enameled in black to represent night, with the moon, stars, etc. This dial is figured differently from modern dials, having 24 hours, 12 for the day and 12 for the night, with the subdivisions and hour and minute hands accordingly. On the case around the lower and dark half of this dial is the inscription, *Sapiens insipientibus sicut luna in nocte*—" The wise man to the ignorant is as the moon to the night." On the case around the upper half of the dial is engraved, in Italian, *Non vi son tenebre per chi creo la luce*—" There is no darkness for Him who created the light."

In the dark half of this dial is a smaller dial with hands, showing the age of the moon, the moon's phases, and the day of the lunar month. The small dial in the upper half of this face has an index gage and pointing hand for regulating the grand movement, which controls the entire twelve hands and movements. Being also wound up as well as regulated from the outside, the works within are permanently closed from dust as well as excluded from prying and meddlesome curiosity, to which precaution we attribute its present perfect condition, being more than two hundred years old. The durability of watches when well made is very remarkable.

This valuable, complicated, and beautiful piece of mechanism is in perfect running order, and performs with astonishing precision in all its movements. It is a French watch, made by Robert et Courvoisier. It must have occupied many months, perhaps years, of time and labor in its construction, and though it is small and handy enough to be carried in the rich man's pocket, it is well worthy a high place in the cabinet of the gems of science and art. It is now the property of Mr. F. W. Chamberlain, 233 Hanover street, Boston.

F. H. F.

Steam and Hot-Water Pipes.

MESSRS. EDITORS:—In an article on the causes of fires in manufacturing establishments from steam pipes, etc., in your paper of the 4th inst., I notice the terms steam and hot-water pipes, are so commingled that one would suppose that they were so nearly alike as to produce the same results, the only real difference being a few degrees in temperature.

In a steam heater a portion of the water (at least that in the pipes) is converted into *steam* before the fixture operates, while a hot-water heater, properly constructed, is simply a circulation of water, filling boiler and radiators, warmed, but never reaching so high a temperature as to form steam, and working with the same pressure that is sustained by the lead pipes of the plumbing fixtures in our houses, consequently no more liable to explosion, and limited to a temperature of 200° at the boiler there is about as much danger of a plumbing job setting the house on fire as from a properly-constructed hot-water fixture.

My impression is, that in all the cases where hot-water pipes have been reported as producing the effects described they were in reality steam pipes.

To save the material requisite in the radiators for heating at a very low temperature is the inducement to use steam. If specifications for constructing hot-water heaters required that the requisite heat in the rooms warmed, say 70°, should be produced with not exceeding 200° at the boiler, there would be no such chemical action as Mr. Braidwood describes, or consequent danger from fire, not to mention the superior quality of heat obtained from surfaces at such low temperatures.

A SUBSCRIBER.

Baltimore, Md.

New Wall Covering.

MESSRS. EDITORS:—In the concluding remarks of Mr. Wight's paper on " Fire-proof Construction " in your issue of the 28th ult., the following remarks occur: " The stone slabs of Mr. Eidlitz are the only rigid material thus far used successfully with iron beams—they are doubtless the handsomest material that can be used for that purpose, but are open to the objection of being heavy and expensive"—it will be pertinent to our inquiry, therefore, to ask if there are any other rigid materials adaptable to this purpose, and possessing the desired qualities of lightness and cheapness. Further on, he remarks that "the cheapest material for wall covering in natural materials would be slabs of white marble, which would cost $1·50 per foot, and three coat plastering laid on iron lath $1·34 per foot." I would inform Mr. Wight that there is in use by the architects of the Southwest, a composition called by the inventor Lithomailite, produced by a method of hardening and marbleizing plaster of Paris, and giving it a high and durable polish. This, I think, is the desideratum in fire-proof buildings, with the material advantage over marble slabs and plastering, that it does not cost over one seventh the price of either of the above styles of finish. It can be put on walls or ceilings in ashlers to suit, at twenty cents per foot. An office 20x40—16 feet high, finished with marble slabs would cost for the walls alone $2,886, while both ceiling and walls could be finished in Lithomailite for $544. The imitations of precious marbles in it are inimitable. It is hard enough to shiver a door knob or key when slammed against it. It has the hearty indorsement of the leading architects of the South, and is the strongest and most elegant substitute for plastering that I have seen in a building during an experience of over thirty years.

G. W. LINCOLN.

Memphis, Tenn.

Explanation of a Curious Phenomenon.

MESSRS. EDITORS:—You are herewith offered an explanation of your " Curious Phenomenon," published a few weeks ago.

Subject: Jar cracked across the bottom. Jar leaks on hard, unpainted surface; is tight on painted surface.

A painted surface is tenacious; oil makes it more so. An unpainted surface is not tenacious; oil makes it less so. The former holds the jar together. The latter offered no resistance to the outward expansion of the bottom of the jar (caused by its own weight) and consequent opening of the crack.

Z.

Pittsburgh, Pa.

A Night Gun-Sight Wanted.

MESSRS. EDITORS:—Could not some one invent a contrivance for illuminating the sights of guns and rifles at night, so as to enable to shoot with certainty when dark? Everyone knows what difficulty attends taking aim with rifles when dark. Might it not be done by a small electric spark on each sight, produced by a miniature battery, concealed in the stock of the rifle or gun, and led to the proper place by a thin copper wire, covered with silk thread, and which could be removed or put on at pleasure?

I leave this idea to some inventive genius, and I have no doubt, by producing some simple and easy-managed contrivance, a patentee might make a good thing for himself and earn the thanks of many a sportsman and frontiersman, if not a glorious place in history.

FRONTIER.

New Mexico.

Railway Ties.

MESSRS. EDITORS:—In reading a recent answer to a correspondent in your paper, touching the life of oak railroad ties, stone ties, etc., a few practical thoughts, the result of 14 years' experience, suggested themselves.

The lasting of oak ties depends very much upon the manner of putting them down, and the condition of the wood at the time they are laid. Take a red-oak tie from the stump with all the sap in and it will not last *three years*; but if piled up and well seasoned before laying, it will last six years. The same remarks will apply to white oak.

There is often a great deal of carelessness on the part of the foreman of repairs in this particular.

Speaking of stone ties, I think the day is not far distant when wrought iron stringers will be used, broad on the surface, so as not to sink under pressure, and bolted together. There would be sufficient spring on such ties, and the rails can be thoroughly fastened to them. They would not present the rigidity of stone blocks, or fail in durability.

Belvidere, N. J. JACOB STONE.

Testimony of an Advertiser.

In a recent issue under the head of " Business Hints," we took occasion to speak of the value of the SCIENTIFIC AMERICAN as an advertising medium. We are frequently receiving evidences of the correctness of our statement from advertising patrons, an example of which we present herewith:

You are following my wishes. You may continue to advertise until I notify to the contrary. I have found during the short time I have had the cupola notice in your paper it has called the attention of iron founders to my improvement, and increased my orders and sales more than all the circulars I have ever sent, and I am compelled to believe and free to admit that the SCIENTIFIC AMERICAN is the best paper for mechanics to advertise in I know of.

ABIEL PEVY.

Lowell, Mass.

(For the Scientific American.)

THE MANUFACTURE OF PLATE GLASS IN ENGLAND AND THE UNITED STATES.

BY THOS. LOCKWOODE.

It is curious to note, that while the glass manufacture in most of its forms has prospered in this country, and factories have multiplied almost without number, yet the manufacture of plate glass has been almost quite left out, and there is at present but one rough plate glass works in operation in the United States, and only one in process of erection.

We propose, therefore, to describe the processes connected with its manufacture in England, hoping that our efforts will be of some use, or, at any rate, will be of interest. There are at present six plate glass factories in England; namely, three at St. Helens, Lancashire—the British plate glass factory at Ravenhead, the Sutton Company, and the Union Company—one at Newcastle-upon-Tyne, one at London, and one at Smethwick, near Birmingham. The British company is the oldest established, having been in successful operation nearly 200 years, the manufacture having been introduced from Venice somewhere in the seventeenth century, and established at Ravenhead shortly after. Three of these British factories melt their " metal " in the Siemens furnace, a process which is also used by the works now in existence in Massachusetts. The process of melting and casting the glass may be familiar to some, but it will be new to most of our readers. The mixture was formerly melted for twenty hours in a pot or crucible, and then ladled out into another vessel called a " cuvette," which was placed by its side in the furnace. But this operation is now dispensed with, and the glass is cast direct from the pot after a melt of from fifteen to twenty hours. A description of one factory will necessarily be a description of all, and therefore we will give an account of the Birmingham factory from personal observations made at that establishment.

The casting house is a building of about one hundred yards long by twenty-five wide. The furnaces are in the center of the building and the annealing ovens are arranged along the whole length of the room on both sides. The pot room, mixing room, and coal sheds, are arranged conveniently around the outside of the building. The mixture being placed in the melting pot, by installments—three fillings being the usual number—is gradually melted down into a homogeneous mass; its perfect fusion is tested by dipping an iron rod into the pot, and drawing a portion of the metal out with it. When the metal is ready for casting, it is allowed to cool down for about an hour. The furnace is then opened and a pair of tongs arranged on wheels, is thrust into the furnace and made to clasp the pot, which is drawn out and placed on a carriage running on a railway to the casting table. The contents are skimmed until all the dross is removed, and the pot is then run up to the side of the table where it is lifted by a crane and tilted over on to the casting table, a large mass of cast iron, about twenty feet long, with side ribs to prevent the metal from flowing off. It is then rolled by a massive iron roller, and as soon as the plate is cool enough to admit of its being moved without crushing it, it is slid off into the annealing oven, which is just on the other side of the table. The table is also on rails, so as to admit of being moved from one oven to another. The plates, after being placed in the annealing ovens, are allowed to stay there, from a week to ten days—the longer the better. When taken out they are either taken to the grinding shed to be submitted to the second process or cut into proper sizes and sent away as rough plate, to be used as skylights, pavement, etc. The plate to be finished for lookingglasses, windows, etc., is then laid on a grinding bench, which may be briefly described as follows: The machinery is nearly all under ground, in a vault, which runs the whole length of the room. The driving shaft from the engine runs in this vault, and is supported by bearings between every bench. This shaft is horizontal and drives a vertical shaft by means of bevel gearing. The upright shaft carries a clutch for the purpose of starting and stopping the machine. The vertical shaft is in the center of the machine, the working part of which is ten feet square, and which has four corner shafts; each of the five shafts has a crank which, in turn, supports and moves a fly, which is literally a square of cast iron having long rods extending from it on both ends, which move with an alternate rectilinear motion, and with a kind of lateral swing at the same time. The glass is laid down and fixed with plaster, on firm stone tables, one on each side of this machine, and these connecting rods move runners over them at a rate of sixty revolutions per minute. The runners are composed of a wooden framework, faced with either iron plates, or with another plate of glass, and sand and water are thrown between the two surfaces by a boy until the whole is sufficiently ground. The Birmingham company have in operation twenty-six grinding machines, which turn out a total weekly product of upwards of twelve hundred feet of glass. It should be stated that after the sand grinding, emery of three different degrees of fineness is used before the plate is taken up. When the glass is fully ground it is raised up and taken to the smoothing shop, where it is smoothed. Formerly this operation was performed entirely by hand, the plates of glass being laid one upon another, having courses of emery running from No. 4 to No. 7 between them, and being plentifully supplied with water. This operation is very similar to grinding, but is a great deal finer and slower. It is now almost universally performed by machinery, the machine being on the same principle as the grinder, but with a speed of only fourteen revolutions a minute, whereas the grinder has sixty. When the glass is smoothed it is taken to the polishing shop, where the finishing process for window plate is given. In the polishing room the glass is again laid on tables and the polishing is performed by means of two bars, which run longitudinally over the glass, carrying blocks which are covered with felt; the table on which the glass is fixed by means of plaster, at the same time traveling, alternately from right to left, and *vice versa*. The glass, during the process, is sprinkled plentifully with a mixture of the red oxide of iron and water until sufficient polish is given, when the plate is taken off and taken to the warehouse, or, if required to be silvered, it is carried to the silvering room, where that process is performed. However, this process is so well known that it is needless to describe it. Large quantities of this glass are sold in the country and much of it is also exported. So much for British plate glass.

We will now turn to the American side and see what is the progress of plate glass there. Some fourteen years ago an attempt was made by a New York company, to commence a factory at Williamsburgh, N. Y., and one or two plates, were really cast, but the enterprise failed. A short time after a couple of window glass blowers and a few capitalists made the attempt at Chelsea, Mass., and shortly after at Lenox, in the same State, still in operation there, and the one alluded to above. It was attended with a large measure of success in the casting of rough plate. Some years ago they commenced experiments with a view to polishing, and a gentleman from Chicopee, in conjunction with some of the stockholders of the company, have patented an invention for that purpose, but from some cause or other they do not seem to be making much progress. Last year they commenced using the gas furnace of Siemens, and are still using it. For a long time the Lenox works was the only establishment of its kind in the United States, but now a rival is to appear on the scene. This is situated at New Albany, Ind., and is owned by Capt. J. B. Ford, a gentleman whose public spirit has done much for that city. He has already set in motion several founderies, glass and other factories, and last winter turned his attention to plate glass. He is about to commence its manufacture on a large scale, and the buildings for that purpose are far advanced towards completion. He expects to make glass by the middle of October. Mr. Bankard, one of the original plate-glass makers of Lenox, has been engaged by Capt. Ford to superintend the making of his glass. Capt. Ford intends to commence polishing immediately, on the European plan, and to effect this has ordered several machines from St. Helens, England, and has the services of an experienced glass polisher from that country. The word fail is not in Capt. Ford's dictionary, and this enterprise cannot fail of success.

As soon as this enterprise gets fully under way the readers of the SCIENTIFIC AMERICAN are promised a detailed account of the establishment.

Improvement in Turbine Water Wheels.

It is a well-known fact that whenever the flow of water through the buckets of a turbine wheel has its velocity diminished by the lowering of the head, a better result is obtained by diminishing the spaces between the buckets.

The writer has often descended, in such an emergency, into the wheel pit to adjust the buckets of one of these wheels which were supplied with movable plates at their outer border, held by set screws; a tedious operation and one requiring great judgment to perform with any approximation to accuracy.

The invention herewith illustrated is intended to furnish a simple and ready means whereby the buckets may be adjusted as the head varies, either while the wheel is in motion or at rest, by hand, or by the action of a regulator.

Fig. 1 is a perspective view of a center discharge wheel with portions of some parts broken away to show better the construction of other parts.

The toothed wheel, A, has a female screw cut through the hub, which plays on the male screw, B, elevating it or permitting it to fall as desired, through an oblong opening in the supporting framework, C. The oblong opening fitting over the oblong shank, D, of the screw, B, prevents its turning on its vertical axis, while it is free to move upward or downward as the wheel, A, is rotated one way or the other.

The head of the screw, B, is a rectangular frame, E, through the lower horizontal part of which an opening admits a shaft, F, which descends through the hollow shaft, G, of the water wheel, to the interior of the water wheel. An upper and an under collar, H and I, are fastened to the shaft, F, by set screws, as shown in the engraving, so that F must obey the motion of the screw, B. The water-wheel shaft, G, rests upon the usual step at the bottom of the wheel.

The lower end of the water-wheel shaft, G, is slotted to permit the passage of horizontal arms, J, attached to an enlarged portion, K, of the shaft, F. The arms, J, with the circular frame, L, and slotted brackets, M, attached to L, rise and fall with the shaft, F, as acted upon by the screw, A. The slotted brackets, M, are inclined to the circular frame, L. In the slots of these brackets (one to each bucket) play pins, N, fastened by a screw bolt to the top edge of the buckets, O. The receiving, or outer ends of these buckets are fixed, being cast with the rim of the wheel; the inner, or discharging ends are movable, being pivoted to the fixed ends of the buckets in the manner of a rule joint.

The operation of the parts is as follows: As the wheel, A, is turned to the left or right, the shaft, F, is lifted or depressed, carrying with it the parts, J, K, L, and the brackets, M. The inclined slots of these brackets act upon the pins, N, and these being attached to the movable inner, or discharging ends of the buckets, open them or close them as desired.

The upper part of the rim is recessed to allow the motion of the pins, and at the same time to allow the top of the bucket to move closely to the rim. The pins are thus placed above the current of water and out of its way.

Fig. 2 shows a plan of the buckets, pins, and slotted brackets, when the buckets are pivoted to swing horizontally.

Fig. 2

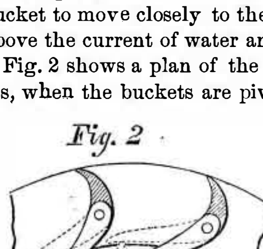


Fig. 3

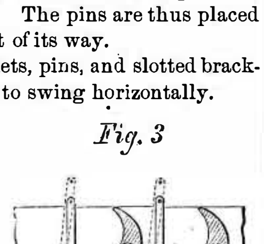
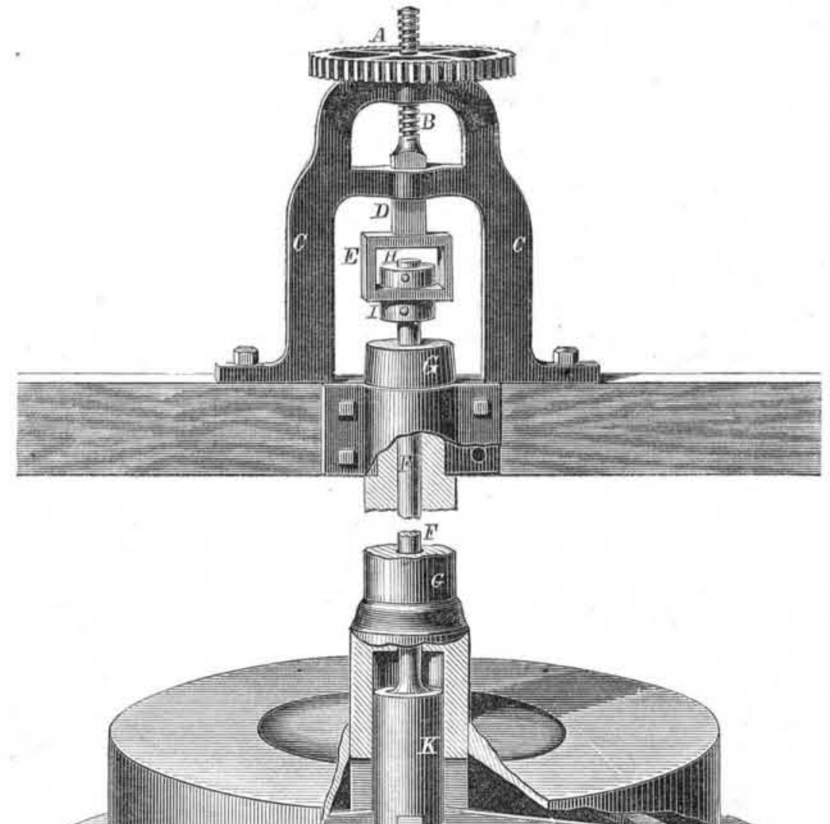


Fig. 3 is an elevation of the buckets when pivoted to swing vertically, showing an extension of the principle to wheels of this description. It will thus be seen that the improvement is equally applicable to turbines of all kinds, and not only does away with a great inconvenience but adds to their efficiency.

Patented, March 9, 1869, by Jesse Newlin, whom address for further information, care N. W. Newlin, 2203 Cherry street, Philadelphia, Pa.

THE SOIL, THE PLANT, AND THE ANIMAL.

How much stronger at every step becomes the likeness between the soil, the plant, and the animal; how much closer their connection, how much more indissoluble the union that binds them together. When dry bone is burned, the ash that remains behind amounts to two thids rits weight, and consists almost entirely of phosphates of lime and magnesia, which are so abundantly present in the ash of different varieties of grain This bone-earth must exist in the soil. The plant draws it from the earth by its roots, the cow eats it with the herbage she crops from the field, and parts with it again in the milk she produces to feed her young. The calf sucks the milk, and works up the phosphates it contains into the form of living bones, adding daily to their size and



NEWLIN'S IMPROVED TURBINE WATER WHEEL.

weight. Without bone our present races could not exist. It forms the skeleton to which the softer parts are attached and by which they are supported; but the life of the animal being at an end the bone as a living thing is discharged and falls to the earth, new plants taking up its phosphates again to send them forward on a new mission into the stomachs of other living and growing animals.

Improved Gas Process.

The *Evening Post*, of this city, reports that Professors Silliman and Wurtz have discovered a new and cheap method of producing a superior illuminating gas. The first step is to bring very highly heated steam into a clay retort, in which pure anthracite coal is burning. The coal is purely carbon; the steam, of course, consists of the same elements as water —that is, the two gases, oxygen and hydrogen. Now, the oxygen of the steam combines with the coal or carbon, and forms the gas known as oxide of carbon, leaving also the hydrogen gas free. These two gases are thus produced in equal volume. They are both easily combustible, and burn with an intense heat; although they give, when burning, hardly any light.

These gases are then mixed with the common illuminating gas, made by distilling bituminous coal. The mixture, it is found by experiment, forms a brilliantly-burning gas, which is better, in some respects, than the best of that with which our houses are usually lighted; for example, it is more permanent under exposure to severe cold. But the main advantage is in the saving of expense. It is plain that this method turns water, and the whole weight of anthracite coal used, into illuminating gas; while the old process yields in gas only the volatile part of the bituminous coal thrown off in distillation.

"Messrs. Silliman and Wurtz, assures us," says the *Post*, "that they are able practically to add fifty per cent to the amount of illuminating gas obtained from a given expenditure of coal, or, what is the same thing, to save one third of the fuel now used in making gas."

Street Crossing.—John Simpson of Cleveland proposes a a plan for street crossing by means of a bridge approached by double inclined planes instead of stairs, which are more easy of ascent, but the difficulty is still to be overcome. Property owners object to a bridge fronting their premises, and what is wanted, is some means of crossing that will take the place of a frowning structure above ground.

The Diffusion of Scientific Information.

In an able address delivered before the graduating class of the Cambridge Divinity School at the close of the summer term this year, John Weiss said a great many forcible and brilliant things. Among these, none has struck us as showing so exact an appreciation of the tendencies of the age as the following remarks upon the general diffusion of scientific information in a popular form, and the avidity with which this information is sought by the American mind.

"Human nature is learning to ask very intelligent and embarrassing questions, while its religious exigences are the same that they ever were, and have to be harmonized with knowledge. Here you may have been taught to gage and appreciate past epochs of spiritual development, and to note their connection with various mental states, and you have indulged religious feelings. But now you are about to discern, by contact with men in vital society, what is essential religion, in order that your service may be timely for this race and country. The past may be the soil that holds your roots, but not a ball and chain around the ankle. If you undertake to drag the dogmatic life of nineteen centuries across the face of the country, your traces will be marked by denudation of the fertility that would prefer your bold husbandry. You go forth to quicken the native germs that lie waiting to succeed the old crops, when decay or the ax shall clear the land. "Instead of the thorn shall come up the fir tree, and instead of the brier, shall come up the myrtle tree."

"Cheap publications of every kind spread the moods of the period far and wide. Their range passes through all the speculative forms, and all the emotions which the world at any time has known. The very richness is a cause of the distraction. Thought is unconsciously embarrassed as so many departments throw wide their doors at once, and display their collections. And there is no statement too scientific to resist the intentions of popular treatment. It is macerated, dissected, volatilized, put up in packages for the trapper and emigrant. Every condition of half knowledge appropriates it. People who are troubled with imperfect nutrition will snatch, at every railway station, a gulp of spectrum analysis, primeval man, the correlation of forces, spontaneous generation, social statics, Carl Vogt's impetuous atheism, Mr. Darwin's pangenesis, Professor Huxley's non-committal protoplasm, and the last message from the summer land.

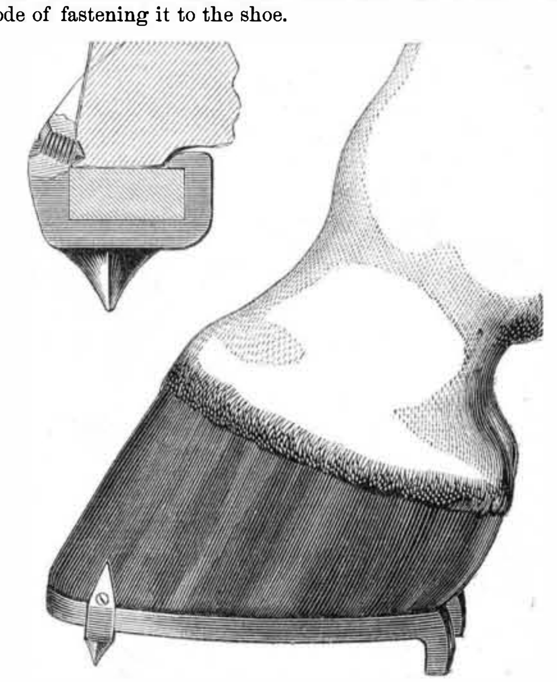
"The scientific mind is making the whole world at once its laboratory and auditorium; and among the hearers there is no distinction of person, color, sex, or previous preparation."

GODDARD'S DETACHABLE CALKS FOR HORSESHOES.

The object of this invention is to furnish a cheap, durable, and efficient calk, easily adjustable, which shall prove a protection against slipping, and shall bear entirely on the shoe, not injure the hoof, or cause discomfort to the horse when shod according to the method proposed.

The inventor claims that it will not cost as much as the blacksmith's charge for calking a shoe as now performed; that it will keep sharp and will prove a great saving of time, as every driver can adjust his own calks as he needs them.

The engraving illustrates the appearance of this calk when fastened to the shoe or the foot of a horse, and also gives a sectional detail showing the construction of the calk and the mode of fastening it to the shoe.



The shoe proper is of the ordinary form, minus the toe calk, in the place of which two of the adjustable calks are used, one on each side of the toe.

The calk is provided with two clasps, as shown in the sectional detail, one of which passes over the inner side of the shoe, and clasps down upon the top of the shoe on the inner side. The other passes upward across the outside of the shoe, and rests not only against the shoe but the outer side of the hoof. It is held in this position by a screw passing obliquely downward through the outer clasp till its point reaches and rests upon the top of the shoe. The calk is made of material best adapted to withstand wear, and of a form best calculated to give a firm hold to the foot in traveling.

This improvement was patented through the Scientific American Patent Agency, May 25, 1869, by Rev. Kingston Goddard, D. D., of Richmond, Richmond county, Staten Island, N. Y., who may be addressed for State, county, or shop rights