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Improved Machine for the Manufacture of Spoked Wheels.

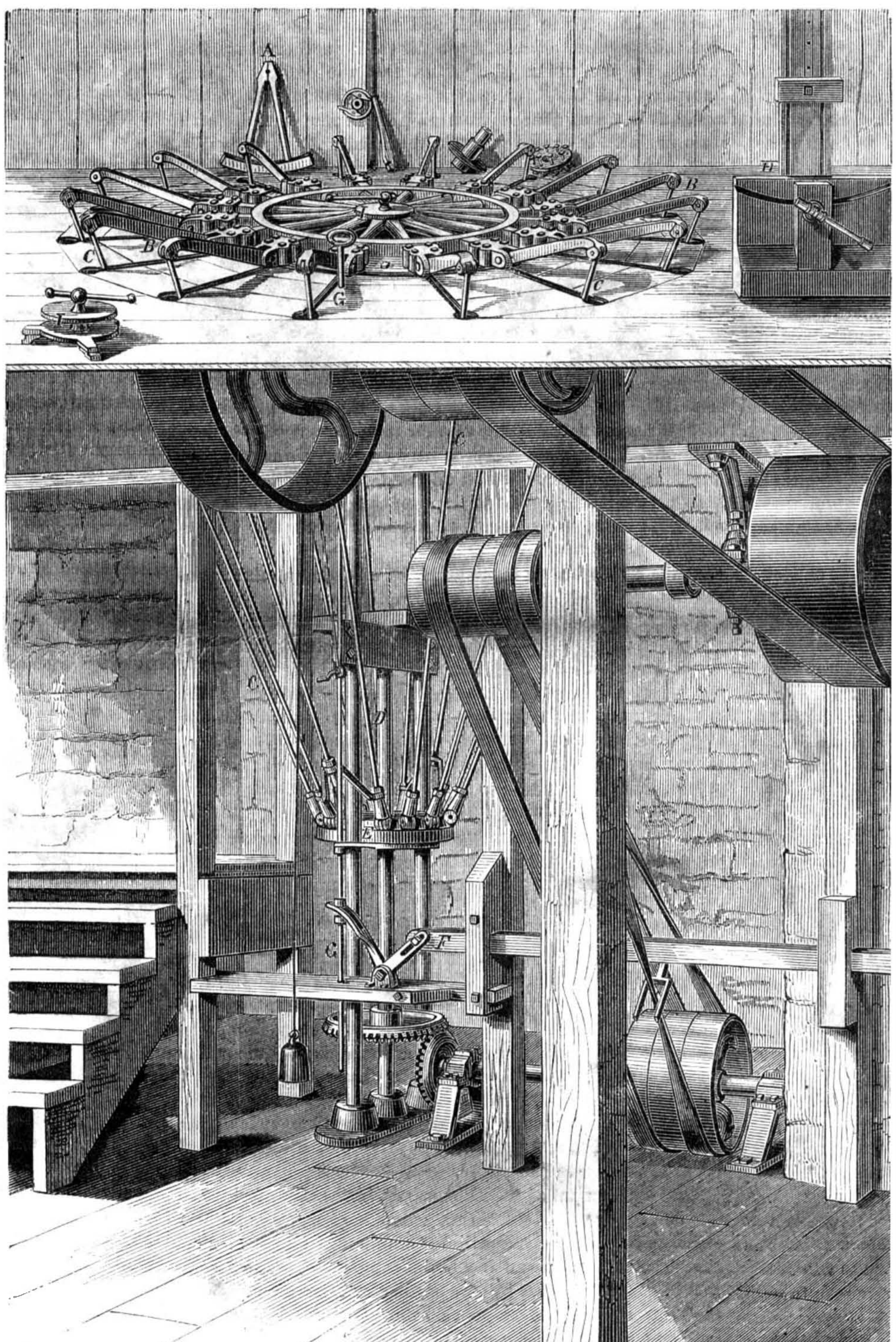
This machine is designed to facilitate and improve the manufacture of that class of spoked wheels used upon heavy vehicles, in which the nave ends of wooden spokes are secured between flat nave plates of metal, one of which has a hub in which the axle bearing is made, and between which the nave ends of the spokes formed, as shown at A in the engraving, are firmly clamped by screw bolts.

The machine acts to force into close contact the flat surfaces of the spokes at their inner ends, and thus compact them, so that their faces form true circular planes upon which the inner faces of the flanges rest.

It will be seen that the machine occupies space upon two consecutive floors. A strong circular plate of cast iron, about seven feet diameter, having its upper surface faced off true, is placed horizontally level with the floor of the shop. Arranged at equal distances around its outer edge, are a number of levers, B, equal to the number of spokes to be set in the wheel —sixteen in this case—having their fulcrums securely bolted to the plate. The long arms of the levers radiate from the plate, about three feet, all around; the short arms are formed into cams, or rolling inclines, or curved wedges, acting upon sliding pins of cast iron, which move freely in a radial direction, in guides formed in the fulcrum blocks. When the long arms of the levers are raised, the sliding pins may be easily pressed outwards until they bear upon the cam-shaped short arms of the levers at the point nearest the fulcrum or center of motion of the lever. When the long arms of the levers are lowered, their sliding pins are forced inwards by the cams, and unite in pressing inward the wheel properly placed in their embrace. The levers are all actuated with rapidity, uniformity, and certainty, by means of wrought-iron rods, C, extending downwards from the ends of the levers, converging to a vertical column, D, under the center of the plate, much as the braces of an umbrella extend downwards from the ribs to the stick. A screw is cut upon the central column, and a nut, E, answering to the slide upon an umbrella stick, raises or lowers all the levers at once, with great facility, and with any required power. Motion is given to the nut by means of beveled gears and a belt with fast and loose pulleys, so arranged that, at the upward and downward limits the belt is thrown automatically upon the loose pulley, and the motion of the nut and levers stopped. Any required motion, either up or down, within the range of the screw, can be obtained with great delicacy and convenience by a shipper, F, actuated by a shipping rod, G. The fellies and spokes, of seasoned second-growth oak, having been perfectly shaped and completely finished by machinery, are first put together by driving two spokes into a felly, one at a time, the felly being held firmly in a vise, H, specially constructed to prevent splitting of the felly or twisting of the spoke, so that a very good fit is obtained at this important point. Eight fellies, with their sixteen spokes, are then placed in the press, when the perfection of the fitting is shown by the perfect joint made by the spokes when they meet in the circle to be curved and embraced by the cast-iron hub; and by the coincidence of the half-holes in the contiguous sides of the spokes, A, which together form the holes for the eight bolts that are finally to hold the hub plates together.

Temporary hub plates, I—one above and one below—with a powerful screw in their center, hold the ends of all the spokes truly in the plane of the circular plate while undergoing the pressure of the levers. The extent of this pressure is ascertained by marking carefully with a sharp pencil around the circumference of the upper temporary hub plate, after the spokes have been brought to a close, firm joint; and then the pressure is put on till the joint of the fellies close up. Another similar mark being made upon the removal of the temporary hub plate, it is found that a space of a quarter of an inch is made between the two pencil marks—a reduction in diameter of half an inch. Now as the difference in circumference corresponding to a difference in diameter of half an inch, is 1·5708 inches, this, divided by 16 (the number of spokes), gives 0·098 of an inch, or substantially one tenth of an inch, as the lateral compression of each fellies. This is by no means the limit, but is probably sufficient to secure the spokes against being loosened by shrinkage in any climate.

The hubs are firmly bolted together while the wheel is in the press, and hold the spokes securely. The fellies spring apart a little, but only a little; and the tire easily makes that all firm again.



MACHINE FOR THE MANUFACTURE OF SPOKED WHEELS.

So great is the facility with which this machine is operated, that we are assured one man with an assistant easily puts together six sets—twelve fore wheels and twelve hind wheels —in six hours and forty minutes, including the time of adjusting machinery for the difference in diameter of the wheels. It is thought that the same machine would so compress wood as to make most admirable car wheels.

The great point in a wheel made in this manner is the thorough compactness of the hub-end of the spoke. The other end of the spoke receives scarcely less benefit. By observing an old wheel it will be seen that the spoke is bedded into the felly. This is done by degrees, and is unavoidable in wheels made in the usual way. The only way to keep the wheel together is to reset the tire so as to take up the looseness caused by this slow crushing process. By putting on a pressure of more than ten times the amount the wheel will ever be called upon to sustain in actual use, it is claimed that the spoke and felly are so compacted that if the tire is properly set, it will remain tight until worn out. The wheels are made by this method perfectly round and true. The pressure distributed about the rim can be varied from nothing to one hundred tuns, if required.

There are reasons why iron-hubbed wheels made in this manner should be far superior to wheels with wooden hubs. The spokes cannot crush into the hub, as they will do into wooden hubs, whether driven full size into a very large hub as was the practice fifty years since, or, as at present, into a smaller hub, the spokes having tenons and shoulders. With wooden hubs the spokes are weakened just where they need the greatest strength.

In the iron-hubbed wheel the spokes are more than twice as large as a wooden hub wheel of corresponding size. It is also claimed that a wheel made on this plan will not shrink, and that as the bases of the spokes are as firmly compressed against each other as it is possible for wood to be, and held by metallic flanges firmly bolted together, it is the most mechanical and perfect method of constructing wagon wheels for heavy work yet devised.

Iron-hubbed wheels are becoming very popular in many localities even when constructed in the comparatively imperfect manner employed before the application of this invention; and there is no doubt that the improvement resulting from the method described will tend to make them more generally popular than hitherto.

Patented, Dec. 28, 1869, by E. A. Archibald, of Methuen, Mass., whom address for State rights or manufactured wheels.

Polishing Granite.

Granite, after having been worked into form with heavy dumpy picks, and then with the hammer and chisel or diamond point, is first ground to a moderately smooth surface with a heavy iron plate fed with sharp sand or coarse emery and water, and put into reciprocal motion, or in turned works the granite is put in quick circular revolution against the rubber. Secondly, the work is smoothed with another iron plate and coarse flour emery. Thirdly, it is further advanced by wooden rubbers with fine flour emery, the rubbers being made the end way of the wood. Fourthly and lastly, crocus is used on thick felt laid on wood or metal. On account of the softness of the mica compared with the quartz and felspar, which together constitute the granite, the hard rubbers must be persevered in until near the conclusion, to keep the work flat, otherwise the mica is too quickly worn away, and leaves minute hollows. Sometimes lumps of granite are used as rubbers instead of the iron plates.

Granite, when worked by the lapidary, is slit and roughly ground in the common mode adopted both with carnelian and alabaster, namely, the slicer with diamond powder and the roughing or lead mill with coarse emery; afterwards it is found best to smooth it on a mahogany wheel with flour emery, and to polish it on the lead wheel with rottenstone; but it requires great care to prevent the soft mica from being unduly worn away.—*Byrne's Handbook for the Artisan, Mechanic, and Engineer.*

The Growth of Tree Trunks.

A paragraph has been round the scientific papers stating that a French naturalist has been measuring the tree-trunks in a forest, and found them all broader in the east-west than in the north-south direction; the cause of the unsymmetry, being ascribed, not very obviously, to the rotation of the earth. Well, another French arborist has been similarly gaging the trees in the neighborhood of Toulouse, and he finds that the greatest swelling of their trunks is towards the east-south-east point of the compass. The explanation offered by this second investigator is more philosophical than that of his predecessor. He refers the deformation to the early morning sun, which warms the easterly parts of the tree more suddenly than the rest, stimulates the flow of the sap, which grows sluggish during the cool of the night, and draws up the nourishing moisture from the soil in greater abundance on the excited side than on those portions of the trunk where the warming is more gradual and its effects less active. Naturally, increased vitality on one side, be it animal or plant, results in developments, or larger growth of that side. There are traditions of some plants turning their flowers toward the sun; the truth may be that the sun only promotes the growth of those blossoms upon which it sheds its direct warmth. As Dulong said, every degree of the thermometer entails a law of nature.

[For the Scientific American.]

COBALT--ITS PROPERTIES AND USES.

BY PROFESSOR CHARLES A. JOY.

In olden times the word cobalt was used to designate a whole group of worthless metals. The miners of those days were full of superstition and imagined that the genii of the mountains would resist all attempts to penetrate their mysteries, and hence they were supposed to throw all sorts of false ores and unripe metal in the way of the workman for the sake of discouraging them from their undertaking. The name of the mountain gnome or sprite was Kobold, and hence the miners called the worthless ore "Cobalt." The bright, shiny ore that vexed the workmen so much was at one time supposed to contain bismuth, and was very little used.

These are the first recorded notions, but there is little doubt that cobalt ores were used for coloring glass some thousands of years before, in Nineveh, Thebes, and Pompeii, as specimens found in those places resemble the beads and ornaments of modern times.

The first really authentic discovery of cobalt appears to have been made in 1735, by the Swedish chemist Brandt, who called it Cobalt King. Chemical analysis had not attained sufficient progress in that early day to enable any one to separate the constituents of ores with absolute certainty, and it was not until 1780 that the existence of cobalt was confirmed by Bergmann. It is a favorite idea on the part of some chemists that nickel and cobalt are one and the same thing, but this doctrine finds very few adherents, and for our purposes we shall regard it as an actual, tangible metal, with characteristic properties of its own. Cobalt is one of the metals found in the atmosphere of the sun, and in the materials that are of extra mundane origin. It usually occurs associated with nickel, arsenic, and sulphur, and is frequently an incidental product in the working of copper, bismuth, and nickel ores.

The best known minerals are smaltine, called also speiss cobalt, cobaltine, or glance cobalt, cobalt bloom, and earthy cobalt. The fact that some of the minerals contain arsenic has lead to applying the name cobalt to the black arsenic sold as a fly powder. It will be seen from the above list that this element is by no means so abundant as manganese or nickel, and in the event of its being required for certain purposes in the arts, it would be difficult to obta n it in large quantity.

There are several ways in which metallic cobalt can be prepared from its compounds, one of the earliest of which was from the oxalate. It is possible to reduce the oxide by heating two parts of the pure oxide of cobalt and one part of pure cream of tartar, for six hours, in a covered crucible lined with charcoal and at a temperature sufficient to melt steel. The regulus obtained in this way is exceedingly hard and brittle, has the color of bismuth, is magnetic, and has a specific gravity of 8·43. By re-melting in a clay crucible it can be freed from carbon, and it then has a silver-white color, specific gravity of 8·754, is softer than steel, very elastic, does not oxidize in air, nor after several days' immersion in water, and is as magnetic as iron. Becquerel found that by electrolysis a brilliant white metal goes to the negative electrode when the chloride of cobalt is first neutralized with ammonia. Prepared in this way it is quite pure, and is malleable and magnetic. By treating an aqueous solution of the chloride of cobalt with sodium amalgam, an amalgam of cobalt is formed from which the mercury can be expelled, and the cobalt obtained in the condition of a fine powder; it can afterwards be fused to a pure regulus.

The above are the chief methods for obtaining the pure metal, and we can now pass to the consideration of some of its properties.

The metal resembles steel, with a slight red tinge, is very hard, and is said by Deville to be more tenacious than iron. This latter property may hereafter give a value to wires made of cobalt where it is required to attain great strength in small compass. Arsenic and manganese render it brittle. Like pure iron it requires a very high heat to melt it, and the temperature of fusion appears to be between that of iron and gold. Its specific heat is 0·1096, and its density ranges between 8·513 and 8·7.

It is said to be magnetic when perfectly pure, and can be converted into a magnet by contact. At a very high temperature cobalt burns with a red flame yielding an oxide. Acids generally dissolve cobalt, nitric acid being especially adapted to this purpose. The metal decomposes water at a red heat, but not at ordinary temperatures. Plunged into fuming nitric acid, it is converted into the passive state, the same as iron, and the duration of this passive state is augmented by previously heating the metal.

Antimony and cobalt fused together evolve heat and light, and afford an iron-gray alloy. The alloy of cobalt and iron is exceedingly hard. Gold and cobalt yield a yellow and very fragile alloy.

The alloy of platinum and cobalt is fusible. Cobalt amalgam is white, like silver. Silver is rendered brittle by it. Alloys of lead and cobalt, and tin and cobalt, have been made, but possess little interest.

Many chemists suppose nickel to be an alloy of cobalt and some other metal. Fairbairn found that the tenacity of cast iron was greatly reduced by its mixture with nickel, and the same result is probable in the case of cobalt. Cobalt is said to reduce copper from solutions. Weiske found that cobalt was contained in nearly every brand of commercial iron he examined, sometimes to the extent of seven grammes in 100 pounds.

Finely divided metallic cobalt is soluble in a boiling solution of caustic potash, and yields a blue liquid, which is supposed to contain cobaltic acid. The finely divided cobalt for this purpose is prepared by heating an intimate mixture of pure oxide with ten to twelve per cent starch meal, or by reducing the oxide with hydrogen.

Cobalt contaminated with phosphorus has a different color from ordinary metal, and loses its luster in the air.

We can now speak of some of the compounds of cobalt that find application in the arts. The oxides and salts are distinguished for their beautiful colors—red, blue, yellow, green—hence they were early used for pigments.

If a little oxide of cobalt be added to melted glass, we obtain a mass, which, after cooling is intensely blue. When this is ground to powder it yields the well-known smalt that at one time was extensively employed by papermakers and in the laundry. The color is very fast, as it is not affected by the atmosphere or by acids or other liquids—and this fact afforded a method of detecting adulterations, as sand or pulverized glass, which was simply immersed in some coloring liquid, could easily be washed clean by an acid. Since the extensive and cheap manufacture of artificial ultramarine was established, the demand, and naturally the supply, of smalt, have greatly diminished. There is another blue color formed by the union of alumina and the oxide of cobalt, known as Thénard's blue, which has long been applied in the arts, but in consequence of its high price cannot compete with ultramarine. It can be prepared by mixing 8 parts freshly precipitated moist phosphate or arsenate of cobalt with 12 to 15 parts also freshly precipitated hydrate of alumina, and exposing, after drying, to a red heat. Thus produced it is a compact, insoluble mass, which can be ground to a fine blue powder. Rinmann's green, which is a compound of the oxides of zinc and cobalt, we described under the head of the compounds of zinc. It is a much-prized green pigment. A beautiful yellow color is produced by mixing the nitrite of potash with a solution of cobalt. A double nitrite of cobalt and potash is produced in the form of an insoluble yellow crystalline body, which is not only of value as a color but offers a remarkably delicate test for the presence of cobalt in solutions. This yellow has been used sparingly, on account of the expense, in aquarelle and oil painting.

By precipitating cobalt with phosphate of soda we have a red violet color, the shade of which varies according to the temperature at which it is prepared.

A fine cobalt brown is produced by calcining a mixture of sulphate of cobalt, ammonia, and iron.

Some of the salts of cobalt, when they contain water, are red, when they are anhydrous they appear blue. This property is made use of in what is called sympathetic ink. If we write with a dilute solution of chloride of cobalt on paper and allow the tracing to dry at ordinary temperatures, the letters will scarcely be visible. Upon the application of heat the writing becomes visible, with a blue color, or sometimes green if nickel be present. The color again disappears on the absorption of moisture.

A fine green color is produced by precipitating cobalt from its solutions by means of a mixture of prussic acid and potash, but the cost of production must prevent any extensive application of this color.

Since the discovery of photography the use of cobalt blue glass has greatly increased. It is an interesting fact in optics that blue glass permits all of the chemical rays of light to pass freely through it, while the yellow rays are intercepted. Pieces of blue glass are used to eliminate the yellow rays when the colors of flames are to be examined for the violet hue of potash, and in other cases of optical research.

The oxide of cobalt, prepared by precipitating the chloride with potassa, has been employed in rheumatism. It is emetic in the dose of 10 to 20 grains. The salts of cobalt are irritant poisons.

The employment of metallic cobalt in the manufacture of German silver would make that article too expensive for general use, but in small quantities it enters into alloys in association with nickel as an incidental component. The deposition of metallic cobalt by the battery can be accomplished the same as is now so extensively done with nickel, and this method is sometimes resorted to, to procure small quantities of the metal. Some of the salts of cobalt are of great value to the chemist in his laboratory, as affording delicate tests for the presence of other bodies.

One of the methods for the manufacture of oxygen gas from bleaching powders, is founded upon the somewhat obscure formation and subsequent decomposition of cobaltic acid. A very small quantity of a solution of cobalt suffices to evolve all of the oxygen from chloride of lime.

We have thus given the principal properties and uses of cobalt without attempting to exhaust the subject.

An Invention Wanted.

The *Herald of Health* says an instrument is very much needed to test the purity of the atmosphere, and the person who will invent and introduce such an article, which shall be simple and cheap, will not only enrich himself, but confer a great boon upon poorly ventilated humanity. We have the thermometer to tell us the temperature of the air, and we have the barometer to tell us the moisture of the air, but we have no means of cheaply and easily measuring the purity of the air. Such an apparatus is needed in every church, lecture room, and place of public gathering, and in every room occupied by human beings, either in public or in private. If people could *see* the amount of poison they were taking into their systems at every breath, they would be more careful to secure pure air to breathe. Such an invention is greatly needed, and the want will soon be supplied. Who will be the one to confer this blessing upon the race?

[For the Scientific American.]

PLATINIZED LOOKING-GLASSES.

BY C. WIDEMANN.

NO. II.

The glass being prepared by the usual method, is soaped, polished and cleansed. The Platinized Glass Works, at Wailly-sur-Aisne (France) where this new industry is carried on, possesses highly improved polishing tables, so much so that the polishing operation occupies only three hours. At the St. Gobain Works this operation requires a manipulation of 48 hours.

After the cleaning operation the glass is carried into the platinizing shop, and the composition giving the metallization is applied to the glass by means of a brush the plate is placed vertically and receives the platinizing liquid to a convenient thickness. It is first applied from bottom to top, then from left to right, and at last from right to left; by these means the oily coating is equalized. This composition, containing a large quantity of essence of lavender, spreads itself instant ly over the surface, drying slowly and without any running Great care must be taken to avoid all dampness and dust; dampness would crisp and wrinkle the surface, and the dust would destroy the regularity of the work, as every grain of dust absorbs liquids concentrically, and thus deprives the surrounding parts.

The platinizing composition needs nothing else to be perfect than great cleanliness on the part of the operator.

In making the platinizing liquid the following materials are used: 100 grammes carefully laminated platina in very thin sheets are taken. It is soaped in order to remove all the grease that might have accumulated during the laminating operation. It is then dissolved in an aqua-regia, composed of 400 grammes nitric acid for 1,000 grammes pure hydrochloric acid. It is heated by means of a sand bath to dryness, care being taken not to decompose the chloride by excessive heat. It is then crushed in a porcelain or glass mortar, and laid on a grinding glass plate, where it is mixed with small quantities at a time of essence of lavender (rectified) care being taken not to work at too high temperature or the reaction would take place on this glass plate. Having added about 1,400 grammes of essence of lavender, the mixture is collected in a porcelain dish and left to itself for eight days, without the least disturbance. The liquid is next decanted, filtered, and left again for six days, and this filtered liquid must then be about 5° at the acid test Baumé. For the above quantity, 25 grammes litharge and 25 grammes barate of lead are taken, and ground to an impalpable powder, with 8 to 10 grammes essence of lavender. This last mixture is then added and stirred with the platinizing liquid. It is then applied as above described, care being always taken to avoid dampness and dust.

As soon as the glass plate to be platinized has received the metallic coat and is sufficiently dry, it is placed in muffles, formed of a frame of cast iron, tongued and grooved, and the parts of which slide in each other.

The fire-place is placed at the back of the oven, which arrangement gives free access to the door, through which the glass is placed in the oven. Movable frames are placed in the cast-iron frame, and receive the glasses to be heated, maintaining them in a parallel and vertical position. Hooks, properly constructed, support a large number of these frames. Also, movable sheets allow glasses of different sizes to be placed in these frames.

The vertical and longitudinal section of the oven is a long parallellogram, and its cross-section is a square. The cooking is regular; and the accidents of fire are regulated by registers or iron gates in the posterior and anterior part of the oven. A series of muffles are placed under the dome.

The platinized mirror thus obtained is of great solidity, and no metal is more resistant to the influence of atmospheric agents. Even when a mirror is thrown into a great fire, at the temperature at which the glass melts, it will have retained its metallic surface. The mirrors do not give false tints to colored objects, as the common mercury alloy does.

The reflection being obtained by the anterior surface, there exists no double reflection; but what is still more remarkable is that the substitution of platina for tin and mercury is that it allows any kind of glass to be transformed into a mirror. The nitrous matter is polished on one face only, and having been submitted to the platinizing process reflects images without distortion from the surface of the metal itself.

Let us now come to the actual process in use; the following conditions had to be filled:

After having suppressed the use of mercury, the glass was to be perfectly colorless and deprived of every defect. The cost had to be reduced, or the old routine would not give place to progress. Not only has Dodé suppressed the use of mercury, but he has by his improvement been able to make better mirrors, for he hides by his process the faults in the glass plates, and obviates half the work of planing and polishing. In order to obtain this result it was necessary to apply the reflecting surface on the front of the glass-plate and not at the posterior surface.

A Flag for the national Capitol has been made in California of silk produced in the State, and it will soon be sent to Washington.

A PLEA FOR "OUR DUMB SLAVES."

Mr. Bergh, the President of the Association for the Prevention of Cruelty to Animals, recently made the following plea for the kind treatment of animals in an up-town church of this city.

He began by saying that he felt somewhat embarrassed at having to lecture in a place where the eloquent pastor had given, on the previous evening, one of the most touching sermons he had ever heard, but though his fare would be plain, the meat would not be diseased, the vegetables would not be stale, and the drink would not be swill milk. The opponents of our cause, said the speaker, go so far as to declare that certain living creatures are not animals.

One of the earliest acts of our society was the arrest of the captain and mate of a vessel from Florida, having on board a cargo of turtles lying on their backs, with their fins pierced with holes, and firmly secured by rope yarns. In this attitude, and deprived of nourishment and water, they had been confined for several weeks. This arrest, as well as the subsequent legal proceedings, were conducted by myself, and I distinctly remember the confidence with which the counsel for the defense announced his theory that the turtle is not an animal, and he asked for a dismissal of the complaint. The judge sustained the counsel's physiological idea, and consequently discharged the prisoners, who immediately commenced suit against me for false arrest, but as no malice was shown the plaintiffs lost their case. I at once dispatched a messenger to Prof. Agassiz, who, of course, refuted the preposterous assumption of the "no animal party." Here Mr. Bergh quoted from learned authorities touching the subject. The opinion of Des Cartes, that animals are mere breathing machines, is controverted at every step. Can they not be educated, and have they not the same passions and affections which exist in mankind? The half-reasoning elephant is not a machine. The cat shows both care and artifice in concealing her kittens. The hen which has been robbed of her eggs goes where she can lay in greater security. If the dog has no perception, how is he to distinguish a man from a hare or pheasant? The learned men of every age have accorded to many animals the power of communicating by language. Their idiom seems strange to us; so do the German, Greek, and Chinese until we have learned them. Oxen and cows will not fatten by themselves, and often they neglect the finest pastures not recommended by the charms of society. Dr. Reed defines instinct as a blind impulse to action, without deliberation or any end in view. Is the wonderful mechanism of the honey-comb mere blind impulse devoid of purpose? It has been said that nature follows a continuous and ascending chain from the mineral to the plant, and from the vegetable to the animal kingdom, the apex of which is crowned by the most perfect work of creation—Man—but I feel satisfied that this perfection is largely shared by the inferior animals. Cruelty to animals is a sin but little thought of by the majority of people; often, owing to the criminal selfishness of mankind, a characteristic which lies at the foundation of a greater part of the sins of this life. The effect produced by cruelty to animals is to demoralize the man who indulges in it. It blunts the finer feelings of the heart, and gradually hardens and depraves the whole character. In the history of nations we find that in their period of decline wild beast shows, in which animals were made to tear each other until the pavement of the arena was red with blood, formed the favorite pastimes of the masses. In the palmy days of Rome, the people loved to witness exhibitions of feats of arms, and contests of the athletes. By force and discipline they became famous for war and law, and, afterward, for refinement and letters; but when luxury came in, dissipation and effeminacy relaxed the better propensities, and when the nation was decaying, then it was that the Roman citizens demanded Indian elephants, and lions from Ethiopia, and bears from the Caucasus. The music which then best pleased a Roman audience was not the chants of those who sang of a nation's valor, but it was the yell of the dying slave that awoke the plaudits of the multitude. It has been the same in Spain, and so it is to-day in that semi-civilized land. When a nation delights in witnessing exhibitions of cruelty, its dissolution is near. He who torments a brute soon forgets to be kind to his own family or to his fellow men. Those who frequent the cock-pit or the prize-ring, are already on the road to the penitentiary and the gallows. A man who habitually abuses his dog or horse is unworthy of confidence. It is well known that the dog, the horse, and the ox weep. Yes! Smile not. I say weep. They have tears of despair as well as the beautiful gazelle. I have heard of a horse which accidentally trod on the foot of his groom, and seeing that he had fallen and fainted from the pain, the animal licked him and covered him with tears. Was this instinct? While I am speaking an effort is being made in the State Legislature to abolish our Society for the Prevention of Cruelty to Animals. The day after this bill is passed the Emblem of Mercy on the corner of Broadway and Fourth street, will be taken down, and then the revolting scenes of the past will be again reenacted. I beg of you as Christian people to protest against this inhuman movement which is about to be made.

In conclusion, my friends, suffer me to commend this subject to the serious consideration of you all, not alone as a religious duty, but because of the perfect personal happiness which the practice of protection to all defenseless dumb creatures secures. For my own part, I have sought and shared the ordinary employments of life in various parts of the world, under the most favored circumstances, but I declare that all these evanescent pleasures combined could never fill my soul with the pure contentment which possesses it, as I lie me down at night, after a day successfully passed in shielding these dumb companions and servants of our race from suffering and abuse.

Civilization will never be a reality until we shall have succeeded in subduing the semi-barbaric spirit which inflicts wanton cruelty on any harmless creature. Morality, public and private interest, and the sentiment of true religion, impose on us the duty of treating with kindness these docile and intelligent beings, which live, work, and die for us.

Something About Gold.

Gold is found sparingly in many hard rocks, such as granite, mica-slate, chlorite-slate, and clay-slate, and sometimes even in limestone and other similar rocks. It occurs far more abundantly in quartz, pure unmixed flint, or silex. In igneous or metamorphic rocks, the quartz usually occurs in veins, or in large, irregular bunches or lumps, with veins diverging from them. These veins are most commonly only a few feet wide, and for the most part traverse the rocks in a vertical or highly inclined position. Sometimes, however, veins or irregular masses occur many yards across in every direction; and sometimes, but very rarely, quartz is found in such abundance as to make what even might be called hills of itself. The gold is disseminated in this quartz, sometimes in such exceedingly minute particles as to be invisible, not only to the naked eye, but even to the eye aided by a powerful lens. Most commonly, the gold is seen as little yellow specks, flakes, or grains scattered through the quartz. When the quartz has a crystalline structure, which it often has, little nests of gold, likewise crystalline, may be seen embedded between the interlacing crystals of the quartz. Where the interstices in the quartz are large, these are sometimes entirely filled up with gold; but not unfrequently irregular holes and crevices seem to have been formed in the quartz by decomposition or rottenness, which have sometimes been subsequently filled with gold. In these cases, the gold assumes irregular forms, such as melted lead will when poured into water—forms which have given people the idea of the gold having been deposited in a state of fusion, a notion in all probability utterly unfounded. How the gold got in the quartz, is a point at present so uncertain, that no man of science would take upon himself the responsibility of answering the question. The size of the irregular lumps thus entangled in the quartz varies greatly, the largest hitherto known single lump in the world being an Australian one of 2,166 ounces weight. It is, however, usually found in small flakes, grains, and dentritic strings, weighing only a few grains.

Whenever the moving waters of the sea, by which drift-materials were formed and deposited and attacked rock containing gold, it would of course break off lumps of it, just as of any other rock, and equally wash, roll, and knock it about, and thus break it into smaller fragments round it into pebbles, and grind it into sand. In this way, much of the gold would be knocked out of the rock, and much water-worn gold accumulated, or water-worn fragments of gold and quartz together.

From this point of time, however, there is a remarkable difference observable in the action of the water on the gold, and on the rock which contains no gold. All kinds of rock, or earth, or stone, at all events all the common kinds, are pretty nearly of the same specific gravity—that is to say, of the same weight, bulk for bulk. Chalk, clay, limestone, compact sandstone, granite, marble, basalt, have all specific gravities varying from 2 to 3—that is, they are twice or thrice the weight of their bulk of water. Pure gold has a specific gravity of 19, or is nineteen times as heavy as its bulk of water; and the most impure ore of gold that occurs in nature has at least a specific gravity of 12 to 15. Gold is about six or seven times as heavy as quartz, or any other stone it is likely to be associated with. The consequence of this is, that moving water has at least seven times less power over it—less power to move it along, either suspended in the water or rolling along its bed. When the drift, therefore, was formed, vast quantities of stone might be removed to great distances, while the gold was left behind, not far from its native site. All the large lumps of gold will certainly be but little removed, as also all the large lumps of quartz, heavily freighted with gold. Grains of gold and small lumps may be carried further, while scale-gold and fine dust, especially if flat and thin, may be carried to very considerable distances.—*Morgan's British Trade Journal.*

Extracting Juice from Sugar-Cane, Beetroot, etc.

M. Julius Robert Scelowitz has discovered a new method of obtaining the juice from such substances as sugar-cane. The process is one of diffusion. The cane, or substance from which the juice is to be extracted, is cut into slices by a special machine. It is then put into a so-called battery of diffusion vessels, consisting of a series of closed water-tight tanks, and is brought into contact with water at an elevated temperature, in a certain succession and systematic order, which is requisite for complete extraction, and for the proper concentration of the juice obtained. Another application is also described, the main feature of which consists in carrying out the whole process of diffusion in one single vessel, or diffuser, in which the extraction of the sugar is carried on continuously by introducing slices of cane through a feeding apparatus at the bottom of the vessel, from which they rise slowly to the top, while fresh water is constantly running in at the top of the diffusion vessel, and is drawn off at the bottom as diffusion juice, after having remained in contact with the slices for a sufficient length of time. The liquid during this operation is agitated by machinery. Could not this principle be applied on a small scale for domestic uses, as in the making of such drinks as lemonade?

Size of Mortar Joints in Brickwork.

This subject may be considered in a variety of ways. First, if we consider that the strength and capability of sustaining weight will be increased by having thicker mortar joints than those commonly made, then it would appear probable that a building erected with mortar walls and without any bricks, would be of still greater strength; but we know that the mortar usually used would stand no such test. It therefore seems probable that thin joints would be preferable. But it may now occur to us—then, why have joints of any thickness; or why should they be of a certain thickness, and neither less nor more? This will lead us to consider the properties of mortar, and the duties it actually performs in brickwork, and to endeavor to discover how we can cause it to most effectually perform those duties.

Respecting its properties, it would be unsafe to consider that mortar is generally capable of bearing the compressile power that brick will bear, therefore the less of it we can manage with the better; but as thin, flattish pebbles will pass through a fine sieve, and may chance to lodge on edge when in a mortar joint, such would in too thin a joint cause the brick above it to ride, and the extra thinness of such joint would consequently be an element of instability instead of strength.

The duties mortar has to perform may be considered principally as two; viz., first, to be the means by which each successive course of bricks may be solidly bedded; secondly, to be the agent which shall enable each brick to bond with those beneath it.

We have already seen that it would generally be inadvisable to have thick joints, on account of any imaginary compressible superiority of the mortar over brick; we shall now see that joints as thin as they can with safety be made will also generally be desirable, when considered in their action, as the means by which "bond" is effected, for bond is the tying, as it were, of bricks by one or more bricks laid across and uniting them, and which is effected by means of the mortar placed between them, which, filling the inequalities of the bricks so placed, will, with a sufficient weight on the upper course, be the means of preventing the bricks in the under course from being dragged apart.

Then to consider whether thick or thin joints will more effectually achieve the bonding, let us consider the action of two stretchers bonding (in English bond) three "headers." If the joint in such case be made thin—say $\frac{1}{4}$ in. thick—then as the stretchers would bear $2\frac{1}{4}$ in. on each of the two outer "headers," and the bonding connection between them would be the mortar under each end of the stretchers, and in each case being in sectional area (taken parallel to the face of the wall) equal $2\frac{1}{4}$ in, by $\frac{1}{4}$ in.; then such would in the tearing asunder of the two outer "headers" be subjected to a compressile strain acting in a direction (nearly or quite) identical with a diagonal to the said area. Now, if we were to increase the thickness of our joint, then the length of the diagonal would also increase, and would consequently be unlikely to resist so great a strain as the shorter one, for the same reason that a long column will generally bear less pressure than a short one of equal diameter; also the angle of inclination of the shorter diagonal, being less than that of the longer, would give it an advantage over the latter.

But let us yet consider it in another way: If a $\frac{1}{2}$-in. joint be stronger than a $\frac{1}{4}$-in. ditto, then why not a 1-in. also stronger than a $\frac{1}{2}$-in., and a 2-in. than a 1-in., a 4-in. than a 2-in., an 8-in. than a 4-in., and so on? Let us consider an 8-in. joint, then our old sectional area of $2\frac{1}{4}$ in. by $\frac{1}{4}$ in. will become 8 in. by $2\frac{1}{4}$ in., the 8 in. being its hight, and consequently the mortar connecting the ends of the "stretchers" with the "headers" will be easily cracked; and the "bond," in this case, show itself to be no bond in reality, as the strain would here be a tensile one, and which mortar would be unlikely to bear.

And, again, if thick mortar joints be the element of strength, why should voussoirs, or arch-bricks, be cut, or rubbed for the sake of strength? or, better still, why not have, as before, joints of, say 8 in. in thickness, or to gain the utmost strength arches of mortar altogether, no bricks being used?—*London Builder.*

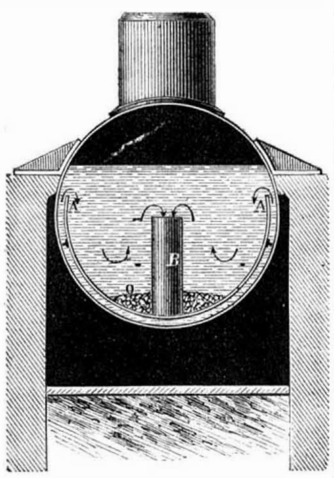
NEW METHOD OF OBTAINING GELATIN.—Crude animal substances, such as the flesh, fat, skin, tendons, bones, etc., either with or without a previous treatment with lime, are treated with benzine, or some other similar hydrocarbon, in a vessel provided with a condensing apparatus for saving any vaporised benzine, or in a closed vessel at an elevated temperature. After a few hours' digestion, the hydrocarbon solution of the fats and oils is drawn off, and may be treated by any of the well-known methods for recovering the volatile hydrocarbon, which may be again used in subsequent operations. The oils and fats are saved and utilized. The animal matters, or purified glue-stock, is now ready for conversion into gelatin by heating with water in the ordinary way.

M. LESSEPS announces that the minimum depth of the Suez Canal is nineteen feet, and that this is over the rock at Serapeum. The rock is to be removed shortly, and then the minimum depth will be at a spot near Suez. It will range from twenty-three feet to twenty-seven feet, according to the hight of the sea.

THE Royal Danish Society of Science, among other prizes, has offered one amounting to $170 for the best essay containing an investigation of the movement of the air in a system of ventilation. The essay may be written in English, French, German, Danish, or Swedish, and must be handed in before October, 1870.

Mud Collectors for Boilers.

We give below a sketch of an arrangement for preventing the incrustation of boilers, designed by Herr Popper, and which was applied rather more than a year ago to a boiler at the machine shop of Herr. G. Sigl, of Vienna, and with good results. Herr Popper's arrangement, which is shown in the sketch as applied to a plain cylindrical boiler, consists of long strips of sheet iron, about twelve inches in width, which are introduced through the man-hole into the boiler and there united, so as to form a half cylinder placed parallel to the lower half of the boiler. This half cylinder is kept in place and supported at a certain distance from the boiler shell, by projections on its exterior. Sigl's boiler, to which the apparatus was applied, is four feet six inches in diameter, and the space in this case between the half cylinder and the external shell was an inch and a quarter at the sides, and two inches and a half at the bottom, the upper edges of the half cylinder being on the level of the low-water line. So far the apparatus does not differ greatly from several arrangements of screen plates for increasing the circulation which have been applied to boilers in many instances, both in this country and on the Continent, during the past few years; but, on referring to the annexed section, it will be seen that Herr Popper attaches to the half cylinder a series of central pipes, through which a downward current can flow to the bottom of the boiler, as shown by the arrows. These pipes, which are made of sheet iron, are, in Sigl's boiler, 5 inches in diameter, and are placed about 24 inches apart from center to center; but it appears to us that the number of these tubes might be increased with advantage, particularly towards that end of the boiler which is exposed to the greatest heat. Around the pipes just mentioned, and filling the lower part of the half cylinder for a depth of eight or nine inches, are placed a number of pebbles, about the size of an egg, these pebbles not only serving to keep the whole apparatus in place, but being also found to perform the functions of taking up the deposits from the water. The trials of Herr Popper's arrangements at Herr Sigl's works have, so far as we have heard, proved very satisfactory, it being stated that the internal surfaces are kept quite clear of scale, and the whole of the matters forming incrustation being deposited on the internal surface of the half cylinder and among the pebbles, the water in the interstices between these latter being always in a quiet state. Where plain cylindrical boilers heated by waste gases, or other means, are in use, it appears to us that the arrangement we have described is worthy of a trial; and we shall be glad to hear of the results of its working in the event of its being applied in this country. In conclusion, we may state that we have been informed that Herr Popper intends applying a similar arrangement to Cornish, marine, and locomotive boilers; but we must confess that we do not at present see how such an apparatus can be advantageously applied in these cases.—*Engineering.*



A Misunderstanding.

The antagonism between capital and labor, like that between religion and science, is more talked about than understood. Its basis is the simple fact that it is to the interest of the employer to purchase labor as cheaply as possible, and of the employé to sell it for as high a price as he can get. But the interests do not present the degree of antagonism implied by the general statement; for, whereas, that of the employer lies distinctly and unqualifiedly upon the side of cheap labor, that of the employé is not to a like extent upon the side of high wages.

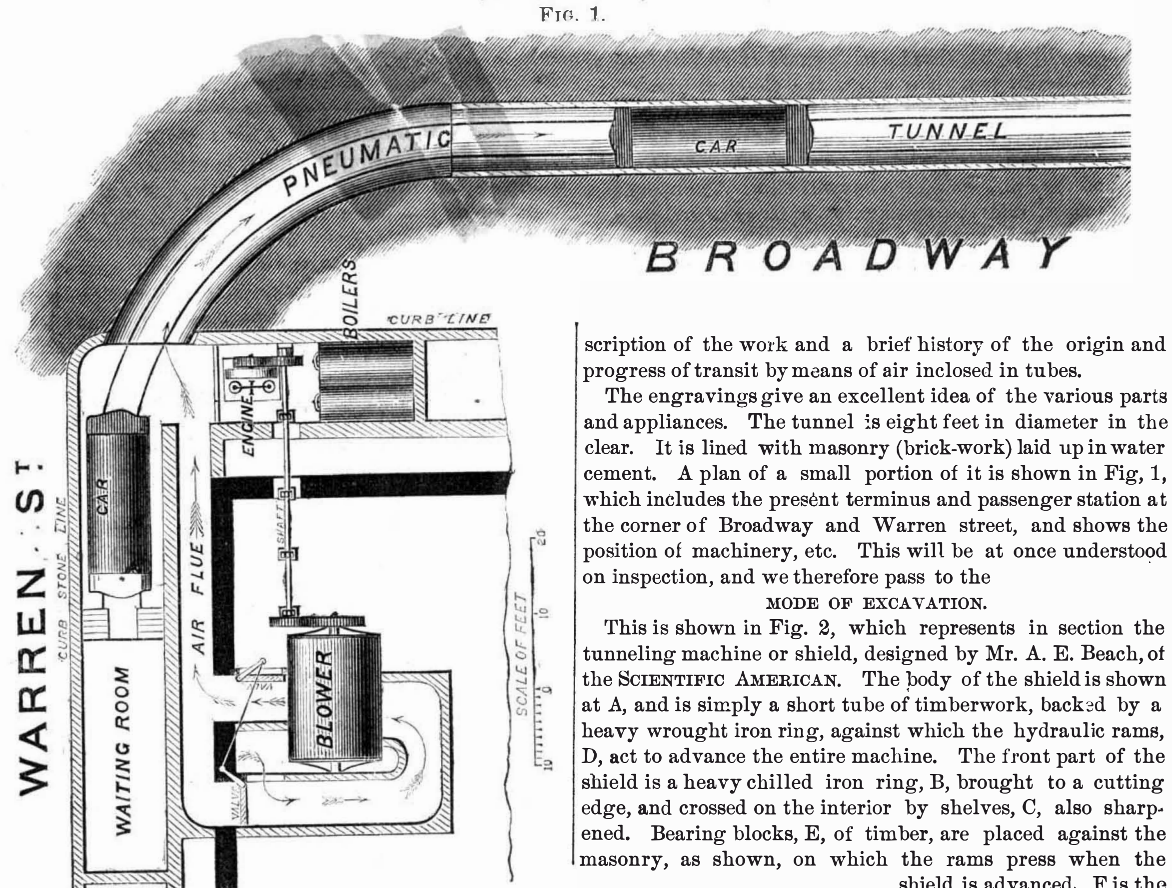
A lower rate of wages tends to develop industries and originate enterprise quite impossible to either start or maintain with the higher rates. This widens the field of labor, and, by making cheap the articles produced, goes far toward compensating the laborer for his direct loss in actual salary.

So, a reduction of wages, though an immediate injury to the individual employé, is eventually a benefit to the community—a benefit of which he as a part of the community gets his share. These truths are ignored by workingmen.

THE PNEUMATIC TUNNEL UNDER BROADWAY, N. Y.

We give this week illustrations of this remarkable work, which, with a brief description of the details of construction and mode of operation, will give the general reader a good understanding of the nature of this mode of transit. Having fully set forth the benefits to be derived from it in a previous article, we shall confine ourselves at present entirely to a description of the work and a brief history of the origin and progress of transit by means of air inclosed in tubes.

FIG. 1.

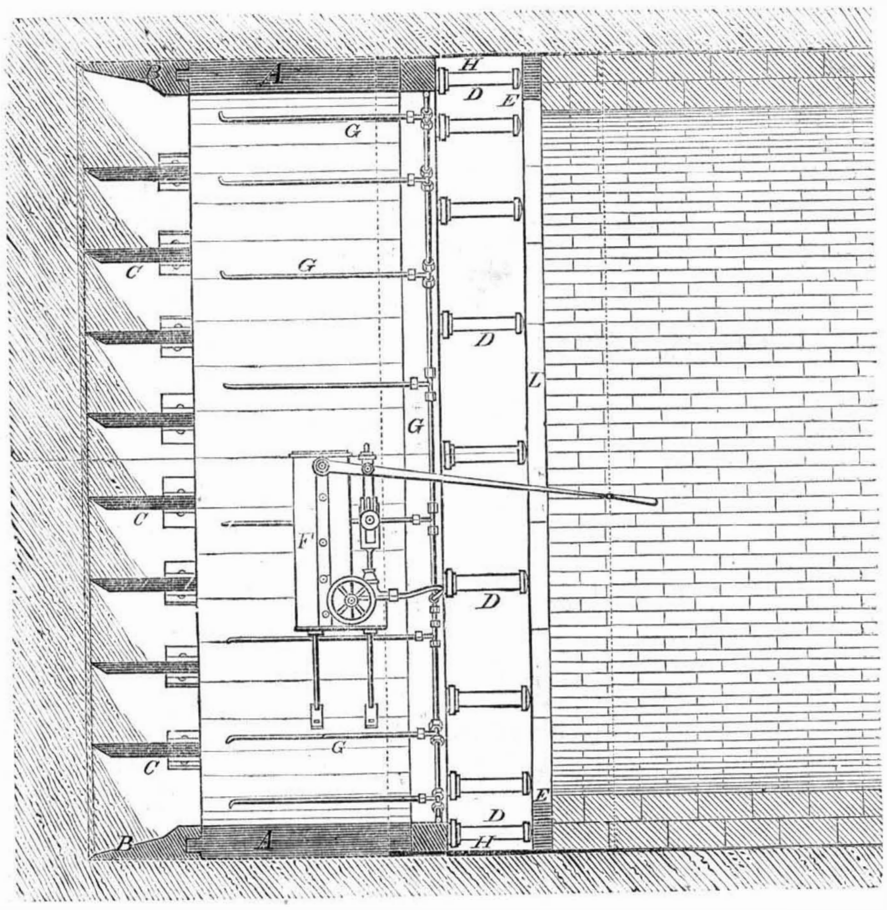


The engravings give an excellent idea of the various parts and appliances. The tunnel is eight feet in diameter in the clear. It is lined with masonry (brick-work) laid up in water cement. A plan of a small portion of it is shown in Fig, 1, which includes the present terminus and passenger station at the corner of Broadway and Warren street, and shows the position of machinery, etc. This will be at once understood on inspection, and we therefore pass to the

MODE OF EXCAVATION.

This is shown in Fig. 2, which represents in section the tunneling machine or shield, designed by Mr. A. E. Beach, of the SCIENTIFIC AMERICAN. The body of the shield is shown at A, and is simply a short tube of timberwork, backed by a heavy wrought iron ring, against which the hydraulic rams, D, act to advance the entire machine. The front part of the shield is a heavy chilled iron ring, B, brought to a cutting edge, and crossed on the interior by shelves, C, also sharpened. Bearing blocks, E, of timber, are placed against the masonry, as shown, on which the rams press when the shield is advanced. F is the pump from which the water is carried to the rams by the pipes G. H is a hood of thin sheet steel within which the masonry is built, in rings of 16 inches length, the bricks interlocked.

FIG. 2.



The operation of this machine is as follows: The pump is worked by one man, and the rams press with a force of 126 tuns against the end of the masonry. This forces the cutting edge and the shelves into the earth to a distance corresponding to the length of stroke in the hydraulic cylinders and the earth being removed the masonry is again advanced, and so on step by step.

Whenever it is desired to alter the course of the shield, it is done by turning cocks in the pipes which lead from the pumps to the rams, on that side which is not to be advanced. The rams then acting upon the opposite side advance it, thus changing the course of the shield. In this way the machine may be guided with the utmost exactness.

The soil through which the tunnel is advancing is of a loose sandy character. Stones are, however, occasionally met with, and of course must be drilled and split out. The hydraulic rams were furnished by E. Lyon, 470 Grand street, New York. We shall refer to them again.

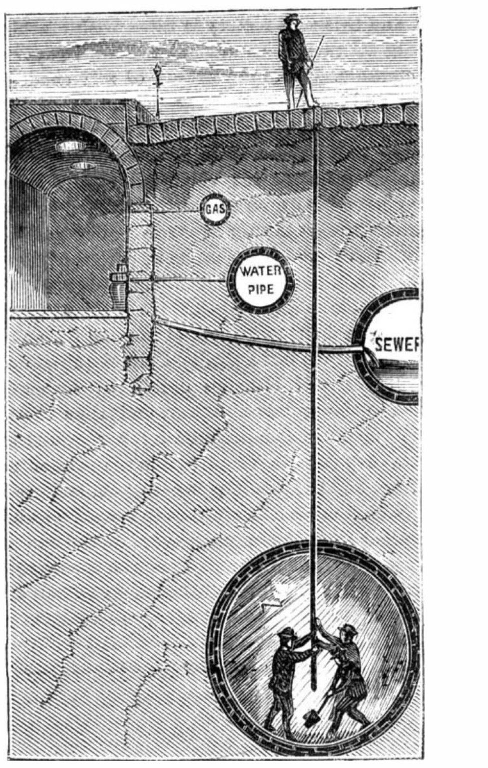
The method of testing the position at night is shown in Fig. 3. This is done by driving up from the center of the tunnel a tube in sections until it reaches the surface, by which the position of the shield is accurately determined. It is generally done at night because the street is then vacant.

A WAY STATION, is shown in Fig. 4. It will be seen that these stations are not to be damp and dimly lighted cellars, but commo-

FIG. 4

dious, airy, and comfortable apartments, wherein passengers may await the arrival of a car with as little inconvenience as they could in the best steam railway stations, and without any of the annoyances that attend the waiting for street cars at street corners.

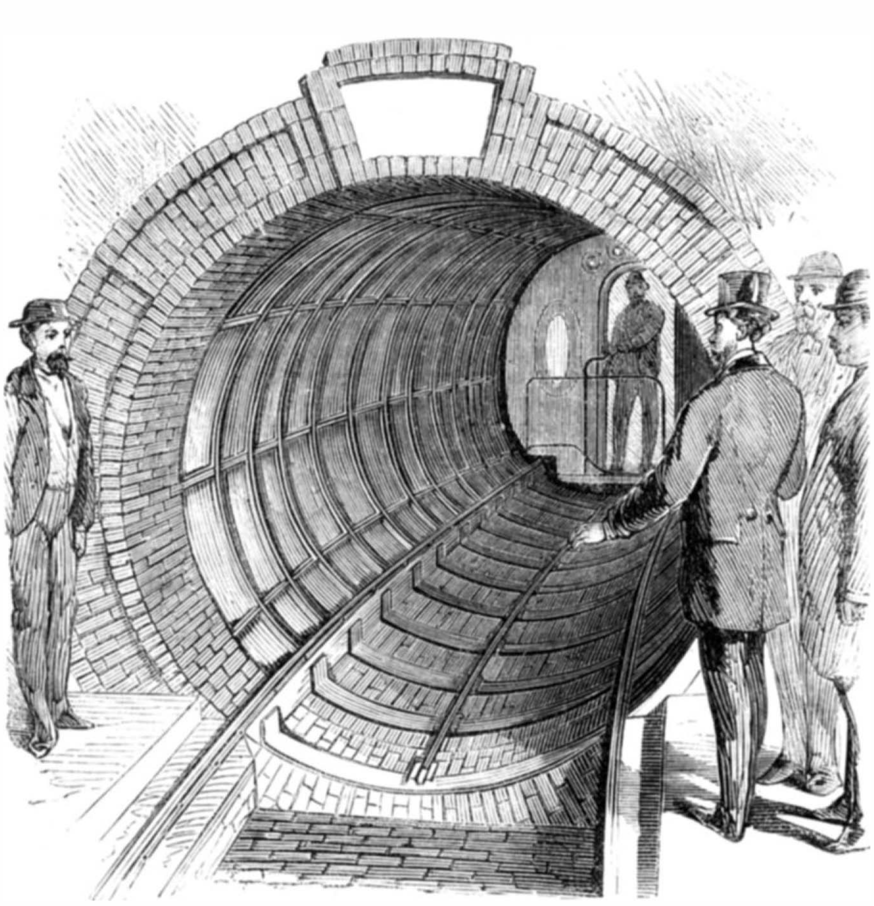
FIG. 3.



THE TUNNEL AND WAITING STATION.

The portal of the tunnel, shown in Fig. 5, is a massive ornamental structure, of circular form, nine feet in diameter, its bed twenty-one and a half feet below the surface of Broadway. The mouth of the tunnel opens directly into a large

FIG. 5.



underground apartment, one hundred and twenty feet in length, fitted up in good style, for the purposes of a waiting and reception station. This apartment is lighted from the pavement, and occupies the entire space under the Warren street sidewalk.

THE PNEUMATIC CAR.

Fig. 6 is a sketch of the interior of the passenger car used in the present tunnel. It is of circular form, richly upholstered, and very comfortable, with seats for eighteen persons. Its interior hight is greater than the cars of the London underground railways. When the pneumatic tunnel is further extended, luxurious cars, 100 feet in length, will be used. The car is brilliantly illuminated by means of a single zircon light.

THE MODE OF PROPULSION

is one of the most simple things imaginable. Air is forced into the tunnel by a gigantic blowing engine made by P. H. & F. M. Roots, of Connersville, Ind., a section of which is shown in Fig. 7. This blower is actuated by a steam engine of 100-horse power, and is calculated to deliver when worked at maximum speed, a volume of 100,000 cubic feet of air per minute. A pressure of one fourth of one pound to the square inch would be an aggregate of three-fourths of a tun on the end of the car, far more than required for propulsion.

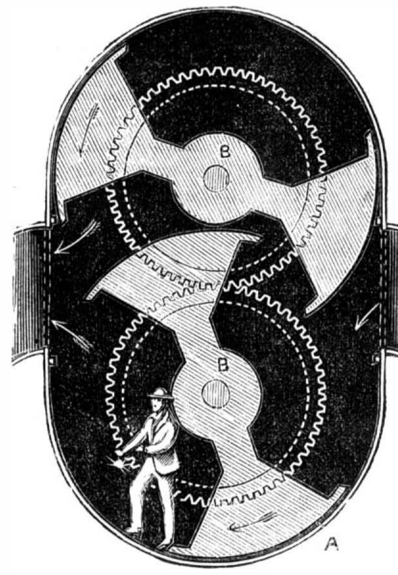
The blowing engine is positive in its action, pressing the air into the tunnel in the direction shown by the arrows on the ground plan, Fig. 1. When the air current is reversed a partial vacuum is produced in the tunnel, and the pressure of the atmosphere then propels the car in an opposite direction.

THE SCOPE OF THE WORK.

The tunnel will when completed, extend from the Battery to the Harlem river.

The tunnel starts from the east end of the reception room,

FIG 7

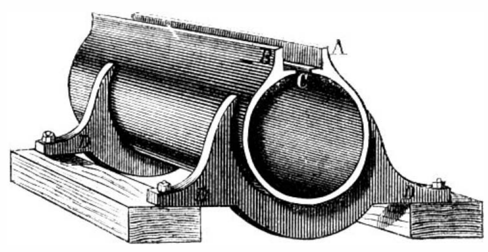


corner of Warren street and Broadway, and extends on a curve to the center of Broadway, thence in a straight line down to a point a little beyond Murray street, where the shield, or tunneling machine now rests. The excavations have been temporarily suspended, for the purpose of affording the press and public an opportunity to examine the works, and witness the operations of the machinery. Mr. Joseph Dixon is the superintendent of the works.

SKETCH OF THE HISTORY OF THE SYSTEM OF PNEUMATIC TRANSIT.

In 1824, John Vallance took out a patent in England for a method of propelling carriages through tubes by atmospheric pressure, and in 1826 he had a car running on this plan. This attempt was succeeded by similar efforts by Messrs. Medhurst and Pinkus. The plan adopted by these gentlemen was the propulsion of the cars by means of a piston

FIG. 8.

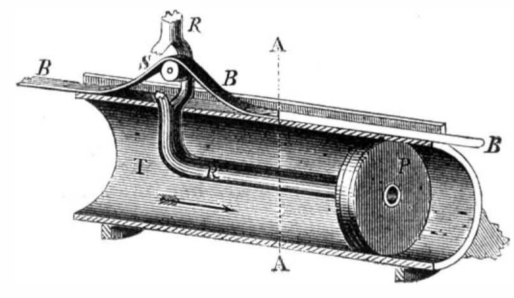


running in a slotted tube; an arm projecting through the slot, forming the point of attachment for the cars, and an endless band closing the slot both before and after the arm as shown in Figs. 8 and 9. The air was in this method exhausted from the tube in front of the piston. This propulsion of cars was successfully performed in this way, but the system is not at present in use.

Vallance's system was again put in operation in 1861, by T. W. Rammell, in London, on a small scale, for carrying letters and packages, where pneumatic tubes, 2½ miles long, and 3 feet in width, have been operated with success for the past seven years.

In 1864 a large tunnel for passenger cars was erected at Sydenham, ¼ of a mile long, and thousands of passengers

FIG. 9.



were transported. This resulted in the incorporation of the Waterton and Whitehall Railway, which is to extend from Charing Cross under the Thames to the Southwestern Railway. It is not yet completed.

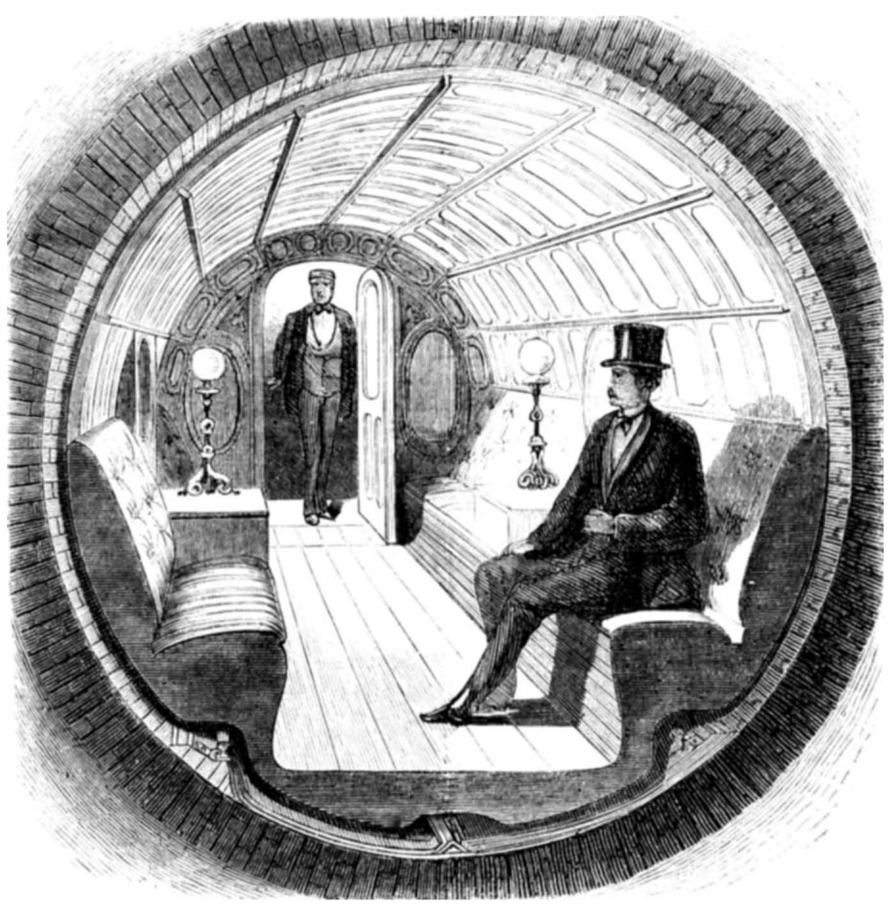
Opening of the Broadway Tunnel to the Public.

The doors of the Beach Pneumatic Transit Company were thrown open to the public for the first time on the 26th ult., when an "Under Broadway Reception" was given, by special invitation to the State authorities, city officials, and members of the press. All the prominent personages of the city and State were present, and the inspection of the works gave the greatest satisfaction. The various daily newspapers have published long accounts of the event, which has produced quite a novel sensation in the metropolis.

The New York *Herald* says "it was virtually the opening day of the first underground railway in America."

The New York *Times* says: "Certainly the most novel, if not the most successful, enterprise that New York has seen for many a day is the pneumatic tunnel under Broadway. A myth, or a humbug, it has hitherto been called by everybody

FIG. 6.



who has been excluded from its interior; but hereafter the incredulous public can have the opportunity of examining the undertaking and judging of its merits.

"Yesterday the tunnel was thrown open to the inspection of visitors for the first time and it must be said that every one of them came away surprised and gratified. Such as expected to find a dismal cavernous retreat under Broadway, opened their eyes at the elegant reception room, the light, airy tunnel, and the general appearance of taste and comfort in all the apartments; and those who entered to pick out some scientific flaw in the project, were silenced by the completeness of the machinery, the solidity of the work, and the safety of the running apparatus."

The *Evening Mail* says: "The problem of tunneling Broadway has been solved. There is no mistake about it. Even as we write, a comfortable passenger car is running smoothly and safely between Warren and Murray streets, demonstrating, beyond contradiction, that it is only a question of time and money to give us rapid and comfortable transportation from the Battery to Harlem river."

The Company has temporarily suspended operations on the tunnel in order to give the public an opportunity to examine their works, which are now open for inspection. The entrance is at 260 Broadway, cor. Warren st., directly opposite the City Hall. The ladies of the Union Home for the Orphans of Sol.

diers and Sailors, a most deserving charity, are in possession of the doors, and receive the proceeds of the admission fee, 25 cents.

The Louisville Railroad Bridge.

The great bridge over the Ohio river at Louisville wa formally opened to travel on the 18th. By this bridge three great and distinct systems of railways are directly connected.

1st. As Louisville is almost directly on the line between Pensacola or Mobile and Chicago, this bridge completes the direct north-and-south all-rail route.

2d. It furnishes the missing link in the connection between Memphis, New Orleans, and points in the lower Mississippi Valley and in Texas, with New York, Boston, Washington, Baltimore, and the principal cities in the Northeastern States, forming a continuous and unbroken line between the South-west and Northeast.

3d. It forms the last link in the chain of roads connecting Savannah, Charleston, Wilmington, Norfolk, and the principal cities in the southeast, with St. Louis, Quincy, Burlington, Rock Island, and the lines starting from points on the upper Mississippi river and penetrating the Far West to the Pacific—making Louisville the central point on the line of unbroken rail route between the Southwest and Northwest.

On the first day of August, 1867, the first stone was laid, with imposing ceremonies, by Mr. W. B. Hamilton, President of the Bridge Company.

The canal draw was delivered in June, 1868, and swung on the 3d of July following. The succeeding spans were put in place as fast as the masonry was ready. The last span was put together and swung on its pier bearings February 1, 1870. Several days were required to change the gage of the track, and on the evening of February 12, the first train, consisting of an engine and twenty-four flat cars, passed over.

The track connecting the Louisville and Nashville Railroad with the bridge, leaves the yard of the depot, north of the engine house near Tenth street, and entering Maple street follows that street to Fourteenth, thence down Fourteenth to Portland avenue, and thence to High street on a prolongation of the line of Fourteenth street, and thence curving to the right, crosses the river at right angles to the direction of the current, striking the Indiana shore at a point fifteen hundred feet below Smith & Smyser's mill. From there the line continues in the same direction in which it crossed the river until it strikes the dirt road between New Albany and Jeffersonville. Thence curving to the right, it enters Ninth street, Jeffersonville, and continues along that street to the depot of the Jeffersonville, Madison, and Indianapolis Railroad. The total length of the bridge proper is five thousand two hundred and ninety-nine feet.

The bridge, when entirely finished, will have foot walks four feet wide on each side, with hand railings. It has a single line of track, and is so arranged that, if desirable, the space of twenty feet six inches between the foot walks may be floored and used for the accommodation of carriages when not occupied for railroad purposes.

A Good Word for the Mole.—Some interesting experiments have recently been made in the grounds attached to the school of Saint Remy, France, as to the useful qualities of the common mole. On the 23d of July a mole was placed in a piece of shrubbery, and was given wornils and grubs for food. In four days he ate 432 wornils and 250 grubs. Another mole was placed on the 7th of August in a large wooden box, and in 12 days he ate 540 grubs and 872 wornils. From time to time vegetable matter, such as was believed to be his usual food, was placed before him, but he never touched it except to make his bed upon it. A third, which had lost a foot in a trap, ate 150 wornils on the first day. It is now argued, from the results of these experiments, that the devastations in the soil committed by the mole are more than counterbalanced by his destruction of noxious insects.

Tanned Cotton Cloth.—The Paris *Cosmos* states that cotton fabrics have been treated with a solution of tannin in the same manner as hides are in the manufacture of leather, and that the cotton thereby acquires greater strength, and better resists moisture and disintegrating effects. The *Cosmos* does not attempt to explain the chemical reaction which produces this important change. We suspect the change cannot be great, since it has escaped the notice of practical tanners. Those who are accustomed to wearing cotton clothes often saturated with tan-liquor, as well as similar clothing untouched by tannin, would not be long in detecting and making known a new virtue in their favorite solution.

Waterproof Garments.—At present in the use of waterproof garments great inconvenience is experienced from the want of escape of the natural moisture exuded from the body. A method of obviating this has been patented in England. The inventors apply to waterproof garments a series of elastic tubes of vulcanized india-rubber, or other material of sufficient thickness and strength to resist any ordinary compression, but still of sufficient elasticity to yield freely to the movements of the wearer. These tubes are attached to the interior of garments by strips or bands coated with adhesive solution; by this means they assert that a free circulation of air under the garment is obtained.

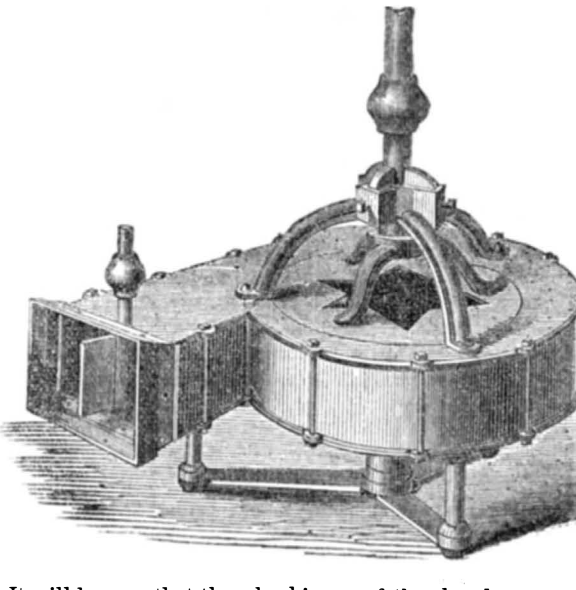
Vine Pests.—Many of the vineyards in France and Italy have been attacked this year by a grub which infests the root of the plant. M. Marchaud proposes the extermination of this pest by watering the soil with sulphureted hydrogen water, which is well known to be very fatal to small animals.

HUBBELL & CAPRON'S IMPROVED TURBINE WHEEL.

A turbine wheel may be properly considered as an instrument for converting the velocity of water into work. The greater its capacity for converting the velocity into work the better the wheel. Provided none of the momentum is, by bad construction, consumed in the effort of the water to escape from the wheel, or an undue portion of it absorbed in friction over rough surfaces, the lower the velocity at which the water leaves the wheel the greater will be the percentage of work obtained from a given initial velocity.

It follows that without sufficient provision for a free escape of that portion of the water which has performed its work, a certain portion of the power residing in the water, whose energy is not wholly exhausted, must be absorbed in forcing out the dead water. The want of such a provision is as important a defect as the want of a free exhaust in a steam engine.

One of the most striking features in the wheel which we this week illustrate is the ample provision made for the escape of the dead water.

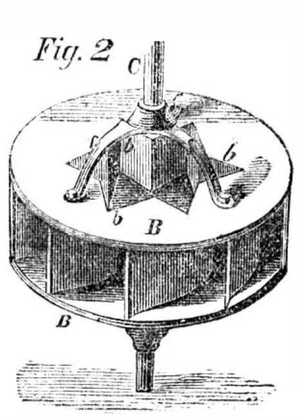


It will be seen that the wheel is one of the class known as center-discharge wheels, and further, that the hub and shaft in the center of the wheel are entirely dispensed with, the wheel being bolted near its perimeter to a tripod which is attached to the vertical shaft. A second tripod resting upon the scroll immediately surrounding the wheel, supports the lower bearing of the vertical shaft.

The wheel may be either cast entire or be made in parts bolted together. The openings for the escape of the water at the top and bottom of the wheel are of star shape, as shown, and occupy about one third the diameter of the wheel.

The buckets are curved metal plates of the form shown in Fig. 2. They are placed tangentially so that the inner end of each bucket extends along the side of one of the notches in the star-shaped openings of the top and bottom plates of the wheel, the other side of the notch being the width of the mouth or space through which the water is discharged between the buckets.

Fig. 2



The water is conveyed to the buckets through a scroll which forms the external case of the wheel, and as it enters, the water acts first upon the outer concave portion of the buckets. It is then deflected toward the center, still continuing its action upon the rear side of the buckets, until it reaches the notches of the star-shaped openings, when its power is exhausted and it discharges by the natural action of its gravity.

The peculiar form and arrangement of the bucket secures the full utilization of the available power of the water, while the free discharge, secured by the star-shaped openings and the absence of hub and shaft in the center, prevents the subtraction of power from the performance of useful work existing in many forms of turbine wheels.

We have not seen this wheel in actual work, but the sound principles upon which it is constructed give evidence that the many warm testimonials to its efficiency, which have been shown us, are well deserved. These testimonials are from practical men, and are of a nature to fully establish all that is claimed for the wheel as being one of maximum efficiency not liable to get out of repair or to be choked by matters deposited by the water, and in all respects satisfactory in its operation. Patented May 8th, 1869.

For further information address Hubbell & Capron, No. 21 Cortlandt street, New York. The wheels are manufactured at Long Pond Mills. Post office address, Ore Hill, Conn.

A German paper states that a train composed of all the locomotives and railroad carriages in Europe would reach from St. Petersburgh to Paris, and would contain 400,000 passenger carriages and 500,000 luggage vans. The network of European railroads represents a length of 70,718 miles; 18,000 locomotives are employed on it, and these rush over a distance of 60,000,000 miles in a year. 150,000,000 cwts. of iron have been used for the rails, and 80,000,000 cwts. of coal are required yearly to feed the engines.

How Wall Paper is Made.

A correspondent of the *Evening Mail*, one of our most interesting daily papers, has recently visited the large wall paper manufactory of Howell Brothers, Philadelphia.

Think, he says, of a building three hundred and ninety-six feet long, five stories in hight, and sixty feet wide. The eastern wing of the same elevation is one hundred and forty feet long, and this vast factory is filled with machinery that is producing all varieties and shades of wall paper at a rate almost incredible. Take the article of sun shades for windows alone, and imagine what the perfection of the apparatus must be that turns out fifty thousand of them weekly. For ordinary wall papers there are ten presses steadily at work, running off some ten thousand rolls a week. The visitor may have his organ of wonder excited by witnessing some of these presses taking in clean paper and turning it off with twelve colors impressed on it, with the most unerring regularity. Then again the arrangement is such that these rolls may be made of any length. If the Royal Geographical Society wanted a belt to go round the earth, any of these machines would turn out a girdle of the required dimensions. Roll after roll becomes united by the simplest process in the hands of a boy, and thus the work goes on. Great length of building is required in such an establishment in order to dry the printed paper; for at one end the printing is going on, and ere the sheet has been carried forward over heated pipes by a simple but most ingenious process to the end of the factory, it is dried and ready for the measuring apparatus, for the folding and condensing or tightening process, in order to its being secured in numbered bundles for the store.

MANUFACTURE OF WALL PAPER.

The division of labor in such an enormous factory presents a most interesting study. Here, for instance, in a separate apartment, are the designers of patterns, evidently thoughtful men; adjoining them are the skilled workmen engaged on the cylinders, where, by means of brass and wood-carvings, the patterns are prepared for use in the printing presses. Here again are men at vast receivers engaged in preparing the *body* that is to be applied to the paper. The earths that are used in this process come from regions far apart. For instance, Perth Amboy, in New Jersey, supplies large quantities of it; but, strange to say, from Atlanta, in Georgia, an article is procured which, to the eye of the uninitiated, appears to be much finer, and yet its price is much less than the duller looking Jersey article. From Atlanta this earth is sent by rail to Savannah, and thence by steamboat, and great though the distance is, the firm pays considerably more for the article which is procured almost at the next door.

HOW IT IS POLISHED.

Then again, glazing or polishing paper. How is that done? Few of our readers imagine that a simple brushing apparatus accomplishes the work. A number of cylinders armed with Tampico grass are made into large brushes. These are caused to revolve with immense velocity as the paper is carried over them and the result is the high polish and glancing appearance that such paper displays. To produce flock paper the process is exceedingly easy,—that is to say, once you know how, and are provided with the proper machinery. A capacious chest is provided and the lid is opened up backwards. Into this chest a roll of newly-stamped paper is conducted, and, of course, it is quite wet. Cloth is pulverized and prepared of the proper shade, and when this chest has received a length of the newly-printed paper the lid is shut down on the dust and the paper, and the boy in attendance commences in the most ridiculous manner to beat the bottom of the chest, which appears to be elastic. The action of the rods raises the pulverized cloth dust and causes the proper quantity to rest on the damp surface, to which it adheres; and so length after length is dusted and thus the work goes on.

THE GILDING.

In another apartment is the gilding process. Girls, with delicate fingers, lay the metal leaf on the proper spot, which by an adhesive paste has been prepared for its reception, and then the roll passes under the press, where the figure is formed, and other hands brush off the superfluous matter. This is one of the most delicate operations in the establishment, as the air caused by the motion of a passing stranger, or even by the lifting of a hand will cause a foot or two of the leaf to fly off.

The capital required for such an establishment must be enormous. Rich papers and of the most *recherche* patterns are manufactured in Paris and in Germany, but France has no establishment so large as this. In England there are several firms of considerable magnitude, but competition has prevented them from attaining the overwhelming size of this concern. As might be expected, it is from the cheaper articles that the great profit is derived. Better for the firm to make two cents a roll off cheap paper than twenty-five or even fifty cents off richer styles. Five millions of rolls in the year at two cents each would produce one hundred thousand dollars, and the capacity of this factory is such that a much greater amount of work may be done.

Any subscriber for the year 1870, whether he receives his paper by mail or through news agents, can have a copy of the prize engraving by remitting seven dollars to this office. This announcement is made to answer a large number of inquiries on this point.

During the seventeen years that the late Prefect of the Seine, Baron Haussman, held office, the city of Paris has expended on extraordinary works alone about $423,500,000.

Correspondence.

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

Asphalt Roads.

MESSRS. EDITORS:—In your issue of the 12th ult., you have a very interesting article on the French asphalt roads, constructed with the Seyssel rock, and the attempts in this country to imitate them. I would here state that I resided in Paris at the time these pavements were laid, and investigated them with great interest.

I notice in that editorial that the New York Central Park Commissioners have been for some time engaged in testing the Seyssel asphalt for constructing roads, and that the results have been very favorable, showing that these gentlemen spare neither labor nor money to have the best known roads, and for which the public is indebted to them. But is the Seyssel asphalt the only substance adapted to give us good and durable roads? I think that I can fully convince you that an asphalt is found in this country as good, if not superior to it, although it has hitherto been known to but very few. I term it the American asphalt.

To answer this statement in a practical and scientific way, permit me to show the comparisons between the Seyssel and American asphalts and the qualities that each possesses.

1st. Do the qualities of the Seyssel asphalt road, as many believe, depend upon the natural combination of the asphalt with the rock wherein it is found?

2d. What is the difference between the Seyssel and the American asphalts; and what is the difference between natural and so-called artificial asphalt, such as coal tar?

In answer to the first query, I would state that the Seyssel, French, asphalt does not depend upon the limestone or carbonate of lime being naturally mixed with it. This is only a mixture and not a chemical combination, and the real quality of the roads formed of it depends entirely upon the asphalt itself.

To the second query we would state that the only difference between the Seyssel asphalt and the American, is that the American contains more asphaltene than the Seyssel. Asphaltene is a derivative substance which requires a very high degree of heat to melt, and is a very bad conductor of heat, as will be seen by the report of Boussignault and Raignault, two celebrated French chemists, the discoverers of asphaltene.

The difference between natural and so-called artificial asphalt, such as coal tar, is very important, and to give a proper illustration of it, it will be necessary to give a chemical description of each.

Natural asphalt is a neutral substance, with which neither acids nor alkalies will combine, and is decomposed by distillation into neutral hydrocarbons of the alcohol series, and chiefly of the paraffine series. It is true that traces of pyroligneous acid and ammonia are produced at about 900 degrees of heat, but these compounds are not pre-existing, and are formed by the decomposition of heterogeneal matters mixed with the pure asphalt at the above-named temperature.

The coal tar, or artificial asphalt, contains:

1st. Acid oils, soluble in alkalies, such as carbolic acid, rosolic acid, brunolic acid, acetic acid, and butyric acid.

2d. Alkaline oils, soluble in acids, ammonia, aniline, and leucoline, etc.

3d. Neutral oils not affected by alkalies, and very little by acids—these are generally called coal oils, and are composed of a great variety of hydrocarbons, the alcohol series, the benzole series, the paraffine series, naphthaline, para-napthaline, pyrene, and chrysene. In fact we see that the natural asphalt is a neutral substance, not affected by alkalies, and only in a small degree by some acids, and certainly not by water, and we see more, that the American asphalt is similar in composition and nature to the Seyssel asphalt, except that it contains more asphaltene requiring a greater degree of heat, to melt it. The Seyssel asphalt melts at 212° Fah., and the American requires about 400°.

The SCIENTIFIC AMERICAN is correct in stating that "most people when asphalt roads are mentioned, get only a confused idea of some sort of artificial concrete made of coal tar and gravel, or some inferior abomination like that which now disgraces the Fifth avenue in this city."

Now let us look at the artificial asphalt or coal tar, and endeavor to explain the causes of the quick destruction of roads constructed with it.

We have remarked that the coal tar is composed of a great many different compounds—the alkaline and acid compounds may combine with water and produce hydrates, and may change the entire nature of the substance, and destroy much of its cohesion; besides this, the artificial asphalt having been submitted to a destructive heat, all these above-named compounds pre-existing in the coal tar, and being simply a mixture of the above-named bodies, between which no affinity exists, the heat will separate many, and leave a road cracked and brittle, which will certainly not last the necessary and expected time.

The foregoing explanation, of which all scientific men will understand the truth and importance, shows that the American asphalt is similar for the construction of roads, if not superior, and that roads constructed with it will last as long or longer than the French asphalt roads, and will stand all the variations of temperature of our climate.

In fact such is the confidence felt in the American asphalt by a few capitalists that a patent has been obtained by a party in one of our Southern cities, and I think it will not be long before our city can have roads precisely similar to those in Paris, but better adapted to our climate.

E J. DE SMEDT.

New York city

Crystallization of Boiler Rivets.

MESSRS. EDITORS:—Six cylinder boilers 36" diameter 30' long, made in 1835, were in use more than thirty years, with a steam pressure from 60 to 80 pounds, and are now in use, and so far as wear or corrosion are concerned, are in good condition; in fact there is no perceptible deterioration.

The water used in the boilers is from a New England river and perfectly soft, the only impurities being a small quantity of vegetable and earthy matter.

The only defect the boilers had manifested during their use was a blister on a sheet over the furnace, which was cut out, and a patch put on with rivets in 1837; and now so far as the eye can detect, the boilers are as good and as safe as when new, 35 years since—incontestable proof of good water and careful usage. The only suspicion entertained against them is old age.

These boilers were removed from their original position after some ten years service, transported something like a half mile, reset without requiring repairs, and gave an acceptable result, but were taken out to make room for modern improvements. In removing them, though the plates were in apparent perfect condition, another and serious defect was revealed. The jarring incident to their removal caused many of the rivet heads to fly off. A smart tap of the hammer near a rivet caused the same result. On examination the iron in these broken rivets was found to be crystallized.

Now when the plate was cut through and a patch was riveted on no rivets started; seven years after, when they were removed and reset no rivets started.

Now how came this crystallization? It cannot be said that they were so when inserted, because it would have been impossible to have closed them by hand riveting if the iron was crystallized. Then again, they were transported by wagon ten miles, and bore the hammering incident to cutting holes for steam pipes, etc., through each, without showing defects, and were once more moved and reset ten years later, showing no defect.

It is to be regretted that no examination has been made of the texture of the plates to see what the state of the grain is; but it is presumed that they have not changed because they have not given out, and the boilers were sold and put at work again in the full knowledge of the condition of the rivets.

Another similar case in the same establishment: Ten boilers 42" diameter 30' long, cylinders, made in 1847, using water from same river, carrying same steam pressure (60 to 80 pounds) are found to be in the same condition and are still at work. Of course anxiety is felt for safety, yet what renders them unsafe; is it old age? Have they, like an old man or beast, though without apparent disease expended their vitality and ceased to exist? If so, why should the rivets, which are invariably of the best fibrous iron, succumb first?

We will suggest as an answer, that the rivets have very much more work to do than the plates, because they have to sustain the strain on a plate the width of the distance from center to center of the rivets, say 2¼" wide, and a section of the rivet is but ·306 □" while the plate is ·562 □".

Then again, the rivet is under a constant and accumulating strain, and has no time to rest, while the strain on the plates ceases when there is no pressure on. It has time to rest, to recuperate.

We say the strain on the rivet is constant and accumulative, because the rivet is closed down hot; as it cools it is obvious that it contracts in length, and the result is a constant tensile strain. It is accumulative because of the constant oxidation between its heads and the plates and between the plates where they lap, and the well known fact that an oxide occupies more space than the material from which it was made, resulting, of course, in increasing tensile strain. With no rest, no time to recuperate, the vitality of the rivets are exhausted and they "die of age." They have done their allotted work.

We are aware that we have not absolutely proved our suggested theory. We are also aware that it will be difficult to prove that it is not the correct one. It is not offered for controversy, but with the hope that it may elicit inquiry and perhaps bring out other views more in accordance with every day occurring facts.

F. W. BACON.

New York city.

The Foot-Pound.

MESSRS. EDITORS:—The foot-pound, as generally explained, is called a unit of force, equal to raising 1 pound 1 foot high against gravitation at the surface of the earth.

In this definition the essential item of time to determine its mechanical value is omitted, and the natural inference would place the time and force as that expended in the descent of 1 pound 1 foot by gravity, or its equal, but reversed action of 1 foot upward, in the same time.

The time of 1 foot descent by gravity is ¼ of a second, by which the value of a foot-pound would be equal to raising 1 pound, 1 foot high, in ¼ of a second; 4 pounds, 1 foot high, in ½ of a second; 16 pounds, 1 foot high, in 1 second.

This may be demonstrated by 1 pound attached to each end of a line over a pulley, thus balanced and moving without friction.

Call the pound at one end, F, the force; and that at the other end, P, the pound to be raised; add 1 pound to F, and it will fall 1 foot and raise P 1 foot in ¼ of a second; or add ¼ pound to F and it will fall 1 foot and raise P 1 foot in ½ of a second; or add $\frac{1}{16}$ pound to F and it will fall 1 foot and raise P 1 foot in 1 second.

It is probable, however, that the foot-pound is estimated by a constant force equal to 1 pound, neglecting the accelerating impetus due to falling bodies. Assuming 1 second as the time intended, the conventional horse-power of Watt would consist of 550 foot-pounds raised 1 foot in 1 second. The foot-pound may also be measured by the quantity of steam of a given density required to raise one pound 1 foot, and without regard to time, by which mode we have 12 cubic inches of 1 pound to the inch in density.

This may be shown mechanically by a supposed cylinder and its piston of 1 square inch area, admitting the steam at the bottom, against a resistance of 1 pound weight without friction, and thus consuming 12 cubic inches of steam of 1 pound to the inch in density.

The infinitesimal fraction of a lb. of coal for the above product, I leave to be deduced by the faithful from the speculative flights given in connection with the foot-pound, wherein the total force in steam developed by the combustion of 1 pound of coal is stated equal to the raising of 2,240,000 pounds, or 1,000 tuns, 1 foot high, and therefore requiring 12 cubic inches of steam at a density of 1,000 tuns to the square inch.

T. W. B.

Pittsburgh, Pa.

[Our correspondent is in error in his assumption that a pound raised one foot is the accepted *unit of force.* It is *the unit of work.* It may take more or less force to perform a unit of work, and the unit of work has not been regarded as the measure of force except when performed in a definite time. One minute is the time generally adopted. Thus the horse-power is equal to the raising of 33,000 foot-pounds per minute.—EDS.

The Length of Belt, Distance Between the Centers of two Pulleys and the Diameter of one Pulley being Given to Find the Diameter of the other.

MESSRS. EDITORS:—Mr. Mersom's rule for the diameter, etc., of speed pulleys, given on page 98, current volume, reduced to algebraic symbols, may be stated as follows:

Let R r be the radii of the pulleys, l=the length of belt, and a=the distance between the centers of the shaft. Then

$$r=R-a\left\{1{\cdot}5708\pm\sqrt{{\cdot}4674011+\frac{l-6{\cdot}28318531\,R}{a}}\right\}$$

This agrees with Mr. Mersom's rule, and the problem may be found worked out by J. B. Henck, C. E., of Boston, in vol. I., page 390, "Mathematical Monthly," published at Cambridge, Mass. 1859. Other solutions will be found on pages 359 and 360 same volume.

X.

Camden, S. C.

Prize Engravings---Cash Prizes.

Under this head we publish a few letters, selected from many others of similar purport, which have been received at this office within a few days.

MESSRS. MUNN & CO.,—*Gentlemen:* The copy of your engraving, "Men of Progress," sent to me, arrived yesterday in good order. Accept my sincere thanks for it. I have presented it to the officers of the S. P. R. R. Co. It will ornament the principal office of the Company.

Very respectfully, M. GILLETT.

Marshall, Texas, Feb. 11, 1870.

MESSRS. MUNN & CO.—*Dear Sirs:* I shall ever feel grateful to you for sending me the magnificent picture ("American Inventors") for the club I sent you, and I only regret that my town is not large enough to secure another club for your valuable paper. My family prize it very highly, and all who have seen it exclaim, "Oh what a glorious picture! Sell it to me," but I refuse.

I remain, respectfully yours, DANIEL SHORT.

Nashville, Ill., Feb. 15, 1870.

MESSRS. MUNN & CO.—*Dear Sirs:* To-day, through the Farmers and Merchants' Bank of Uhricksville, O., I had forwarded a draft on you in my favor for the amount of two hundred and fifty dollars. As you have announced in your paper of February 19th, this is the prize awarded me for my list of subscribers.

Please accept my most sincere thanks for this generous appreciation of my labor in procuring the list. Although in a financial point of view the present result may not be very satisfactory to you, yet in future the foremen at Dennison shops, as well as myself, will combine our efforts to keep up the large list sent from here and add others to it from time to time.

As I have no personal acquaintance with you, and you are under no special obligations to me, it proves that you have made a just and equitable distribution of your prizes. We all feel very much elated, as we think it reflects considerable honor on our "new town" showing the literary taste of the employés at Dennison shops P. C. and St. L. R. W.

Very respectfully,
M. MOODY, Chief Clerk.

Dennison, Ohio, February 21, 1870.

MORTAR.—The disadvantages arising from those kinds of mortar at present in use are chiefly owing to inferior sand being used, and the great difficulty of obtaining sand at a moderate price. A material has been invented which does away with these difficulties, for when used it requires only to be mixed with water. In order to make one tun of this mortar, the following substances should be ground by machinery: 288 lbs. of lime (either caustic or the hydrate), 1728 lbs. of slag, and 224 lbs. of calcined coal-shale clay. These materials having been ground to the degree of fineness required, are mixed, and are ready for use. From the nature of the substances used, there would be, doubtless, a more rapid chemical action than that which takes place in ordinary mortar. For plastering purposes the compost seems to be eminently suitable.

Improved Clay Crusher.

This is an improved form of machine for the crushing of clay and other similar substances, preparatory to its manipulation with water to render it plastic and fit it for molding.

Its construction will be readily understood by reference to the drawings; Fig. 1 being a perspective view, and Fig. 2, a cross section through the crushing cylinders.

These cylinders are armed with cogs as shown in both engravings. Between each row of cogs or teeth are formed deep rectangular grooves. To metallic plates bolted to the cross-pieces of the frame of the machine are bolted bars, or scrapers, distinctly shown in Fig. 2, and in perspective Fig. 1. These bars are not bolted down rigidly but are allowed some play to accommodate themselves to any slight inequalities of surface in the grooves, into which their points penetrate. Their office is to scrape off the clay compacted between the cogs and in the grooves of the cylinders. The crushed material then falls directly beneath the cylinders, from whence it is removed as occasion requires.

The arrangement of the gearing with the fly-wheel for regulating its movement will be readily understood upon inspection of the engraving Fig. 1.

Instead of using cylinders with cogs and grooves cut on them, the inventor prefers to construct toothed rings which may be fastened on the central shafts or cylinders, and separated by collars which form the bottoms of the grooves.

When this form of construction is adopted, the toothed rings and collars are firmly bound together by rods and nuts running parallel with the axes of the cylinders, the object of which is to prevent their spreading by the wedge-like action of the clay as it crushed into the grooves.

It will be seen that the machine is perfectly free from any weakness arising from complications, and that it must not only be effective but durable in practice.

The difficulties designed to be overcome by this invention and which led to its construction are sufficiently instructive to the general reader to merit notice.

The machine is intended to crush any hard, tough clay, whether it be dry, half dry, green as dug from the pit, or mixed, for the purpose of making it into brick.

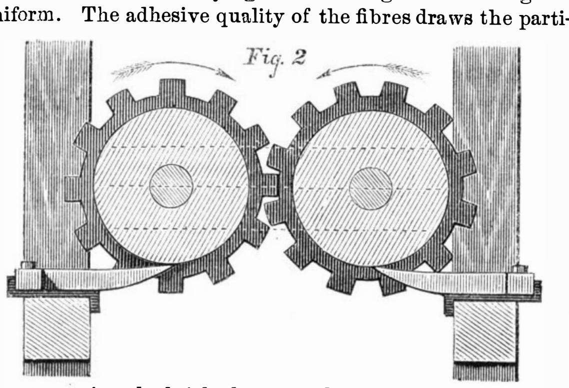
It crushes, tears, and disintegrates it so that the water percolates freely through it, when put into a pit or vat to soak, preparatory to grinding it into "mud," as the prepared clay is called by brickmakers; after which, being tempered by means of the common tub tempering mill, or by any other means, it becomes perfectly homogeneous without which no clay will make good brick.

It does its work thoroughly, rapidly, and with about the same power as required to drive the common tub-tempering mill.

It was gotten up more especially to prepare *fire-clay*, a very tough, hard clay, used in making fire-brick; but is equally useful in preparing any common tough clay, such as cannot well be used without freezing or drying.

Tough, hard, fresh dug clay from the pit, passed directly through this machine, will, we are assured, soak and temper into homogeneous "mud," equally as well as that which has been disintegrated by means of frost or drying.

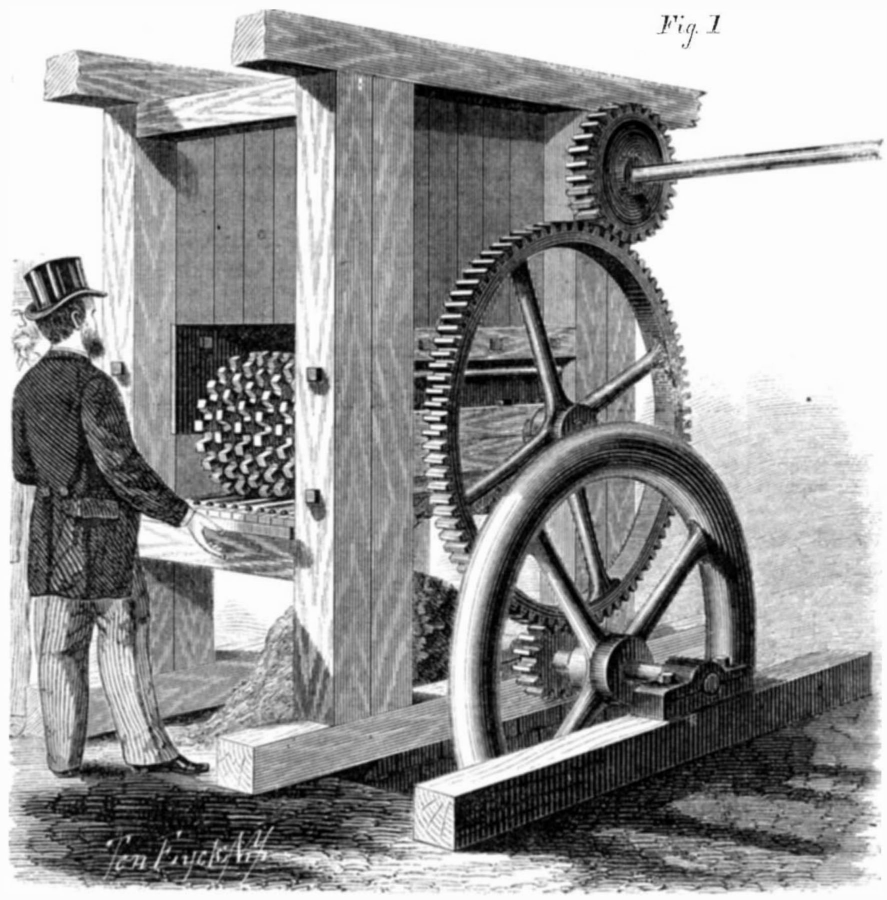
Brick, made of mud, a part of which is in lumps—large or small, and a part plastic, are liable to crack, and are generally very rough or uneven, the plastic parts shrinking away from the lumps; but if the clay is properly disintegrated by any means the mud becomes homogeneous, that is, it becomes all plastic alike, and in drying and burning the shrinkage is uniform. The adhesive quality of the fibres draws the parti-



cles composing the brick close to each other, and when burned the substance becomes like stone, fine or coarse, according to the nature and quality of the clay and sand used in the composition. The finer and tougher the clay used, the more solid and durable will be the brick, especially for wear in pavements and to bear great weight.

The most common method of preparing fire-clay and other tough clays, is to chop it by hand with spades, but this method leaves it in small solid lumps, impervious to water, and is expensive, requiring the labor of eight or ten men to prepare the clay as fast as the clay crusher will do it, and then it is very imperfectly prepared.

If clay is thoroughly dried, there is nothing better to crush it than the common bark mill, such as is used by tanners for grinding bark. The pores being open, water dissolves and readily makes it homogeneous, but if any of the clay be but half dried it sticks to the teeth of the mill and at once clogs it; but practically clay is seldom dried or frozen to any great extent, especially fire-clay. This fire-clay (as it is called on account of its peculiar properties for resisting fire) when used for manufacturing iron and other like purposes, is found east of the Allegheny mountains, mostly in the town of Woodbridge and vicinity, in the State of New Jersey; and the best quality, such as is used for making fire-brick, is worth six dollars a tun at the mines. It is deposited from twenty to thirty feet below the surface, the surface being all cleared off down to the clay. The clay is dug with gouge-formed spades which require the full power of a man to drive them into it, being dug in lumps or "spits" which are thrown out of the pit by the hands of men, sometimes from a depth of ten or more feet on to a platform, ready to transport either to the factories in the vicinity, or to the docks for shipment. The spits of clay, as they are called, are thrown into wagons, carted to the docks, and put directly into vessels for transportation to the factories in Philadelphia, Boston, Troy, Buffalo, and other places, or stacked in heaps ready for shipment; and when delivered at the factories is stowed in large heaps under cover, a portion of it dry, a portion half dry, and a large portion about as green as when dug from the pits, and occasionally, when some dry clay is put in the bottom of the vessel and the vessel leaks, a portion of mud. Thus, when the cargo is discharged we have dry, half dry, green clay, and mud all mixed together; and this condition of the clay when deposited at the works, was the moving cause of the invention of the clay crusher.



HALL'S CLAY CRUSHING MACHINE.

The bark mill for grinding dry clay, and a revolving cutting machine, which cut the half dry clay into thin slices, preparing it much faster than the chopping process with spades but not much better, were formerly employed; but a machine that would work the clay in all conditions combined, was the desideratum sought.

After several costly experiments, the present machine was found to work to the entire satisfaction of the inventor, and the experimental machine has, we are told, been constantly at work, eight months or more, at the factory of Hall & Sons, Buffalo, readily devouring every kind of clay put into it, without the least difficulty. This firm has also used one of the crushers at their Perth Amboy Factory several months, and have abandoned all other means of preparing clay.

The machine is necessarily strong and heavy, weighing over two tuns. Experiments had to be tried on a full size machine, and were costly; and to reimburse himself either through the exclusive use of it by the firm of which he is a member, or by both using and selling to others, the inventor obtained a patent, through the Scientific American Patent Agency, January 11, 1870.

Not wishing to monopolize the use of so useful a machine, he now offers it to the public for sale. At present machines will only be made to order. They can be seen in operation at any time during working hours, at A. Hall & Sons' Fire Brick Works, at Perth Amboy, N. J., or at Hall & Sons' Fire Brick Works, Buffalo, N. Y.

For machines or information apply to Alfred Hall, Perth Amboy, N. J.

The Fear of Men in Animals.

The fear of men in animals is a slowly-acquired instinct. Mr. Darwin, in his account of his travels, gives some interesting instances of the fearlessness of birds little exposed to man in South America. The crew of Byron's vessel were astonished at the manner in which the wolf-like dog of the Falkland Islands approached them merely out of curiosity. Compare these traits with the admirably organized expeditions for the plunder of baboons, elephants, etc., and the rude customs acted upon for self-preservation of the half-wild dogs of the Peninsula and the East, wherein the care of the weak and young, the usefulness of sentries, the value of signals, the difference between sham and real danger, and the advantage of confusing traces of retreat, seem all to be known, and it will be pretty evident that man, the thinker, has to a considerable extent reacted on animals wild and domestic. Even in my own quarter it is the steady belief of the shepherds that the common sheep-dog has progressed in intelligence and docility within the last fifty years by care ful selection. "Where the dog is not valued for intelligence, as in some Eastern countries, it is a much more stupid animal than with us."

The China Trade on the Pacific Railway.

Some moons ago, says the San Francisco *News Letter*, we were tossing high our ready caps in air at the supposed advent of the Oriental merchant, who was believed to be awaiting a pilot just outside the heads, with a ship full of tea, silk, porcelain, and curiously-carven ivory, which he was to dump upon our wharves and permit us to send *via* Chicago, to Liverpool. He didn't come. Fact is, he has gone round the other way, through the Dutch Gap canal at Suez Whence this cold shoulder? After having expended a few hundred millions in preparing a highway for the nations, the nations stubbornly decline to walk over it. The gorgeous East, albeit somewhat disposed to loll sleepily upon divans and smoke opium, has yet a business kind of eye, and sends his wares by vessels having immediate dispatch.

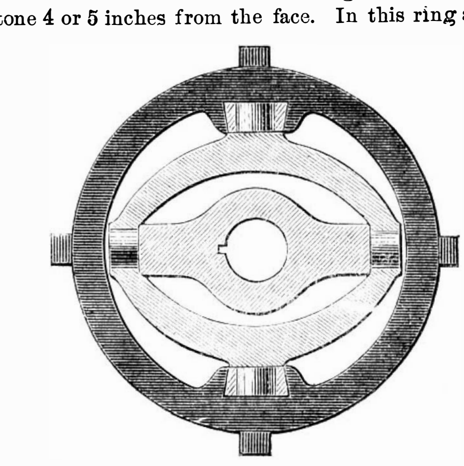
Practically our highway of the nations (we are not alluding to the sea) stops abruptly at the Pacific Mail Company's wharf. We run a monthly line of steamers to China; the Peninsular and Oriental run a weekly line. That is the delicate shade of difference, and it is quite sufficient to cook our commercial goose.

We are not sufficiently affluent to do better, although we have the steamers all afloat, and Thomas Mooney is clamorous to have them put on. If this were a private affair of our own, affecting only the interests of California, we could regard it with some faint touch of satisfaction. It is a charger of a radically different hue. The entire country is interested in securing the trade of China, by which alone we can hope to harvest what we have sown from the Missouri river to Pacific tide-water. We must get our money back on that railroad, and to do so the railroad must be virtually extended to Hong Kong, by semi-monthly trips of the Pacific Mail. This will do it, and Congress must do this. It is arrant nonsense to talk of doing it without additional subsidy. The Company can afford to dispatch a steamer monthly, but some years must elapse before they can afford to do more. Indeed, if something be not speedily done to secure the China trade, they can never afford it, and we shall have the gratification of sitting meditatively by the seaside with our chin in our palms, and translating the murmur of the waves into a pronounced jeer at a very Stupendous Ass.

UNIVERSAL BALANCE FOR MILLSTONES.

A correspondent of the English *Mechanic* has invented a universal balance for millstones, of which we copy the engraving.

The invention consists of an outer ring built in or let into the stone 4 or 5 inches from the face. In this ring are two



dovetail grooves, and in each a brass step is fitted, so as to slide up and down tight; these steps are regulated by two set screws, fixed in the top side of the ring; inside this ring is another oval one with a stud or center on each side fitted into the above-mentioned steps; and inside this ring is fitted the driver; all the centers are equal in length and line.

Charles Lever, the "Harry Lorrequer" of many a novel, the "Cornelius O'Dowd" of *Blackwood*, and the British Consul at Trieste, requires no less than eighteen hours of sleep a day. He writes but two hours at a time and never makes an alteration.

A writer in *Notes and Queries*, says: "An old gentleman informed me that he had made it a constant practice for the last fifty years, during the frost, to watch a mole-hill, and had always found that if the mole threw up fresh earth, within forty-eight hours the frost would be gone."

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THE NEW EXPLOSIVE DUALIN.

Beyond a brief notice of the new explosive, dualin, as it is called, we have purposely said nothing about it, preferring to wait and see whether it possessed enough merit to warrant much attention, rather than cumber our space with an account of what might prove, after all, but another example of a long list of compounds which have never attained any practical importance.

If, however, the accounts that reach us are to be relied upon, this compound bids fair to prove of some value. It is claimed for it that it possesses the slow combustibility of gunpowder with the intense rupturing force of nitro-glycerin, that it may be handled with safety, and that it is not liable to spontaneous combustion.

This explosive is the invention of Carl Dittmar, of Charlottenberg, Prussia, who thus describes it.

"Dualin is a yellowish-brown powder, resembling, in appearance, Virginia smoking tobacco. It will, if lighted in the open air, burn without exploding; but, if confined, it may be made to explode in the same manner as common powder. It is not sensitive to concussion; will not decompose by itself, nor cake or pack together; may be readily filled into cartridges; and it matters not whether the place where it is stored be warm or cold, dry or damp. It has from four to ten times the strength of common powder, and is stronger than dynamite. * * *

"Dualin consists of cellulose, nitro-cellulose, nitro-starch, nitro mannite, and nitro-glycerin, mixed in different combinations, depending on the degree of strength which it is desired the powder should possess in adapting its use to various purposes."

The preparation of cellulose, nitro-starch, nitro-mannite, and nitro-cellulose, involves distinct processes, which will be found described in another column.

How future trials may affect the popularity of dualin, if it can at present be said to have acquired popularity, we can not undertake to say. It is only fair to say that in the opinion of some good judges, it is decidedly inferior in power to dynamite, though it is said to be cheaper. It will explode in contact with flame which does not ignite dynamite. On the contrary, it may be used in temperatures which freeze dynamite and render the latter incapable of being directly exploded. But dynamite may be used when wet and may even be exploded under water in drill-holes, while dualin, like gunpowder, is, we are informed, useless when wet. This fact gives dynamite an immense advantage over dualin for mining and engineering purposes.

The claims of dualin to take front rank as an explosive can not yet be conceded, but there is little doubt that it is far better than many other compounds which the last few years have brought forth. Before it can gain the full confidence of miners and engineers, it must undergo many more trials than have yet been made. It is, however, only just to say that reports from the Hoosac tunnel, where it has been successfully tried, are highly favorable.

We learn that experiments were made in the United States, January 5th, 1870, in a quarry near Washington City, belonging to the Messrs. Lewis & Hall; January 18th and 19th, at Hoosac Tunnel; and January 22d, at Roxbury, near Boston, Mass.

The attested results of these trials leave no doubt in our minds that dualin is much safer than nitro-glycerin It is also stated that such experiments as have been performed with this explosive in Europe have given the most satisfactory results.

THE CULTIVATION OF TIMBER.

"When you have nothing else to do plant a tree; it will grow when you are sleeping." This advice we think may be extended to times when people are not at leisure, and to the United States Government as well as private individuals. Why not make a business of planting trees? We are well aware that in many cases trees have been planted and grown with success, by private individuals and on private estates, but the fact remains that large areas of public domain are to-day entirely without timber, and the sources from which lumber can be derived to supply the needs of this territory upon its future settlement, are undergoing a drain which will ultimately exhaust them.

If there exist reasons why the agricultural department of our Government could not, if disposed, greatly increase the value of the public lands by rendering nude portions tree-bearing, they are not now obvious to us.

Our continent possesses a variety of forest trees of industrial value, exceeded by no area of similar extent. Certainly in all this variety there may be found some adapted to vigorous growth in almost any climate, or any soil capable of sustaining vegetation.

THE LAW OF "VIS VIVA."

One of the best definitions we have seen of the term *vis viva* is that it is "the measure of mechanical work developed by motive forces or inertia, *in variable motion*." When the full import of all its terms is comprehended, this definition will be found to accord with the notion of force as precedent to motion. So long as this notion of force prevails, so long must the term *vis viva* or its equivalent be a necessity in the intelligent conception of the laws of motion.

Let us briefly examine this definition with a view to clear away some of the vagueness with which this subject is attended in the popular mind.

What is meant by mechanical work? Certainly, this can be expressed in terms of its accepted unit the foot-pound. A foot-pound is a pound raised one foot without regard to time. This is the *unit of work*. It is not a unit of force, as it is sometimes erroneously considered. More or less force will be required to perform it, according as the time in which it is done is shorter or longer. Power is force in relation to time. The mightiest force requires time to produce an effect. The most infinitesimal force will produce an effect in time.

All this is inseparable from the idea of force as existing independently of matter and antecedent to motion. A mechanical effect is *motion produced*; motion involves the idea of distance traversed, distance traversed involves the idea of time in which it is traversed. But distance traversed does not necessarily imply mechanical work performed. It is only when a resistance is overcome that work is accomplished. A body moving in absolute space performs no mechanical work, though it move with a constant velocity forever. Let it, however, encounter some other body having less motion and it performs work. It increases the motion of the mass which it strikes against, or some of its particles, or it may produce both these effects. The mass-motion produced is mechanical work. The effect upon the striking body is no less work. Its motion is decreased by the impact.

Increase or decrease of mass-motion is, properly speaking, *mechanical work*, and we shall find upon strict examination that this is all implied by the term. But as no increase or diminution of motion can take place in a body without its receiving or imparting motion from or to another imparting or receiving body, it follows that *vis viva* practically relates only to transmission of motion from one body to another, in *space and time*.

It will be seen that the idea of *vis viva* is, therefore, essentially different from the term momentum, which is simply the amount of motion a body possesses, considered with relation to definite periods of time and definite distances, and which is expressed by mass or weight multiplied by the time it traverses a definite distance. Momentum has no reference to the amount of motion a body can impart or receive in time and space.

The terms "motive forces" and "inertia" convey the idea of material forces or matter in motion. The expression, "in variable motion," seems unnecessary, since the very idea of imparting or receiving motion implies variable motion. The expression MV^2 (mass or weight multiplied into the square of velocity) is the mathematical symbol of *vis viva;* that is the measure of the mechanical work developed by a moving body—or in other words the change of motion produced by it on another body in space and time—is measured by its mass multiplied into the square of its velocity.

It must be further observed that *vis viva* is not a measure of force, but of the mechanical work performed, or the change of mass motion produced.

Whether we accept the notion of the existence of occult force which acts upon matter, or accept the doctrine that there is no force which the human mind can recognize other than moving matter, there still remains the necessity for an expression of the law of the transmission of motion. One thing is certain, a body cannot transmit motion it does not possess, and if momentum expressed by MV (mass multiplied into velocity) be the absolute amount of motion a body possesses, it certainly cannot impart the motion expressed by MV^2 or its mass multiplied into the square of its velocity. Evidently there must be some limitation to the interpretation of one or both of these expressions, which will reconcile their apparent conflict. This limitation is, we think, to be found in the fact that in momentum definite spaces and times are considered with uniform motion, while in *vis viva* the motion considered is a variable one, or one in which motion is constantly received or imparted; and that MV^2 determines the space through which a body will move before it comes to rest, when opposed by a resistance capable of absorbing all its motion. MV, or momentum, is the expression of the motion of a body neither imparting or receiving motion, and therefore performing no work. Momentum is an absolute expression when the factor of time in the velocity is constant. *Vis viva* is a proportional or relative term only.

Thus a body moving uniformly through a definite space in a definite time, has a momentum expressed by its mass or weight multiplied into its velocity. While passing through the space, or when it has passed over the space, it has the power to overcome a certain constant resistance, and to move a certain distance before it imparts all of its motion to a resisting medium. Its relative or proportional power to move through such a resisting medium or to overcome an attractive force is its *vis viva* (MV^2) as compared with other bodies moving through similar media or opposing an equal attractive force. It is not an absolute expression of the quantity of motion in a body, like momentum. It has reference only to space traversed, while motion is being absorbed by resistance.

WHAT OYSTERS EAT.

Not long since a journal which claims to instruct the public in regard to the preservation of health, came out with a sweeping denunciation of oysters as an article of diet. What little of argument could be gleaned from the whirlwind of denunciation with which the use of oysters as an edible was assailed amounted to this. Oysters are nasty. Whatever is nasty is injurious to health. *Ergo*, oysters are unwholesome diet.

In whatever particular oysters are generally nasty, or whether they are particularly nasty in general was not, to our thinking, made out very clearly; but the subject has since received more scientific treatment at the hands of the Rev. J. B. Reade, F.R.S., who has been investigating into the private, domestic, and personal habits of these delicious "sea violets." The Rev. J. B. Reade, F.R.S., has been interviewing a large number of oysters, and has read a paper before the Microscopical Society giving the result of his researches. Oysters are proverbially reticent, but they have at last been made to reveal the secrets of their prison houses.

It may not be generally known that the question of what constitutes the food of marine animals which exist at great depths, is at the present time much mooted among naturalists. We do not take it upon us to say whether the discoveries of Mr. Reed are calculated to add to the zest with which most people swallow this prince of bivalves; but he found in the stomach of every oyster he examined "myriads of living monads, vibrios in great abundance and activity, and swarms of a conglomerate and ciliated living organism, which may be named *Volvox ostrearius*, somewhat resembling the *V. globator*, but of so extremely delicate a structure that it must be slightly charred to be rendered permanently visible."

The oyster is not therefore a vegetarian; he doubtless swallows his *Volvox ostrearius*, his vibrio, or his monad, with as great satisfaction as we humans swallow him when he lies delicately quivering on the half-shell, with the added savor of a drop or two of lemon juice. But he does not confine himself to the few plain dishes we have mentioned. Mr. Reade has been able to make out the following bill of fare:

"*Actinocyclus senarius, Ceratoneis fasciola, Coscinodiscus minor, C. patina, C. radiatus, Dictyocha aculeata, D. fibula, D. speculum, Gallionella sulcata, Navicula entomon, Tripodiscus Argus, Xanthidium furcatum, X. hirsutum, Zygoceros-rhombus, Z. Surirella*, and two new species of this genus."

Mr. Reade does not add to this attractive list that "all other delicacies will be served in their season;" but he does say, that the oyster, like creatures of a larger growth, lives on the food which is successively in season; and he finds that even a different shore is marked by a decided difference in the infusorial contents of the stomach. The "Scotch Natives" are characterized at the present time by innumerable circular forms, resembling the Coscinodiscus. Others are nearly destitute of these living rotatory disks, but they are much richer in more interesting species; and in addition to the silicious shelled infusoria which are received into their stomachs, they also occasionally furnish examples of calcareous Polythalamia adhering to the inner surface of their shells.

Who knows but that as science advances oysters may be fattened on selected food, as pork designed to be extra fine is fed on corn. Who knows but that the coming oyster may be recommended to the palates of gourmands as prime Coscinodiscus or New Jersey Volvox?

A PLEA FOR THE SOCIETY FOR THE PREVENTION OF CRUELTY TO ANIMALS.

The man who professes Christianity and belies his profession by a total want of sympathy for the mute and patient servants who, for small reward, minister to his daily wants; who can stand unmoved by compassion and see animals maimed and tortured at the caprice of wanton cruelty; who can witness such acts without his breast swelling with righteous indignation—is either a self-deluded formalist, or a consummate hypocrite.

There are many who profess Christianity in the State of New York; yet how many of these will feel a blush of shame or hurl a word of protest, at the despicable movement now on foot against the Society for the Prevention of Cruelty to Animals.

The attempt to repeal or limit the wholesome laws under which this society has been able to do so much good, is made in the interest of brutal men by brutal men representing the brutish element of our metropolitan population.

It is a burning disgrace to the State and a blot upon our civilization, and can never succeed except through the apathy of those who should stand in solid array against such action. Every pulpit should protest, and every generous voice be raised in denunciation of this outrage.

It has been charged that the fanaticism of Mr. Bergh has led to this movement. We deny it. That gentleman has, indeed, been in earnest in his good work. He has bravely stood up against deprecation, misrepresentation, and calumny, and has succeeded in spite of the indifference of the courts, in bringing some thorough scoundrels to justice. That is what is the matter. He has compelled the horse railway companies to treat their overworked beasts a little more humanely, at the sacrifice of a very small portion of their enormous profits. That is the extent of his fanaticism. It is not Bergh, it is Beelzebub who is the source of this mischief, and let the blame rest upon him and the very large portion of his family who render this city such a pleasant abode for the order-loving and the law-abiding.

We are glad to see that the press has generally denounced the attempt to destroy this noble organization, and we do not doubt that there is still humanity enough left to sustain it in full possession of its present powers.

SYSTEMATIC THINKING.

Charles Reade and Wilkie Collins are two of the most famous and brilliant novelists of the present day. Each of these men has contributed much to the amusement and something to the instruction of mankind. Each has given to the world a special boon. Reade has invented a word, and Collins a phrase, each of which is one of the most forcible of its kind.

In a late number of "Put Yourself In His Place," now appearing serially in the *Galaxy*, Reade has given us the word "*vicaria*." Henry Little having, by a systematic course of thinking, wrought out of his inventive brain some new and valuable improvements in saw-grinding machines, applies for a patent, and is fairly crushed by what he calls the "*roundabout swindle*." He complains to his good friend, Dr. Amboyne, that by the treatment he had received "one would think an inventor an enemy of the human race," and proposes to burn his models and renounce invention altogether. His account of the matter is certainly not complimentary to the English method of transacting patent business.

To the disgusted inventor the doctor thus quaintly discourses: "That system of go-betweens, and deputy-go-betweens, and deputy-lieutenant-go-betweens, and of nobody doing his own business in matters of state, really is a national curse and a great blot upon the national intellect. It is a disease; so let us name it. We doctors are great at naming diseases; greater than at curing them:

Let us call it Vicaria.
This English malaria.'

Vicaria is good; better than our familiar synonym, "red tape."

"When we are not occupied in making machinery," Wilkie Collins makes Mr. Franklin Blake say to Betteredge, in his novel, "The Moonstone;" "when we are not occupied in making machinery, we are (mentally speaking) the most slovenly people in the world." This was Mr. Franklin Blake's way of setting forth what he was pleased to term "the curious want of system in the English mind." We think Mr. Franklin Blake did injustice to the English mind, but the phrase "slovenly minded" is a master stroke.

People who think unsystematically are slovenly-minded people. The facts and ideas stored away in their upper chambers are all topsy-turvy. No sooner do they turn over something in the hope of finding another something than they cover up still another something, which, in its turn, will soon be wanted and rummaged after. Their heads are not well-arranged libraries, but garrets filled with rubbish. If they commence to think upon any subject, they shift it about, taking only glimpses of it here and there. They do not, like the systematic thinker, take a subject to pieces as a watchmaker does a watch, and lay the parts all in order under glass covers, but pitch them into all sorts of by places and corners, and generally getting bewildered in trying to replace them, become hopelessly muddled and give it up.

A great deal is said now-a-days about the power of modern thought; but it would be well to remember that all the thinking which bears fruit, is systematic thinking. Many a young man imagines himself to be thinking when he is merely day-dreaming. Thinking implies an active state of mind calling up images, holding them fast, and arranging them in order; not a passive condition in which troops of ideas, or shadows of ideas, flit across the mental vision like figures in a kaleidoscope.

Thinking, worthy of the name, is work—systematic, calm, and connected; and the man who has not got his mind so disciplined that he can thus command it, is not yet a thinker.

That systematic thinkers are so few, is attributable in a great degree to early bad training. Not one teacher in fifty in our primary schools deems it of importance to teach children *how to study*, and a less proportion are competent to do this if they would. The most of them think their duties are comprised in keeping an orderly school, hearing recitations, assisting pupils to do hard sums, and allotting tasks. Especially in the latter do they excel. Memorizing is with most of them a name for mummery—a thing to be done by holding the head on one hand, swinging first one foot and then the other, and forcing the lips to repeat a formula until they will run of themselves long enough to get through a recitation, by very force of momentum. And this laborious, meaningless task, they think, is study. In other words, study is to them the teaching of the lips to move from force of habit, while the mind may be wandering any where and every where.

Thus a vacant wandering habit of mind is secured with the spelling lesson, and ground in with the rules of grammar; and unless by rare good chance, the unfortunate overtasked and mentally disgusted young intellect meets in its onward progress some one who can show it the mistake, or has native genius to discover it without help, it grows into habitual slovenly-mindedness.

After all, teachers are no more to blame than parents who demand that progress shall be measured by pages of a book, rather than by power to think.

CONCERNING PATENT OFFICE MATTERS.

A correspondent of *Work and Play* gives his experience in regard to Patent Office matters, in the following practical observations, which we commend to the attention of our readers:

"The Patent Office is near the Post Office, and both about a mile from the Capitol. On the lower floors of the huge building designated as the Patent Office, are the numerous rooms occupied by the various officials, and above are immense halls filled with glass cases, in which are deposited models of inventions for which applications for patents have been made. Every person, without regard to age or sex, is equally entitled to a patent. In order to procure a patent, it is not necessary for the inventor to go to Washington; in fact, it is much better that he should not; because, not being conversant with the rules and practices of the Patent Office, he will probably make some blunders, and fail to comply with some of the red-tape requirements, and thereby make himself unnecessary trouble. There are, in the larger cities, many patent soliciters or agents, whose business it is to transact business with the Patent Office; and if they are honorable men, they can do it much better than the inventor. A man having invented a machine or piece of mechanism which he wishes to patent, first makes a miniature edition of it, which is called a model. A model for the Patent Office must not be more than one foot long or high, so that some large machines must be very much reduced. This model is taken to some patent agent or soliciter, to whom is explained its whole operation, and all the points wherein it differs from other similar machines. The agent must then make complete drawings of the model, such as to fully illustrate every part and its operation. The law requires two sets of these drawings, and, therefore, one set having been made on paper, a copy is made on tracing muslin, and, by means of letters of reference on these drawings, a very full and complete description of all the several points of the invention is written. This description is called the specification, and at the end of the specification the whole is summed up in a nutshell, and this is called the claim. When the agent has all these prepared, the inventor is obliged to make oath that he is the original and first inventor of the machine or device described, and then the model, drawings, specifications, and fifteen dollars are sent to the Commissioner of patents at Washington; but the Commissioner sees very few of the applications, for, although directed to him, they go into the hands of men called examiners.

"The applications for patents are divided into classes, thus: all inventions relating to guns, pistols, cannon, etc., are in one class; everything connected with farming in another, and so on. For each class there is a special set of examiners in a room by themselves. When an application for a patent saw-horse comes in, the models, drawings, and specifications are given to the proper examiners, and in turn the case is taken up by them and investigated. They refer to all the patents that have been granted on saw-horses, examine, if necessary, the models in those huge glass cases in the hall above, examine the reports of English and French patents, and if, after all possible search, they can not find anything similar, the patent is allowed, and the inventor is notified that if he will send twenty dollars more, his patent will be granted. But if something is found that an examiner thinks looks like the saw-horse in question, then the application is rejected, and all the fond hopes of the inventor are dashed to pieces; and that is just my condition at the present time. Ordinarily, there is so much business on hand, that cases must wait several weeks and even months, before they are examined; but when in Washington, Mr. F. saw the examiner having charge of the class into which my case would come, and he said he was so nearly up with his work, that my turn would come very soon; and a few days ago I received notice through Mr. F. that the application was rejected, because something similar had been found in some old English book. I don't think that is fair; I didn't know anything about it, and I do not believe there was ever one in this country; but the law says that I must not only be the original inventor, but also the first inventor, and of course, if some one in England has invented it before, I am not the first; but it is a bad law, and if I ever get to Congress I will have it changed."

THE LIGHTEST MACHINE.

Probably the lightest engine ever constructed was the invention of Mr. Stringfellow, that received the prize of £100 sterling from the Aeronautical Society. It is a one-horse power engine and weighs 16 lbs.; the diameter of cylinder is two inches, stroke of piston three inches; works under a pressure of 100 lbs. to the square inch, and makes 300 revolutions the minute. We are reminded, in this connection, of some curious observations that have been made on the power exerted by birds in flying. It has been calculated that a goose accomplishes the work of 400-horse power in flying, but by an arrangement of its wings is actually obliged to exert a far smaller power. According to de Lucy a mosquito weighs 460 times less than the grasshopper, and has proportionally 14 times as much surface exposed by its wings. The sparrow only weighs a tenth as much as the dove, and yet its wings have twice the surface. The sparrow weighs 339 times less than the Australian crane, and possesses wings that have seven times the surface. These curious investigations have been made in the interest of aeronautical science.

MR. RUTHERFURD'S STAR PHOTOGRAPHS.

By means of a 11-inch objective this distinguished astronomer has obtained photographs of several groups of stars. One of these groups, comprising 43 stars in the constellation of pleiades, some of them of the 9th magnitude, was obtained after an exposure of three or four minutes.

By means of a very delicate micrometer Mr. Rutherfurd has been able to measure the arc of the angle which separates the stars of this constellation. These results have been compared by Dr. Gould with those formerly obtained by Bessel, and confirm the remarkable accuracy of the latter's work. By means of photography Mr. Rutherfurd can obtain, in one night, results that cost the German astronomer the labor of ten years. Mr. Rutherfurd has also taken photographs of the solar spectrum, showing a large number of lines not mapped by other investigators. There was in this instance also a remarkable confirmation of the accuracy of Kirchhoff's chart of the spectrum, mapped from actual observation and experiment.

Materials for Telegraphic Insulators.

Ebonite insulates much better than glass, and is far less apt to become damp than even porcelain. It is the best material yet known for the insulation of electrical apparatus. Compared with porcelain or earthenware, it less easily becomes wet in mist, but more easily in rain. Rain forms detached drops upon a surface of earthenware, but covers ebonite with a continuous film. Thus the latter acts with most advantage when it forms the inner cup of a compound insulator, and is protected by earthenware from the direct action of rain.

The surface of ebonite becomes rough and spongy, so as to retain dirt, and it matters not how perfect the substance of the insulator may be if its surface is defective.

But although ebonite will not maintain a high state of insulation for a long period, it may be advantageously used in certain cases to secure freedom from accidental interruption; for it is not liable to be broken, nor does it seem to afford temptation to stone throwing.

The best material for an insulator is a really good porcelain, thoroughly vitrified, so as to insulate perfectly even when unglazed. Its value arises principally from its polished smooth surface, which resists the formation of a continuous film of moisture, does not retain dust, and is washed clean by rain.

The objection to porcelain is, that considerable skill is required to select it, and to distinguish between a good and an inferior sample. As it is a compound of several substances, it is difficult to secure uniformity of composition, and much is left to the care and honor of the manufacturer.

Though a good glaze does not deteriorate by age or exposure to the weather, it is difficult to distinguish between a good and a bad glaze by inspection or electrical test, and it is quite possible that a glaze which appears good and insulates well, may crack by age.

Brown stoneware is both excellent in quality, cheap, and durable. Its surface is not equal to that of porcelain, so that it never insulates so well as the best specimens of the latter, but the glaze never cracks. Again, it is not a compound; so that when a manufacturer possesses a suitable clay, and takes care in its preparation, the uniformity of his ware may be depended on. It is also comparatively easy to distinguish its quality, and to detect faults in its manufacture.

Small pieces of ware are more easily burned, and therefore more likely to be perfect than large ones. There is, therefore, a great advantage in forming an insulator of separate hollow pieces or cups, placed one inside the other and fastened with cement; if one is defective there is a probability the others will be sound, and if the pin or bolt be covered with an insulator (such as ebonite), insulation will not be destroyed if the earthenware be entirely useless.

All insulators should be tested before they are used. Part of the glaze should be ground off to test the body.

They should be placed in a trough of dilute sulphuric acid, or salt and water, allowed to remain several hours, and tested with 250 cells and a delicate horizontal galvanometer, to prove if the bolt is perfectly insulated from the liquid in the trough, the edge of the insulator being slightly greased to prevent the water spreading over it. The acid must be very carefully washed off after the tests. From its power of repelling water, grease greatly aids insulation in damp weather; paraffine, again, enormously improves it; so that in testing samples it is necessary to ascertain carefully that they have not been coated with these substances.

In order to learn the comparative value of different kinds of insulators, they should be fixed upon standards in sets of not less than 10, exposed to the rain equally on all sides, and tested when the weather is uniformly wet. Almost any insulator will suffice in fine weather, while that which tests best in slight rain may not give the same result in extreme wet, when the insulation is most tried.—*Handbook of Practical Telegraphy.*

The Mormon Tabernacle.

It deserves the name of wonderful. Its like does not exist in our land, if anywhere. It is an edifice two hundred and fifty feet long inside, and one hundred and fifty feet wide. Brick columns or walls about twelve feet high, four feet thick, and some twelve feet deep, placed around the entire circumference, at intervals of about ten feet, support the walls and roof, and give free entrance and exit through wide doors on the inner side directly to the ground floor, upon which level is the great audience chamber, capable of comfortably seating fifteen thousand persons. The roof is like a monstrous half egg-shell cut through its longer diameter. It is supported on arched trusses and coned with pine, and no supporting columns break its great expanse. Its hight is over sixty feet. The pulpit occupies one end, and an organ higher than the Boston monster, almost as broad and musically excellent, is in process of construction, and nearly completed, back of the pulpit. The whole interior, pulpit and all, is white pine. The long benches are curved in seat and back in a way to make them, though uncushioned, more comfortable than those in most modern churches. At intervals curtains of thick white canvas are looped up across the ceiling, ready to let down to decrease the size of the room when small audiences are present. Here Brigham and his bishops preach Sunday afternoons, and while there are services in the morning, the chief attendance is at the ward churches, where the elders conduct the services.—*Architectural Review.*

TYNDALL ON HAZE AND DUST.

One of the most remarkable, and, perhaps, one of the most prolific discoveries of modern science, says the *Pall Mall Gazette*, was announced and described by Professor Tyndall in a lecture recently delivered at the Royal Institution. The subject of the lecture, which was illustrated by a series of very beautiful experiments or demonstrations, was the very familiar one of "Dust and Disease," and its object was to show the probability of an intimate connection between atmospheric dust and epidemic diseases. Every body knows that whenever a direct ray of sunshine crosses a shaded room its direction is made manifest by a line of apparent vapor. Looking at this vapor, it is seen to consist of innumerable particles of dust, which float in the atmosphere, and, catching and reflect ing the sunshine, are rendered visible.

In the course of some beautiful experiments on the decomposition of vapors by light, Dr. Tyndall found it to be essential that he should get rid of this floating dust. He strained the air through a tube filled with bits of glass wetted with concentrated sulphuric acid, and through another tube filled with bits of marble wetted with caustic potash; he even made it bubble through the liquid acid and the potash solution, but still the dust particles remained in it. He tried various other ways of straining out this dust, but none of them succeeded. At length he passed the air on its way to the tube over the flame of a spirit lamp, and at once every particle of the dust disappeared. It was, therefore, organic matter, and the flame had burned it.

Passing the air a little more quickly over the flame, a fine blue cloud appeared in the tube—the smoke of the dust particles. The organic and combustible nature of these particles was a discovery, for they had hitherto been taken to be inorganic and incombustible. Air was then passed through a tube which contained a roll of platinum gauze; and it was found, that when the platinum was cold, the dust particles all passed through with the air, but that when it was made red-hot, the dust particles were all consumed. In this case, too, when the air was forced quickly through, a fine blue cloud of smoke appeared, just as in the experiment with the spirit lamp. An attempt was then made to burn the dust particles by the concentrated rays of a convergent mirror, but it failed; the particles flitted too quickly through the focus of the burning ray to be consumed by it.

The next experiment was to put the flame of a spirit lamp in the ray of light which was revealing the floating dust. At once the flame was seen to be surrounded by wreaths of darkness, resembling intensely black smoke. On lowering the flame beneath the beam of light, the same dark masses were seen wreathing upward. "They were, at times," said Dr. Tyndall, "blacker than the blackest smoke that I have ever seen issuing from the funnel of a steamer, and their resemblance to smoke was so perfect as to lead the most practiced observer to conclude that the apparently pure flame of the alcohol required but a beam of sufficient intensity to reveal its clouds of liberated carbon." But when a red-hot poker was placed under the beam, the same black wreaths came floating through. A hydrogen flame was next put under it, and the whirling masses of darkness wreathed upward more copiously than ever. The blackness was, therefore, nothing but air from which all dust particles had been burned out, and which, consequently, contained nothing to catch the light and reflect it to the eye, as the dust particles do.

Here, however, a difficulty came in. The same effect was produced by a copper ball not hot enough to burn the dust, and by a flask filled with hot water. In this case it was found that the air was rarefied with the warmth, and, as the dust particles were not heated to the same extent, it dropped them and floated upward without them. Other gases, even common coal gas, carefully prepared so as to exclude the dust particles, have the same black appearance when they cross a ray, which the dust-laden air renders visible, and if coal gas or hydrogen be let into the top part of a glass shade, which has been placed in a sunbeam or ray of the electric light, the line between the dust-laden air and the gas is rendered visible—where the air is, the shade will seem full of the illuminated particles; where the gas is it will appear absolutely empty. "The air of our London rooms is filled with this organic dust, nor is the country air free from its pollution. It only needs a sufficiently powerful beam to make the air appear as a semi-solid rather than a gas."

Nobody could, in the first instance, without repugnance, place the mouth at the illuminated focus of the electric beam and inhale the dirt revealed there. Yet we are inhaling it every moment, and the wonder is, that so small a portion of it should be injurious to health.

What is the portion of this ever-present and all-pervading dust which is injurious to life? Now, it was long believed that epidemic diseases were propagated by malaria, which consisted of organic matter in a state of motor-decay; that when such matter was taken into the body through the lungs or the skin, it had the power of spreading in it a similar decay—yeast was a case in point. Why should not a bit of malarious matter operate in the body as a little leaven, leavening the whole lump? But, in 1836, Cagniard de la Tour discovered the yeast plant, which, when placed in a proper medium, grows and spreads, and produces what we call fermentation. In the next year Schwann, of Berlin, discovered the plant independently. He also proved, that when a decoction of meat is effectually excluded from common air, and supplied solely with air which has been raised to high temperature, it never putrefies. Putrefaction, therefore, he said, came from the air, and could be destroyed by a sufficiently high temperature. Helmholtz and Ure repeated and confirmed his experiments; but the high authority of Gay Lussac, who ascribed putrefaction to oxygen, drove chemists back on the old notion. That notion was finally exploded by Pasteur, who proved that the true ferments are organized beings who find in what we call ferments their necessary food.

Side by side with these discoveries grew up the germ theory of epidemic disease. Kircher expressed the idea, and Linnæus favored it, that epidemic diseases are due to germs which, floating in the atmosphere, enter the body and produce disease by the development of parasitic life. Sir Henry Holland has favored this theory, which derives its strength from the perfect parallelism between the phenomena of contagious disease and those of life. As an acorn planted in the soil gives birth to an oak which produces a whole crop of acorns, each of which has power to reproduce its parent tree, and thus, from a single seed, a whole forest may spring, so a germ of disease, planted in a human body, grows and shakes abroad new germs, which, meeting in other human bodies with their proper food and temperature, finally take possession of whole populations. Thus Asiatic cholera, beginning in a small way in the delta of the Ganges, spread itself, in seventeen years, over nearly the whole habitable world.

An infinitesimal speck of small pox virus will develop a crop of pustules, each charged with the original poison. The reappearance of this scourge, as in the case of the *Dreadnought*, at Greenwich, so ably reported on by Dr. Budd and Mr. Busk, is explained by the theory which ascribes it to the lingering of germs about the infected place. Surgeons have long known the danger of admitting air to an opened abscess, and abscesses are always opened by an instrument which carefully excludes the air from contact with the wound. The instrument should, of course, be scrupulously clean; but it can be made perfectly clean in an atmosphere of dust only by being made as hot as its temper will bear. This is not done, and therefore inflammation often sets in after the first operation; rapid putrefaction accompanies it, and the pus, which at first showed no traces of animal life, is now found to be full of active little organisms called vibrios. Professor Lister, from whose letter this fact is derived, contends that this astounding development of animal life is due to the entry of germs into the abscess during the first operation, and their subsequent development by favorable circumstances. Hay fever is another case in point.

The celebrated physiologist Helmholtz suffers from the 20th of May till the end of June from a catarrh of the upper air passages, and he has found, that during this period, and at no other, his nasal secretions are peopled by these vibrios. They nestle in the cavities of the nose, and a sneeze is necessary to dislodge them. These are uncomfortable statements, but if the germ theory is found to be true, it will give definiteness to our efforts to stamp out disease; and it is only by some definite efforts under its guidance that its truth or falsehood can be established. Hence, Dr. Tyndall says he reads with sympathy such papers as those of Dr. Budd, of Bristol, on cholera, scarlet fever, and small pox. Dr. Budd's imagination may occasionally tempt him to a flight beyond his facts, but without this dynamic heat of heart the solid inertia of the Briton can never be overcome. As long as heat can warm the truth without singeing it much, as long as enthusiasm can overmatch its mistakes by unequivocal examples of success, "so long," said Dr. Tyndall, "I am disposed to give it a fair field to work in, and to wish it Godspeed."

CONCLUSION.

Returning to the dust, Dr. Tyndall drew certain practical conclusions from the survey of these two classes of facts. The dust cannot be blown away by ordinary bellows, since the air they send out is equally full of the particles. But fill the nozzle with cotton wool, not too tightly pressed, and the air s filtered, and being then blown across the beam of light, forms a clean band of darkness, like the air from the spirit lamp, or from the heated platinum wire. This was the filter Schroeder used in his experiments on spontaneous generation; it was also turned to account in the excellent researches of Pasteur. Since 1868, Professor Tyndall has constantly employed it himself.

The most interesting of all illustrations of this filtering process is furnished by the human breath. Fill the lungs with ordinary air and breathe through a warm tube—warmed to prevent the condensation of the watery particles—across the beam of light which is revealing the dust particles in the air. The particles move with the moving air, but the current from the lungs shows, at first, as many particles as the ordinary atmosphere. Gradually, however, the particles clear away from the course of the breath, and by the time you have completed your expiration, the expired air cuts a sharp black line through the motes in the sunbeam. The air has left its dirt in the lungs, and the last portions of the expired breath are free from floating dust. But empty the lungs as far as possible, and then inhale a deep breath through a handful of cotton wool, and on expiring this air in the same way, it cuts a black line in the sunbeam at once. Place the tube below the beam and blow upward, and the air rises through the dancing particles like black smoke, just as it did from the heated surfaces on which the dust was burned. The cotton wool has completely intercepted the floating matter on its way to the lungs, and, as no dust was inhaled, none is exhaled.

Here, then, is the philosophy of an instinctive habit of medical men. In a contagious atmosphere the physician puts his handkerchief to his mouth, and inhales through it: in so doing he keeps back the floating germs. If the poison were a gas, it could not be thus intercepted. Dr. Bence Jones repeated Dr. Tyndall's experiment with a silk handkerchief, with a similar but less marked result. Cotton wool is, in fact, the best and surest filter, and a physician who wants to hold back from the lungs of his patient, or from his own lungs, the germs by which contagious disease is said to be propagated, will employ a cotton wool respirator. "After the revelations of this evening," concluded Dr. Tyndall, "such respirators must, I think, come into general use as a defense against contagion. In the crowded dwellings of the London poor, where the isolation of the sick is difficult, if not impossible, the noxious air around the patient may, by this simple means, be restored to practical purity. Thus filtered, attendants may breathe the air unharmed. In all probability the protection of the lungs will be the protection of the entire system. For it is exceedingly probable that the germs which lodge in the air passages, and which, at their leisure, can work their way across the mucous membrane, are those which sow in the body epidemic disease. If this be so, then disease can certainly be warded off by filters of cotton wool. I should be most willing to test their efficacy in my own person; and time will decide, whether in lung disease, also, the woolen respirator cannot abate irritation, if not arrest decay. By its means, so far as the germs are concerned, the air of the highest Alps may be brought into the chamber of the invalid."

Fecundity of Fishes.

The fecundity of fishes is enormous. I have carefully (by weighing the whole spawn and then counting the number of eggs in an exact portion) calculated the number of eggs produced at one litter by several of our native species, as follows:

Species.	Weight of fish.	No. of eggs.
Yellow perch	3½ ounces	9,943
River smelt	2 "	25,141
Fresh-water smelt	10 "	80,000
Whitefish (Coregonus)	2 pounds	25,076
Schoodic salmon (average)	1½ pounds	about 600
Sebago salmon (full count)	2 pounds 10 ounces	2,368

Sea or river salmon (migratory) yield on the average a little less than a thousand eggs for each pound weight; and shad not less than fifty thousand per fish.

These numbers, however, fail to convey to the mind an adequate idea of the possible consequences implied in them. A simple arithmetical calculation may assist us.

Take, for instance, the salmon, whose powers of reproduction and rate of growth are better known than those of most species, remarking, however, that the salmon is among the least fecund of the larger fishes. Let us now assume that a female salmon will at the age of four years produce seven thousand eggs at one spawning (a very moderate estimate), and that all the eggs hatch, and all the young arrive at maturity, the sexes being equally divided.

Commence with a single pair. The female lays 7,000 eggs. At the end of four years the first brood has arrived at maturity, and numbers 7,000 salmon; and half of these, or 3,500, are females, and each of them produces 7,000 eggs, total, 24,500,000 eggs; and these eggs in four years more have all become full-grown fish, forming the second brood. At the end of twelve years from the start the third brood arrives at maturity, numbering 85,750,000,000. At the end of the sixteenth year the fourth brood, numbering 300,125,000,000,000—salmon enough to cover the whole State of Maine a hundred feet deep.—*Charles G. Atkins, Commissioner of Fisheries, Maine.*

Preservation of the Body of Mr. Peabody.

The preservation of the remains of the late Mr. Peabody was intrusted to the hands of Dr. Parry. The process carried out consisted in injecting the whole body through the arteries with a solution of arsenic, containing also some bichloride of mercury.

Twenty-four hours afterwards another liquid, consisting of a saturated solution of tannin acid, was thrown in, with a view of effecting the gradual conversion of the gelatinous structures into the tanno-gelatin, or the basis of leather. None of the viscera were removed or disturbed, and before the opening into the chest required for the injection, practiced through the aorta, was closed, an arsenical paste, or rather cream, consisting of arsenic, camphor, and spirits, was introduced into the thoracic cavity; also through an opening in the diaphragm into the cavity of the abdomen, and freely distributed about.

Death had taken place about two days and a half before the process was commenced, and decomposition had set in, so as to produce great distension of the abdomen; but the process was found to check all this, and, when completed, all signs of a tendency to decomposition were removed. We may add that under the silk shroud, and upon the floor of the coffin, there was placed a bed of well-burnt animal charcoal.

THE ZIRCON LIGHT.

We have lately examined this excellent improvement, as applied to the passenger car of the Beach Pneumatic Transit Co. The car, in size, is about the same as an ordinary street car, and a single zircon light illuminates its interior with brilliancy. Two small cylinders of compressed oxygen and hydrogen are carried on the car, from which pipes extend to a small burner that supports a piece of zircon, not more than ¼ of an inch long and ⅛ of an inch in diameter. Against this little pencil of zircon the two gases impinge, and heat it so intensely as to make it glow with a clear and steady light.

Those who fancy that underground railway riding in New York is likely to be a dark and dismal affair will receive new impressions on the subject when they enter the premises connected with the Broadway tunnel.

One of the great advantages of the zircon light is that it burns like any other light without requiring adjustment. The light carried on the car before mentioned, burns steadily for 7 hours without being touched. The zircon pencil lasts for three months, and is, in effect, the wick of the light. Information concerning the zircon light can be had of the New York Oxygen Gas Company, corner of Eleventh avenue and Forty-first street, New York city.

Action of Magnetism on Various Gases.

M. Treve has communicated to the French Academy some remarkable results of experiments upon the action of magnetism upon the various gases. When the spark from an induction coil passes through a Geissler tube filled with hydrogen the gas becomes luminous, having a blue tint, plainly violet at the extremities of the tube, and of a fine red color in a capillary prolongation. But upon placing the latter part of the apparatus between the poles of a magnet the red instantly disappeared, giving place to a perfectly white light. In like manner oxygen, which gives a milky white light in the capillary tube, became red; nitrogen deepened its blue to a still deeper blue: the brilliant white of carbonic acid became deep blue; the blue of silicium fluoride became a bluish violet. The spectra of these luminous tubes changed when the capillary portions were subjected to the action of magnetism.

BOILER EXPLOSIONS.—From the report of the Manchester Steam Users' Association it appears that there were fifty-eight boiler explosions in England during 1869, by which eighty-six persons were killed and one hundred and twenty-six injured. The greatest number of explosions took place at collieries. The boilers from which most of the disasters resulted are described as plain cylindrical, egg-ended, camber-ended, and flat-ended (externally fired). The causes of the explosions are stated to be, first, malconstruction giving twenty-six cases; second, defective condition giving fifteen cases; third, over-heating giving nine cases. The nature of the remaining eight cases had not been ascertained.

TIN IN CALIFORNIA.—The Chief of the Cabinet of Practical Geology and Mining of the United States General Land Office, has very recently written a letter, stating that additional information in reference to the discoveries of tin in San Jacinto, San Bernadino county, Cal., has been received, and specimens of the ore have arrived. The analysis of an average specimen by a competent chemist and mineralogist shows that the ore contains 13·37 per cent of pure tin. The ore is intermixed with tourmaline, containing boracic acid, and with cassiterite. This combination is reported to be unusual and highly interesting, and the yield of tin is double that of the ores at the Cornwall (England) mines.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

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 should be by volume and page.

L. H., & Son., N. Y.—We know of no lacquer used for finishing sadirons. We think you can get the finish you speak of, or at least one equal to the sadiron finish thus: See that your buff wheels are well balanced after they are covered. Let the wheel be covered with thick leather before covering with the emery. Get as good a surface on the article as you can from a wheel covered with No. 70 emery. Mix flour of emery with melted beeswax and stir in till it is thick. When the mass is cool rub it on a new covered wheel with No. 80 emery. Then set the wheel running, and hold on a flint to smooth it until the surface is sufficiently fine to suit.

W. McC., of Iowa.—Under the circumstances we do not think there will be a sufficient saving between a non-condensing and a condensing engine to pay first cost of condensing apparatus, extra skill in management, and extra cost of repairs. The quantity of water required to condense, say at 60 degrees, will be 9,375 gallons per hour, but to provide for waste, say 10,000 gallons. We know of no better mode to cool the water than to expose it to the open air in a series of shallow tanks arranged like the steps of a stairway, so that the water may fall in a thin sheet from one to another.

C. M., of Mass.—You need not fear that water, in passing from a slate roof to your cistern through zinc gutters and pipes will be contaminated. You may test the presence or absence of zinc by adding to a small quantity two or three drops of hydrochloric acid, and then adding carbonate of soda in solution. If zinc be present a white precipitate will be formed.

S. T. T., of Md.—Any solid substance which will begin to sink in water, will sink, if unobstructed, to the bottom. The reason is this. Any solid now known is more compressible than water. Compressing it increases its specific gravity and renders it less buoyant than before the pressure was put upon it. As it goes down then its tendency to sink is increased rather than diminished.

V. C., of Wis.—To make a blue paint for a drum, you may use a shellac varnish and color to the tint desired.

A. B.—We have no doubt a wall made of sand, gravel, small stones, and good water lime cement, will make a good wall for a barn cellar, if good water lime is used and the work properly done.

X. Y. Z., of N. B.—The pressure per square inch of water upon the sides of vessels, is as the hight of the column, not as the diameter.

B. & W., of N. H.—You will find the information you desire in an article published in another column.

E. C., of O.—When the lime is precipitated from a solution of chloride of lime, the solution will no longer be chloride of lime. You can make a clear solution of chloride of lime by filtering.

J. A. V., of Ind.—We think you will find all the information you seek in "Practical Treatise on Heat" by Box. Published by Henry Carey Baird, 406 Walnut street, Philadelphia, Pa.

H. De L., of Pa.—A constant temperature is better for any kind of distillation than a fitful and varying one, if maintained at the proper point.

J. Slack.—To make chloride of gold, dissolve the gold in three times its weight of nitro-hydrochloric acid (aqua regia) and evaporate nearly to dryness. The salt can be made more neutral by repeated crystallizations and washings.

N. W. West.—Hand saws are made of steel plate of the right thickness. The teeth are cut in a suitable machine. We shall probably give a description of the hardening process in a subsequent issue. Your third inquiry cannot be answered in brief. You will find the subject discussed at length in works on metallurgy.

E. G. S., of N. B.—You will find a rule for computing the mean pressure in steam cylinders, in "Bacon's Richard's Steam Engine Indicator," published by D. Van Nostrand, 23 Murray street, New York. You do not give sufficient data; you have omitted to mention the clearance.

J. L. C.—For plumbing work in dwellings, except for water intended for drinking, we should prefer the seamless brass or copper tubes to any other. For pipes intended to convey water for culinary and drinking purposes, we prefer block-tin lined lead pipes.

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.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

"Winn's Portable Steam Brick Machine," makes more and better brick than any other machine in the world. Address Wright & Winn, Lock Haven, Pa.

Parallel Vise.—The most durable, labor-saving, and strongest, with the firmest hold. A. P. & M. Stephens & Co., 91 Liberty st., New York.

Perforated Zinc and Sheet Iron for separators, smut machines, grain dryers, tubular wells, malt kilns, etc. R. Aitchison & Co., Chicago.

T. F. Randolph, Steam Model Works, Cincinnati, Ohio.

Excelsior Turbine Water Wheel.—This superior water wheel has been found, by a final test, to excel, nearly one third, the best wheel in this country. For cheapness, durability, and power, it can not be equaled. Full particulars given by circular. Address Isaac S. Roland, Reading, Pa.

Foreman Wanted.—One who understands molding all kinds of heavy machinery, and a temperate man, can find constant employment by applying to Murray, Moore & Co., Portsmouth, Ohio.

Bone Mill Wanted.—Address Oil Company, Columbia, S. C.

Peck's patent drop press. For circulars, address the sole manufacturers, Milo Peck & Co., New Haven, Ct.

For the Best Upright Drill in the World, address Wm. M. Hawes & Co., Fall River, Mass.

Wanted—The address of manufacturers of power hub cupping machines, and wheel boxing machines. J. Bodley & Sons, wagon makers, Wheeling, W. Va.

Scientific American—Back Nos. and Vols., for sale. Address Theo. Tusch, No. 37 Park Row, New York.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4·00 a year. Advertisements 17c. a line

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

To Rent—East River water front, stores and vacant lots suitable for manufacturing or mercantile purposes, together or separate Daniel W. Richards & Co., 92 Mangin st.

A half interest in the new and very valuable patent, Shackleton's System of Utilizing Exhaust Steam, for sale on reasonable terms. We give a few testimonials where it has been in use for some months. Moore & Sealy Brothers; Yates, Wharton & Co.; P. W. Vail & Co.; M. Gould & Son, Newark, N. J. Perth Amboy Fibre Co., 40 Broadway, N. Y. Tweedy & Co., and Randle & White, Danbury, Conn. Crane, Tubbs & Co.; A. T. Lum, and J. Y. Brokaw, Elizabeth, N. J., etc., etc., etc. The above save from 35 to 50 per cent. For particulars apply to A. Carr, 45 Cortlandt st., N. Y., or address P. O. Box 19, Elizabeth, N. J.

Portable Pumping or Hoisting Machinery to Hire for Coffer Dams, Wells, Sewers, etc. Wm. D. Andrews & Bro., 414 Water st., N. Y.

Two 60-Horse Locomotive Boilers, used 5 mos., $1,300 each. The machinery of two 500-tun iron propellers, in good order, for sale by Wm. D. Andrews & Bro., 414 Water st., New York.

American Boiler Powder—A safe, sure, and cheap remedy for scale. Send for circular to Am. B. P. Co., P. O., Box 315, Pittsburgh, Pa.

For fire brick, fire clay, furnace tile, glass pots, stove linings, sewer pipe, drain tile, garden vases, pedestals, hydraulic cement, plaster of Paris, etc. Address D. R. Ecker, No. 13 Smithfield st., Pittsburgh, Pa.

See advertisement of Thomas' Lathes in another column.

Cold Rolled—Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

Keuffel & Esser, 71 Nassau st., N. Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves

For tinmans' tools, presses, etc., apply to Mays & Bliss, Brooklyn, N. Y

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U. S. Patent Office.

How to Obtain Letters Patent FOR NEW INVENTIONS.

Information about Caveats, Extensions, Interferences, Designs, Trade Marks; also, Foreign Patents.

FOR a period of nearly twenty-five years, MUNN & CO. have occupied the position of leading Solicitors of American and European Patents, and during this extended experience of nearly a quarter of a century, they have examined not less than fifty thousand alleged new inventions, and have prosecuted upward of thirty thousand applications for patents, and, in addition to this, they have made, at the Patent Office, over twenty thousand preliminary examinations into the novelty of inventions, with a careful report on the same.

The important advantages of MUNN & CO.'S Agency are, that their practice has been ten-fold greater than that of any other Agency in existence, with the additional advantage of having the assistance of the best professional skill in every department, and a Branch Office at Washington, which watches and supervises, when necessary, cases as they pass through official examination.

CONSULTATIONS AND OPINIONS FREE.

Those who have made inventions and desire a consultation are cordially invited to advise with MUNN & CO. who will be happy to see them in person at the office, or to advise them by letter. In all cases, they may expect an HONEST OPINION. For such consultations, opinion, and advice, NO CHARGE is made. A pen-and-ink sketch and a description of the invention should be sent.

TO APPLY FOR A PATENT,

A model must be furnished, not over a foot in any dimension. Send model to MUNN & CO., 37 Park Row, New York, by express, charges paid, also, a description of the improvement, and remit $16 to cover first Government fee, and revenue and postage stamps.

The model should be neatly made, of any suitable materials, strongly fastened, without glue, and neatly painted. The name of the inventor should be engraved or painted upon it. When the invention consists of an improvement upon some other machine, a full working model of the whole machine will not be necessary. But the model must be sufficiently perfect to show with clearness the nature and operation of the improvement.

PRELIMINARY EXAMINATION

Is made into the patentability of an invention by personal search at the Patent Office, among the models of the patents pertaining to the class to which the improvement relates. For this special search, and a report in writing, a fee of $5 is charged. This search is made by a corps of examiners of long experience.

Inventors who employ us are not required to incur the cost of a preliminary examination. But it is advised in doubtful cases.

COST OF APPLICATIONS.

When the model is received, and first Government fee paid, the drawings and specification are carefully prepared and forwarded to the applicant for his signature and oath, at which time the agency fee is called for. This fee is generally not over $25. The cases are exceptionally complex if a higher fee than $25 is called for, and, upon the return of the papers, they are filed at the Patent Office to await Official examination. If the case should be rejected for any cause, or objections made to a claim, the reasons are inquired into and communicated to the applicant, with sketches and explanations of the references; and should it appear that the reasons given are insufficient, the claims are prosecuted immediately, and the rejection set aside, and usually **Without Extra Charge to the Applicant.**

MUNN & CO. are determined to place within the reach of those who confide to them their business, the best facilities and the highest professional skill and experience.

The only cases of this character, in which MUNN & CO. expect an extra fee, are those wherein appeals are taken from the decision of the Examiner after a second rejection; and MUNN & CO. wish to state very distinctly, that they have but few cases which can not be settled without the necessity of an appeal; and before an appeal is taken, in any case, the applicant is fully advised of all facts and charges, and no proceedings are had without his sanction; so that all inventors who employ MUNN & CO. know in advance what their applications and patents are to cost.

MUNN & CO. make no charge for prosecuting the rejected claims of their own clients before the Examiners and when their patents are granted, the invention is noticed editorially in the SCIENTIFIC AMERICAN.

REJECTED CASES.

MUNN & CO. give very special attention to the examination and prosecution of rejected cases filed by inventors and other attorneys. In such cases a fee of $5 is required for special examination and report, and in case of probable success by further prosecution, and the papers are found tolerably well prepared, MUNN & Co. will take up the case and endeavor to get it through for a reasonable fee, to be agreed upon in advance of prosecution

CAVEATS

Are desirable if an inventor is not fully prepared to apply for a Patent. Caveat affords protection, for one year, against the issue of a patent to another for the same invention. Caveat papers should be carefully prepared.

The Government fee on filing a Caveat is $10, and MUNN & Co.'s charges for preparing the necessary papers are usually from $10 to $12.

REISSUES.

A patent when discovered to be defective, may be reissued by the surrender of the original patent, and the filing of amended papers. This proceeding should be taken with great care.

DESIGNS, TRADE MARKS, AND COMPOSITIONS

Can be patented for a term of years, also, new medicines or medical compounds, and useful mixtures of all kinds. When the invention consists of a medicine or compound, or a new article of manufacture, or a new composition, samples of the article must be furnished, neatly put up. Also, send a full statement of the ingredients, proportions, mode of preparation, uses, and merits.

PATENTS CAN BE EXTENDED.

All patents issued prior to 1861, and now in force, may be extended for a period of seven years upon the presentation of proper testimony. The extended term of a patent is frequently of much greater value than the first term; but an application for an extension, to be successful, must be carefully prepared. MUNN & Co. have had a large experience in obtaining extensions, and are prepared to give reliable advice.

INTERFERENCES

Between pending applications before the Commissioners are managed and testimony taken; also, Assignments, Agreements, and Licenses prepared. In fact, there is no branch of the Patent Business which MUNN & Co. are not fully prepared to undertake and manage with fidelity and dispatch.

FOREIGN PATENTS.

American inventors should bear in mind that five Patents—American, English, French, Belgian, and Prussian—will secure an inventor exclusive monopoly to his discovery among ONE HUNDRED AND THIRTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such, that patents can be obtained abroad by our citizens almost as easily as at home. MUNN & Co. have prepared and taken a larger number of European Patents than any other American Agency. They have Agents of great experience in London, Paris, Berlin, and other Capitals.

A Pamphlet, containing a synopsis of the Foreign Patent Laws, sent free
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Recent American and Foreign Patents.

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

SEED PLANTER AND FERTILIZER DISTRIBUTER.—Joseph Arrington, Livingston, Ala.—This invention has for its object to furnish a simple, convenient, and effective machine, which shall be so constructed and arranged that it may be easily and conveniently adjusted for planting cotton seed or other seed, or for distributing guano, or other fine ferti zer, doing its work well and thoroughly in either capacity.

CAR COUPLING.—John Whiteford, Pond City, Kansas.—This invention has for its object to improve the construction of the ordinary car coupling so as to make it self-coupling, without diminishing its strength or reliability.

CLOTHES WASHER.—Benjamin Pine, New York city.—This invention has for its object to furnish an improved washing machine, which shall be simple in its construction, easily operated, and effective in operation; washing the clothes quickly and thoroughly by pressure and without injuring the most delicate fabrics.

SOLDERING FURNACE.—John McPherson, Baltimore, Md.—This invention has for its object to economize fuel by locating the draft pipe in the lower part of the furnace, and by making use of a reversible grate, placed over the inner orifice of the draft pipe, which causes the fire to burn higher or lower, according as the draft opening in the grate is placed up or down; and to make the furnace self-cleaning by providing a chamber beneath the draft pipe, into which cinders and ashes may fall.

PLOW.—Mark Rigell, Newton, Ala.—This invention relates to the pivoting of the coulter to the beam, in such a manner that the coulter may yield readily to obstacles too powerful to be thrust aside; and to the application of a spring to the coulter, for the purpose of keeping it up to its work whon net yieldingto such obstacles.

SHEEP SHEARING TABLE.—J. R. Marshall, Marion, Pa.—This invention consists of a pivoted frame, provided with stocks for confining the sheep's legs, and a strap for sustaining its weight, and capable of holding the sheep in an upright position on its posterior, or in a recumbent posture on its side; and connected with a folding and cording apparatus for bundling the fleece.

MEAT CUTTER.—Wm. B. Heintzie, Williamsburgh, N. Y.—This invention relates to a new machine for cutting meat into small pieces, and consists chiefly in the employment of rotary cutters, hung upon axles that are secured in a rotary disk; and also in the use of a vertically adjustable bed or support for the meat to be cut.

INSTRUMENT FOR DRAWING GEOMETRICAL LINES.—Wm. Ritchie, Wilmington, Ill.—This invention relates to a new instrument which can be used for producing all kinds of curves, as well as straight lines, and which can be readily set and adjusted to draw with exactness the requisite curve or line. The invention consists chiefly in the arrangement of a frame, which carries a pencil or other marking instrument, and which is supported on a revolving frame or bed, wherein it can also slide. The combined sliding and revolving motion of the instrument produces the volutes, the grades of which can be regulated by the angle at which the instrument is caused to slide. The invention also consists in the general combination of devices used on the instrument with a trammel for producing ovals and volutes around the same.

COMBINED HAME AND COLLAR.—James H. Ferguson, Greenville, Ind.—This invention relates to improvements in hames and collars for horses, having for its object to provide a combination of the two devices in one, under an arrangement calculated to be cheaper in cost of construction, better adapted for service, and less rigorous to the animals.

WHIP SOCKET HOLDER.—Z. A. F. Lefébere and J. H. Davis, Plattsburg, N. Y.—This invention relates to a new and useful attachment for connecting whipsockets to the dash-boards, and holding them in a way to be readily detached; and consists of a clasp ring, made in two parts jointed together at one end, and provided with catches at the other, which spring together, one of the said parts being provided with a short outward curve to take around the iron bar of the dash-board, or with a hole for screwing or riveting to the said bar, when made of wood.

THOROUGH BRACE.—Jas. E. Requa, Sonora, Cal.—This invention relates to improvements in thorough braces for carriages, wagons, and other vehicles, and consists in making the same of steel, iron, or other metal wire, braided into thin flat strips or belts, and provided with suitable swivel or other connections.

MANUFACTURE OF WATER-PROOF FABRICS FROM REFUSE RUBBER.—Marcar Wahram Beylikgy, Constantinople, Turkey.—The object of this invention is to utilize the shavings and refuse of rubber goods, in the production of a new and useful fabric.

CORN PLANTER.—George D. Hayworth, Decatur, Ill.—This invention relates to improvements in that class of corn planters wherein the valves are worked by a knotted cord stretched across the field, secured at each end, and working over the machine as it moves back and forth to work the valves.

LOCK NUT.—Oswald S. Freeland, Newport, R. I.—This invention has for its object to furnish a simple, convenient, and effective lock nut for bolts upon machinery, and in other places where they will be exposed to jarring to prevent the said nuts from being worked off or loose by said jarring.

STEAM WAGON.—E. P. Talcott, Blair, Neb.—This invention hasfor its object to furnish an improved steam wagon, which shall be so constructed and arranged that it may be conveniently used for drawing a gang of plows, or for drawing any other desired loads through fields or upon common roads.

STEAM GENERATOR.—C. J. Stolbrand, Columbia, S. C.—The object of this invention is to furnish a steam generator, which shall be cheap, safe, economical, and effective, and it consists in a double sphere, or two spherical vessels combined, the space between the two spheres being the water space, and the inner sphere being the steam chamber.

STEAM BOILER.—James Jacobs, Maysville, Ky.—This invention relates to a new and useful improvement in steam boilers, and consists in arranging within the boiler and within a drum or steam chamber connected therewith, or in a boiler without the drum, a series of shallow pans for containing water and receiving sediment, whereby the steam generating power of the boiler is greatly increased, and whereby all damage or loss occasioned by sediment in the boiler is avoided.

HARVESTER.—James McCaffery, Waterloo, Iowa.—This invention relates to new and useful improvements in machines for harvesting grain, whereby much time and labor is saved.

MEDICAL COMPOUND.—J. T. Mulkey, Walton's Ford, Ga.—This invention elates to a new and useful medical compound for the cure of burns, bruises, and cutaneous diseases.

SEAT FASTENER.—Lorenzo Brown, Odessa, N. Y.—This invention relates to a new and useful improvement in fastenings for wagon seats, sliding doors and gates.

WARPING MACHINE.—Roscoe C. Reynolds and Cyrus I. Barker, Lewistown, Me.—This invention relates to improvements in warping machines, and consists in so arranging the driving mechanism of the warping roller that it may, by the movement of a hand lever, be started and run slowly, and increased to the required motion before the belt is shifted to the fast pulley; the object being to first take up the slack of the yarn given off by the spools in consequence of being continued in motion at the time of stopping, by their momentum, longer than the roller, and to start the spools into motion again without breaking the yarn.

DITCHER.—C. F. Woodruff, Newbern, Tenn.—This invention consists in providing the front cutting bar with splitting bits, extending down from its under side, for excavating the bottom of the ditch, and with blades at its ends for forming the sides of the ditch.

TOOL HOLDER FOR GRINDSTONES.—Philip Leonard, Sharon, Pa.—This invention relates to improvements in tool holders for holding the tools or scrapers to grindstones and traversing them along the face of the stones, and adjusting them for grinding on different bevels. It consists of a slotted bed-plate arranged for attachment to the wooden frames of the stone by screws or bolts so as to be adjusted toward or from the face of the stone and provided with uprights, wherein a vertically oscillating plate is journaled at the edge next the stone, which plate serves for the support and laterally traversing bed of a tool or scraper-holder which is capable of sliding to or from the stone, and is provided with a screw for operating it.

COMBINED MOWING MACHINE AND HAY SPREADER.—J. H. Dater, Eagle Mills, N. Y.—This invention relates to an improvement in mowing machines, whereby they are made to spread and disturb the grass mowed by them. The invention consists in the combination of a hay spreader with a mowing machine, the spreader being arranged behind the frame of the mower.

CLOCK.—Michael Tromly, Cincinnati, Ohio.—This invention consists in a new escapement, the same being made up of a single pallet, provided with a wire arm, connected at its free end with a cam groove on the hub of the balance wheel, in such a manner that, at each vibration of the latter, the pallet is thrown out to allow one tooth to pass.

ORGAN AND MELODEON ACTION.—John C. Briggs, Ansonia, Conn.—This invention has for its object to so arrange the action of all reed and pipe instruments, that an extra or sub-base note of the lowest key belonging to a chord of music can be played without requiring that extra note, belonging to either of the keys of which such chord is composed, to be played; the solos, played by the left hand, can thereby be kept free of base notes, with the exception of the lowest, all the other notes being treble notes. Any independent part of any musical composition can therefore be played upon the keyboard of a reed or pipe instrument. Inversely, the same invention is applicable to the playing of an extra treble note of the highest key belonging to the chord, without playing any more treble notes of the same chord.

PLOW.—Mark Rigell, Newton, Ala.—This invention consists in the combination of a plant protector with a plow.

FASTENING FOR RUBBER SHOES.—Mrs. Helen Ekin Starrett, Lawrence, Kansas.—This invention consists in straps secured at their lower ends to the inside of an overshoe, and intended to be fastened over the top of the foot, in any suitable manner for the purpose of retaining the shoe thereupon.

TIRE SETTING AND COOLING APPARATUS.—C. B. Guy, Postville, Iowa.—This invention relates to improvements in apparatus for holding the wheels for setting wagon tire, and consists in an arrangement of the holding frame for adjusting the holding spindle or bolt toward or from one edge thereof; also, in an arrangement for tilting the frame, by means of a foot treadle, to bring the rim of the wheel thereon down into water held in a trough at the side for cooling the tire.

PLOW.—A. C. Judson, Grand Rapids, Ohio.—This invention relates to a new manner of providing a cutter on a plow by extending the landside beyond the front edge of the moldboard, and to a new method of strengthening and stiffening the moldboard by extending the standard clear forward into the plow to the junction of the landside and moldboard, or of two moldboards.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING FEB. 22, 1870.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT OFFICE FEES:

On each caveat	$10
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On filing a Disclaimer	$10
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On an application for Design (seven years)	$10
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100,000.—SUNBONNET FOR HORSES.—John Anderson, Brooklyn, N. Y.
100,001.—SEED PLANTER AND FERTILIZER DISTRIBUTER.—Joseph Arrington, Livingston, Ala.
100,002.—PRINTING PRESS.—Henry Barth, Cincinnati, Ohio.
100,003.—PROCESS AND APPARATUS FOR THE MANUFACTURE OF IRON AND STEEL.—Henry Bessemer, London, Great Britain. Patented in England Nov. 10, 1868.
100,004.—HANGING CRANK SHAFTS.—J. M. Beugler, Williamsport, Pa.
100,005.—MANUFACTURE OF WATER-PROOF FABRICS FROM WASTE RUBBER.—M. W. Beylikgy, New York city.
100,006.—CELLAR HOIST OR ELEVATOR.—H. L. Bowers, Harrisburg, Pa.
100,007.—VEGETABLE CUTTER.—W. A. Boyden and C. J. Mann, Altoona, Pa.
100,008.—COAL SHOVEL.—J. F. Brewer (assignor to S. Stow Manufacturing Co.), Plantsville, Conn.
100,009.—ORGAN OR MELODEON ACTION.—J. C. Briggs, Ansonia, Conn.
100,010.—SEAT FASTENER.—Lorenzo Brown, Odessa, N. Y.
100,011.—RECLINING CHAIR.—W. A. Bury, Crosse Isle, Mich. Antedated Feb. 17, 1870.
100,012.—UMBRELLA.—Alonzo B. Caldwell, Syracuse, N. Y.
100,013.—WATER HEATER FOR GREEN HOUSES.—S. E. Chubbuck (assignor to himself, I. Y. Chubbuck, and S. E. Chubbuck, Jr.), Boston, Mass.
100,014.—HEAD REST.—E. P. Cook, Cartersville, Ga.
100,015.—BEEHIVE.—H. B. Cooper, Memphis, Tenn.
100,016.—GRATE BAR.—T. S. Davis, Lancaster, Pa.
100,017.—STEAM HEATER FOR BURNISHING IRONS.—J. M. De Lacy, Trenton, N. J.
100,018.—SWITCH SIGNAL.—H. A. Efner and Chas. Boynton, Marshall, Mich.
100,019.—JIB HANK FOR VESSELS.—H. K. Eldridge, Cambridge, Mass.
100,020.—DINING AND IRONING TABLE AND QUILTING FRAME.—Thomas Elkins, Albany, N. Y.
100,021.—MARINE DRAG.—John Faunce, Washington, D. C.
100,022.—COLLAR AND HAME FOR HARNESS.—J. H. Ferguson, Greenville, Ind.
100,023.—NUT LOCK.—O. S. Freeland, Newport, R. I.
100,024.—STOVE GRATE.—Geo. Froh, Philadelphia, Pa.
100,025.—CHURN.—Heman Gardiner, New York city. Antedated Feb. 5, 1870.
100,026.—DOOR KNOB.—John W. Grogan (assignor to himself and James Duffy), Brooklyn, N. Y. Antedated Feb. 12, 1870.
100,027.—APPARATUS FOR COOLING AND PURIFYING BEER, WATER, AND OTHER LIQUIDS.—J. P. Gruber, New York city.
100,028.—TIRE SETTING AND COOLING APPARATUS.—C. B. Guy, Postville, Iowa.
100,029.—CASK FOR CONTAINING FERMENTABLE BEVERAGES.—John Hamilton and Robert Paterson, Glasgow, Great Britain.
100,030.—RAILWAY RAIL.—Alonzo Hanmer and David Grim, Pittsburgh, Pa.; said Alonzo Hanmer assigns his right to P. L. Grim, Beaver county, Pa.
100,031.—HALTER.—W. M. Harris, Dixon, Ill.
100,032.—CORN PLANTER.—G. D. Hayworth, Decatur, Ill.
100,033.—GRAIN DRILL.—Martin Hayden, Dowagiac, Mich. Antedated Feb. 12, 1870.
100,034.—REFRIGERATOR.—Adam Heinz (assignor to himself, J. L. Fisher, and G. J. Munschauer), Buffalo, N. Y.
100,035.—MEAT CUTTER.—Wm. B. Heintzie, Williamsburgh, N. Y.
100,036.—REGISTERING PUNCH FOR RAILROAD CONDUCTORS.—Austin D. Hoffman (assignor to himself and Charles H. Morse), Chicago, Ill.
100,037.—TILL ALARM.—A. D. Hoffman (assignor to Chas. H. Morse), Chicago, Ill.
100,038.—ELECTROPLATING WITH ANTIMONY.—James Spooner Howard, Mansfield, assignor to himself, E. Adams, Jr., Attleborough, T. E. Grover, Mansfield, and N. Carpenter, Attleborough, Mass.
100,039.—COMPOUND FOR CURE OF COUGHS, COLDS, ETC.—William H. H. Irwin, Philadelphia, Pa. Antedated Feb. 5, 1870.
100,040.—CULTIVATOR.—Nathan L. Isgrigg, Moore's Hill, Ind.
100,041.—STEAM GENERATOR.—James Jacobs, Maysville, Ky.
100,042.—PLOW.—A. C. Judson, Grand Rapids, Ohio, assignor to E. O. Judson.
100,043.—COMPOUND TO REMOVE GREASE FROM CLOTH, SILK, PAPER, ETC.—M. B. Kimm (assignor to himself and G. G. Stetcelee), Grand Rapids, Mich.
100,044.—LATCH FOR GATES.—James Kindel, Wilmington, Ohio.
100,045.—CULINARY VESSEL.—G. Landrine, Jersey City, N. J.
100,046.—CLASP FOR SECURING WHIP SOCKETS TO DASH-BOARDS.—Zephaniah A. F. Lefébere and James H. Davis, Plattsburg, N. Y.
100,047.—TOOL HOLDER FOR GRINDSTONES.—Philip Leonard, Sharon, Pa.
100,048.—TREMOLO FOR ORGANS.—John R. Lomas, New Haven, Conn.
100,049.—VEGETABLE CUTTER.—G. Lutz, J. Schultheis, and M. Florentin, Newark, N. J.
100,050.—COMMERCIAL PORTFOLIO.—S. E. Mandlebaum, St. Louis, Mo.
100,051.—HARVESTER.—Jas. McCaffery, Waterloo, Iowa.
100,052.—DUMPING WAGON.—Edward Miller, Milwaukee, Wis. Antedated Feb. 11, 1870.
100,053.—SERIES OF DIES FOR FORMING THE HEADS OF KING-BOLTS.—R. R. Miller, Plantsville, assignor to himself and J. B. Savage, Southington, Conn.
100,054.—SMUT MILL AND SEPARATOR.—John Mills and A. G. Waldo, Milwaukee, Wis.
100,055.—SPIKE FOR RAILWAYS.—James Montgomery, New York city.
100,056.—BALANCE SLIDE VALVE.—Geo. R. Moore, Philadelphia, Pa.
100,057.—OINTMENT FOR BRUISES, BURNS, ETC.—J. T. Mulkey, Walton's Ford, Ga.
100,058.—RAILWAY OIL CAR.—S. W. Murray and B. P. Lamason, Milton, Pa.
100,059.—PAPER FEEDER.—Oliver Norelius, Minneapolis, Minn.
100,060.—STAY FOR TRUNK LIDS.—D. C. O'Conner, New York city.
100,061.—WINDMILL.—Walter Peck, Rockford, Ill.
100,062.—WASHING MACHINE.—Benjamin Pine, New York city.
100,063.—TANK FOR RENDERING LARD.—David Pinger, St. Joseph, Mo.
100,064.—FRICTION CLUTCH.—F. A. Pratt (assignor to Pratt, Whitney & Co.), Hartford, Conn.
100,065.—DRAWBRIDGE.—T. W. Pratt (assignor to himself and Boston Machine Co.), Boston, Mass.
100,066.—STEELYARD.—William B. Preston, North Chelsea, Mass.
100,067.—PICTURE ENVELOPE.—Robert Price, New York city.
100,068.—THOROUGH BRACE.—James E. Requa, Sonora, Cal.
100,069.—BOOKBINDING.—George H. Reynolds, New York city.
100,070.—WARPING MACHINE.—R. C. Reynolds and Cyrus I. Barker, Lewiston, Me.
100,071.—PROCESS OF BLEACHING AND CLEANING VEGETABLE FIBERS.—E. T. Rice, New York city. Antedated February 10, 1870.
100,072.—INSTRUMENT FOR DRAWING GEOMETRICAL LINES.—Wm. Ritchie, Wilmington, Ill.
100,073.—STOVE SHELF.—John R. Robertson, Syracuse, N. Y.
100,074.—WEATHER-STRIP.—Horace A. Robison, Cleveland, Ohio.
100,075.—SASH HOLDER.—Charles W. Rockhold, Peoria, Ill.
100,076.—CHURN.—Rice Farrar Ross, Marshall county, Miss.
100,077.—TRUNK STAY.—Edward Semple, Chicago, Ill.
100,078.—HARVESTER RAKE.—D. B. Shirk, Brunersville, Pa.
100,079.—FAUCET FILTER.—Montgomery P. Simons, Philadelphia, Pa.
100,080.—PORTABLE GAS GENERATOR.—Wm. Snodgrass (assignor to himself and J. M. Browne), Macomb, Ill.
100,081.—COMPOUND TO BE USED AS AN ARTICLE OF DIET.—W. D. St. Clair, Chicago, Ill.
100,082.—LEATHER-SPLITTING MACHINE.—Caleb S. Stearns, Marlborough, Mass. Antedated Feb. 12, 1870.
100,083.—SPRING CHAIR FOR CHILDREN.—Mathias Stephan, Canton, Ohio.
100,084.—WATER RAM.—K. W. Stetson, Kingston, Mass. Antedated Feb. 18, 1870.
100,085.—STEAM GENERATOR.—C. J. Stolbrand, Columbia, S. C.
100,086.—STEAM WAGON.—E. P. Talcott, Blair, Nebraska.
100,087.—CASE FOR CURING AND TRANSPORTING TOBACCO—G. E. Tuckett, Hamilton, Canada.
100,088.—HORSE POKE.—Myers J. Van Aken, Sturgis, Mich.
100,089.—SAW-GRINDING MACHINE.—George Walker, Middletown, N. Y.
100,090.—STEAM AND AIR ENGINE.—G. Warsop, Nottingham, Eng. Patented in England, Sept. 8, 1868.
100,091.—MALT KILN.—John G. White, Albany, N. Y. Antedated Feb. 17, 1870.
100,092.—CAR COUPLING.—John Whiteford, Pond City, Kansas.
100,093.—SAFE.—L. F. Whiting and Franklin Smith, Boston, Mass.
100,094.—BOLT FEEDER FOR MILLS.—B. A. Wing, Galesburg, Mich.
000,095.—DEOXIDIZING AND CARBONIZING IRON ORES.—C. Adams, Philadelphia, Pa.
100,096.—VULCANIZED RUBBER HOSE.—H. A. Alden, Matteawan, N. Y., assignor to the New York Rubber Co.
100,097.—HAND-MOTIVE CARRIAGE.—J. Allgaier, Philadelphia, Pa.
100,098.—WHEELBARROW.—Henry Alter, Lakeport, Cal.
100,099.—PHOTOGRAPHIC SCREEN.—J. A. Anderson, Chicago Ill.
100,100.—BROADCAST SEEDER.—William S. Archer, Dayton, Ohio.
100,101.—RAILROAD SWITCH.—Jno. L. Arms, St. Louis. Mo.
100,102.—POTATO CULTIVATOR AND DIGGER.—W. J. Avery and Tunis Laberteaux, Marshall township, Mich.
100,103.—COAL ELEVATOR.—A. S. Bailey, Chicago, Ill.
100,104.—HORSE HAY RAKE.—A. B. Barnard, Worcester, Mass.
100,105.—COTTON PRESS.—Charles J. Beasley, Petersburgh, Va.
100,106.—ALARM GUN.—C. J. Beasley, Petersburgh, Va.
100,107.—HOT-AIR FURNACE.—Oscar Bellman and John W. Garver, Hagerstown, Md.
100,108.—PAINT BRUSH.—C. S. Benjamin and Edward Story, Washington, Ill.
100,109.—MANUFACTURE OF PAPER.—E. B. Bingham, Newark, N. J.
100,110.—HEATER AND VENTILATOR.—Geo. W. Blake, New York city.
100,111.—MACHINE FOR GROOVING SHEET METAL.—C. F. Bitsenick, Providence, Pa.
100,112.—NEEDLE FOR SEWING MACHINE.—John L. Boone, San Francisco, Cal.

100,113.—Stop Cock.—Joseph Breeden, Birmingham, Eng. Patented in England, Feb. 23, 1869.
100,114.—Clothes Dryer.—Benoni S. Brown, Chicago, Ill.
100,115.—Tube Stopper.—Wm. Brown, Hoboken, N. J.
100,116.—Seat for Cars, etc.—James Casseday (assignor to himself and J. D. Holt), Philadelphia, Pa.
100,117.—Portable Furnace.—Thomas Chadwick (assignor for one half his right to F. W. Cozad), Newton, Iowa.
100,118.—Blind Slat.—M. W. Clark, Worcester, Mass., assignor to R. Ball & Co.
100,119.—Altitude Instrument.—Hall Colby, New York city, assignor to himself and G. G. Colby, Washington, D. C.
100,120.—Feather Renovator.—Abel D. Cook and James Graves, New Madrid, Mo.
100,121.—Children's Carriage.—William E. Crandall, New York city.
100,122.—Wagon Spring.—J. N. Crannell, Champaign, Ill. Antedated Feb. 11, 1870.
100,123.—Bag Holder.—Leonard Crofoot, Pavilion, N. Y.
100,124.—Combined Mowing Machine and Hay Tedder.—J. H. Dater, Eagle Mills, N. Y.
100,125.—Machine for Rolling Car-Coupling Pins.—Wm. Davis and Joseph While, Cleveland, Ohio.
100,126.—Faucet.—J. M. A. Dew, Chicago, Ill. Antedated Feb. 18, 1870.
100,127.—Mode for Forming Blown Glassware.—Hiram Dillaway, Sandwich, Mass.
100,128.—Combined Cotton Chopper and Cultivator.—John D. Dunn, Griffin, Ga.
100,129.—Gate.—Charles H. Eggleston, Marshal, Mich.
100,130.—Watch Regulator.—D. W. Eldredge, Boston, Mass.
100,131.—Manufacture of Copper and in Separating other Metals Therefrom.—J. B. Elkington, Birmingham, England. Patented in England, November 3, 1865.
100,132.—Construction of Chairs.—H. H. Evarts, Chicago, Ill.
100,133.—Bedstead.—H. H. Evarts, Chicago, Ill. Antedated February 14, 1870.
100,134.—Street Pavement.—E. M. Fowler (assignor to H. G. McGonegal), New York city.
100,135.—Machine for Cutting Soap into Slabs.—Joseph Gallipo Cohoes, N. Y.
100,136.—Brick Machine.—B. M. Gard, Urbana, Ohio, and E. R. Gard, Chicago, Ill.
100,137.—Strainer for Coffeepot.—C. L. Gilpatric, Hyde Park, Mass.
100,138.—Base Burning Stove.—J. H. Goodfellow (assignor to himself and R. S. Goodfellow), Troy, N. Y.
100,139.—Sewing Machine.—Wm. O. Grover, Boston, Mass.
100,140.—Grip Pulley.—A. S. Hallidie, San Francisco, Cal.
100,141.—Steam Generator.—Joseph Harrison, Jr., Philadelphia, Pa.
100,142.—Wine Press.—C. F. Hartmann, Nazareth, Pa.
100,143.—Skylight.—George Hayes, New York city.
100,144.—Feed-Water Purifier for Steam Generators.—H. K. Hazlett, St. Louis, Mo.
100,145.—Hedge and Tree Trimmer.—C. E. Healy, New London, Ohio.
100,146.—Railway Car Coupling.—T. R. Herd, Allegheny City, Pa.
100,147.—Coupling Cars.—Thomas Hess, West Bonn, Pa.
100,148.—Metallic Roofing.—Thos. N. Hickcox, Brooklyn, N. Y.
100,149.—Rotary Steam Engine.—J. W. Hill, Jefferson, and Thomas Roberts, Panora, Iowa.
100,150.—Lock for Wagon Seat.—Edgar Hitt, Poundridge, N. Y.
100,151.—Masts of Vessels.—Edgar E. Holley, New York city.
100,152.—Quadrant and Sextant.—Frederick Holzach, New Orleans, La.
100,153.—Signal Apparatus.—A. H. Huntington, Galesburg, assignor to Wm. McKee, Neponset, Ill.
100,154.—Grain Conveyer.—Olof Johnson and C. O. Wall, Galva, Ill. Antedated February 16, 1870.
100,155.—Egg Beater.—Frank Krandelt, San Francisco, Cal.
100,156.—Steam Clothes Washer.—M. T. Lamb, Davenport, Iowa.
100,157.—Pitman Connection.—S. T. Lamb, New Albany, Ind.
100,158.—Pitman Joint for Harvesters.—S. T. Lamb, New Albany, Ind.
100,159.—Pitman Joint for Harvesters.—S. T. Lamb, New Albany, Ind.
100,160.—Soldering Machine.—Jos. Le Comte, Brooklyn, N. Y.
100,161.—Ruffling Attachment for Sewing Machine.—A. M. Leslie, Chicago, Ill., assignor to himself and Cornell, Ward, and Comings.
100,162.—Pump.—G. W. Low, Ravenna, Ohio.
100,163.—Manufacture of Fertilizers from Animal Substances.—Orazio Lugo, Baltimore, Md.
100,164.—Clamp for Stay-Log.—J. N. Lyman, New York city.
100,165.—Stone and Stump Extractor.—J. B. Lyons, Milton, Conn.
100,166.—Punch and Press.—W. Stinson Lord, Crawford, Miss.
100,167.—Roofing and Flooring.—P. N. Mackay, Virginia City, Nevada.
100,168.—Potato Digger.—O. E. Mallory (assignor for one half his right to S. B. Lusk), Batavia, N. Y.
100,169.—Fence.—Harris H. Margeson, San Francisco, Cal.
100,170.—Sheep Shearing Table.—J. R. Marshall, Marion, Pa.
100,171.—Extensible Gas Tube for Chandeliers.—H. L. McAvoy (assignor to himself and Samuel Ault, Jr.), Baltimore, Md. Antedated February 10, 1870.
100,172.—Implement for Under-Cutting Sand Cores in Flasks.—Wm. L. McDowell, Philadelphia, Pa.
100,173.—Car Coupling.—E. T. McKean, Hammonton, N. J.
100,174.—Soldering Furnace.—John McPherson, Baltimore, Md.
100,175.—Grinder for Rattler for Cleaning Castings.—George Miller, Johnston, R. I.
100,176.—Jack for Carriage Springs.—R. R. Miller, Plantsville, Conn., assignor of half interest to J. B. Savage.
100,177.—Fifth-Wheel Head for Carriages.—R. R. Miller, Plantsville, Conn., assignor of half interest to J. B. Savage.
100,178.—Die for Forming Heads of King-Bolts.—F. B. Morse, Plantsville, Conn.
100,179.—Drive Well Tube.—J. M. Mott, Chicago, Ill.
100,180.—Horseshoe.—A. L. Murphy, Philadelphia, Pa.
100,181.—Harvester Dropper.—Ephraim Myers, Creagerstown, Md.
100,182.—Water Filter, Liquor Cooler, and Refrigerator.—W. F. Nickels, Philadelphia, Pa.
100,183.—Cultivator.—A. B. C. Nusbaum, Sacramento, Cal.
100,184.—Safe.—D. O. Paige, Detroit, Mich.
100,185.—Bridge.—C. H. Parker, Boston, Mass.
100,186.—Cap for Metallic Cans.—G. H. Perkins, Brooklyn, N. Y.
100,187.—Wagon.—Eli Petteys, Chestertown, N. Y.
100,188.—Subsoil Plow and Scraper Combined.—J. Reynolds, Crystal Springs, Miss.
100,189.—Eraser Attachment for Pencils, etc.—Geo. H. Richards, New York city.
100,190.—Wagon Seat.—D. H. Richardson, Henrietta, N. Y.
100,191.—Life Raft.—John Rider, New York city.
100,192.—Car Coupling.—H. S. Root, Muncy, Pa.
100,193.—Boat-Detaching Apparatus.—John Ross, San Francisco, Cal.
100,194.—Wardrobe Hook.—J. B. Sargent, New Haven, Conn.
100,195.—Lock.—Zebadiah Sargent, Rochester, N. H.
100,196.—Separator to be Used in Distilling Liquors.—George W. Shaw, Buffalo, N. Y.
100,197.—Apparatus for Towing Rafts, etc.—E. O. Shepardson, St. Louis, Mo.
100,198.—Paper-Box Machine.—Daniel Simmons, Jun., New York city.
100,199.—Ditcher and Grader.—J. G. Sisson and Lark Delana, Arcola, Ill.
100,200.—Harvester Rake.—E. W. Skinner, Madison, Wis.
100,201.—Brake and Ratchet for Elevating and Lowering Buckets.—Isaac T. Smith, Richmond, Va.
100,202.—Negative Plate for a "Smee" Battery.—Luther L. Smith, Brooklyn, N. Y.
100,203.—Steam Engine Governor.—William Smith, Philadelphia, Pa.
100,204.—Railway Car Coupling.—Elias F. Sneider, West Penn, Pa. Antedated February 16, 1870.
100,205.—Furnace.—Thomas Speakman, Camden, N. J.
100,206.—Shifting Bar for Sleighs.—A. J. Spencer, Middletown, Conn.
100,207.—Fastening for Overshoes.—Helen Ekin Starrett, Lawrence, Kansas.
100,208.—Manufacture of Gas from Petroleum.—Levi Stevens, Washington city, D. C.
100,209.—Folding Chair.—Alexander W. Stewart, Glasgow, Scotland. Antedated August 22, 1869.
100,210.—Mechanical Leech.—Frederick A. Stohlmann, Brooklyn, N. Y., and Andrew H. Smith, New York city, assignors to Frederick A. Stohlmann.
100,211.—Heating and Ventilating Apparatus.—B. F. Sturtevant, Jamaica Plain, Mass.
100,212.—Grain Drier.—B. F. Sturtevant, Jamaica Plain, Mass.
100,213.—Packing for Piston Rods.—Charles Thayer and David McPherson, Rome, N. Y.
100,214.—Washer for Screw Bolts.—Nathan Thompson, Brooklyn, N. Y.
100,215.—Corn Planter.—E. A. Thrush, New Kingston, N. Y.
100,216.—Screw Propeller.—Charles G. Toense, Jersey City, N. J.
100,217.—Escapement for Time Pieces.—Michael Tromly (assignor to himself and W. L. Hasbrouck), Cincinnati, Ohio.
100,218.—Shears.—Friedrich Ulrich, Brooklyn, E. D., N. Y.
100,219.—Fruit Ladder.—James H. Verity, Lansing, Mich.
100,220.—Automatic Latches.—Edward Voigt, Philadelphia, Pa.
100,221.—Gearing for Harvesters.—A. H. Wagner, Chicago, Ill.
100,222.—Machine for Making Horseshoes.—James T. Walker, Albany, N. Y.
100,223.—Shingle Machine.—Gustavus Walton, Minneapolis, Minn.
100,224.—Apparatus for Producing Butter from Cream.—Stanton D. Warner and Owen W. Thomas, Richmond, Ill.
100,225.—Cancelling Stamp.—Wm. A. Wheeler, New York city.
100,226.—Hook for Harness.—Abner White, Macon, Ga.
100,227.—Revolver.—Rollin White, Lowell, Mass.
100,228.—Broom Brace.—Freeman O. Willey, Wilmette, Ill.
100,229.—Sand Paper Holder for Finishing the Soles of Boots and Shoes.—Herbert L. Willis, South Easton, Mass.
100,230.—Machine for Making Nails and Spikes.—Thomas Wood, Matteawan, N. Y.
100,231.—Ditcher.—C. F. Woodruff, Newbern, Tenn.
100,232.—Reversible Percolator.—Samuel Woolston, Vincentown, N. J., and Wm. Corfield, Philadelphia, Pa.
100,233.—Hook for Harness.—Gustav Bernd and Adolph Bernd, Macon, Ga.
100,234.—Cap for Powder Boxes Used for Domestic Purposes.—Henry A. Bartlett, Philadelphia, Pa.
100,235.—Grain Dryer.—B. F. Sturtevant, Jamaica Plain, Mass.
100,236.—Pressure Blower Wheel.—B. F. Sturtevant, Jamaica Plain, Mass.
100,237.—Pressure Blower Wheel.—B. F. Sturtevant, Jamaica Plain, Mass.
100,238.—Hot-air Blower.—B. F. Sturtevant, Jamaica Plain, Mass.
100,239.—Pressure Blower.—B. F. Sturtevant, Jamaica Plain, Mass.
100,240.—Compound Air-heater and Steam Condenser.—B. F. Sturtevant, Jamaica Plain, Mass.
100,241.—Compound Air-heater and Steam Condenser.—B. F. Sturtevant, Jamaica Plain, Mass.
100,242.—Compound Air-heater and Steam Condenser.—B. F. Sturtevant, Jamaica Plain, Mass.
100,243.—Uniting Tubes to Tube Sheets.—B. F. Sturtevant, Jamaica Plain, Mass.

REISSUES.

3,847.—Insulator.—Louis A. Cauvet, New York city.—Patent No. 48,906, dated July 25, 1865.
3,848.—Weather Strip.—F. C. Gridley, Hudson, Wis.—Patent No. 56,209, dated July 10, 1866.
3,849.—Machine for Engraving Calico Printer's Rollers.—John Hope, Thomas Hope, and Heber Le Favour, Providence county, R. I., assignees, by mesne assignments, of John Hope and Thomas Hope.—Patent No. 13,462, dated August 21, 1855.
3,850.—Machine for Bending Wood.—Wm. P. Letchworth, Buffalo, N. Y. Patent No. 81,095, dated August 18, 1868.
3,851.—Tile Machine.—F. M. Mattice, Detroit, Mich.—Patent No. 20,286, dated May 18, 1858.
3,852.—Wrench.—The Collins Company, Collinsville, Conn., assignee of Lucius Jordan and Leander E. Smith.—Patent No. 50,364, dated October 10, 1865.

DESIGNS.

3,854.—Ornamenting Glassware.—Thomas B. Atterbury, Pittsburgh, Pa., assignor to Wm. Doyle, Birmingham, Pa.
3,855.—Ornamenting Glassware.—John Bryce, Pittsburgh, Pa.
3,856.—Piano Case.—George H. Davis, Boston, Mass.
3,857.—Lamp Chimney.—Edward Foster, Boston, Mass.
3,858.—Caster.—George B. Garrett, Philadelphia, Pa.
3,859 to 3,861.—Stove Plate.—Nicholas S. Vedder, Troy, N. Y. Three patents.
3,862 to 3,866.—Stove Plate.—Nicholas S. Vedder, Troy, N. Y., and Tobias S. Heister, Lansingburg, N. Y., assignors to Nicholas S. Vedder. Five Patents.
3,867.—Stove Plate.—Nicholas S. Vedder and Francis Ritchie, Troy, N. Y., assignors to Nicholas S. Vedder.
3,868.—Pressure Gage Case.—Edwin A. Wood, Utica, N. Y.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

130.—Wooden Pavements and Cutting the Blocks therefor.—W. W. Ballard, Elmira, N. Y. January 15, 1870.
143.—Gas Burner.—Augustus Hubbell, Washington, D. C. January 18, 1870.
190.—Journal Bearings, etc.—Stuart Gwynn, New York city. January 21, 1870.
213.—Mowing and Reaping Machine.—W. N. Yost, F. W. Andrews, L. Stewart, and H. A. Hutson, Pennsylvania, U. S. January 22, 1870.
220.—Knitting Machine.—G. H. Harding, New York city, and P. Wright, Glasgow, Scotland. January 25, 1870.
221.—Anti-Friction Rollers.—W. B. Scott, New York city. January 25, 1870.
235.—Furnace Grates and Water Heaters.—C. E. Hutson, Commerce, Mo. January 26, 1870.
236.—Preparing Surfaces for Skating in all Seasons.—M. J. Bujac, New York city. January 26, 1870.
261.—Mechanism for Spinning Wool.—D. Goff and D. L. Goff, Pawtucket, R. I. January 28, 1870.
279.—Apparatus for Producing Rotary Motion.—A. G. Waterhouse San Francisco, Cal. January 31, 1870.
294.—Sewing Machine Needles and Needle Arms.—G. A. Lloyd, San Francisco, Cal. February 1, 1870.
297.—Wrench.—A. G. Coes, Worcester, Mass. February 1, 1870.

APPLICATIONS FOR EXTENSION OF PATENTS.

Lock.—William Henry Akins, Ithaca, N. Y., has applied for an extension of the above patent. Day of hearing April 27, 1870.

Continuous Sheet Metal Lathing Surface.—John B. Cornell, New York city, has petitioned for an extension of the above patent. Day of hearing April 27, 1870.

Ventilating Damper for Stoves.—John Magee, Chelsea, Mass., has petitioned for the extension of the above patent. Day of hearing May 4, 1870.

Grinding Circular Saws.—William Clemsen, Middletown, N. Y., has applied for an extension of the above patent. Day of hearing May 11, 1870.

Coupling for Vehicles.—Harvey Miner and Henry M. Stevens, New York city, and Mary Saunders, Hastings, N. Y., executrix of William H. Saunders, deceased, have petitioned for an extension of the above patent. Day of hearing May 11, 1870.

Elastic Bottoms for Chairs and other Articles.—Lysander Spooner Boston, Mass., has applied for an extension of the above patent. Day of hearing May 18, 1870.

NEW BOOKS AND PUBLICATIONS.

Metal Trades' Directory.

Symonds, Wentworth & Co., No. 19 Central street, Boston, Mass., will publish, early the ensuing spring, a directory of the iron, steel, and hardware and metal trades, and their collateral branches of business; it will embrace a complete list of the manufacturers importers, wholesale and retail dealers, jobbers, commission merchants, and brokers of iron, steel shelf, and builder's hardware, tools, agricultural implements, machinery, stoves, castings, wire, tinman's supplies and tools, railway, steamboat, machine and carriage maker's supplies, saddlery, hardware, safes, locks, steam and gas fixtures, cabinetmaker's and undertaker's trimmings, firearms, cutlery, plumber's materials, and all goods manufactured in whole or in part from the baser metals. The publishers desire the address of the machinists, iron founders, and metal workers and dealers throughout the country.

Advertisements.

Advertisements will be admitted on this page at the rate of **$1·00** *per line. Engravings may head advertisements at the same rate per line, by measurement, as the letter-press.*

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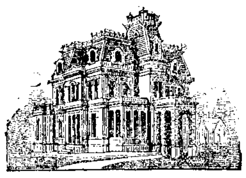

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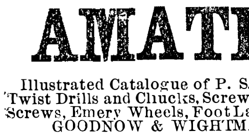

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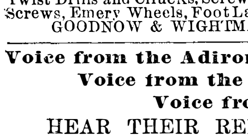

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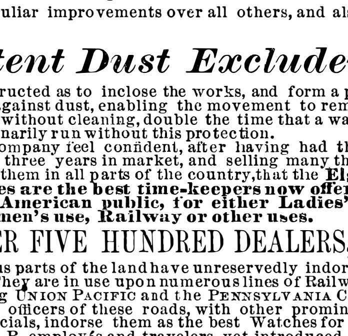

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in various parts of the land have unreservedly indorsed them. They are in use upon numerous lines of Railway, including UNION PACIFIC and the PENNSYLVANIA CENTRAL, and officers of these roads, with other prominent R. R. officials, indorse them as the best Watches for the use of R. R. employés and travelers, yet introduced.

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Office of the Hudson River Rail Road, Gen'l Sup't, New York, Jan. 17, 1870.

T. M. AVERY, ESQ., President National Watch Co.

DEAR SIR:—The Watch made by your Company, which I have carried the past two months, has kept excellent time. I have carried it frequently on engines, and have been on the road with it almost daily. During this time it has run uniformly with our standard clock. Truly yours, J. M. TOUCEY, Gen'l Sup't.

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J. R. Reed & Co., "	M. M. Baldwin & Co., San
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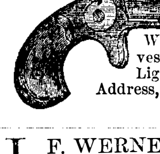

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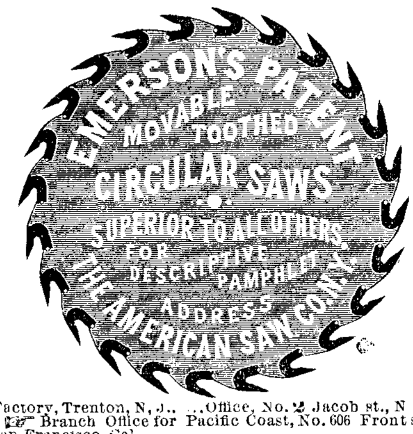

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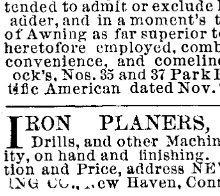

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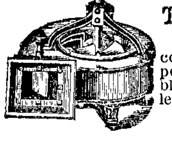

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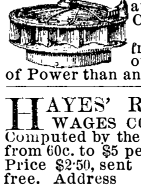

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