *D3* line. What is the nature of the substance which produces it is still unknown; it is found whenever the prominences and chromosphere are examined. Other lines are sometimes seen, such as the sodium and magnesium lines. These are, however, generally found in the lower portions of the prominences and in the chromosphere proper, rarely being seen in the more elevated portions of the prominences, probably by reason of the greater gravity of the vapors of these metals over hydrogen gas. Continued observation showed that the sun was surrounded by immense masses of hydrogen, ejected from the chromosphere, which were continually changing their form, bursting out, now here, now there; and when we consider that only a small portion of the sun's surface can be examined on any one day, only the edge or limb, it is apparent that innumerable outbursts occur of which we have no knowledge.

Of the mighty forces which are at work in that orb, which has been justly termed the ruler, fire, light, and life of the planetary system, we can have no conception: of the forces which have the power of hurling immense masses of matter to the hight of hundreds of thousands of miles, and at a velocity with which we are entirely unacquainted. That the chromosphere is the abiding place of terrific cyclonic storms, and (if we may be allowed the expression) volcanic eruptions, is a fact beyond doubt; daily evidence meets our eyes attesting to the turmoil going on therein.

HEARD'S VENTILATING HAT.

Not only in tropical climates, but in the torrid temperature of midsummer, experienced in our latitude, will such an invention, as the one illustrated in our engraving, be found of great service and comfort. The overheating of the head has often resulted in total prostration and even death, while undoubtedly many lesser disturbances of the general health are indirectly caused by it, not to speak of the great discomfort, resulting from a heavy almost air-tight head covering, in hot weather. While it is requisite that the head should be protected from the direct rays of the sun, it is also desirable that the air should have free access to all parts of the scalp, thus keeping it cool, carrying off the perspiration, and obviating not only the greater evils above alluded to, but the minor one of baldness, which is greatly hastened by overheating.



The making of a few perforations at the top of the crown of a hat does not really make a ventilating hat. To ventilate an air space requires either very much larger openings than these, in proportion to the space to be ventilated, or else openings below as well as above, so that the currents of heated air rising may meet opposing descending currents, and may be freely replaced by cooler air entering at the bottom.

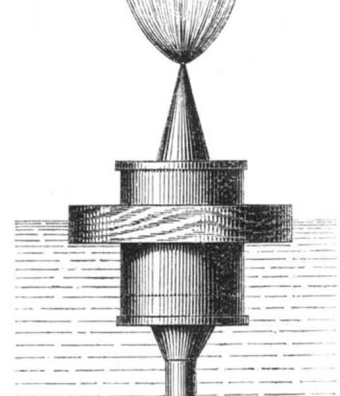
Now, in this hat, these principles are fully carried out. Air enters through an annular space formed between the sweatband, A, and the exterior, B. Rising equally about all parts of the head, it passes out of the opening, C, which extends entirely about the top of the crown, the part, D, overlapping the part, B, so as to exclude rain.

The hat may be made of any suitable material, and the ventilating device does not, as will be seen, interfere with conformability to reigning styles.

The invention was patented May 24, 1870, by Dr. Joseph M. Heard, then of Aberdeen, Miss., but now of West Point, Miss., whom those desirous of manufacturing on royalty may address for further particulars.

INEXTINGUISHABLE SIGNAL LIGHT.

In a Belgian exchange, the *Chronique de l'Industrie*, we find the description of an interesting little invention, which has found favor with the Grand Duke Constantine, of Russia, and has been adopted into the naval service of that country. It is a signal light of peculiar properties, being ignited by water, and, although unable to ignite other objects, not to be extinguished by wind or water. It is said to produce a very powerful and brilliant light, which can be observed at a great distance and retains its illuminating quality, though in small compass, for a considerable length of time.



The apparatus, an invention of N.T. Holmes, consists of a sheet metal cylinder, having a conical top and a tube of about six inches in length projecting from its bottom. It is filled with phosphate of calcium, which is prepared in the following manner: Pieces of chalk are put into a crucible, together with a quantity of amorphous phosphorus, and then brought to a white heat. The chalk, becoming incandescent, absorbs the vapors of phosphorus, and thereby becomes phosphate of chalk. The apparatus, when filled with this substance, is hermetically closed and preserves it for an indefinite period.

When to be used, the top of the cone is cut off, and a hole bored through the end of the pendent tube. A float is connected with the cylinder in the manner shown in the engraving, and then launched. The water, entering the tube, causes the phosphate of calcium to decompose and to generate a quantity of gas, which, escaping at the top, is ignited by contact with the air, and remains so until the contents have been entirely consumed. It is stated that the London Board of Trade has recommended the adoption of these signals in place of the blue danger signals at present in use in the commercial navy, experiments having proved the superiority of this ingenious invention.

HOW TO PRESERVE SOAP GREASE.—Fill a cask half full of good strong lye and drop all refuse grease therein. Stir up the mixture once a week.

[For the Scientific American.]

COMBINED CAST IRON AND WROUGHT IRON ARCH GIRDERS.

A cast iron arch girder is considered as a long column subject to a certain amount of bending strain, and the resistance will be governed by the laws affecting the strength of beams, as well as those relating to the strength of columns. By reason of the slight curvilinear form of the cast iron arch girders, so much in general use, they will not compare as favorably with the laws governing columns as with those governing beams.

The metallic arch in one piece differs materially from a stone or brick arch. In the latter, by the use of separate blocks, the capacity of the material to resist compression only is exerted; while, with the use of an arch of any material in one piece, both extension and compression are brought into play.

A stone or brick arch is an arrangement of blocks (*voussoirs*) set in a curvilinear form, each block separate from the other, and subject only to compression. The greater the weight placed upon the arch, the more compressed and compact these *voussoirs* become. Their resultant pressure, or the thrust of the arch, is received by piers or abutments at the extremities; and, should a slight yield of the abutment take place, it would only cause a further setting of the *voussoirs*, and not affect the strength of the arch in the same degree that would be caused by the elongation of the wrought iron tie rod in a cast iron arch girder, as the deflection of the latter is not great before rupture takes place, and a slight elongation of the rod causes considerable deflection.

Most materials used in the construction of arches have a much greater capacity to resist compression than to resist extension; and it is obvious that this system of *voussoirs*, when made of a material whose resistance to compression is greater than to extension, has an advantage over those in which the material is used in one piece. As wrought iron possesses the property of greater resistance to extension than to compression, its use is analogous that of a tie rod.

In the cast iron arch girder, both extension and compression are exerted, as on a straight beam, and these are the greatest at those points which are most distant from the neutral axis of cross section; hence the point of rupture will occur at one of these two extremes.

In cast iron, the resistance of compression is to that of extension in the ratio of six and a half to one; and, being a rigid, crystalline, unmalleable substance, weak in its resistance to extension as compared to that to compression, it becomes a matter of calculation, which should be based upon

experiment, to adjust the malleable wrought iron tie, which has a certain degree of extensibility, coming into play in proportion as the girder is loaded. These girders, as ordinarily constructed, have the arch or casting in one piece, with grooves at the ends to receive the wrought iron tie rods; the latter, being a little shorter, are expanded by heat and then placed in position in the casting, and allowed to contract in cooling, to tie the bottom of the casting, thus acting as an abutment to receive the horizontal thrust of the arch. If the tie rod should be too long, it does not receive the full proportion of the strain until the cast iron has so far deflected that its lower edge is subject to a severe tensile strain which cast iron is feeble to resist.

If, as is more frequently the case, the tie rod is made too short, it is subject to severe initial strain, which is added, to the strain proper induced by the load, to produce rupture. Wrought iron is extended about a one thousandth part of its length by every ten tuns of direct strain per square inch of cross section, which is the limit of elasticity of the best iron, as eight tuns per square inch is for ordinary iron. Therefore, a cast iron arch girder, with wrought iron tension rod, cannot be considered as an elastic arch confined between fixed abutments.

The usual careless manner in which these wrought iron tie rods are adjusted to the cast iron arches, ordinarily one quarter of an inch and occasionally three eighths of an inch less in length than the recess made in the casting for their reception, thus detracting from their capacity to resist strain and causing the cast iron arch to camber or the rod to elongate—usually both—with want of knowledge of the proper proportion of the cast iron arch to the tie rod, imperfect castings, bad welds, and great atmospheric changes, are the causes of the several failures of these girders in this city during the past few years. The last case of this kind occurred in a building on the southeast corner of 56th street and Sixth avenue, New York, on the 28th of last November. The thermometer had fallen 22° in a few hours, and the three inch rod of the girder parted at the weld. This girder, whose distance between the supports was about 25 feet, was marked to sustain 125 tuns, and broke with a load of about 60 tuns. It was set up in the building just before the enforcement of the law requiring it to be tested.

In view of these facts and the observations I have made in testing about 270 of these girders, I conclude that, as ordinarily made, in proportioning the wrought iron tie to the cast iron arch, one square inch of cross section of tie rod should be allowed for every ten net tuns of load imposed upon the span of the arch. Regarding the arch as flexible, or as possessing no inherent stiffness, and the tie rod as a chord without weight, the following formula is proper:

Let S equal span in feet; V the versed sine in feet; U the uniform load per foot of span; H the horizontal thrust or strain; then

$$H=\frac{U S^2}{8V}$$

P. H. Jackson,

Inspector of Iron Construction, Department of Buildings, New York city.

[For the Scientific American.]

FRICTIONAL GEARING.

BY E. S. WICKLIN.

NUMBER II.

To select the best material, for driving pulleys in friction gearing, has required considerable experience; nor is it certain that this object has yet been attained. Few, if any, well arranged and careful experiments have been made with a view of determining the comparative value of different materials as a frictional medium for driving iron pulleys. The various theories and notions of builders have, however, caused the application to this use of several varieties of wood, and also of leather, india rubber, and paper; and thus an opportunity has been given to judge of their different degrees of efficiency. The materials most easily obtained, and most used, are the different varieties of wood, and of these several have given good results.

For driving light machinery, running at high speed, as in sash,door,and blind factories,basswood,the linden of the Southern and Middle States (*Tilia Americana*), has been found to possess good qualities, having considerable durability and being unsurpassed in the smoothness and softness of its movement. Cotton wood (*populus monilifera*) has been tried for small machinery with results somewhat similar to those of basswood, but is found to be more affected by atmospheric changes. And even white pine makes a driving surface which is, considering the softness of the wood, of astonishing efficiency and durability. But for all heavy work, where from twenty to sixty horse power is transmitted by a single contact, soft maple (*acer rubrum*) has, at present, no rival. Driving pulleys of this wood, if correctly proportioned and well built, will run for years with no perceptible wear.

For very small pulleys, leather is an excellent driver and is very durable; and rubber also possesses great adhesion as a driver; but a surface of soft rubber undoubtedly requires more power than one of a less elastic substance.

Recently paper has been introduced as a driver for small machinery, and has been applied in some situations where the test was most severe; and the remarkable manner in which it has thus far withstood the severity of these tests appears to point to it as the most efficient material yet tried.

The proportioning of friction pulleys to the work required and their substantial and accurate construction are matters of perhaps more importance than the selection of material. The mechanic who thinks he can put up frictional gearing temporarily and cheaply will make it a failure. Leather belts may be made to submit to all manner of abuse, but it is not so with friction pulleys. They must be most accurately and substantially made, and put up and kept in perfect line.

All large drivers, say from four to ten feet diameter and from twelve to thirty inch face, should have rims of soft maple six or seven inches deep. These should be made up of plank, one and a half or two inches thick, cut into "cants," one sixth, eighth, or tenth of the circle, so as to place the grain of the wood as nearly as practicable in the direction of the circumference. The cants should be closely fitted, and put together with white lead or glue, strongly nailed and bolted. The wooden rim, thus made up to within about three inches of the width required for the finished pulley, is mounted upon one or two heavy iron "spiders," with six or eight radial arms. If the pulley is above six feet in diameter, there should be eight arms, and two spiders when the width of face is more than eighteen inches.

Upon the ends of the arms are flat "pads," which should be of just sufficient width to extend across the inner face of the wooden rim, as described; that is, three inches less than the width of the finished pulley. These pads are gained into the inner side of the rim; the gains being cut large enough to admit keys under and beside the pads. When the keys are well driven, strong "lag" screws are put through the ends of the arm into the rim. This done, an additional "round" is put upon each side of the rim to cover bolt heads and secure the keys from ever working out. The pulley is now put to its place on the shaft and keyed, the edges trued up, and the face turned off with the utmost exactness.

For small drivers, the best construction is to make an iron pulley of about eight inches less diameter and three inches less face than the pulley required. Have four lugs, about an inch square, cast across the face of this pulley. Make a wooden rim, four inches deep, with face equal to that of the iron pulley, and the inside diameter equal to the outer diameter of the iron. Drive this rim snugly on over the rim of the iron pulley having cut gains to receive the lugs, together with a hard wood key beside each. Now add a round of cants upon each side, with their inner diameter less than the first, so as to cover the iron rim. If the pulley is designed for heavy work, the wood should be maple, and should be well fastened by lag screws put through the iron rim; but for light work, it may be of basswood or pine, and the lag screws omitted. But in all cases, the wood should be thoroughly seasoned.

In the early use of friction gearing, when it was used only as backing gear in saw mills, and for hoisting in grist mills, the pulleys were made so as to present the end of the wood to the surface; and we occasionally yet meet with an instance where they are so made. But such pulleys never run so smoothly nor drive so well as those made with the fiber more nearly in a line with the work. Besides, it is much more difficult to make up a pulley with the grain placed radially, and to secure it so that the blocks will not split when put to heavy work, than it is to make it up as above described.

As to the width of face required in friction gearing: When the drivers are of maple, a width of face equal to that required for a good leather belt (single) to do the same work is sufficient. Or, to speak more definitely, when the travel of the surface is equal to twelve hundred feet per minute, the width of face should be at least one inch for each horse power to be transmitted, and for drivers of basswood or pine, one and a half to two inches.

The driven pulleys, as before stated, are wholly of iron. They are similar to belt pulleys but much heavier, having more arms and stronger rim. The arm should be straight rather than curved, and there should be two sets of arms when the face of the pulley is above sixteen inches. For the proportion of these pulleys, a very good rule is to make the thickness of rim two and a half per cent of the diameter, that is, when the pulley is forty inches diameter, the rim should be an inch thick.

To secure perfect accuracy, these pulleys must be fitted and turned upon the shaft; and when large, should rest in journal boxes in the latter while being turned. If simply swung upon the lathe centers, they are liable to vary while the work is being done. When turned exactly true, round and smooth, these pulleys must be carefully and accurately balanced. The neglect of this last essential point has worked the destruction of otherwise well made friction pulleys.

When thus constructed, there is a beauty about the movement of this gearing, which at once enlists the favor of all who can appreciate the "music of motion," and gives character to its builder. Its efficiency and peculiar advantages will be more fully shown in a future article.

Sea Weed as a Fertilizer.

The sea weeds that are thrown up on the shores of salt water have long been prized in this country, as in Europe, for their fertilizing action when applied to the soil. The annals of Scotch and Irish husbandry contain ample testimony to their value, and it has been asserted that the recent great advance in the cost of iodine largely depends upon the fact that much of the sea weed, which was formerly burned for the iodine makers, is now employed for agricultural purposes.

I have recently examined a sample of a commercial article brought into the trade by the Quinnipiac Fertilizer Company, of New Haven, under the name of "Kelp Fertilizer." This is simply sea weed dried and reduced to such pulverization that it readily passes a sieve with one fourth inch meshes. Professor D. C. Eaton pronounced the sample I analysed to be chiefly *Fucus nodusus* or rock weed.

Its composition, as taken from a bag of 100 lbs. weight, was:

Moisture	11·01
Organic matter (by difference)	69·10
Sand	1·59
Sulphuric acid (SO_3)	6·82
Phosphoric acid (P_2O_5)	0·28
Lime	1·10
Magnesia	1·19
Oxide of iron (Fe_2O_3)	0·37
Potash	2·18
Soda	2·22
Chloride (and iodide) of sodium	4·14
	100·00

The crude ash=21·13 per cent.

Nitrogen=1·20, equivalent to ammonia 1·46 per cent.

In this analysis, the dried substance was carbonized at a low heat, and extracted with water, before incinerating.

On comparison with stable manure of good quality, using the average of a number of analyses of the latter, it appears that the relative quantities of the active ingredients are expressed by the following figures:

	Stable Manure.	Kelp Fertilizer.
Organic matter	1	5—6½
Nitrogen	1	2—3
Phosphoric acid	1	1—2½
Sulphuric acid	1	23—25
Common salt	1	37—54
Soda	1	23—32
Potash	1	3—4
Lime	1	2—2½
Magnesia	1	1—6

It thus appears that, by the addition of thirty pounds of fish guano (containing two pounds each of nitrogen, phosphoric acid and lime) to 1,970 pounds of the dry kelp, the tun of mixture would be worth, as far as can be judged from the quantity of the several solid ingredients, five times as much as the best stable manure. This consideration is one of high importance where, as in the Connecticut valley, stable manure sells for $10 to $15 per cord and often cannot be got at any price. The mixture named makes a pretty close imitation of stable manure in a dry and therefore concentrated form.

When used fresh from the sea shore, as thrown up by the tide, sea weed speedily suffers decomposition, and disappears in a short time; its saline ingredients become a part of the soil, but its organic matter would seem to be of little permanence.

Once dried, however, it becomes a rather slow acting fertilizer, and in various instances, where it was used in field trials last year, it gave the best results when applied very early to as to become fully swollen with the spring rains. It is deemed advisable to use with it a small quantity of some active nitrogenous manure.—*S. W. Johnson, in the American Chemist.*

Patent Suit on Car Wheels.

In the Supreme Court of the United States, Mowry *vs.* Whitney—appeal from the Circuit Court for the Southern District of Ohio.

This suit was brought by Whitney to restrain Mowry from an alleged infringement of a patent, granted to Whitney in 1848 and extended in 1862, for a process prolonging the time of cooling, in connection with annealing cast iron car wheels.

The defence was that the process was not new, and that the appellant had not adopted it in his mode of cooling cast iron wheels. The decree was for the complainant, and the case being referred to a Master for an account, the sum reported in favor of Whitney by that officer was about one hundred and twenty thousand dollars. It is here insisted that the Court erred in holding that Whitney's patent is protected against prior annealing processes, because former processes were confined to "unchilled articles," and also in deciding that the appellant's process was an infringement of the patent, when they were, in point of fact, essentially different. One cools by placing the wheel in a cooler and the other in a net chamber. The patent of Whitney is invalid because there is no novelty in it. It is simply the application, of a process well known, to a purpose analogous to purposes to which it had been applied long anterior to the alleged invention. It is also urged that it is void because what is claimed is not useful, as the process would destroy the hardness of the rim (or chill) of the wheels, and thus detract from their durability. It is further contended that the Court erred in apportioning the profit of Mowry by the alleged infringement, and in overruling the exception taken to the report of the Master. C. B. Collier and A. G. Thurman for appellant; H. Baldwin, Jr., E. W. Stoughton and B. R. Curtis for appellee.

Bailey's Paper Barrels.

Mr. William H. Bailey has recently patented, through the Scientific American Patent Agency, an improved paper barrel, intended as a means for protecting non-liquid contents of barrels from loss, adulteration, and change of trade mark. The paper barrel is to be used within a wooden barrel and properly printed, to show the mark of the manufacturer, even if the same should have been erased from the wooden barrel. In the sale of flour, sugar, paints, etc., it often occurs that dishonest dealers will remove the barrel heads of inferior brands and substitute therefor those marked with the names and devices of superior qualities, thereby seriously injuring the public and the most conscientious manufacturers. This will be made impossible by the application of the inner paper barrel, which is printed at both ends, and marked with the firm name and device, and which cannot be removed without being destroyed and having the contents of the barrel entirely displaced. The paper barrel also prevents the adulteration of the contents of the barrel and the escape of the contents through crevices between the staves, which at present occasions serious losses to dealers and consumers.

The paper barrel is made to fit exactly within the wooden barrel and with heads at the ends. These heads are also cut out of paper, and gummed or otherwise fastened to the sides either by having lips or ears on the latter overlap the heads, or by having lips or a flange on the head gummed to the sides, or otherwise. In place of paper, equivalent simple or compound fabrics may be employed. The bulging body of the paper barrel is made in sections properly gummed together or in one piece.

In using the invention, the paper barrel fitted with one head is firmly gummed or held in place within the wooden barrel, and then filled as far as required. The other head is then gummed or fastened to the body. The wooden barrel head is finally put on.

Roebling's Rubber Fillings for the Grooves of Transmission Wheels.

This is a rubber filling for lining the grooves of cast iron wheels, which run at a great velocity and are principally used for the purpose of transmitting power to distant points by means of wire ropes. The same filling may, however, be used for other grooved wheels running at a slower speed, and for different purposes.

It is composed of a core of hard rubber, surrounded by a skin of soft rubber, about one eighth of an inch thick, more or less. This coat of soft rubber extends along the two sides and the bottom, and is omitted on top, where the rope rests. By means of this combination two difficulties are overcome. One is the difficulty of inserting the filling into the dovetailed groove and yet having it large enough to fill the groove completely and not be thrown out by the centrifugal force, which is very great, owing to the high velocity of the wheels. The other difficulty is to find a material hard enough on top to resist the wear of a rapidly running rope, and at the same time have the necessary velocity. This is accomplished by surrounding a core of hard rubber by a skin of soft rubber, which has elasticity enough to allow of its being driven into the groove and of expanding sufficiently afterward to hold it there, and yet is hard enough to resist the wear of the rope.

This improvement is calculated to remove one of the chief drawbacks incident to the telodynamic system of transmitting power through long distances. It was patented through the Scientific American Patent Agency, March 19, 1872, by Mr. A. Roebling, of Trenton, N. J.

It is a miserable economy to save time by robbing yourself of necessary sleep.

SCIENTIFIC AND PRACTICAL INFORMATION.

SURFACE ELECTRICITY.

M. Terquem has recently made some experiments for further elucidating the fact that the exterior surface of a hollow body is alone affected by electricity. Faraday showed that a small animal, placed inside a cylinder of wire gauze, was not incommoded when the cylinder was so highly electrified that sparks were freely given off by it. He also constructed a room, 12 feet in each dimension, of metallic wire, and suspended it by ropes of silk; and he found that, occupying this room, with electroscopes and electrometers at hand, there was not the slightest indication of electrical action inside the chamber, even when sparks of considerable length were given off by the metal of which it was made. M. Terquem verifies these results by taking a metal birdcage and suspending it to an insulated conductor of an electrical machine. While sparks sufficient to indicate a highly charged electrical condition were obtained from the exterior, pitch balls, feathers, and even a gold leaf electroscope remained unmoved inside. Two bundles of linen yarn were hung, one outside and one in; the inside one was unaffected, while the outside was excited, the threads diverging from each other and giving out sparks.

SULPHIDE OF SODIUM.

This salt has lately been used in blowpipe analysis as a reagent, in the following manner: The mineral under examination is fused with borax under the reduction flame. A small quantity of sulphide of sodium is then added, and the substance again submitted to the flame. Iron, silver, copper, lead, nickel, cobalt, bismuth, palladium, thallium, and uranium give opaque masses of a brown or black color. Zinc gives a white mass; the product with cadmium varies from red to yellow as it cools; that of gold and platinum give a bright light brown, and that of tin, a translucent yellow brown.

DETECTION OF MALIC ACID.

The adulteration of wines with cider can easily be detected by filtering and adding ammonia in excess. The apple juice will immediately deposit crystals on the side of the test tube. Genuine wine sheds a pulverulent deposit which does not adhere to the glass, and is devoid of a crystalline structure. Acetic acid will dissolve either of these precipitates. The deposit from the cider consists of flat crystals with parallel sides; that from wine shows star shaped formations. The treatment with acetic acid shows the presence of lime and phosphoric acid in both cases, the quantity of lime in the wine being minute.

SCARLATINA.

Mr. W. M. Searcy suggests the frequent examination of the tonsils of all persons living in a house where scarlatina is present, as the redness and enlargement of these organs are premonitory symptoms of the disease. Nitrate of silver in solution—one dram to one ounce distilled water—is a good local application, and if the case be severe, aperient medicine is used in conjunction therewith.

THE AGASSIZ EXPEDITION.

Professor Agassiz's party have visited Rio di Janeiro, and have explored the whole neighborhood of that beautifully situated port. The distinguished naturalist has forwarded a large number of specimens to the Cambridge Museum, Massachusetts. A cotemporary is responsible for the following:

During a trip to the Southern Parahyba river, the Professor obtained specimens of a number of species of fishes, some of them entirely unknown to science, which he very very carefully placed in alcohol for preservation. On his way back to Rio di Janeiro, he passed the night at a gentleman's residence, and his host's cook, naturally looking upon the party merely as gentlemen sportsmen, poured off the alcohol and served up the valuable specimens nicely fried for breakfast. It was an appropriate repast for a scientific party; but it is hardly to be supposed that the worthy professor would have enjoyed it if he had known at the time the source from which the supplies had been drawn.

THE DEAD SEA.

Being without an outlet, evaporation is the only escape of the water pouring into it by the river Jordan and some other streams. Each brings into that extraordinary reservoir, which is a depression in the earth's crust thirteen hundred feet below the water level of the Mediterranean, an immense mass of materials which must at last fill it up, when the Jordan will then run on beyond and find an outlet to the sea, if the world remains in its present physical form long enough.

The Jordan wafts down ninety cubic yards of water every second. Each day it carries in six and a half bushels of salt, liberated from rocks on its passage, in each ninety cubic yards. Therefore that dreadfully salt, bitter reservoir has nearly reached the point of saturation.

When no more salt can be dissolved, then it will accumulate on the irregular bottom till it reaches quite near the present surface. Its future will have quite as much interest for coming ages as its past history.

POROUS FILTERS.—In the course of an examination of filters, at the instance of the *British Medical Journal*, Professor Wanklyn has had proof that filtration through beds of porous materials includes very powerful chemical action, albuminoid matter being instantly resolved into ammonia and other products by the action of the filter, which, indeed, behaves in this respect like a boiling solution of permanganate of potash. A good filter is a sanitary engine of great power.

THE best and most durable insulation for electric wires is to tin them and cover with pure rubber.

UMBRELLA FRAMES.

The following are the processes which are required to make the frame of an umbrella, as seen in the manufactory of Messrs. Cox, Brothers, and Holland.

Nearly one hundred pairs of hands have their part in the preparation of the frame alone of this little article.

The covers were, till within sixty years, made of oiled silk, the frames of whalebone or bamboo cane. Steel was introduced about 20 years ago, the change being induced partly by the increasing cost of the whalebone, and partly through the great improvements accomplished in the manufacture of elastic steel.

No less than 2,500,000 sets are issued in one year from the manufactory of this firm alone.

The frame or furniture—as it is technically called—of an umbrella or parasol is composed of six parts. 1. The rib, the ends of which are named respectively the tip and the notch ends. 2. The stretcher, having the fork end and the last end. 3. The runner, which glides up or down the stick on opening or shutting the umbrella. 4. The notch or wheel, forming the apex or bottom of the umbrella, which is riveted to the stick. 5. The open cap, which fits outside the cover over the notch, and forms a finish. 6. The ferule, which is placed at the bottom of the stick and protects it when used in walking. In certain cases, there is also a seventh part—the stick—which is made of taper metal tube.

The wire of which the furniture is made is received into the manufactory in coiled bundles, and cut into the required lengths by a machine. Four or five gross of these lengths, now called "ribs," tightly confined within three or four iron rings, are placed in a furnace, and brought to a red heat: when the heat has uniformly penetrated the whole bundle —care being specially taken not to oxidize the metal—it is laid on an iron plate having a number of grooves corresponding to the number of rings clasping the ribs, the rings being fixed at such intervals as to fit into the grooves. A heavy iron bar is now laid upon the ribs and kept moving backwards and forwards, causing the ribs to rotate on their own own axes, thus not only straightening them by the friction, but softening the steel and preparing it for subsequent manipulations. The ribs are now taken to "the heading shop," where, by means of presses and press tools, the heads or "tips" of the ribs are made. The indentation to receive the hole for sewing on the cover is next impressed. These and a great number of other operations are carried on in separate departments or "shops," minute subdivision of labor being found essential for commercial success. In the piercing shop, the hole is punched and the rib is completed at the "tip" end. In another shop, the eye is punched at the tip end, the eye is put on a steel peg, and the notch end of the rib is formed in a pair of dies similar to those in which a needle eye is made. The ragged or superfluous portion is now removed and the end of the rib made smooth and round. The hole is then pierced to receive a threading wire, which forms the axis for opening and shutting the umbrella. The ribs now receive an impression in the middle, and they are sent to be hardened and tempered by the usual process of heating in a muffle and immersion, while hot, in a bath of oil. They are then again confined within rings and revolved as before in the straightening operation. They are next gradually heated till the steel attains a blue color, after which every rib is tested singly, to see that the proper degree of elasticity has been obtained. This is an important consideration, and requires a very nice proportion of tempering; as, if the heat in the tempering muffle has been too high, the steel becomes too soft, while on the other hand, if not carried far enough, the articles become brittle and useless. The rib is now ready to receive the stretcher joint, which is made as follows: Brass wire is drawn, with a groove down the center, and is cut into lengths suitable for joints; the rib is placed within the groove of one of these bits of wire, the horns of the bit are elongated to enable it, in an after operation, to surround the rib at the place where it has been marked to receive it, otherwise the joint would slip on the smooth surface of the rib; the rib, with the joint, is now placed between a pair of engraved dies in a press, and the pressure applied by this means is sufficient to make the joint fast, as well as round and smooth all over. This is a most ingenious process, only recently perfected. This joint is drilled, and the rib is complete and ready for japanning.

The stretcher is made as follows: The wire in coils is placed upon a reel, drawn through rollers to straighten it, and cut into suitable lengths. One end of the stretcher is split by means of press tools, about half an inch down it. In another pair of tools this split is opened by a wedge shaped punch, which widens into the shape of the stretcher fork, descending into the die in a uniform shape. The fork in another pair of tools is then flattened on each side at one operation, and pierced so as to be attached to the stretcher joint on the rib. The hole is now put upon a peg, and the other end of the stretcher is formed in the same way as described above in the case of the top end of the ribs.

The ribs and stretchers are now japanned, when they are taken to the riveting shop, where a large number of girls are employed in riveting them together.

In addition to the above kind of ribs and stretchers, there are several others, known as the Paragon, the Premier, and Hollow ribs, which are cut out of sheet steel, and curved round until they nearly become tubes. These improved makes are considered to be both lighter and stronger, and as the extra cost is but a few pence per frame, this construction is adopted for all the best silk umbrellas. These better qualities have also enamelled tips to the ribs, which are fixed by fusion, with the aid of a blow pipe.

Runners are made of brass and iron. They are constructed as follows: The "blank" for the barrel is cut by circular shears into oblong pieces, knocked round on a mandril, and soldered at the joint. A ring of metal is cast and rimered to the size of the barrel, where it is now soldered at one end, and a ring of brass at the other. They are next turned on a lathe, and a groove turned in at the end which is afterwards to be notched to receive what is called "the threading wire," which is the axis on which the stretcher works.

They are next taken to a notching machine, the exclusive invention of this firm, which, as a most important advance upon the methods hitherto in existence, demands special notice. Until this machine was invented, all notches were cut by hand, and, however skillful the workman, they were necessarily, in some measure, cut at irregular intervals. This was not of vast importance while the "gores" of the covers were cut out by hand, but after the introduction of sewing machines and machines for cutting out the gores also, this irregularity became a serious difficulty, which this firm has now, by an ingenious arrangement of levers, happily surmounted, and the notches are cut with mathematical accuracy that confers upon their frames a well merited distinction.

The runners are now smoothed at the bottom, minutely examined by the foreman and sent to be japanned or silvered as required. The top notch or wheel is made from a brass casting, turned and notched by the machine just described. The open cap is cut from a round "blank," when it is raised by dies in a stamp, three or four times successively, being stamped deeper at every operation. The bottom is punched out, taken to a lathe and turned, and afterwards subjected to a bronzing process, peculiar to this house, or, if for common caps, japanned. The ferules are also cut out of round blanks by machinery, and repeatedly drawn in presses until the required depth is obtained, being annealed and cleaned between each drawing. The bottom of each ferule is then cut out, and an iron blank inserted and soldered into its place. As this iron bottom is twice as thick as a penny, it is capable of enduring a vast amount of wear when the umbrella is used, as it is almost universally the case, as a walking stick.

The whole of the ordinary umbrella furniture is sent away in parts, to be fitted, covered, and finished by other manufacturers. There is another class of frames, furnished with tubular metal sticks, which are fitted as complete frames before they leave the manufactory; these are particularly adapted to hot climates, which are found seriously to warp the wooden sticks.

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 February, 1872:

During the month 745 visits were made, and 1,534 boilers examined—1,443 externally, and 370 internally—while 194 were tested by hydraulic pressure. The number of defects in all discovered was 794, of which 198 were regarded as dangerous. The defects, in detail, were as follows:

Furnaces out of shape, 34—4 dangerous; fractures, 79—39 dangerous; burned plates, 53—29 dangerous; blistered plates, 96—12 dangerous; sediment and deposit, 111—9 dangerous; incrustation and scale, 130—4 dangerous; external corrosion, 54—16 dangerous; internal corrosion, 20—6 dangerous; internal grooving, 23—3 dangerous; water gages defective, 29—12 dangerous; blow out defective, 13—4 dangerous; safety valves overloaded or out of order, 24—12 dangerous; pressure gages defective, 104—19 dangerous, varying from -6 to $+12$; boilers without gages, 3—2 dangerous; deficiency of water, 9—9 dangerous; braces and stays loose and broken, 24—15 dangerous; boilers condemned, 7. There are many cases of glaring neglect reported, showing not only a great want of attention on the part of those having charge of boilers, but on the part of owners and users as well. If some responsible person would give a few moments' attention each day to the boilers and boiler connections, many disasters would no doubt be prevented. Among the instances of carelessness met with, are the following: A safety valve leaking badly, instead of being repaired, was found with a plank laid across the lever, loaded down with bricks—300 pounds pressure would probably not have been sufficient to raise this valve. In another case, where the boiler was in a building with a flat roof, the safety valve lever was found wedged under one of the rafters; this was regarded as an economical arrangement, "because it saved steam!" We might fill a page with similar instances, but enough has been said to show that destructive accidents need not be attributed to mysterious agencies.

WE are informed that the French and Austrian governments have succeeded in the propagation and cultivation of sponge, and the experiment is likely to be made elsewhere, as the result is commercially valuable.

AN obdurate screw may be drawn by applying a piece of red hot iron to the head for a minute or two, and immediately using the screw driver.

IF you are caught in a drenching rain, or fall into the water, by all means keep in motion sufficiently vigorous to prevent the slightest chilly sensation until you reach the house; then change your clothing with great rapidity before a blazing fire, and drink instantly a pint of some hot liquid

BOOKS introduce us into the best society; they bring us into the presence of the greatest minds that ever lived.

PROPOSED CITY RAILROAD.

Among the recent projects for rapid transit in New York is that of Mr. R. H. Gilbert, for an elevated railway, on the plan so tastefully represented in the accompanying engraving.

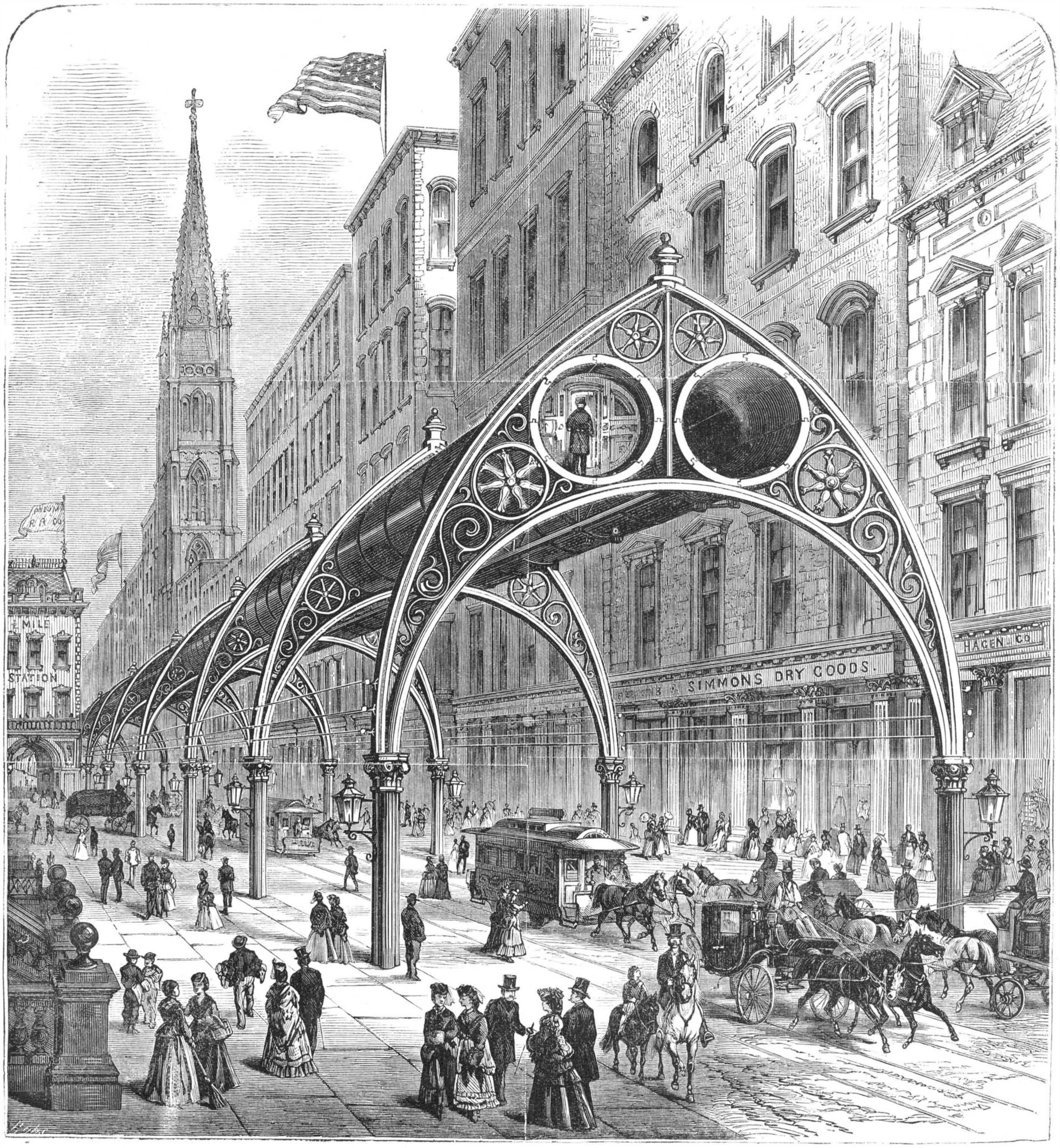
The plan is to place along the street, at distances of from fifty to one hundred feet, compound Gothic iron arches, which shall span the street from curb to curb, at such an elevation as shall not interfere with the ordinary uses of the street. On these arches, a double line of atmospheric tubes, eight or nine feet in diameter, are to be secured. The arches are strongly connected with each other by means of a vertical, latticed or trussed girder running between the tubular ways, which are to be firmly joined to it on either side by ties of suitable construction. Through the tubes, supported as described, cars, carrying passengers, are to be propelled by atmospheric power. There is also provision in the same set of arches for two or more sets of tubes for the transportation of mails and packages. The stations will be situated at distances of about one mile apart along the line, and will be provided with pneumatic elevators to raise passengers to and from the place of transit with perfect safety, thus obviating the necessity of going up and down stairs for transit. The movement of the cars or trains along the line, as well as their arrival and departure from stations, is made known at all points by a telegraphic device which is automatically operated by the cars in passing.

A bill is now before the New York Legislature to authorize the construction of this work, which, it is alleged, can be economically and expeditiously executed. The bill has been favorably considered and reported by the Senate Committee, and meets with no opposition except on the part of the property owners and occupants of buildings on the streets which are intended to be occupied by the works. These people object to the erection of this ornamental structure or big bridge, as they term it, in front of their doors, and claim that the presence of the tubes would be equivalent to the roofing over of the street. They will consent to nothing that cuts off their light and air.

Everybody in New York wants rapid transit, but, strange to say, the moment that any body sets to work with a definite plan for its realization, they are vigorously opposed and the work prevented.

A New Anemometer.

A new form of anemometer has just been constructed in Europe, and seems likely to prove of material service to all who desire to notice and record the direction and velocity of the wind. The anemometer consists of an ordinary pair of Beckley fans and a set of revolving cups, fixed in any convenient situation, and connected by insulated wires with a galvanic battery and with a recording apparatus. There is no limit to the length of the connecting wires, so that, for example, recording instruments at Lloyd's might be connected with fans or cups at any part of the coast. The recording instrument itself consists of a clock, a wind dial, a reel of paper, and an endless band carrying a carbon paste for printing. The dial indicates the direction of the wind, and the printing band prints this direction every half hour. The same band records every quarter of an hour of time and every completed mile that the wind has traversed. The slip of paper issued by the machine is about an inch broad, and it receives the time on its left hand margin, the direction of the wind on its right hand margin, and a dot for each mile on a central line, so arranged as to be comparable with the time record. The number of dots marked on the paper between 10 and 11, for example, indicate the velocity of the wind during that period of time, and the dots become crowded as the velocity increases, and stand farther apart as it decreases. The battery is composed of zinc and carbon elements with dilute sulphuric acid, and will work for six months without attention. The reel of recording paper holds a supply for three months, and the clock can be made to run this length of time without winding; so that the whole apparatus would be as nearly as possible self acting. Ordinarily, however, it would be desirable for the attendant in charge of it to date the recording slip every twenty-four hours, and an eight day clock would be sufficient for the requirements of most observers. The great advantage of the instrument, says the *British Trade Journal*, is in the character of its record, and in the fact that the electrical communication does away with the use of cranks and shafting, which are not only costly and heavy and far less delicate, but which also render it necessary that the recording instrument should be in the immediate neighborhood of the fans.



GILBERT'S PROPOSED CITY ELEVATED RAILWAY

Scientific American.

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Contents:

(Illustrated articles are marked with an asterisk.)

THE GREAT SEWING MACHINE JOB BEFORE CONGRESS.

We recently alluded to the application now pending before Congress for the extension of the Wilson sewing machine patent which covers the feeding device, a feature which all sewing machines must have. The existence of this patent is a bar to the introduction of a variety of improved machines, which will be brought out next year if the Wilson patent is not extended, for it expires in 1873. The owners of improvements are not allowed by the parties who control the Wilson patent to put their goods in the market.

The Sewing Machine Ring, consisting of the Wheeler & Wilson Company, the Singer Company, the Grover & Baker Company, and the Howe Company have had the almost exclusive monopoly of the sewing machine business for the past quarter of a century. This is long enough in all conscience.

Under the shadow of these patents, Wilson's patent being a chief one, they have wrung from our people many millions of dollars in profits, and to-day they charge American citizens sixty-five dollars for the same machines that they sell on the other side of the Atlantic for half the money. It would be a wicked thing for Congress to do to extend this monopoly. It has lasted long enough, and ought now to die a natural death.

In the memorial of W. L. Groot and others, we find the following interesting particulars:—

The corporations above named "are now selling machines in England, Ireland, Scotland, France, Belgium, Holland, Austria, Russia, Prussia, Norway, Denmark, Sweden, Spain, and other countries of Europe, at one half the price they offer the same sewing machines to our own people, and cheaper than they can be produced by the poorly paid labor of Europe, where the manufacturer, who has no patents to dread and no 'combination' to interfere, realizes, even at the price of one half what we must pay, a profit of 100 per cent. This unjust discrimination carries its own strong logic why no further extension shall be granted to enable a few to oppress thousands.

NUMBER AND PRICE OF SEWING MACHINES.

Not counting the great number of sewing machines made and sold since the origin of the business, the chief patent of which has expired and is now sought to be renewed by Congressional legislation, your memorialists annex the number made in 1870 only by the companies forming this 'combination,' the statement being made under oath:

Singer Manufacturing Company sold................	127,833
Wheeler & Wilson Manufacturing Company sold..	83,208
Grover & Baker Sewing Machine Company sold....	57,402
The Howe Sewing Machine Company sold........	75,156
Total....................................	343,599

These were retailed at an average price of $65 each, making in the aggregate $22,332,935. The same number of sewing machines would have retailed in Europe at half the price charged here, and our people must pay for this number sold them $11,166,967.50 more than the people of Europe are charged. This great product is only of four companies, not counting many others, all of whom have paid a tribute to this 'combination.' Their aggregate wealth is more than $50,000,000, and all of it is clear gain, the small amounts which were originally invested being too insignificant for comparison at this day. This is easily apparent when the incontrovertible fact is made known that the cost of each sewing machine sold at $65 is less than $12. If this patent is not extended, the price of all sewing machines now selling at $65 must be reduced to $32.50, and there will be no difference between our people and those in Europe, as there is an abundance of capital anxious to produce better sewing machines at $35 than are now sold at $65, and to have liberal, legitimate reward for both labor and capital.

Your memorialists will be ready at any time to appear before Congress, both in person and by attorney, to give such additional proofs, and to propound such questions, to the applicants or their attorney, as it is impossible to present in the limits of this memorial.

SEWING MACHINES AND THEIR EFFECT UPON HEALTH.

It is one of the accompaniments of almost every change in human habits, brought about by advances in civilization, that the health of the public is influenced in some way. Often new complaints are engendered, or old ones are complicated, so that medical science is kept constantly on the alert to combat attacks from unexpected quarters. It has been charged against that most valuable of modern labor saving inventions, the sewing machine, that the act of impelling it by foot power, as almost universally practiced, has resulted in injury to female health. At first these charges were hardly more than surmises, but they were finally made direct and positive, with how much reason it is the object of this article to enquire. Fortunately for our purpose, we find in the report of the Massachusetts State Board of Health an extended discussion of the subject, from the pen of Arthur Nichols, M. D., which contains many facts and statistics drawn from various sources. Of these facts we shall freely avail ourselves, and shall thereby further the object of the publication of all such reports, the general enlightenment of the public.

In 1860, Dr. A. K. Gardner expressed, in the *American Medical Times*, his opinion that the exercise of propelling sewing machines with the feet, so far from being injurious, is really beneficial inasmuch as it gives exercise, which, though it affects only part of the body, is still better than no exercise at all.

Dr. Vernois stated, in 1862, in the *Annales d'Hygiène Publique*, that, both in males and females, the motion produced cramps, partial paralysis, and, in females just beginning to operate, a peculiar and injurious nervous excitement.

Dr. William Ord, in a report on the sanitary condition of dressmakers and needlewomen in London, 1863, states that, while in general the exercise is beneficial and tends to improve the health of females, the cramped position sometimes causes pain in the chest and indigestion, and that delicate women are greatly exhausted by this particular work.

This testimony was followed by something far different in 1866, from M. Guibout, physician to the Hôpital Saint Louis, in Paris, who, in a paper read before the Société Médicale des Hôpitaux, made such strong statements, in regard to the effect of sewing machines upon female health, that general apprehension resulted. Shortly after the reading of this paper, Dr. Feurnier attributed a case of paralysis of sensation in bottom of the foot, occurring in a girl admitted to the same hospital, to the use of the sewing machine; and the publication of this case increased the general alarm.

The opinions of Dr. Espagne, Professor at the Montpellier University in France, were published in 1869, in which he denies that any injuries result, from the use of the feet on sewing machines, other than general fatigue and muscular pain.

Next follow the published opinions of the celebrated Dr. Decaisne, who has done so much toward enlightening the world upon the effects, of various trades, professions, and callings, upon the health of those engaged in them. He examined and questioned a large number of women, searched hospital records, and came to the conclusions which are thus summarized:

"The effects of this work upon the muscular system differ in no respect from those of any other kind of excessive labor involving the use of certain portions of the body to the exclusion of others. The affections most commonly complained of are muscular pains, pain in the region of the kidneys, and cramps in the lower extremities; none of which, however, are developed among those working three or four hours daily. These pains, cramps, etc., are most commonly found among beginners, and usually diminish after one has become accustomed to the motion of the machine.

The use of the sewing machine, when employed within moderate limits, without overworking, as is too often done, is attended with no greater inconvenience to health than working with the needle, as was shown by the examination of 28 women between the ages of 18 and 40, employed from three to four hours daily."

We now come to the investigations of the Massachusetts State Board of Health. The Board circulated widely this printed question, "Have you observed any injury to health from the use of sewing machines moved by foot power? If so, please to send us all the information you may have on the subject." To this question, 138 replies were received, representing 120 different towns. Of this number, 80 report one or more instances of injury, and 58 return negative or doubtful answers.

We cannot give place to even a synopsis of the various replies. They however establish the fact that, among operatives on sewing machines, certain complaints do exist in greater proportion than with other females, while they as plainly show that this results not from the exercise itself but from is excess. It is avowed by Dr. Nichols that these complaints are not inseparable from the propulsion of the sewing machine by the feet, but that excessive work of this kind is very likely to be followed by injury, if not by total prostration.

Now what is excessive work with one kind of a machine might be far from excessive with another. The number of hours per day these operators work would not injure them were the machines driven by steam power. Anything more than from five to ten minutes labor, without rest, on the brakes of the old style fire engine would be excessive for most men. But because this labor is too much, it does not follow that an engine cannot be made upon which a man might work six hours without over fatigue.

Operators at sewing machines are obliged to sit with backs entirely unsupported and the knees elevated, thus keeping the spinal muscles constantly on the stretch, inducing the pain in the small of the back which is the most constant effect of work of this kind. This irritation is reflected by sympathy to other parts, and general debility finally results. We have never seen any satisfactory reason why the tables of sewing machines which are operated by foot power should not be brought up over the lap, so that the operator might sit leaning slightly backward, with the spine thoroughly supported and the limbs extended. We proposed this once to a leading manufacturer, and were told that the notion that women were injured by working on sewing machines had no foundation in fact. We argued that those who had investigated the subject, though claiming that moderate exercise of this sort would not injure, almost unanimously insisted that excess would injure, and added that profitable employment with such machines implied an extent of labor which these authorities claimed to be excessive on machines as at present constructed. We failed, however, to convince him that any improvement in form was either desirable or practicable. Notwithstanding this discouragement, we put our idea to the test of actual trial, and found that all who had been accustomed to work on the old machine, who tried the modified position above described, were unanimous in testifying to the superior comfort and ease secured by it. There may be improvements made in treadles, as suggested by Dr. Nichols, but these do not reach the root of the evil. It is the position, not the mere labor of propelling the machines, that fatigues the operator.

Those who tried our plan of raising and bringing the table up nearer the person, and placing the treadles farther away, found no difficulty, in handling the work or in keeping it properly placed on the table, as the manufacturer above alluded to seemed to apprehend. The whole body was placed in an easy unconstrained position, and so supported as to rest rather than fatigue the back. We look to see some such change made in the construction of sewing machines. They are so valuable in many departments of industry that invention will not rest till their full utility is developed. The value of an improvement that would enable an operator to work even one hour per day longer than at present, without injurious fatigue, can scarcely be over estimated.

DEATH OF SAMUEL F. B. MORSE.

After a few days' illness which, with his great age, led to anticipation of a fatal result, Professor Morse died at ten minutes before eight o'clock in the evening of Tuesday, the 2d of April. His long and varied life, and his universal renown, will give interest to the following particulars:

He was born at Charlestown, Mass., on April 27, 1791. His early education was acquired at Yale College, and his career would have been through life that of a painter, had not circumstances directed his attention to scientific pursuits. With a view of following the first named vocation, he left the United States in 1811, in company with Washington Allston, to study his art under the tuition of the well known Benjamin West. The Society of Arts, of London, recognized the merits of the young artist, and awarded him a medal for a piece of sculpture, a "Dying Hercules." After four years' absence, he returned to his native country and subsequently established an association which, after many changes and against much opposition, became, in 1826, the National Academy of Design. He again visited Europe in 1829, and, while on that continent, was elected to the Professorship of Literature of the Arts of Design, in the city of New York University.

In the year 1826 or 1827, his attention had reverted to electro-magnetism and cognate subjects, of which his education at Yale had given him a sound practical knowledge; and he had an additional incentive to this pursuit in his close and intimate acquaintance with John Freeman Dana, then a colaborer with Morse in the lecture theater of the New York Athenæum. He returned from his second visit to Europe in 1832, and in conversation with his fellow passengers on the ship (the *Sully*) concerning the recent obtaining of an electric spark from a magnet, mentioned the idea of an electro-magnetic and chemical recording telegraph. The more zealous and indiscreet of his admirers claim for this conversation the credit due to an original idea, whereas the desirability and possibility of telegraphing by means of electricity had already occupied the attention of Mr. Ronald, who had erected eight miles of insulated wire in his garden and dispatched signals through it, and who published an account of his method in the year 1823. Other inventors in England and France, in the latter part of the eighteenth century, had been working towards a similar object, and it is impossible and unnecessary to decide to whom the thought first came. Certain it is that it had been largely canvassed long before Professor Morse's labors commenced. But it is to Morse that the credit of long and enduring perseverance in introducing a practical and efficient telegraph is due; and he was enabled to do this great service to mankind by the invention of the electro-magnet by Joseph Henry, to whom all users of electro-magnetism, for whatever purpose, must confess themselves indebted.

It is hardly necessary, just now, to describe the difficulties against which Morse fought so courageously. Recent events in this city and considerable newspaper discussion have called public attention to all the facts, and full justice has been done to Morse, not only by his admiring and grateful countrymen, but by scientists and public men, by crowned heads and peoples in all parts of the world. He had to struggle for years against the prejudices and timidity of capitalists; he went to England in 1838 with his invention, only to find that an electric telegraph—in which the signals were conveyed by the pointing of a needle on a dial—had been already patented and introduced to the public by Messrs. Cooke and Wheatstone; but persistency at last met its reward, and success and fame, honors and wealth fell to his share; and he has left us after the enjoyment of a long life, crowned with an unusual meed of all those things for which men ordinarily toil and worry away their existences.

He was liberal and charitable in all his transactions, and took a paternal interest in all that belongs to the great invention he gave to the world. Living alternately in New York city and at his country residence on the Hudson, near Poughkeepsie, N. Y., his face was well known to all classes of his countrymen; and the latter part of his life was unclouded by trouble, and his end was peaceful.

SPIRITUALISM ANSWERED BY SCIENCE.

Mr. H. L. Hinton, 744 Broadway, N. Y., has issued the pamphlet entitled as above, by the celebrated London barrister, Mr. Edward W. Cox, in which he gives expression to his views concerning spiritualism, or spirit manifestations, as deduced from the series of scientific experiments made last year in London, under the auspices of Dr. Crookes, Dr. Huggins, and others, Mr. Cox being one of the examining party. A description of some of these experiments, with drawings of the testing apparatus employed by Dr. Crookes, will be found in our back numbers.

In the present work Mr. Cox describes the various forms of spirit manifestations that he has witnessed, from which it is evident that he has been a careful and extensive observer. He has become fully satisfied that intelligent noises or rappings are actually produced, that chairs, tables, or other objects are undoubtedly moved, and that the proofs of the reality of these demonstrations are just as absolute as are the proofs of any other fact in nature. The force by which these demonstrations are made, he calls psychic force. It may be indicative, he thinks, of the existence of a soul within man, and it is this soul which he thinks may exercise psychic force beyond the body. He rejects the idea that the manifestations are produced by the agency of disembodied spirits. They are purely and wholly the result of forces residing in the human organism, and neither our departed friends, angels, or devils have to do with them. The medium is never able to communicate anything that is not already known to some person present.

This psychic force, Mr. Cox thinks, operates by a vibratory or wave like action, is opposed to and capable of overcoming the attraction of gravitation. Tables and other objects that are moved are first filled, so to speak, with the psychic emanation, which renders them buoyant in the air, when they float, swing, and sway about as if supported by an invisible balloon.

One of the explanations of these phenomena, and upon which Mr. Cox lays much stress, is *the unconscious cerebral action of the mind of the medium*, which action is manifested through the psychic force. Now as this unconscious cerebral action can be induced and made to set men's bodies in motion, without their knowing it, it becomes a question whether Mr. Cox himself and his friends did not have their cerebrums unconsciously excited so that they could hear noises and see sights that in reality never took place; or so that they could not see the person who pushed the piano, lifted the table, or forced down the balance.

What Mr. Cox and Dr. Crookes now need, in order further to verify their published conclusions and observations, is a scientific apparatus so made as to indicate the true condition of their own cerebrums. An instrument, that shall be capable of indicating the unconscious excitement or action of the mind, would be of great value in pathology. In addition to its uses in unraveling these "spirit" mysteries, it would doubtless be of inestimable importance to physicians in the diagnosis and treatment of mental disorders and diseases that react upon the brain.

There are various forms of unconscious cerebral action to which persons have been subject. To some individuals, visions and spectral personages have appeared when they have been wide awake and in the full possession of their ordinary senses. Sir David Brewster mentions several examples of this kind of cerebral action.

The latest phases of these psychic demonstrations, as brought out in this country, to wit, the visible production of the forms of departed friends, standing out clear and positive in the presence of the members of the psychic circle, have never been witnessed by Mr. Cox; at least he makes no mention thereof; nor does he allude to the spirit flames and lights now produced here. Mr. Cox should come over and visit Mrs. Mary Andrews, at Moravia, N. Y., who will show him things in this line that will probably make his hair stand on end. One visitor has assured us that the sight of these things brought on a cold perspiration, and he felt as if the gates of the eternal world had been actually thrown open. Until Mr. Cox goes to Moravia, it is evident that spiritualism will not be fully answered by science.

REPEATED spectroscopic measurements made last year by Professors Zöllner and Vogel, in Germany, show that the velocity of rotation of the sun on its own axis is at the rate of six hundred and sixty miles an hour.

A TRADES UNION TIRADE.

To appeal to the passions and prejudices of men rather than their reason, to distort and misrepresent facts, statements and motives, to misconstrue the slightest and most friendly criticism into an abusive attack, and to reply to it by real and undisguised scurrility and abuse has ever been the method of discussion and the characteristic manner of men who, through the false pretence of regard to the interests of the working classes, seek only the furtherance of their own private interests and purposes. We are sorry to say that in this spirit the editor of the *Machinists' and Blacksmiths' Monthly Journal*, an International Union organ, published at Cleveland, Ohio, comments upon some remarks of ours relative to the action of trades' unions in regard to apprentices.

The immediate cause of offence, to our brother editor, is the clause in one of our recent editorials which follows:

"The refusal of mechanics' unions to reconsider their unreasonable restriction, whereby their own sons are denied the privilege of learning the trades of their fathers, is one of the mysteries of the age. We have before alluded to this, for we feel that the prosperity of the country, the interest of humanity, and the welfare of coming generations, all demand that the shutting out of boys from learning trades ought to cease, so that they may be trained up to become good workmen, and able to learn an honorable mode of living."

Upon this we are charged by the editor with being very abusive, with departing from the truth, with being "opposed to trades unions, not from principle," with being destitute of virtue, with shamming interest in the welfare of the mechanic, with giving nothing tangible for their benefit, and with picturing a state of affairs that does not exist. We are sarcastically complimented for our learning and directly called feeble minded, both of which are equally flattering from such a source.

Perhaps we shall again be called abusive when we say that such a tirade can avail nothing against the truth of the paragraph which has provoked this uncalled for attack. We might add that a contrast, between the tone of our offending paragraph and the charges based upon it, might lead candid minds to throw back the charges of abuse upon the accuser, and inspire some doubt as to his respect for the truth and candor he professes to revere.

LIGHTNING RODS.

"We have a company in our town putting lightning rods on our houses. They use a copper rod, corrugated or fluted, and they fasten the rod to the shingles with zinc, allowing the rod to rest on the shingles and against the sides of the houses. My idea of putting up rods is to insulate the rod by means of glass tubes. But when questioned on the subject, the company's agent produced a paragraph, from an essay by Sir David Brewster, in which that eminent philosopher is made to say that the old theory of insulation is exploded, and that the conducting rod should be placed as near as possible to the object to be protected, in other words, should touch the wood and shingles of the building.

Now, I am a constant reader of the SCIENTIFIC AMERICAN, and many of our engineers and builders read your paper. We wish to know from you what we shall do with the rod that is not only not insulated from the house but put in as close contact with it as possible. A reply through your paper will be read and acknowledged with gratitude by many of your readers in this place and surrounding country.

W. C. McDOUGAL."

Meridian, Miss., March, 1872.

Answer.—The method of attaching the rod which you describe is correct; it should not be insulated. The golden rule in regard to the erection of lightning rods is to *place the lower end of the rod in communication with an extensive conducting surface underground;* the electricity is thereby dissipated without injury to the building should the rod be struck.

If the area of this conducting surface equals that of the roof of the building, the rods being of proper size, perfect protection may be expected, not otherwise.

You will invariably find, in the examples of rodded buildings that have been damaged by lightning, that the lower extremities of the rods were not arranged in accordance with the above rule. The general practice is simply to stick the extremity of the rod into the ground for a short distance and there leave it, no provision for underground conducting surface being made. This is a very defective and unsafe practice.

A good way to provide the necessary conducting surface is to connect the rod with an iron pipe, laid down specially for the purpose and extended several hundred feet under ground away from the building, burying the pipe for the whole distance in charcoal or in moist earth. Another plan is to make a trench leading from the building and fill in with old iron or iron ore, the lower end of the rod being made to communicate with such conducting material. Leader pipes, metal roofs and chimneys should also be connected with this conducting material. In towns where there are water and gas mains, the lightning rods should connect with them, as the metals of such pipes present large conducting surfaces.

You will perceive from the foregoing that an essential part of the lightning rod is *an extensive conducting surface underground.* If your rod lacks this, it is of little value, your house is not protected, and in the very next thunder storm you may suffer damage.

COLONEL C.W. JENKS has traced into the Blue Ridge several fine veins of corundum, some of them four feet wide, in Franklin, N. C.

NEW BOOKS AND PUBLICATIONS.

THE AMATEUR MICROSCOPIST; or, Views of the Microscopic World. A Handbook of Microscopic Manipulation and Microscopic Objects. By John Brocklesby, A.M., Professor of Mathematics and Natural Philosophy, Trinity College, Hartford, Conn. New York: William Wood & Co.

This is a very convenient and useful little work, full of practical instruction upon the uses of the microscope. It is profusely illustrated with engravings which show the construction and various powers of the instrument, together with views of many remarkable objects that may be easily obtained and prepared for observation. A most interesting chapter is that devoted to crystallizations, in which the author presents us with many new drawings, and gives directions for preparing the slides so that the process of crystal formations may be readily witnessed under the microscope. This part of the work will be especially welcomed by amateurs. The examination of crystals is always attended with peculiar interest. The beholder revels for the time being amid sights of gorgeous beauty, and gazes upon gems seemingly most rare, exquisite, and precious. This book is a valuable addition to our stock of scientific literature.

BARRY'S FRUIT GARDEN. New Edition. New York: Orange Judd & Co., 254 Broadway.

This volume of 490 pages, as its title implies, is devoted to the culture of fruits of every variety in orchards and gardens. It also contains hints on the kind of soils best adapted for the different varieties, best modes of propagation, pruning, training, etc. It describes the diseases incident to the various fruit trees, the kinds of insects that prey upon them, and the remedies for ridding trees of the evil. The book is illustrated with numerous engravings of green houses, propagating beds, grafting, pruning, and garden implements, and the mode of training trees into beautiful and grotesque shapes. It also contains directions for the management of strawberry plants and other like fruits, with a chapter on nutting trees, etc. It is a work important to every agriculturist, and will find ready sale.

POCKET BOOK OF MECHANICS AND ENGINEERING. By John W. Nystrom, C. E. Philadelphia and New York: J. B. Lippincott & Co. New edition, revised and enlarged.

This book is already extensively known, this being the eleventh edition. In the present revision and enlargement, much valuable matter has been added. For example: Logarithms of numbers and of trigonometrical functions for every minute of a degree, or for every four seconds of time, are given; also the eight natural trigonometrical functions for angles, expressed either in degrees or time, as may be required. In regard to dynamical terms, the author proposes to abolish a great number of them, including "moment of inertia," which is a well established term in the philosophy of dynamics. A list is also given of proper dynamical terms, limited to force, motion, time, power, space, work, static and dynamic momentums, which the author maintains are all the terms necessary in dynamics. Examples are given for the dynamics of fly wheels, in which the term "moment of inertia" ought to perform an important function, but does not appear in the formulas and calculations. However right or wrong the author might be in the philosophy of dynamics, his reasoning is well worthy of attention. Barometrical tables, for the measurement of hights, are new and very complete, in English and French measurers which have been arranged by the author from actual practice among the Andes; also, original formulas for the flow of water in bends of pipes; the evaporation on the surface of water, under the atmosphere; the harmonical and geometrical scales of vibration in music or acoustics; illustrations of the expansion of bodies by heat, at and near the temperature of fusion. The article on air and heat, and the specific heat of gases, contains simple and valuable formulas with original examples. The properties of inflamed gunpowder and its dynamics in heavy ordnance are given; also the properties of water and steam, with formulas and tables; also an original rule for determining a standard nominal horse power of steam boilers. On the parabolic construction of ships, the author gives a formula by which any form of a ship can be recorded, and by which any ship builder familiar with the parabolic method can construct a ship of a definite form. The formulas and tables for the parabolic method are very simple and complete.

NEW AND COMPLETE CLOCK AND WATCHMAKER'S MANUAL: Comprising Descriptions of the Various Gearings, Escapements, and Compensations now in Use in French, Swiss, and English Clocks and Watches, Patents, Tools, etc., with Directions for Cleaning and Repairing. With Numerous Engravings. Compiled from the French—with an Appendix containing a History of Watchmaking in America. By Mary L. Booth, Translator of the Marble Worker's Manual, etc. New York: John Wiley & Son, Publishers, 2 Clinton Hall, Astor Place.

This will, we should opine, be a valuable book for the watchmaker's and jeweler's craft, although there is not much in it regarding American improvements in watchmaking. The brief sketch of the history of watchmaking in this country is not of much importance. There is much in the book, however, useful for instruction and reference. The printing and binding are not of the highest order, and we suppose that the publishers sought rather to place the work before the public in cheap form than to limit its sale by a more expensive style of execution.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 8 to March 14, 1872, inclusive.

BATTERY GUN.—W. A. Mills, Salisbury, Conn.
BILGE WATER INDICATOR.—A. Harris, New York city.
BOAT LOWERING APPARATUS.—C. C. Quaritius, Canarsia, N. Y.
BOOT HEEL.—F. Richardson, F. Hacker, Providence, R. I.
COTTON CLEANING MACHINE.—N. B. Hail, Providence, R. I.
DIAL PLATE.—J. C. Dunn, E. C. Lewis, L. Atwood, B. W. Marshall, W. B. Mussy, B. M. Baily, C. E. Kilby, D. B. Channell, Rutland, Vt.
ELECTRIC TORCH.—W. W. Batchelder, New York city.
GOVERNOR.—J. B. Duff, Patchoque, N. Y.
HEALD, ETC.—D. C. Brown, Lowell, Mass.
LEATHER MAKING MACHINERY.—E. Fitzhenry, Somerville, Mass.
PREVENTION OF RAILWAY ACCIDENTS.—S. W. Emery, E. P. Doyen, W. Sparrow, Portland, Me.
PROPELLING VESSELS, ETC.—A. Mot, G. E. Weaver, Providence, R. I.
ROLL FOR SPINNING MACHINE.—W. A. Caswell, Providence, R. I.
ROLLING MACHINE.—A. Johnson, New York city.
ROTARY ENGINE, ETC.—C. Avery, Tunkhannock, Pa.
SEWING MACHINE.—J. A. House, Bridgeport, Conn.
TRIMMING BOOT SOLES, ETC:—S. H. Hodges, Boston, Mass.

Business and Personal.

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

Notes & Queries.

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

1.—COLORING CASTOR OIL.—How can I impart a yellow color to castor oil, without injuring its medicinal value?—S. W. O.

2.—SOLVENT FOR ANILIN GREEN.—Can any one inform me of a volatile non-acid solvent for anilin green?—A. G., Jr.

3.—SEASONING HICKORY.—Can any one inform us, through the columns of your paper, the best way to season second growth hickory for stone cutters' mallets, so that they will not check?—G. W. B. & Co.

4.—KILN FOR DRYING CORN.—I am in pursuit of the best method of kiln drying corn, but cannot find anything that suits me. Can your readers make some suggestions on this point?—J. M. P.

5.—DYEING.—How are anilin colors used in dyeing, and what are the proper recipes for preparation? How can I color fabrics with chrome green and yellow, and with Prussian blue; and what is used as a "set" or mordant for each?—S. W. O.

6.—CEMENT FOR VARNISHED WORK.—Can you inform me how to make a glue or cement to fasten wood to painted or varnished work, so that it will adhere as well as on unpainted work?—PAINTER.

7.—STRENGTH OF WOODEN VAT.—Can any one inform me what pressure a wooden vat, 16 feet deep and 10 feet wide, of staves five inches thick, hooped with ⅜ iron, 19 inches apart, will bear, and what should be the limit of pressure of steam therein? The vat is used in preparing straw.—L. A. S.

8.—TIMBER FOR WATER PIPES.—What kind of timber will make the best and most durable piping for conveying water under ground, and should the bark be left on or taken off?—C. H.

9—NICKEL PLATING LEAD PIPE.—Can any one inform me what, if any, are the advantages of nickel plating the supply or induction pipes of pumps? Will such plating prevent the deleterious effects which are said to be caused by the placing of lead pump pipes in wells?—B.

10.—EXPANSION OF MERCURY BY HEAT.—Will some one of your readers inform me how much per cent mercury will expand when heated from 0° to 100° Fahr.? Which metal comes nearest to mercury in its degree of expansion?—S.

11.—STAINING POPLAR A WALNUT COLOR.—I would like to know how to stain poplar or other light colored woods a walnut color, so that I can rub it down smooth after staining. I can stain a very nice walnut with permanganate of potash, but it does not go deep enough in the wood, and any attempt to rub smooth rubs off the stain.—J. R. H.

12.—NICKEL IN SOLUTION.—Nickel, held in solution so that it can be applied with a brush, is much needed. It must be chemically prepared with such ingredients as not to discolor polished steel, and should evaporate at a low temperature of heat, leaving the articles plated with nickel. The discoverer of such an article would find an immense sale for it, and would confer a lasting benefit on manufacturers of, dealers in and users of polished tools.—J. E. E.

13.—PITCH OF SCREW PROPELLERS.—Can any of your readers give a simple method of computing the correct pitch of screw propellers from the dimensions of the wheel?—G. R.

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.

LARGEST ENGINE IN THE WORLD.—W. N. G. is informed that we used the figures given by our informant regarding this engine. It was probably the crank that weighed one tun, and not the crank pin.

A. B. S., of La., sends a black mineral specimen and says: Will you kindly let me know the cost of having the enclosed specimen of plumbago analyzed? I would also like to be informed of the number of graphite mines now worked or known to exist in North America, the value of said mines, etc.—Answer: Your specimen is not "plumbago," but is simply a soft bituminous shale. If you will compare the traces on paper made by it and by a good lead pencil, you will see the difference. The best graphite (plumbago) mines in the United States are at Sturbridge, Mass., Ticonderoga, N. Y., Brandon, Vt., and Wake, N. C.

FAST COLORS.—Query 8, March 16.—If the material to be dyed black is woolen, be sure, in the first place, to have it thoroughly free from grease, and clean. Boil in your logwood (half weight of material) liquor for an hour, and add the copperas, in solution, gradually, and continually stirring; after boiling awhile, the addition of a little muriate of tin in solution will give a brilliancy of tone. Now take out the goods, drain, and expose to the action of the air for an hour or two, after which give a thorough washing in water, and eventually with warm soapsuds.—E. H. H., of Mass.

TEST FOR LEAD IN WATER.—Query 24, March 9.—To F. C. The best test is sulphuretted hydrogen. Precautions to be observed: Evaporate in a porcelain vessel or a porcelain lined preserving kettle. Lead is usually present in water, as carbonate or some other insoluble compound, hence most or all of it remains on the filter and should be tested for there. The sulphuretted hydrogen may be prepared from black sulphuret of iron and either oil of vitriol or muriatic acid, no heat being required. The gas should be washed by passing through water. F. C. may prepare the gas quite as well, if not better, by heating together a little flowers of sulphur and some paraffin.—E. J. H., of—

MELTING ASPHALTUM.—No. 1, March 23.—To H. E. W.—This can easily be done in a pot over the fire.—E. H. H., of Mass.

TEMPERING TRAP AND OTHER SPRINGS.—W. R. H. should take good cast steel, work at a low heat, and forge evenly; temper in salt water, and then heat gradually and evenly until it will burn tallow when some is rubbed on. Continue the heating till the blue flame ceases to appear and the flame is white. This is, I believe, the best mode for trap or other large springs; who knows of one better adapted for small springs?—W. H. R., of Pa.

PAINTING BATH TUB.—If C. A. H. will have his bath tub painted with dead flat colors, and then varnish it, it will not scale.—W. C. R., of W. Va.

TEST FOR IRON AND STEEL.—Tell J. H. that if he let fall a drop of nitric acid on steel, it will cause a black spot upon it, but if upon wrought iron, it will not have this effect. He will find this a simple and easy method of distinguishing the two.—H. S., of R. I.

DEMAGNETIZING STEEL.—Let J. B. W., page 200, scour his tools with fine emery, and he will remove the magnetism from them, as it only affects the surface of iron and steel.—C. T., of Vt.

FROSTING GLASS.—G. P. may make a saturated solution of Epsom salts, and cover his glass with it by means of a piece of rag. In crystallizing, the salt will present a pretty appearance.—E. H. H., of Mass.

MAKING RULES.—J. E. M., may dissolve shellac in alcohol, and add a little gum elemi to give increased toughness. To blacken the figures, mix a little lampblack with the above.—E. H. H., of Mass.

PREPARING SKELETON.—G. L. F., after cutting off as much flesh and cartilage from the bones as possible, should then boil them in water till the remainder easily separates. The French still further prepare their skeletons, by bleaching for a short time in a weak solution of chloride of lime. This is no disadvantage whatever.—E. H. H., of Mass.

DISINFECTING WELL.—The most feasible plan for cleansing the well would, I think, be putting in an abundance of chloride of lime. The quantity I can't suggest, not knowing the depth of water. Mix the powder to a smooth cream with water and pour in. Give the sides a thorough washing over, and allow to remain some days in order to effectually destroy the putrid matter; constant agitation of the water will tend to wash the stuff out of the crevices. Afterwards pump all out, and again allow the water to accumulate and again pump out. After a while, I think the well will be found perfectly clean and pure. I would like to know of the success of the plan.—E. H. H., of Mass.

SHELLAC VARNISH WITH LINSEED OIL.—J. C. may dissolve the lac in either a strong solution of ammonia or a saturated solution of borax, and then add the oil and thoroughly agitate, to form an emulsion. The ammonia will be found the best, as in use it will evaporate and leave the coat of lac and oil.—E. H. H., of Mass.

CLEANSING SOAPY FELTS.—W. H. P. will probably find that, after the soap is washed off as thoroughly as may be, the addition of stale urine or dilute ammonia will remove the remainder. These alkalies will be better than either caustic soda or potash, as less likely to affect the color of the material.—E. H. H., of Mass.

W. A. McD., of Pa.—The black "hairs" attached to the coke are pure carbon. If these is any appreciable difference in quality between the hairy coke and the hairless coke, it is in favor of the former. The white hairy substance that you send, resembling cotton wool, which you say is formed by passing a jet of steam through the slag that issues from the bottom of the furnace stacks in which the Fayette county coke has been used, is only the silica of the slag, blown into threads by the steam jet. It readily melts and is not like asbestos as you suppose.

A. H. M. & Co., Ala.—The mineral you send is a soft bituminous shale without any graphite. It may be (and is) used to adulterate graphite for stove polish and the like; but it can never take the place of true graphite in the manufacture of pencils and in the electrotype art.

WATER IN AQUARIA.—I have had an aquarium for fifteen months without changing the water, and C. D. can have similar success by taking some porous stone, broken into small pieces, and covering the bottom of the aquarium to a depth of two inches. In this place some myrtle, water lilies, or other plants that will thrive under water. Do not put in too many plants, and wash such as you use free from all dirt. Fill the aquarium with water, put in your fishes, place the vessel out of the sunshine, and let Nature do the rest. Study how to proportion the plants to the fish, as the plants yield oxygen to the fish and the fish carbon to the plants.—S. B. R.

DIVIDING CIRCLES.—Your correspondent R. C. W., query 19, Feb. 17, wishes a method of dividing circles. The best method is by calculating as follows: Let n equal the number of parts into which the circle is to be divided, d equal the diameter, and c equal the length to be spaced off, that is, the side of inscribed polygon; then will c divided by d is equal to (*sine* times 180 divided by n)°. A near approximation, when n is large, is c divided by d is equal to 3·141593 divided by n. Let n equal 63, then by the first formula: c divided by d is equal to 0·049846, and by the second c divided by d is equal to 0·049866; hence c equals d multiplied by 0·049846.—H. A., of Conn.

BRASS FOUNDING.—If D. G. will take a sand crucible, and allow it first to be well warmed up, he can heat it safely in a blacksmith's fire, although, at best, there is some liability to crack. He should have on a good supply of coal, so that the crucible is not too close to the sharp blast; then use a light blast, and heat slowly until the brass is melted. When hot, it will look white on the surface. If the brass, as he says, "will not run," let him add to the old brass a little good sheet copper, and a small quantity of block tin. Old brass will not run well, if remelted several times, unless thus treated. The white smoke of which he speaks is nothing uncommon.—W. H. R., of Pa.

PAINTING SHEET IRON.—Query 18, March 16.—Let J. C. mix together one pint good varnish, one pint boiled oil, and red lead sufficient to produce a proper consistency. Prepare it a few hours before wanted, and repeatedly stir while using. Use no turpentine or dryers. I have a stack thus painted which has stood the weather and heat for two years, and remains as when first done, but changing to a darker color. The expense is trifling. This is applicable to C. A. H.'s bath tub, and I would advise him to give it a trial.—J. K. W., of Mich.

WORCESTERSHIRE SAUCE.—White vinegar, 15 gallons; walnut catsup, 10 gallons; Madeira wine, 5 gallons; mushroom catsup, 10 gallons; table salt, 25 pounds; Canton soy, 4 gallons; powdered capsicum, 2 pounds; powdered allspice, 1 pound; powdered coriander seeds, 1 pound; cloves, mace, and cinnamon, of each, ½ pound; assafœtida, ¼ pound, dissolved in brandy, 1 gallon. Boil 20 pounds of hog's liver in 10 gallons of water, for 12 hours, renewing the water from time to time. Take out the liver, chop it, mix with water, and work it through a sieve; mix with the sauce. *Imitation No.* 1.—White vinegar, 240 gallons; Canton soy, 36 gallons; sugar house sirup, 30 gallons; walnut catsup, 50 gallons; mushroom catsup, 50 gallons; table salt, 120 pounds; powdered capsicum, 15 pounds; allspice, 7 pounds; coriander, 7 pounds; cloves, mace, and cinnamon, of each, 4 pounds; assafœtida, 2½ pounds, dissolved in St. Croix rum, 1 gallon. *Imitation No.* 2.—White vinegar, 1 gallon; Canton soy, 1 pint; molasses, 1 pint; walnut catsup, 1½ pints; table salt, 4 ounces; powdered capsicum, 1 ounce; allspice, 1 ounce; coriander, ½ ounce; cloves, ¼ ounce; mace, ¼ ounce, cinnamon, 6 drams; assafœtida, ¼ ounce, in rum 4 ounces; mix. *Imitation No.* 3.—Take port wine and mushroom catsup, of each 1 quart; walnut pickle, 1 pint; soy, ½ pint; pounded anchovies, ½ pound; fresh lemon peel, minced shallots, and scraped horse radish, each 2 ounces; allspice and black pepper (bruised), each 1 ounce (or currie powder, ⅜ ounce); digest for 14 days, strain, and bottle.—H. W. B., of N. J.

WORN COINS.—By heating these gradually, the inscription will, in almost all cases, make its appearance.—A. J. H., of N. Y.

Recent American and Foreign Patents.

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

ICE CREAM HOLDER AND FILLER.—Henry R. Robbins, Baltimore, Md.—The invention consists of a base cup made of tin, a paper cylinder to receive the cream, and a tin foil cylinder on the outside. These can be furnished to the confectioner at less than one cent apiece. The patent also covers a filler, consisting of an elongated cup and plunger. The cup is principally intended for convenience on cars and in public places, where the vessel must necessarily be sold with its contents.

METHOD OF FORCING PLANTS.—Chas. Reese, Baltimore, Md.—The invention consists in fixing a sponge in the throat of a vessel so that a part of it shall come in contact with water in the body of said vessel, and then filling slits or apertures thereof with bulbous roots. The porous character of the sponge causes the absorption of water, and allows the roots to ramify therethrough. A rapid growth follows and a quick evolution of the flower. The latter is much larger and more brilliant in its colors than by any method heretofore known.

BOLT FASTENING FOR FISH PLATES.—Thos. W. Kirkwood, McKeesport, Pa.—The invention consists in combining a lock plate with fish plates, so that when nuts require tightening up, the rivets can be cut, removed, and replaced without removing the fish plates.

APPARATUS FOR TRACING DRAWINGS, PICTURES, ETC.—Casper Zweifel and Edward Stevens, Pomeroy, O.—This invention relates to an apparatus by which a mirror is made to reflect light through a glass plate and through a picture, drawing, or the like laid upon said plate, and through tracing muslin or other similar material laid upon the picture for the purpose of enabling an operator to accurately delineate upon the tracing muslin the outlines of the picture.

PROCESS AND APPARATUS FOR YELLOWING TOBACCO AND SUBSEQUENTLY RENDERING IT PLIABLE.—Chas. W. Flippen, Laurel Grove, Va.—The invention consists in a new process of yellowing tobacco by applying heat and steam simultaneously, previous to curing it, and in the means by which it may be thoroughly and effectively accomplished.

HOT BLAST OVEN.—Richard Long, Pittsburgh, Pa.—This invention relates to an oven for heating the blast of a furnace by means of the combustion, within the oven, of gases drawn from the furnace, the chief novelty of the invention consisting in an apparatus for burning the gases inside of flues passing vertically through the oven while the blast is passed through chambers enclosing said flues, the blast therefore flowing outside of the flues instead of inside of them, the latter having been, up to the date of this invention, the common mode of conducting the blast.

CAR ROOF.—John L. Burnham, Nashville, Tenn.—The invention consists in making a roof having arc-shaped and longitudinal undersheathing and cross pieces for outer cover, with intermediate longitudinal and continuous sheets of metal, which slightly overlap each other. It makes both a very cheap and durable car roof.

WATER WHEEL.—Vincent M. Baker, of Preston, Minn.—This invention relates to a new arrangement of gates and mechanism for adjusting the same in water wheels. It consists principally in connecting with each gate a vibrating chute plate, which will carry the water at the most advantageous angle to the wheel, whatever the position of the gate. The invention also consists in a new manner of hanging the gate, adjusting and connecting it with the several gates. The flanges of the cylinder and crown plate are curved, forming a flaring and convenient entrance for the water. The gate can swing independently of the chute plate, and *vice versa*. Each gate is pivoted at or near the middle, and with its inner part fully overlaps its chute plate, while its outer part more or less covers the inner part of the gate next behind. The gates can be adjusted according to the amount of power to be obtained. But the chute plates are self-adjusting, and will, it is claimed, always swing toward the wheel to carry whatever water is at disposal at the most advantageous angle.

PLASTIC COMPOSITION.—Thomas B. Gunnings, of New York city.—This invention relates to a new plastic composition claimed to be of great value when applied to the manufacture of boxes and other useful and ornamental articles, since it is strong, durable, sufficiently elastic, beautiful in appearance, susceptible of high polish and distinct ornamentation, and impervious, practically, to air, water, and fatty substances. The composition consists, principally, of finely powdered carbonate of lime and shellac so combined and treated as to produce the desired effect. To one part, by weight, of good shellac—preferably the kind known in market as "Camel's"—two parts, by weight, of finely pulverized marble are added. The ingredients should be finely powdered before mixture, then put into a suitable vessel, exposed to heat, and stirred constantly until melted into a homogeneous mass, which should then be rolled out to a suitable thickness. It can then be reheated, molded, and pressed or otherwise shaped into the desired form. When bleached shellac is used, it may be necessary to reduce the proportion of marble somewhat, as the fusibility of the shellac is generally diminished in the bleaching process. In some instances, where a light shade is desired, pure white chalk may be used in place of the marble, one part of bleached shellac being used to one and a half or to one and five eighths parts of chalk. Different colors may be obtained by adding suitable coloring matter to the materials when first mixed. Composition containing different colors can be mixed so that the articles made from it will present a marbled appearance. Alabaster, travertine, agaric mineral, all the various marbles, and also the calcareous spars, such as calc spar, Iceland spar, etc.; also the marble known as dolomite, containing carbonate of magnesia; also limestone, containing silicate of alumina or clay, or other matter, coral, etc., may be employed in this, their use being covered by the broad claims allowed in the patent, which are as follows: A new calcareous composition made as described, and the method described of preparing the ingredients and producing the calcareous composition. The composition in some of its lighter shades will resemble ivory somewhat in appearance, strength, and elasticity; but, owing to its plastic state when heated, and to its capacity for taking color, this composition can be more frequently applied than ivory.

RAILWAY SWITCH.—Patrick Carrigan, of Sturgeon, N. Y.—The construction of this railroad switch causes the rails to be securely held in place when adjusted, and enables the weight of the sliding or movable rails to bring them exactly in line with the stationary rails should they be moved by the switch rod a little too far or not quite far enough. The invention consists mainly in providing V shaped projections on the rail chair and switch rod, which, engaging V recesses formed in the bottom of the groove in the chain or block in which the switch rod works, holds the rail securely in place when adjusted, and, at the same time, the inclined sides of the projections cause the rails to slide into line with the stationary rails, should they be moved a little too far or not quite far enough by the switch lever. The invention thus differs materially from those in which the ends of the rails fit in sockets formed with straight sides, since, in the latter case, the rails will not enter the sockets unless a very perfect adjustment be first effected by the operation of the switch rod and lever.

SPRING FOR VEHICLES.—Alexander W. McKown, of Honesdale, Pa.—This invention consists in a combination of auxiliary springs with the ordinary springs of a wagon and connecting devices, whereby the auxiliary springs may be utilized to reinforce the ordinary springs according to the weight of the load, and thus avoid the present objectionable practice of using the same springs for light or heavy loads, for both of which they cannot be well adapted. The ordinary springs are provided with a cross bar or bars rigidly connected to them at the ends. These bars carry cranked, pivoted, or hooked devices, or any equivalent thereof, arranged to confine the auxiliary springs to the cross bars to re-enforce the main springs or to disconnect them, as may be required by the conditions of the load.

SPARK ARRESTER.—Russell Hawkes and Henry J. Paine, of Providence, R. I., assignors to themselves and Joseph Kelley, of same place.—The upper end of the smoke stack is closed, except in the middle, from which a pipe of wire gauze or perforated sheet metal, projects downward and connects at the lower end with the steam exhaust pipe. All smoke that reaches the smoke chamber is by the force of the exhaust, as well as by the ordinary draught and by its own impetus, caused to enter a perforated pipe and ascend in the same to escape. Sparks and cinders, however, of larger size than the apertures of the pipe cannot escape into the same, but are, by the same stated forces, carried up around the pipe into an upper, outer, and closed part of the smoke stack. In this upper outer part are some inclined rings which deflect the ascending sparks or cinders, and cause them to enter an annular space, which is formed in the smoke stack by an upright tube. The lower end of the space is closed, except where it communicates with two, more or less, pipes, which communicate with as many horizontal or inclined tubes that lead back to the fireplace. Thus all the sparks, cinders, etc., that are carried to the chamber are conducted back to the fireplace for complete consumption. It may be necessary to create a draft in the inclined tubes in order to force the sparks and cinders backward therein. For this purpose, these pipes are carried through the front end of the engine, and open or perforated in front, so the air entering them during the forward motion of the locomotive may carry the cinders into the furnace, besides furnishing oxygen for a more complete combustion of the gases. Since the tubes are thus open at both ends, the light of the fire that shines through them is utilized by attaching to their front ends spherical reflectors with glass faces. These will constitute signals that can be used for suitable purposes, and will be displayed without the use of lamps or extra lights.

GAS APPARATUS.—Charles Seeger, of Quincy, Ill.—The invention consists in combining, constructing, and arranging the essential parts of a retort furnace, namely, the upper fire chamber, its ring grate, the retort passing through the grate, the doors of the furnace, the ash pit, and its doors provided with air inlets; with a second fire chamber, having a grate and an ash pit, provided with a drawer. The independent flues of the two fire chambers terminating in a common flue, a steam or gas outlet from the retort is provided, and also a perforated chamber to contain the article to be heated. The advantage of combining the two fires with retort chamber is claimed to be economy of time in heating and a comparative saving in the fuel.

EARTH CLOSET.—Anthony W. Davis, of Wilmington, Del.—A hopper or receptacle for the earth is placed behind the seat. The bottom of the hopper is formed by a fixed grate, under which there is a similar but movable grate. A spring or grate moves the movable grate forward under the openings of the grate to hold the bottom of the hopper closed. The hinged lid of the closet is provided at its sides with projecting arms or levers which reach down to and connect with a movable frame under the seat. The receiving vessel of the closet is placed upon the movable frame or case. By opening the lid, the movable frame is brought forward so as to place the vessel under the seat, the hopper meanwhile being closed. When the lid is closed, the frame with the vessel is moved back under the hopper, the frame striking an ear of the movable grate and pushing the latter back so as to open the bottom of the hopper. The earth can then freely flow into the vessel.

MACHINE FOR TURNING LOGS IN SAW MILLS.—Alexander Rodgers, of Muskegon, Mich.—This is an improvement in the construction of E. Tarrant's machine for turning logs in saw mills, patented August 25, 1868, which is claimed to render it more convenient in use, and more effective in operation, while requiring less power to operate it, and enabling a smaller chain to be used. It consists in a sheave, in combination with the arm of a toothed bar, to receive the chain, by which construction the strain upon the chain is distributed upon its two parts, so that the chain may be made lighter, and at the same time the friction pulley may be made smaller, thus giving greater speed to the device.

BARBER'S AND DENTISTS' CHAIR.—Anthony Abel, of New York city.—This invention relates to the construction of chairs with adjustable backs, for barbers' and dentists' use, having special reference to the raising and lowering the back of the chair. It consists in a screw and bevel gear wheels supported in a hinged yoke, and connected with the back and bottom of the chair, so that when the nut is revolved the screw will be raised or lowered as the bottom side or collar of the nut wheel rests upon the arm of the yoke. As the back of the chair is raised or lowered, the relative position of the screw thereto will change; but, as the screw is pivoted at its top end to the back, or is allowed to turn and passes through the hinged yoke, the parts work easily together and without undue friction.

OSCILLATING STEAM ENGINE.—George F. Lowry, of Lake Mississippi, Miss.—This invention relates to a new arrangement of oscillating steam engine, and more particularly to a new valve, new crank connection, and new link motion. The valve is made with two sets of apertures or steam passages, each set having three arms to connect with the inlet and exhaust in the requisite manner. The crank motion is peculiar, consisting, principally, in the arrangement of a disk with a series of projecting crank pins, which alternately connect with the oscillating slide that is attached to the end of the piston rod. The link motion, finally, is an inclined rail, on which the above mentioned slide travels, and which connects with the valve so as by its changed inclination to reverse the valves and the motion of the engine. The mere change of position of said rail is, therefore, sufficient to reverse or arrest the motion of the engine, and the same is, therefore, under very convenient control. Its several advantages make the improved engine peculiarly adaptable for use on steamboats, locomotives, and other moving devices, though it can also be profitably employed on stationary machinery. The improvements are covered by five claims upon which the patent was issued.

MACHINE FOR JOINTING STAVES.—Arza M. Benson, of Cleveland, Ohio.—The staves are jointed by two cutter heads, the shafts of which are set at an angle so the faces of the cutter are inclined to give the required convexity to the joint. A swinging table is provided with adjustable clamps for different lengths of staves. By shaping the cutter heads in a peculiar manner, the work can be done much faster than on the old plan, as projecting naked arms allow the knives to commence cutting on the stave with heavy shavings—or, in other words, to cut away the stave as fast as it is being fed ahead, until the ends of the staves are sufficiently cut away to come to a bearing on the round part of the cutter head, when light shavings only will be cut.

PRINTING PRESS.—Berthold Huber, of Williamsburgh, N. Y.—This invention is an improved movement for printing presses by which the cylinder will be made to move at the exact rate of speed with the bed plate, while in contact with the bed plate, and allowed to move at a different rate of speed during the rest of its revolution, to bring it again in contact with the bed plate at the proper time, thus allowing the cylinder to be made smaller than it can be made when the ordinary movement is used. The invention is only applicable to those presses in which the bed plate is driven by a crank movement. A variety of devices is employed to effect the desired object, embraced in two claims upon which the patent has been issued.

CORN PLANTER.—Samuel L. Donnell, of Humboldt, Tenn.—This invention consists in a combination of a hopper, bottom apertured board, wheel having pins and cups, and a corrugated and pivoted plate having inclines arranged in a new and peculiar manner by which, with other parts not new and therefore not comprised in the claim, a very neat, compact, and apparently effective machine for the purpose designed is secured.

ROAD PAVEMENT.—Matthew K. Couzens, of Yonkers, N. Y.—This invention relates to a new arrangement of constituents for a roadway, and has for its object to combine strength and antifrictional qualities with simplicity of construction, convenience of laying and of taking up. A difficulty with ordinary road beds for cities and towns is that the occasional taking up of portions makes the even replacement difficult, and often causes the subsequent sinking of the road at such places. This invention consists in the arrangement of prismatic blocks, made of concrete or artificial stone, and grooved on the surface, and in their combination with an asphaltum covering. The edges of the blocks are made with alternate ribs and grooves so that they will lock together when placed upon a road; but every tenth gutter block is made without such ribs or grooves to enable its convenient removal and that of the blocks adjoining. The surfaces of all the blocks are grooved or indented to become sufficiently roughened for the attachment of the asphaltum covering. Such covering, sufficiently thick, is subsequently spread over the blocks, and forms the actual road bed. By a heated tool, the asphaltum can at any time be cut to detach the blocks beneath and permit their removal. After replacement the joints are merely closed by the application of liquid asphaltum, so that hardly any material is wasted by such removal and replacement. In place of asphaltum, any equivalent bituminous covering may be used.

FASTENING KEY FOR COFFINS.—John Homrighous, of Royalton, Ohio.—The object of this invention is to provide a substitute for screws, used in fastening the lids of coffins, and for all similar purposes, whereby much time and annoyance may be saved. It consists in a key, ordinarily constructed so that it can be turned like a thumb screw. The shank of the key passes through the cover and enters the side or end of the coffin the same as a common wood screw. One or more spurs project from the side of the shank near its end. These spurs are preferably flat and sharp on one edge, and placed spirally on the shank, or like the thread of a screw, so that when the key is turned the spurs will draw the key down and tighten the cover to the side, the same as would be done by turning down a screw, a shoulder on the shank of the key giving the desired hold on the cover. To apply the key, a hole is bored through the top or cover and in the side or end, and then a channel is cut in one side of the hole of sufficient size to admit the spurs. With the hole thus prepared, the key may be dropped into it, and when it is turned, the spur or spurs will penetrate the wood and act the same as a screw thread to draw the parts of the coffin, box, or other article together. The lower edge of the obliquely placed spur is sharpened or made thin, so that it will readily penetrate the wood. Ordinarily, the spur or spurs will be placed so that the key would be turned to the right to fasten, and to the left to unfasten. One fourth of a revolution will do either. A great saving of time is thus effected, as compared with the time required for driving screws with a screw driver.

PADDLE MECHANISM FOR BOATS.—Charles Howard, of New York city.—This is an improved paddle mechanism for the propulsion of vessels and boats. A shaft is arranged across the boat and connected in a suitable manner with a steam or other engine, which is supported on said boat. At the outer ends of the shaft are cranks which work outside of the boat. On the outer end of each crank is a gudgeon, on which fits a suitable box provided in the paddle near the center of same. Another pair of shorter cranks is secured to the ends of a shaft, which is placed parallel to and over the other or main shaft. The outer end of each short crank is attached to an arm, which connects it with the upper end of the paddle. These shafts are geared so that they turn alike, and the two cranks at each end always point in the same direction. When they revolve, the long crank, which is attached near the middle of the paddle, carries that part of the paddle further forward and aft than the short crank, which is attached to the upper end of the paddle, carries that end. This difference in the length of the cranks causes the lower end of the paddle to move further than the upper end, and, therefore, it makes a longer stroke than if both cranks were of the same length. By varying the relative lengths of these cranks, the paddle is made to go into and come out of the water at any desirable angle. If the cranks were of the same length, the lower end of the paddle would move no further fore and aft than the circle of the cranks would measure, as the paddle would always remain upright, and the stroke would be too short. If, on the other hand, there were no upper crank, and if the arm attached to the short crank and upper end of the paddle were secured to a stationary pivot instead of to a short crank, it would give the paddle too much stroke, and cause it to strike the water at so great an angle as to waste its power by driving the water downward at the forward end of the stroke, and raising the water at the back end of the stroke. These paddles are designed for the stern, side, or bow of the boat. If they are placed at or near the bow, the blades of the paddle are set at an angle from the beam of the boat, the edge next to the boat being further aft than the outer edge. This angle of the blade throws the water diagonally from the bow, and prevents its piling up in front of the boat. The rapid motion of the paddle causes a partial lowering of the water at the bow, which accelerates the speed. If the paddle is placed at or near the stern, the outer edge of the paddle is placed further aft than the edge next to the boat. This is to prevent the paddle from lowering the water under the stern of the boat, and to facilitate the steering of the boat.

TRAY HOLDER.—Obed Fahnestock, of Indianapolis, Ind.—This invention consists of a small horizontal lattice frame of metal, with a handle at one side, and short legs on the bottom with screw threaded holes formed in them from the top, on which the tray is fastened by screws or, it may be, rivets entering said holes; and the handle is arranged so that it may be taken in the hand to hold the tray while resting on the arm behind, the hand grasping said handle to enable one to hold the loaded tray by one hand, and allow of using the other for other things.

POCKET FLASK.—Rogers George, of New York city.—This invention furnishes an improved pocket flask, so constructed that the operation of putting on the cup or cap will cork the flask, and the operation of taking off the cup or cap will uncork the flask; and it consists in the cork or stopper, permanently attached to the cap or cup of the flask, as hereinafter more fully described. A stopper, made of cork, rubber, or other suitable material, is permanently attached to a cap or cup which is placed on the top of the flask. This may be done by securing a small screw to said cup, upon which a cork or stopper is placed and secured by a nut. The cork or stopper may be attached to the cup or cap in any other substantial and convenient manner. The shape of the cups is immaterial. It is preferred that the cups should conform somewhat to the form of the glass flask, and their bottoms should be flat, so that they may stand steadily upon a table or other support when required.

INSTRUMENT FOR EXTRACTING AIR FROM FRUIT JARS.—John H. Parrish, of Talladega, Alabama.—This invention relates to and consists in a peculiar construction of a tubular perforator, which is passed through the cork of the fruit jar. There is an orifice through which the air enters, and one through which the air escapes. The perforator being passed through the cork, the cork is inserted into the neck of the jar. When the jar, with the cork and perforator inserted, is placed in the water, and the contents are brought to the boiling temperature, the steam generated will exclude the air which will be driven into the tube, and escape therefrom through the outlet. The cork should be soft and elastic, and tightly driven in. The perforator is so small and delicate that the orifice it has made through the cork will upon its withdrawal be instantly closed by the elasticity of the cork, so that air is excluded; but to render the top of the cork perfectly impervious, a cap of cement, gum, or any other suitable material is used. It is claimed that, with the use of this perforator, the fruit preserving jar is cheaply made. The process or operation of "putting up" fruit or vegetables is rendered very simple, and the result is equaled only where the best and most perfect fruit preserving vessels are used.

SOFA BEDSTEAD.—Joseph Schafer, of New York city, assignor to himself and George W. Smith, of same place.—This is an improved sofa bedstead, constructed so that it may be extended to serve as a bedstead, and, folded up, to serve as a sofa, and when folded up shall give no indication that it can be extended. The construction is strong, durable, not liable to get out of order, and conveniently extended and folded. It is moreover capable of being made highly ornamental, the construction admitting of elaborate as well as plain designs, so as to meet the various tastes and means of the general public.

WAGON BODY LIFTER.—Edward A. Chatfield, Waterloo, Iowa.—This is an improved apparatus for lifting wagon boxes, wood racks, hay racks, etc. from and lowering them upon the running gearing of wagons, enabling a single person, or even a boy, to readily remove and replace a wagon body or rack. The box is provided with staples at the side with which iron loops engage. A post sustains a pivoted lever bar, one end of which being lowered engages the iron loop at one end of the box. When the opposite end of the lever bar is depressed, it raises one end of the box. The link now being attached at the depressed end, the box is so nearly balanced that a slight effort suspends it, at a level high enough to allow the running gear to be drawn from under it.

HUB FOR CARRIAGE WHEEL.—Joinville F. Fowler, Alliance, Ohio.—This is an improvement in the construction of wheels whose hubs are made of a wooden core encircled by metal bands. The hub is made of wood, and provided with projecting ribs in which mortises for receiving the spokes are arranged. The spokes are properly tenoned to fit the mortises. Two metal rings are fitted over the ends of the hub, and provided, respectively, with flanges, which bear against the sides of the rib. Each flange has a lip with which it overlaps the edge of the rib. By means of screws or bolts the flanges are secured to the rib, and the rings thereby held in place. By means of these flanged plates the use of metal between the spokes is dispensed with, the spokes being allowed to come close together.

[OFFICIAL.]

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DESIGNS PATENTED.

5,734.—FRONT FOR GRATE.—J. Bryant, San Francisco, Cal.
5,735.—RADIATOR.—L. S. Daniels, Foxborough, Mass.
5,736.—SHAWLS.—J. Hodgson, Philadelphia, Pa.
5,737.—HYDRANT.—C. Seltman, Washington, D. C.
5,738.—BEER MUG.—C. Ballinger, Wilkins Township, Pa.
5,739 to 5,741.—TYPES.—H. Brehmer, Brooklyn, N. Y.
5,742.—GLASS WARE.—J. Bryce, Allegheny county, Pa.
5,743.—FENCE.—F. A. Fleming, Curwinsville, Pa.
5,744.—BEER MUG.—J. H. Hobbs, Wheeling, W. Va.
5,745.—LABEL.—T. K. Leslie, New York city.
5,746.—OIL CLOTH.—J. Meyer, Lansingburgh, N. Y.
5,747.—OIL CLOTH.—V. E. Meyer, Lyon's Farms, Elizabeth, N. J.
5,748.—CARPET.—F. Nowell, Milford, N. H.
5,749 and 5,750.—HEATING STOVES.—W. Sanford, New York city.
5,751.—BOW.—J. G. Wallace, Cincinnati, Ohio.

TRADE MARKS REGISTERED.

722.—LANTERN.—Chicago Manufacturing Company, Chicago, Ill.
723.—LIQUORS AND WINES.—Clarke & Schultze, New York city.
724.—SPOOL COTTON.—J. & P. Coats, Paisley, Scotland.
725.—OYSTERS, FISH, ETC.—S. H. Davis & Co., Detroit, Mich.
726.—TOILET PREPARATION.—S. S. Fitch & Co., New York city.
727.—VARNISH, OIL, AND NAPHTHA.—Forest City Varnish, Oil, and Naphtha Company, Cleveland, Ohio.
728.—MEDICINE.—S. Gilliland, Pittsburgh, Pa.
729.—METAL TOOLS, ETC.—G. W. Hallett & Company, West Meriden, Conn.
730.—JEWELRY.—Joslin, Palmer & Williams, Leominster, Mass.
731.—COPYING PRESSES.—A. Le Clercq, New York city.
732 and 733.—BADGES, ETC.—H. Taplin, Lowell, Mass.
734.—BLANK BOOKS.—J. E. Tilton & Co., Boston, Mass.
735.—CLOTHING.—Willoughby, Hill & Co., Boston, Mass., and Chicago, Ill.
736.—LAMP OIL.—Sharp & Craig, Princeton, Ind.

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:

20,728.—HAND DRILL.—H. H. Packer. June 12, 1872.
20,777.—RAILROAD CAR SEAT AND BERTH.—Z. Cobb. June 19, 1872.
21,059.—STEAM ENGINE.—H. and F. J. L. Blandy. July 17, 1872.
20,736.—FIRE AND BURGLAR PROOF SAFE.—T. Sharts. June 17, 1872.
20,920.—SPINNING FRAME.—A. Houghton. June 26, 1872.
20,960.—HEEL SHAVER.—V. Snell. July 3, 1872.
20,719.—HARVESTER.—W. F. Ketcham. June 12, 1872.

EXTENSIONS GRANTED.

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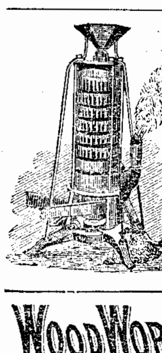

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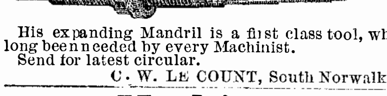

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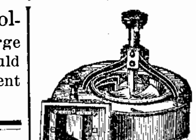

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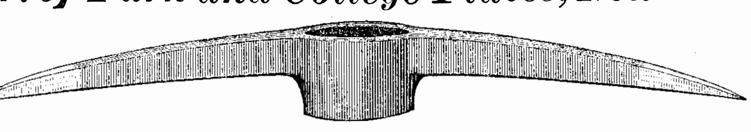

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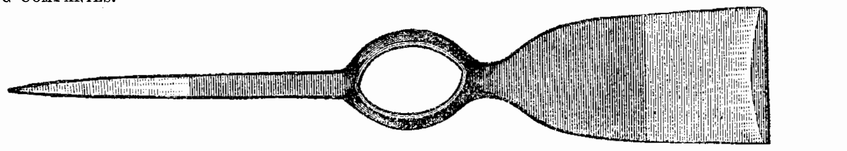

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