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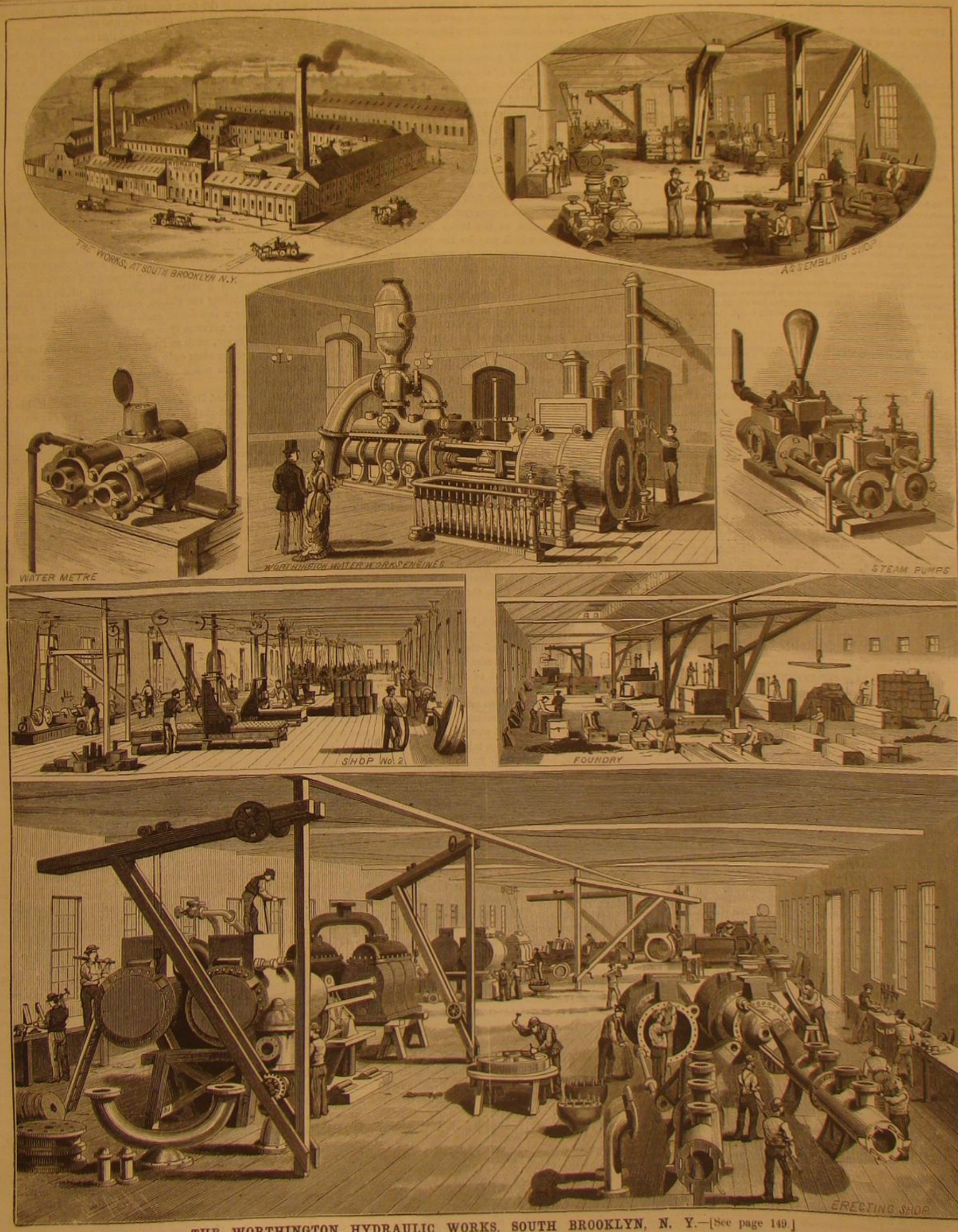

THE WORTHINGTON HYDRAULIC WORKS, SOUTH BROOKLYN, N. Y.—[See page 149.]

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NEW YORK, SATURDAY, SEPTEMBER 4, 1880.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 244,
For the Week ending September 4, 1880.

Price 10 cents. For sale by all newsdealers.

THE INSPECTION OF STEAM BOILERS.

There is no doubt that a steam boiler is in many respects a much more dangerous neighbor than a powder magazine. In order to be safe a steam boiler needs continual attention and care, while neglect or ignorance may have the most fatal results. In regard to a powder magazine, all it needs to be perfectly safe is to be left alone. Neither neglect in the watch nor absence of attendants can involve any danger; in fact, when the doors are securely fastened, no attendance whatever is needed. The only dangers are downright imprudence with fire, and lightning; both are easily guarded against by very simple precautions and well constructed lightning rods. Age will not deteriorate a powder magazine; on the contrary it will prove the reliability of its construction and management and the safety of its location; but, on the contrary, age is, in a steam boiler, an element of the most imminent danger, and, as experience shows almost daily, it is the main cause of the disasters which of late have become alarmingly frequent.

It is a peculiarity of human nature that familiarity with danger begets contempt of the same; hence that owners and managers of steam boilers have proved themselves so neglectful that all civilized governments have enacted laws to secure more safety against steam boiler calamities (we will not say accidents, as every thing has a cause) than are afforded by the care of the owners themselves and their engineers.

We have such laws, but unfortunately they are not sufficiently effective, and this for several causes: first, they are not framed according to the full light which science and experience has shed upon the subject; they only require a test of hydraulic pressure of the boiler, a test which will not reveal weak spots which may be the result of faultive design, imperfect construction, or wear by age—weak spots which, being worn down so far that they could just stand the pressure of the test, soon after, by continued wear, give out at a lower pressure. The Sewanhaka disaster appears to be due to a cause of this kind; namely, in the supposition that the boiler had actually been tested at the pressure required; but there are doubts in this regard, as it is well known that inspectors appointed by the government have often been neglectful in their duties, and, trusting to good luck, gave the certificates without making the test to the full extent as required by law. This is a second cause that the laws passed by the United States Government for the public safety in regard to steam boilers have not been as effective as intended and expected.

A third cause is the incapacity of many of the inspectors, who used to be appointed after an examination so ridiculously easy that any schoolboy who has learned his lessons in natural philosophy can pass it. We are glad to say that recently great improvements have taken place in this regard, so that when the old, ignorant inspectors are weeded out, and more capable ones are appointed in their stead, public safety will become greater in this regard, provided, however, that also the inspectors are men of integrity, who will not hesitate to condemn boilers even when the owner offers a bribe to save himself from the great expense involved by the purchase of new ones.

The thorough investigation to which the Sewanhaka disaster referred to above has given rise shows that a small weak spot in a tube in the rear of the furnace, by suddenly giving out, threw a jet of steam forward, which, like a back draught, threw the fire out of the furnace doors and ash pit, and set the dry woodwork around at once in a blaze. This escape of steam was so small as not to interfere perceptibly with the boiler pressure, as the engine could be kept running until the boat was run ashore, which was done so successfully that all lives might have been saved if the passengers had not lost their presence of mind in the panic which ensued after the discovery of the fire.

There is one consolation after such calamities, not for the poor victims and their relatives, but for the survivors and the public in general. It is that every such incident teaches a lesson which makes the future more safe in this regard. The disaster in question promises to be especially useful in this respect. It will result in a revision of the laws on steam boiler inspection, on the choice of the men to be appointed as inspectors, and on their behavior after being appointed, convincing them that they are not irresponsible for the consequences of their carelessness in giving certificates for old and worn out boilers, as was the case with the Sewanhaka. They have, as well as the owners of the boat, been arrested for manslaughter.

In regard to the revision of the law, the best which can be done is to adopt the mode of inspection practiced by the steam boiler inspection and insurance companies in London, England, and in Hartford, Connecticut. These companies, who make themselves responsible for damages to boilers under their charge, are not satisfied with the mode of inspection prescribed by the United States law, but add to this a thorough test of all parts of the boiler by means of the hammer handled by a practical expert, who in this way can detect any weak and dangerous spot. If such a spot is found the owner has to have it properly repaired, or the company will not insure it, which is only done after approval by their own inspectors.

Statistics are there to prove the results. While boilers approved by the United States inspectors have been continually exploding, sending death and destruction around, the explosion of boilers in charge of the insurance companies has very rarely caused any disasters, and if one gave out, it was always proved to be caused by the most gross carelessness or recklessness of those in charge. Many boiler owners, therefore, have grown disgusted with the United States inspection, calling it a farce and an imposition, and the flourishing condition of the inspection and insurance companies has been the necessary result.

DR. TANNER'S GREAT FAST.

We call the attention of our readers to the full account of Dr. Tanner's world celebrated great forty days' fast to be found in the SCIENTIFIC AMERICAN SUPPLEMENT of this week, No. 244. It is from the pen of Dr. Vander Weyde, who, in his position as one of the watchers, and in his capacity as Professor of Chemistry of the U. S. Medical College, when the fast took place, had charge of the chemical and microscopic investigations, and therefore ample opportunity to collect the data required to give the complete account of this remarkable physiological experiment.

It should not be lost sight of that this case is very different from cases where a fast is held by necessity, such as being compelled by disease, by shipwreck, by being lost in a wilderness or forest, being buried in a mine, or lost in a cave. Dr. Tanner had enormous advantages over all these cases, and hence that he could indulge at once in hearty meals, as his digestive apparatus was not impaired by disease, nor his nervous system shattered by anxiety; in such cases it would be very dangerous, if not fatal, at once to indulge immediately in such abundance of food. In the case of shipwreck, the exposure of the survivors, resulting in a total want of any comfort, but to the enduring a suffering from other distressing discomforts, and exposure to the elements, contributes as much if not more to the fatal results than the need of nourishment. To this must be added the anxiety and uncertainty which keeps the nervous system upon an exhausting strain. It is the same with those being lost in a wilderness or forest, Of these the forest gives the best chances of survival; but in case of burial in a mine, the utter want of light and the gloom surrounding the victim, combined with the extreme anxiety, make a fast under such circumstances the most destructive to the nervous system. Persons who, for instance, were lost in caves, such as frequently happened in the Mammoth Cave, were, after only a few days' search, found to be nearly insane, so much so that they hid themselves from the searchers.

It is evident that Dr. Tanner had an easy time, if his fast is compared with that of any of the fasters for causes mentioned above. If he had been locked up under the threat that no food would be given him for forty days, he surely would not have stood it so well, as the mere consciousness of the constrained situation would have affected his mind, and all ease and comfort would have been at an end. To the contrary, his mind was kept at peace because he had plenty of air and water, the comforts of good shelter, and all the conveniences of civilized life; he could read his papers and keep up his usual correspondence, walk, ride, or stay at home, converse with congenial friends, and, best of all, he knew that if he wanted food it would cost him only a word to obtain what he desired at once. Fasting under such circumstances can, of course, be much longer prolonged than if it is done by necessity.

These facts were overlooked by those who from the first declared a forty days' fast an impossibility, and staked money on it. They were not well informed about actual fasts for so long a period, of which there are instances on record, or they did not believe the truth of such records. They judged only from the results of many well known constrained fasts which ended fatally within thirty, twenty, and even ten days, and were kept under unfavorable conditions, often by delicate girls of comparatively tender age and of a feeble constitution, perhaps of consumptive tendency to begin with; therefore they declared all claims of those who pretended to be able to fast as long as forty or even only thirty days as fraudulent and impossible without the deception of secretly taking food. Having this as a fixed idea in their minds, they expected that a careful watch would surely cause the death of any man who pretended to be able to fast for so long a period, and hence the clamor of defective surveillance.

It must be a satisfaction to Dr. Tanner that his uprightness and honesty in regard to keeping strictly to the conditions of his self-imposed trial are now generally granted even by his former most violent opponents, who acknowledge freely that his behavior as a gentleman has proved him to be far above surreptitiously taking food while he was pretending to fast.

They have had their eyes opened to the fact that Dr. Tanner's case was very different from most other real or pretended fastings; that in him we have a man of a strong, tough, and wiry constitution, at an age between forty and fifty, which, for such a constitution, is that of the greatest resistance, a man provided with a copious layer of adipose tissue or fat around his body, and of a weight of one hundred and fifty-seven and a half pounds, which is far above the average for his height, which is rather below the medium, so that he must be classed among the small men. A tall man of that weight surely would not stand it as well. Even a tall man of greater weight would possess no advantages, as army statistics prove that large men, who may be stronger in regard to muscular power, are less strong in regard to their powers of endurance than smaller men, who, as is well proved by long experience, stand various sorts of privation and fatigue better than large men, who usually are the first to break down under each circumstances.

Dr. Tanner may not have proved that everybody can fast forty days, but if he has only proved that man can fast

longer than has generally been supposed, that we are all eating too much, and that for a family remedy, fasting affords a better, safer, and more economical cure than the taking of all sorts of patent medicine, to which many people are so much addicted, he has done a really good work.

We recommend to our readers the perusal of the full account of the fast.

EFFECT OF STARVATION ON THE BLOOD.

Further observations upon the gradual improvements of Dr. Tanner's blood have made it necessary to modify the statements made at the close of the article on this subject in the last number of the SCIENTIFIC AMERICAN (see page 128). It was noticed that the quality of the blood varied greatly in different specimens obtained from day to day, and even in specimens drawn the same evening. It was at last found that if the blood was drawn from a very small puncture, from which it had to be pressed out forcibly, it was found to be in a much worse condition than if drawn from a deeper puncture from which it flowed freely. It is evident that in the first case it was drawn only from the capillaries, and in the second case from the larger vessels, in which a regular circulation takes place. This appears to prove that the abnormal corpuscles linger in the capillaries, and that it takes time to remove them therefrom, while in the larger vessels, in which free circulation takes place, restoration may already have been accomplished to a considerable extent. Close observation appeared to show that this restoration was taking place in two ways, by a cleaning and healing process of the affected corpuscles, and by the formation of new ones. The first was proved by the observation of corpuscles in all stages of the healing process from the most abnormal to the perfect smooth ones. Some of those which had become free of fungoid spores appeared, however, to have suffered considerably, some were partially destroyed, some were only half or parts of perfect corpuscles, and no doubt such will be either eliminated from the system or the defective parts healed up. Which of these takes place is a question. The second process of restoration was proved by the appearance of fresh and small corpuscles, looking very smooth and perfect, and bearing the stamp of youthfulness upon their appearance—we would almost say countenance—a freshness which became more striking the higher the magnifying powers were by which they were observed, in comparison with the affected corpuscles, in which the higher powers showed the imperfections more strongly.

This corroborates what other microscopists have observed in regard to the formation of new young blood corpuscles. It has, however, been denied by others who failed to observe it; but this is merely negative testimony, of which there appears to be a great deal in the medical profession; it proceeds from a kind of conservatism, which lies at the basis of all the medical intolerance manifested by the so-called regular school against all supposed innovations, even among their own brotherhood.

A striking illustration was offered in this regard by the discovery of Prof. Cohnheim, of Kiel, who found that pus globules could originate from the white blood corpuscles, but whose observations were most strenuously opposed at first by the majority of the profession, who could not see it. It may be mentioned here, as it has some relation to Dr. Tanner's fast, by which fast the number of his white blood corpuscles was more than quadrupled. It is well known that persons subject to privation of food have a strong tendency to pus formation and running sores, and if starvation increases the number of white corpuscles, these combined facts appear to support Cohnheim's theory. The opposition against it was, however, set at rest by Dr. Bastian, in London, and Surgeon Woodward, U. S. Army in Washington, who verified Cohnheim's observation, and by Huxley, who adopted it in his great lecture on protoplasm.

The number of white corpuscles did rapidly diminish after the fast in Dr. Tanner's blood, and was soon reduced to the normal proportion; but the interesting change in the red corpuscles and their very gradual restoration during a length of time, is a contribution to science which Dr. Tanner has given after the end of his fast, and this should be acknowledged.

MAKING PROFITS OUT OF HUMAN WEAKNESS.

It is not only among lawyers that a certain class is found who induce quarrelsome or avaricious people to go into lawsuits by telling them they are right and must seek redress by law. They do this only for the purpose of obtaining their professional fees, in place of giving them the honest advice to settle amicably, by mutual agreement, as *in nine cases out of ten would be far better.*

We find the same class of men among doctors, who, when people mention some slight ailment, make them believe that they are sick, or soon will be very sick if they do not take a certain course of medical treatment which they will prescribe. They also do this for the purpose of obtaining a professional fee, in place of giving them the honest advice to fast for one or two days, to take rest, and to stop drinking and smoking, if they are addicted to these vices. *In nine cases out of ten this would be far better.*

The lawyer of this class makes the client believe that he has been wronged, and the doctor makes the patient believe that he is very sick. They all have their own profit in view, and play upon human weakness, which, in some individuals, consists in combativeness, in others in imaginary weakness of body, and again, in others, in conceit about their mental accomplishments.

There is no profession in which men can make money out of it by telling people about their weakness of mind. The only mental weakness of which people sometimes complain is defective memory, but they will never complain about defective judgment or defective common sense. This agrees perfectly with what a German physician has lately argued in an essay, that insanity is a blessing, as the insane live in an ideal sphere, which usually is far happier than the reality in the world of trouble through which they have passed and which made them insane. But the fools outside the asylums, which largely outnumber those in confinement, are happy also, while the sensible people have all the cares. How far it is right to attempt the cure of the insane is another question. The German physician referred to considers it an act of unkindness, if not cruelty, to restore the happy lunatics in asylums again to this world of troublesome realities, while we consider the cure of the lunatics out of the asylums an impossibility. Already Solomon had found this out when he said: "Though thou shouldst bray a fool in a mortar among wheat with a pestle, yet will not his foolishness depart from him."

NEW APPLIANCE FOR HARBOR FIRES.

The recent total loss of the steamer City of New York by fire in this harbor, as well as the extensive destruction of property at Hunter's Point caused by the going to pieces of the burning bark Nictaux, suggest the urgency of new appliances for our harbor fire service, which, had they been in use, would have greatly limited the damage.

If the fire boat Havemeyer had been provided with a ram, so as to be able to scuttle the burning ships as soon as it became evident that the engines were unable to subdue the fire, the ships as well as the cargoes would have been saved with comparatively little loss.

To furnish the Havemeyer with an orthodox ram now would scarcely be advisable, as she has not been built for that purpose, and therefore would have to undergo alterations which would necessitate her withdrawal from service for a considerable time. There is, however, a simple way of fitting her with a ramming apparatus without altering her at all. A long, heavy floating spar, lashed to her side, and protruding from twenty to thirty feet from her bow, might be carried on board, to be used when called for. Experiments alone can decide whether she will be able to bear the strain of the collision when this spar is fastened by strong ropes, which will not part by the contact, or whether the ropes ought to be so thin as to part by the shock. Perhaps it might be found most practicable to cut the lashings a second or two before the collision takes place, and leave it to the impetus of the spar alone to break the burning vessel's side, and enable the Havemeyer to steer clear of the wreck.

The shortest way to scuttle a ship, however, would be the application of *small torpedoes* loaded with some high explosive, for instance dynamite. The torpedoes could be constructed just powerful enough to knock a hole of certain dimensions in a ship's bottom, and might be applied either by a spar from the Havemeyer direct, or, when practicable, they could be fastened to the burning vessel by competent men in a rowboat, and then be exploded by electricity from a safe distance. In cases where the vessel's cargo consists of naphtha or other highly inflammable substances, the spar ram would have to be resorted to.

We have no doubt that General Abbot, commanding the United States Engineer Battalion at Willetts' Point, would be willing to instruct our fire commissioners about the proper charge of dynamite required for the operation, and the authorities of the Brooklyn Navy Yard would be able to give every facility and the best advice for rigging the necessary torpedo spar on board the Havemeyer.

RAIN THEORIES.

Some years ago, at the occasion of a long continued drought, several individuals published suggestions in the papers for means to produce rain. One which was brought prominently forward was that some big fire should be made. According to the theory suggested, the ascending hot air currents, aided by the water formed by the combustion of the hydrogen present in most all ordinary fuel, a copious rain would surely result. As an argument it was brought forward that rain storms have often succeeded large battles, when a great deal of gunpowder was burned. Unfortunately for this theory the amount of hydrogen present in the charcoal of gunpowder is so insignificant as practically to amount to nothing, while the chief products of its combustion are carbonic and sulphurous acids, with free nitrogen and some sulphide of potassium. Statistics also do not sustain the assertion that rains always follow great battles, as there are scores of instances that this was by no means the case. Unfortunately for the theory of the party who suggested the starting of fires for the promotion of rain, shortly afterward the woods took fire in several parts of the Northwest, and even also in New York State, as is frequently the case after long continued drought, but not the least impression was made, and rain did not fall for a long time afterward.

Mr. Bell's suggestion that a single timely rain would pay the cost of one of his rain-towers, described on page 113 of the SCIENTIFIC AMERICAN, may be very true, and that a nation who could control the rain would "prove her wealth and grandeur," but the questions are: Would such a tower have any influence on the rain at all? Are there not local and temporary circumstances which produce ascending and descending air currents much more powerful and extensive than can be produced by any number of such towers? What will the moisture amount to which can be conveyed by an ascending column of air of twenty feet diameter? How will we saturate this ascending air with moisture, or subtract the moisture from the descending clouds so as to diminish their enormous bulk before bottling them up? A mere superficial consideration of these and similar questions shows already the absurdity of the idea, and we would not think it worth while to answer them if the answers did not enable us to incorporate some useful practical ideas.

These questions are answered by the solution of the simple problem in physics, How much moisture such a tower can throw in the atmosphere? and this is easily found. Let us suppose that the inventor is able to saturate this air with moisture, which he cannot do, but for the sake of argument we will suppose the circumstances as favorable as possible, and grant that he succeeds to do this. Let this air have the medium temperature of 60°, then, as it has been demonstrated that such air when saturated can contain not more than seven grains of water per cubic foot, every cubic foot of air thrown upward through the tower will bring so much watery vapor in the atmosphere. As the interior shaft is 20 feet diameter, or nearly 300 square feet surface, and we suppose that he succeeds in moving this air upward at the rate of 15,000 feet per hour, he well get 15,000 × 300, or 4,500,000 cubic feet of air, which for 7 grains per cubic foot gives 7 × 4,500,000 = 31,500,000 grains, or nearly 4,100 pounds of watery vapor per hour. An ordinary locomotive evaporates more than twice this amount, and being high pressure without condensation, throws it all in the atmosphere, so that every working locomotive is, in regard to the cloud-making watery vapor it evolves, equivalent to two of Mr. Bell's rain towers, if not three, as an ordinary locomotive evaporates as much as 12,000 pounds of water per hour, consuming to do this 2,000 pounds of coal, producing from 6,000 to 7,000 pounds of carbonic acid gas and a variable amount of water, from the variable amount of hydrogen in the fuel.

Let us now consider that several hundred locomotives are at present daily running over the plains of Colorado, Utah, and adjacent almost rainless districts, where the air is exceedingly dry, where in many regions there are no lakes or rivers within more than a hundred miles distance, and where most of the rivers always dry up in summer, and are in any case insignificantly small, so small indeed that there exists no navigation even for a row boat. We meet people born there who had never seen even a small sailing vessel or steamboat. Consequently there is no evaporation, and all the moisture in the air and the clouds, seldom seen, must be wafted there by the winds from more favored regions. If, now, in such a region some hundreds of locomotives blow watery vapor in the dry atmosphere at the rate of 12,000 pounds per hour each, which as every pound of steam occupies a place of 25 cubic feet, every locomotive throws 300,000 cubic feet of steam per hour in the atmosphere, which for 100 locomotives, working 7 hours per day, is 100 × 7 × 300,000, or 210,000,000 cubic feet of steam, which mingled with ten times its amount of air may make a respectable little cloud.

This estimate will explain why the climate has changed in many regions of the West, and rains have become more frequent where formerly they were too scarce, and all this since railroads have been built and railroad trains travel daily through the formerly rainless districts.

Natural Silver Plating.

A curious instance of natural silver-plating is reported from the Lord of Lorne Mine, of the American Flat section, Nevada. The sides next to the veins and the hanging walls of the ledge are covered with a thin coating of natural plating of pure silver as smooth as glass. The vein itself is narrow, and is being prospected by means of a tunnel. The superintendent says this peculiar feature of the inclosing walls is observable so far as the tunnel has followed the ledge. The ore of the vein itself is of a soft, easily-worked nature, showing considerable chloride as well as sulphurets, yet not giving very high assays. The filmy deposit of silver on the walls was evidently condensed and forcibly deposited there under immense pressure, as it has a smooth, burnished appearance.

Cotton Factories at Petersburg, Virginia.

The following interesting particulars are given with regard to the cotton industry of Petersburg, Va.: The Ettrick Manufacturing Company have 6,060 spindles and 250 looms, and give employment to 215 operatives. The annual consumption of cotton is 3,000 bales, with a yearly manufacture of 2,900,000 yards of cloth. The Matoaca Manufacturing Company have 9,600 spindles and 260 looms, and give employment to 225 operatives. The consumption of cotton yearly is 2,500 bales, and they turned out last year 3,605,000 yards of cloth. The Battersea Manufacturing Company has 3,600 spindles and 100 looms, and employs 90 operatives. The annual consumption of cotton is 1,500 bales, and the yearly manufacture of cloth 1,300,000 yards. The Petersburg cotton mill has 3,288 spindles, 110 looms, and turns out daily nearly 5,500 yards of goods, such as fine sheetings, shirtings, and drillings. It consumes annually 1,000 bales of raw cotton. The Blandford factory, owned by the same company, located in Blandford, is run by steam, and turns out about 3,000 yards of cloth daily. The Mechanics' cotton factory has 3,600 spindles and 100 looms, and consumes a thousand bales annually, and the manufacture of cloth is 5,500 yards per day, or about 1,650,000 pards per annum.

LAWN MOWING MADE A PLEASURE.

As one recalls the comparatively few closely-cut and well-kept lawns to be seen a few years ago, and now looks about and beholds them on all sides, it becomes evident that the people are better provided with means to gratify the desire to beautify their homes and public grounds, and that at a much less expense than in former days.

The lawn mowers of ten and even five years ago were not only high priced, so that but few could afford to purchase them, but even the smaller sizes were made so heavy and cumbersome to handle, that it required a strong man to put them in practical operation. The cutting apparatus was imperfectly made, and the journals and gearing were unprotected, so that dirt and grass soon clogged up the machine, giving rise to complaints which have led inventors to devise new machines to obviate so far as possible the difficulties of the past; the result is that he who has a lawn can afford to purchase good mowers and cut his own grass.

Among the number of new mowers made with a view of overcoming the difficulties referred to, the one herewith illustrated is at present attracting public attention; and lawn owners in general will find it worthy of careful consideration on account of its marvelous ease of handling while in practical operation, and the numerous improvements which have been applied to it in a very desirable manner.

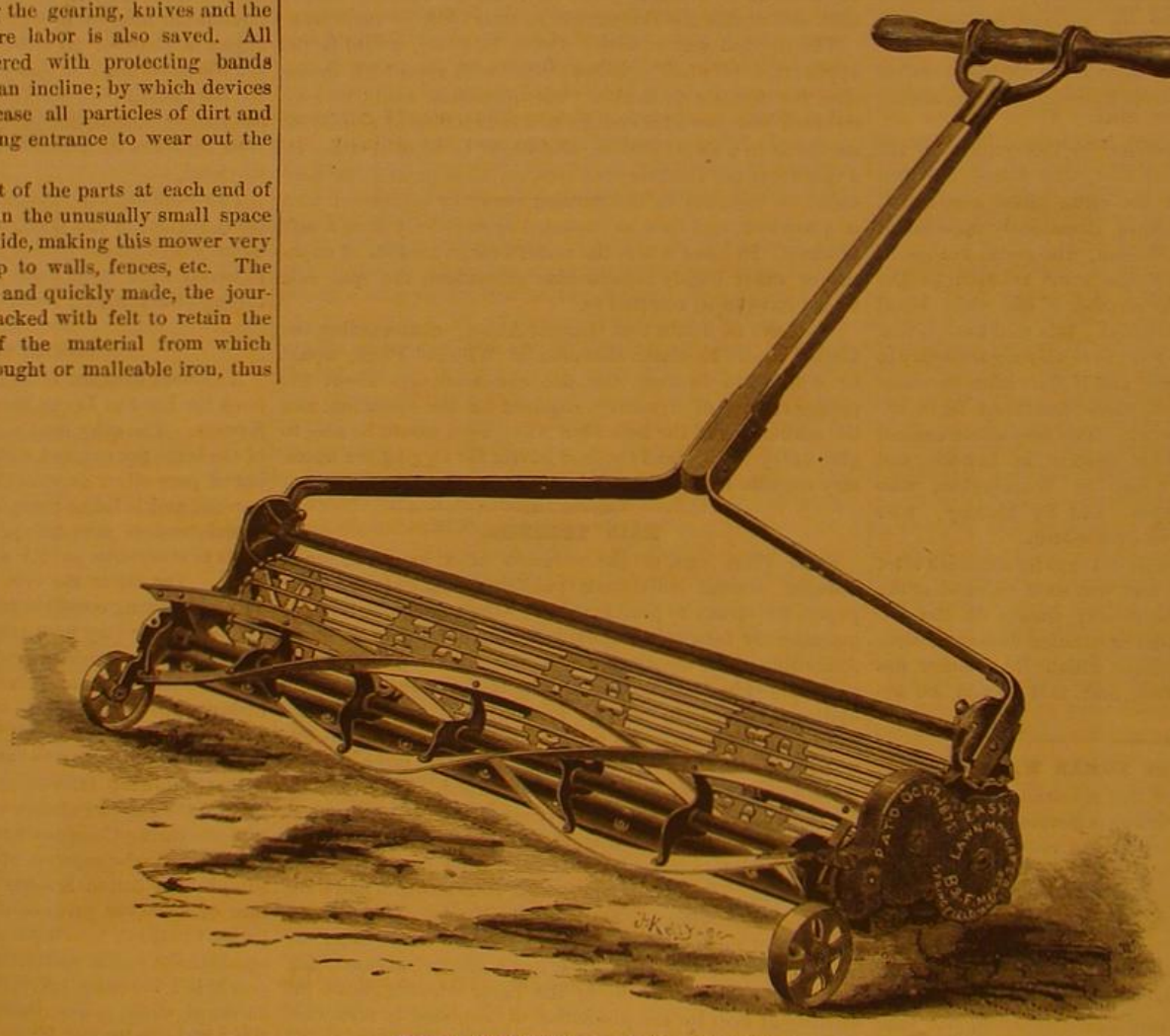
It is well known that a side-wheel mower always runs with one wheel in the standing grass, breaking it down, so that the next time the grass is passed over it is not all cut: and the day after mowing it is frequently the case that rows of standing grass may be noticed on various parts of the lawn.

In the mower herewith shown Mr. H. G. Fiske, the inventor and patentee, avoids using either side or rear wheels, or even a solid roller, the latter being objectionable by making the mower run hard and heavy, and being of but slight service as a means of rolling down the unevenness of the ground. To obtain a means of traction and to make the mower extremely light, he employs an open roller, which is made largely of steel wire, secured at intervals around the circumference of two end disks, and intermediate supports are placed in the longer rollers to make the whole rigid. By this method of construction the roller can be made extremely light; and since the openings are sufficiently large to allow the grass to protrude, the best possible traction is obtained, and that without bringing any of the usually necessary pressure to bear upon it. By this arrangement alone it is said about one half the power required to operate other mowers is saved, and by strictly adhering to true scientific principles in forming the gearing, knives and the journals throughout much more labor is also saved. All the exposed journals are covered with protecting bands and the oil holes are drilled on an incline; by which devices in addition to the tight gear case all particles of dirt and grass are prevented from finding entrance to wear out the movable parts of the mower.

By an ingenious arrangement of the parts at each end of the mower the knives cut within the unusually small space of one inch of the extreme outside, making this mower very convenient in cutting close up to walls, fences, etc. The several adjustments are easily and quickly made, the journals to the cutter shaft are packed with felt to retain the oil, and a large proportion of the material from which the mower is made is steel, wrought or malleable iron, thus procuring great strength with light weight.

The adjustment of the handle is quite convenient and novel in its way, as by means of sliding bolts it may be removed in an instant for the purpose of putting the mower in a small space. The handle may be as quickly applied at any desired elevation, or it may be secured at a forward angle, so that the cutting apparatus may be tilted up from the ground, and by swinging the handle backward to the ground, the entire mechanism is so elevated that by applying a crank to the end of the cutter shaft it may be turned backward, and oil and emery applied for grinding the knives, without specially preparing the mower therefor. The spiral knives are hardened and are made of a hooking shape, that they may be dressed on the front edge with a sharp file for the purpose of keeping a keen edge on them.

The mower, when in operation, is quite silent and would be scarcely noticed by a passer by, and what is not less important, its construction enables a young man to operate a forty inch machine, in quite high grass, for hours at a time with relatively little fatigue. A slight-built boy of ten years of age has been known to cut quite heavy grass for an hour at a time with a twenty-four inch machine. In general appearance the machine is compact, tasteful, and handsomely ornamented. The Blair & Fiske Manufacturing Company, of Springfield, Mass., are the manufacturers of this mower, which they have very appropriately named the "Easy" lawn mower. They are making them in seven sizes, beginning at ten inch cut and ending with a twenty-four inch. They also have a thirty and a forty inch machine, but these are made only to order. The latter is shown in our engraving. Naturally with the many advantages claimed for the "Easy" lawn mower there is little difficulty in attracting the attention of the public and the trade in general. Jobbers throughout the country are rapidly making arrangements for local agencies in their vicinity for next season and very large sales are anticipated.



THE 'EASY" LAWN MOWER.

WITHERS'S IMPROVEMENT IN TEA KETTLES.

IMPROVED TEA KETTLE.

The engraving shows an improvement in tea kettles patented by Mr. W. S. Withers, and now being introduced by Messrs. Withers & Wolfe, 84 Whitehall St., Atlanta, Ga.

This improvement is designed to prevent the possibility of the handle of the kettle becoming heated, a common occurrence with utensils of this class when placed over the fire, and also by the same arrangement to prevent the lid from raising or moving from off the kettle, holding it firmly pressed down when it is tipped or inclined, thus avoiding the escape of hot water and steam.

The invention consists in connecting the bail or handle with the lid or cover of the kettle by a rod, so that when the lid is closed upon the kettle the handle will be held erect, or, if the bail is turned over to the side, the lid, which is hinged to the kettle at that side, will be raised accordingly, and when the handle is grasped to raise the kettle, the lid is prevented from moving either vertically or laterally. When the lid of the kettle is closed the handle is held erect, and when the handle or bail is grasped and the kettle raised, the hinged lid will be held firmly against the body of the kettle over the orifice in its top, and thus prevent the escape of steam or water, as the lid cannot possibly raise or slip to the side, even though the kettle be turned half over in the direction of the spout.

The lid may be raised wholly or partially from off the kettle by depressing the handle, as represented by the view in the background, which dispenses with the trouble and inconvenience of taking hold of the lid for that purpose, as is the case with the ordinary class of vessels of like character. The great advantage of this improvement is that the handle, not being permitted at any time to be in contact with the side of the kettle, cannot become heated.

MISCELLANEOUS INVENTIONS.

Mr. Albert M. Da Costa, of Brooklyn, N. Y., has patented an improved finger guide for type writers, by means of which the keys may be quickly located without the aid of sight.

An improved match box has been patented by Mr. Georg Wenström, of Stockholm, Sweden. It is provided with a sliding cap or inner box, which is divided into two compartments—one for holding matches and the other for receiving the end of the cigar for lighting—and formed with a slit at one side for the insertion of a match within the lighting chamber; also, in a tongue formed on the inner box, which, in connection with an opening in the outer box, forms a cutting device, combined with a chamber formed at the inside of the match box to receive the cuttings.

An improvement in mechanism for mixing and feeding material to the stones of a grinding mill, whereby the action of the mixing and feeding devices is rendered uniform, one being started or arrested at the same time with the other and operated at the like rate of speed, has been patented by Mr. James P. Lowell, of Purcellville, Va.

A machine for sawing shingles from blocks, which is so constructed that the shingles may be sawed with their butts up and down alternately, so that the blocks will be kept square and the length of the shingles will always be in line with the grain of the wood, has been patented by Mr. Elias C. Schermerhorn, of Alder Creek, N. Y.

Mr. William T. Wainwright, of Dry Sawmill, Pa., has patented an improved bench plane, which may be used for square jointing, for beveling, and for rabbeting.

An improvement in stove boards has been patented by Mr. A. Irving Griggs, of New York city. The invention consists in constructing a stove board made with a bead and a hem, and having the lower ply of the hem corrugated and its edge turned up against the plate within the cavity of the bead, and the veneer cemented to the lower side of the middle part of the plate.

An improved coffin handle has been patented by Mr. George S. Eaton, of Brooklyn, E. D., N. Y. The object of this invention is to furnish coffin handles simple in construction, easily and quickly put together, and not liable to break.

Mr. Paul Crippen, of Bronson, Mich., has patented a waterproof paint compound, consisting of alum, coal tar, and sulphur boiled together.

Messrs. Marshall J. Allen, of New York city, and William E. Bradley, of Frankfort, Ky., have patented an improved process of saving the sugar and starch contained in a waste product in the manufacture of whisky and utilizing it. The process consists in freeing the slop from the bran, chaff, and coarse particles of grain, and introducing the liquid thus obtained in place of water in the succeeding operations with fresh grain.

An improved ironing machine has been patented by Mr. John Socias y Rubio, of New York city. This invention is an improvement in the class of machines in which the sad iron is suspended and adjusted vertically by a screw, and is designed to provide means for suspending a sad iron which will allow it to be moved in any direction over the ironing table; also, to suspend the sad iron by yielding or elastic devices, to enable it to be operated easily and efficiently.

Mr. Benjamin F. Sherman, of Ballston Spa, N. Y., has patented an improved hydrocarbon furnace, having the bottom of its combustion chamber made with a series of longitudinal pockets containing asbestos or analogous absorbent material, with perforated oil pipes embedded therein, and with alternating air chambers rising between said pockets and communicating below with the portion of the furnace corresponding to the ash pit, the said air chambers being perforated at the top and surmounted by inclined hoods or sheds which deflect the currents of air down upon the surface of the saturated asbestos.

Mr. Louis Graf, of Van Buren, Ark., has patented a process for producing colored photographs on linen or analogous material, which consists in the employment of a collodion mixture consisting, essentially, of distilled water, nitrate of silver, absolute alcohol, chloride of calcium, citric acid, and ordinary collodion.

An improved strap for baby chairs has been patented by Mrs. Mary W. Blacker, of Brentwood, N. Y. The invention consists in a waist belt having a forked strap attached to the front, which strap is connected with the belt by two side straps, which form loops for passing the baby's legs through, the belt being passed around the baby's waist and one of the rear rounds of the chair back, and then buckled, whereas the forked ends are fastened to the front legs of the chair. Further information may be obtained by addressing Mr. Frank E. Blacker, Brentwood, Suffolk Co., N. Y.

Mr. Frederic A. Weise, of Brooklyn, N. Y., has patented a glass mould designed more especially for making "fountain bottles" and the like, in which the glass may be more evenly or suitably distributed than in the present style of mould, and from which the bottle may be more easily and quickly removed.

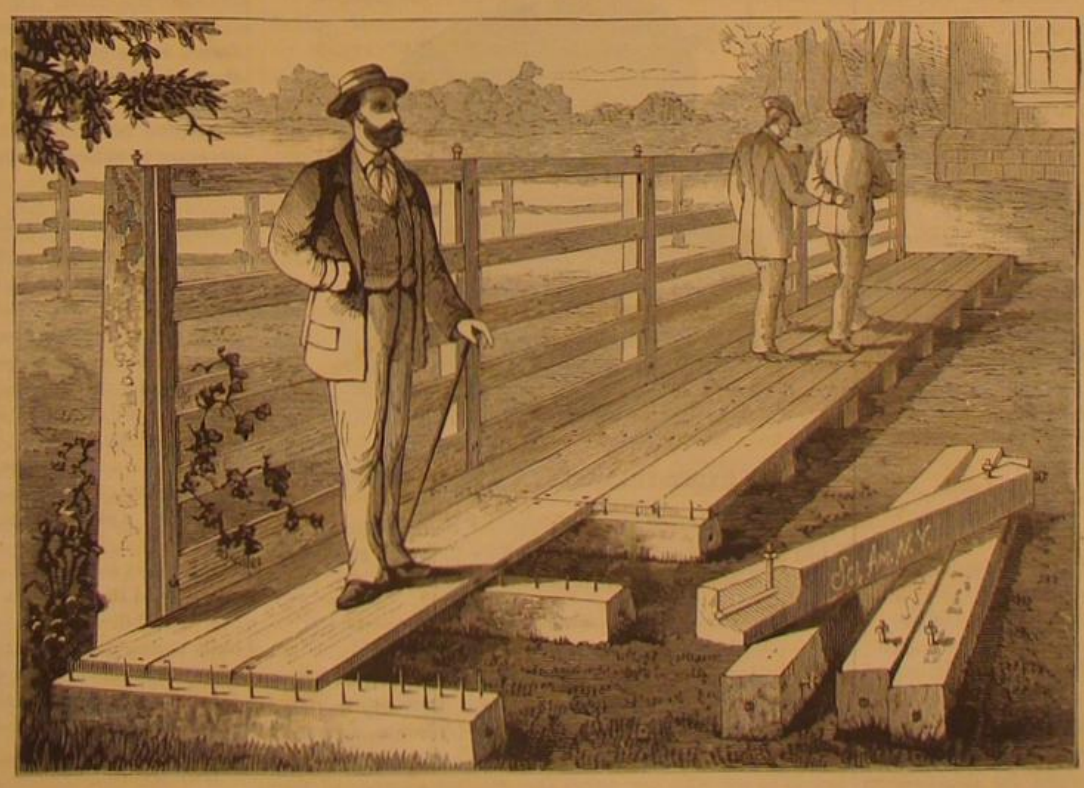
An improvement in the class of planters having reciprocating seed slides, with which auxiliary devices are combined to assist in regulating the discharge of seed, has been patented by Mr. Leonhard Grieser, of Minonk, Ill. The invention consists, mainly, in the employment of a curved reciprocating block or bar, which is located in the hopper and attached to the seed slide, with which it reciprocates simultaneously, so as to alternately open and close one of its two adjacent openings, and thereby alternately permit and prevent the escape of seed through the openings.

Mr. W. I. Wooster, of Harvard, Ill., has patented an improved blind fastener and slat operator, which consists of a slotted strip of wood or metal fixed vertically on a side of the blind and connected with each blind slat, said strip of wood or metal being moved vertically to open or close the slats and to bolt the blind by means of a rod that passes through the window frame.

CONCRETE FENCE POST AND SILL.

The engraving represents a novel fence post, also a sill for plank walks and plank roads, recently patented by Mr. Andrew Climie, of Ann Arbor, Mich. These articles are made of concrete strengthened by iron rods. The process of manufacture is exceedingly simple, and may be successfully conducted by any ordinary laborer. The moulds in which the posts and sills are formed are made of wood and arranged to hold the iron parts in position until the concrete sets. In the post the iron rod extends lengthwise through the center, and is provided with branches which project laterally through the concrete and beyond the surface of the post to receive nuts for holding the fence boards or rails, the ends of the branches being screw-threaded for receiving nuts for this purpose. The posts are planted in the ground like ordinary fence posts. If desired, a top rail or cap may be secured to the top of the post by a nut on the end of the central rod.

The sills or ties for plank walks and roads are moulded in the same way, and are provided with screws or spikes for securing the planks in place. These posts and sills are practically indestructible, and afford a means of building good and durable fences and walks where timber is scarce. This combination of iron and concrete insures great strength and rigidity, and when the question of durability is considered this will undoubtedly be found much cheaper than other kinds of posts.



CLIMIE'S CONCRETE FENCE POST AND SILL.

A Well that Needed Cleaning.

The following articles were taken from a well recently at Pollock, Missouri: Four wash pans, eleven half pint cups, two hats, four tin dippers, one brass tablespoon, one boot and one shoe, and one basket, one teacup and one saucer, two half gallon buckets, one piece of lightning rod. Evidently the family which had used that well was not lacking in small boys as well as general unthrift. Such a rubbish pit, however, might be a much less dangerous source of water supply than many seemingly clean wells with cess pool connections.

NOVEL FOLDING STAND.

The folding stand shown in the annexed engraving was recently patented by Messrs. Freeborn & Chase, and is being largely manufactured by Mr. T. W. Freeborn, of Newport, R. I. It has been well introduced, and has received the indorsement of prominent hotel men and others who have adopted it. It is very simple and practical, consisting of cross legs pivoted to each other, the jointed arms hinged to the upper part of these legs, and a two-part top attached to the jointed arm so as to elevate the stand in the center when folded, and is provided with handles formed by openings on opposite sides of the line between the two parts of the top, so that one motion of the arm of the person using it can be closed or opened instantaneously. It is made into various articles of which the butler's stand is one of the most important. Perhaps the leading feature of the patent is the cutting board, which is appreciated not only by dressmakers and milliners, but by every woman who has her family sewing to do. It has a great advantage over the ordinary lap board, as it can be left with the work on it without disarranging it. It also relieves the operator of all weight, and consequently entails no injury. It can be folded quickly when not desired for use. These stands are made up as chessboards and writing desks; they are also made in the form of a saddle rack, which is appreciated by those who have occasion to clean and dry harnesses.

FREEBORN'S FOLDING STAND.

The dotted lines in the engraving show the movement of the parts in folding. It is not often that a simple invention like this can be applied conveniently to so many useful purposes.

Further information may be obtained by addressing Mr. T. W. Freeborn, P. O. box 108, Newport, R. I.

NEW INVENTIONS.

Mr. Claude I. Wallis, of Memphis, Ala., has patented a simple and convenient pocket pen and brush for marking boxes, packages, etc. It consists of a tube or hollow handle containing an ink reservoir, a brush at one end of the handle inclosed in an elastic thimble, and in communication with the ink reservoir, and of a double-nibbed pen fixed in the opposite end of the handle from the brush.

A frog for timber chutes has been patented by Mr. Henry L. Day, of Truckee, Cal. The invention consists in attaching to the chute, at any convenient point, a frog, which consists of a long timber mortised obliquely into a timber of the chute, and of two or more shorter timbers, whose pointed ends may be entered into the ground, and whose larger ends rest on a cross piece that is set close against the chute in the angle made by the timber and the chute. It is stated that when other conditions are equal, this frog enables one to deliver in a given time one-third more logs than can be delivered by the old method of rolling them into the chute. Timber chutes are sometimes three or four miles long.

Simon J. Freeman, of New York City, has patented a fastener for meeting rails of sashes, so constructed as to fasten the sashes automatically as the sash is closed, which cannot be unfastened from the outer side of the window.

An apparatus for the manufacture of ice has been patented by Mr. Andrew J. Zilker, of Austin, Texas. The object of this invention is to provide means by which artificial ice may be detached from the moulds in unbroken blocks.

Mr. John R. Pafford, of Cuero, Texas, has patented a light, cheap, portable, and durable bed bottom, which can be fitted to any bedstead.

Mr. Horatio N. Bill, of Willimantic, Conn., has patented an improvement in fire kindlings and machine for manufacturing the same. The object of the invention is to make a cheap and readily-ignited kindling block.

Mr. Patrick W. Groom, of St. Louis, Mo., has patented an improved handle socket strap for shovels, spades, and scoops. The invention consists in combining a flanged socket with a recessed blade.

An improved gate has been patented by Mr. William H. Tobey, of Livonia, Mo. The invention consists in a gate having one or more of its lower rails made in two parts, correspondingly beveled where they meet between the braces, and one of them secured at its unbeveled end by a detachable pin.

An improvement in hame tugs has been patented by Mr. Jacob E. Moeller, of Centralia, Ill. This invention relates to that portion of carriage harness which is used for adjustably connecting the forward end of the trace with the hook or cockeye of the hames.

An improved seat lock has been patented by Mr. John L. Dolson, of Charlotte, Mich. The object of this invention is to furnish fasteners for the seats of spring wagons and other vehicles, so constructed as to hold the seats securely and allow them to be readily removed and adjusted.

Mr. Richard Ray, of Lake City, Fla., has patented an improved umbrella or sunshade, so constructed in the top or cover as to more effectually protect the person from the rays of the sun or from rain.

An improvement in umbrellas of that form in which some of the ribs are longer than the others, or in which the staff is connected eccentrically to the cover, to allow the person to occupy the center of shelter and be better protected from rain or the sun's rays, has been patented by Mr. Alexander H. Ege, of Mechanicsburg, Pa.

A compound rotary and reciprocating churn in which is employed a rotary dasher to whip the milk, in combination with a reciprocating dash to displace the liquid, so that the entire liquid contents of the churn may be quickly and continuously presented to the action of the rotary paddle or dash by the movement of the reciprocating dash, has been patented by Mr. Andrew Mearns, of Tolesborough, Ky.

Mr. Rhodes Arnold, of Waltham, Mass., has patented a novel arrangement of the bridle rein, whereby the rider is enabled to exercise control over the animal without exerting great power and without extraordinary strain upon the rein itself.

An improvement in horse collar fastenings has been patented by Messrs. Ebenezer Fisher and John Watson, of Kincardine, Ontario, Canada. This invention relates to an improved fastening for metallic horse collars, more particularly for that for which the same inventors have received letters patent of the United States No. 224,671.

An improved form of mail bag for horseback routes, designed to facilitate the packing of mail matter therein and its removal therefrom, has been patented by Mr. Thomas J. Mayo, of Paintsville, Ky.

Mr. Goldsborough Robinson, of Louisville, Ky., has patented a novel process and apparatus designed especially for drying leaf tobacco after saturation with alcohol for improving its color and quality, but applicable generally to the recovery of any volatile liquid which has been used in the treatment of another substance to which it adheres.

Mr. Ambrose Giraudat, of Neury, N. J., has patented a machine for cutting lace from paper to be used for ornamenting paper boxes, cigar boxes, and for other purposes.

Mr. Otis E. Drown, of Pawtucket, R. I., has patented an improved machine for breaking, rubbing, and stretching raw hide in the manufacture of leather for belting and lacing. This work has heretofore been done by winding the hides on shafts or drums while tension was applied by fixed bars between which the hides were stretched The object of this invention is to facilitate the operation and permit regulation of the tension.

A cheap and simple device, especially designed for railroad cars, to be affixed to the outsides thereof for holding and protecting cards of address, etc., has been patented by Mr. Frederick G. Hunter, of Moncton, New Brunswick.

An improved gate has been patented by Mr. Arza B. Minton, of Philomath, Oregon. The invention relates to that class of farm gates which are operated by means of cords suspended from posts, and has for its object to furnish an improved mechanism for opening and closing the gates.

Mr. Joseph C. Fowler, of Arcola, Texas, has patented an improvement in running gear for wagons. The improvement relates to king bolts and coupling devices for connecting the forward axle of wagons, carriages, and other vehicles, and it consists in a king pin or bolt which passes from a socket in the bolster through braces and enters a socket in the top bar of the axle, where it is held by a cross pin, the bolt and braces thereby sustaining the weight. The lower end of the bolt is formed as a rounded bearing in a direction transversely of the vehicle, so that the forward wheels and axle may conform to the ground without effect no the wagon body.

Mr. Edward Seyfarth, of Lanark, Ill., has patented an improved ear piercer, so constructed that the puncture can be made exactly in the desired spot and so quickly as to be painless.

Mr. John B. Haskell, of Staunton, Va., has patented an improvement in the class of pails and cans which are constructed with hollow walls or in part of some material which is a bad conductor of heat for the purpose of preserving food for a considerable time at a temperature which is either above or below that of the surrounding atmosphere.

An improvement in pipe couplings has been patented by Messrs David B. Hand and Ephraim H. Reitzel, of Columbia, Pa. This invention particularly relates to a means for connecting the heating pipes between the cars of a railway train, but is also applicable to other purposes. It consists in a novel construction and arrangement of coupling devices, whereby provision is made for affording a universal motion to the pipes

Native American Minerals.

Professor R. Pumpelly, Special Census Agent, Newport, R. I., wishes to obtain information, for use in the forthcoming census report, in regard to the occurrence in the United States of the *raw material* from which the substances named in the appended list are obtained.

Any aid which our readers can give us, either by a list of the localities where the raw material of one or more of the substances named is found, or by a list of the persons or firms from whom we can obtain such information, will be thankfully received by Professor Pumpelly, at the above address. The substances referred to are:

Apatite,	Iron pyrites (for sulphuric acid),
Asbestos,	Kaolin,
Asphaltum (albertite),	Lithium,
Arsenic,	Manganese,
Antimony,	Molybdenum,
Bismuth,	Magnesia,
Borax,	Mica,
Chrome,	Nickel,
Cobalt,	Niter,
Corundum and Emery,	Serpentine,
Hydraulic cement,	Slate pencils,
Fluorspar,	Soda,
Feldspar (for potash),	Soapstone,
Grahamite,	Talc,
Graphite,	Tin,
Gypsum,	Whetstone or novaculite,
Glass sand,	Wolfram or tungsten,
Infusorial earths,	Zinc.

Legal Recognition of the Nature of the Small Boy.

A Western railroad company was sued for damages on account of injuries to a small boy who was surreptitiously playing on a turn-table. The case was brought before the Kansas Supreme Court, which decided in favor of the plaintiff. The court said:

"Everybody knows that by nature and by instinct boys love to ride, and love to move by other means than their own locomotion. They will cling to the hind ends of moving wagons, ride upon swings and swinging gates, slide upon cellar doors and the rails of staircases, pull sleds up hill in order to ride down upon them on the snow, and even pay to ride upon imitation horses and imitation chariots swung around in a circle by means of steam or horse power. This last is very much like riding around in a circle upon a turn table. Now, everybody, knowing the nature and the instincts common to all boys, must act accordingly. No person has a right to leave, even on his own land, dangerous machinery calculated to attract and entice boys to it, there to be injured, unless he first takes proper steps to guard against all danger; and any person who thus does leave dangerous machinery exposed, without first providing against all danger, is guilty of negligence."

CONVENIENT PORTABLE BATHING APPARATUS.

The annexed cuts, which we take from *La Nature*, represent a simple, practical, and compact shower bath, or hydro-

Fig. 1.—HYDRO-THERAPEUTIC APPARATUS IN OPERATION.

therapeutic apparatus, as the inventor, Mr. Gaston Bozérian, of Paris, names it. In Fig. 1 the apparatus is shown in operation, and in Fig. 2 is shown folded and packed for storage or transporation. A description of this operation is scarcely necessary, as the engraving fully illustrates it.

A traveler can take such a bathing apparatus with him and enjoy all the comforts afforded him at home or in city hotels. The apparatus can be adjusted to deliver water from above or from below, or from above and below at the same time, as shown. The ring can be adjusted according to the height of the person, for adults or children, and in the latter case a grown person can do the pumping. As can be seen, the apparatus can be taken apart and packed to occupy the

Fig. 2.—HYDRO-THERAPEUTIC APPARATUS PACKED.

space of a large tin pan, and can be readily stored away when not in use. It has a slatted floor to which the pumps, etc., are fastened. This floor is removed when the pan is cleaned.

ROPE JUMPING.

As cooler weather approaches the jumping rope will be more and more in the hands of girls. Properly used it is not an objectionable plaything. But children cannot be too frequently cautioned against jumping against time or competing to see who can jump the greatest number of times without stopping. In an essay on popular customs on public health in the recently published annual report of the Department of Statistics of Indiana, Dr. J. W. Hervey, of Indianapolis, lays great stress on the danger of this practice. None, he says, is more injurious; and in illustration of its evil effects he mentions a case of real occurrence in that city. The patient, a girl of twelve years, was dead when he reached the house. He says: "On inquiry I learned that she had jumped the rope at school, a few days before, five hundred times. Think of five hundred rushes of blood upon the little heart in quick succession! No wonder I had to make the certificate of death, 'Emboli, or clot in the heart, caused by overheat and jumping straight up five hundred times.'"

Not only does this practice throw a great and sometimes killing strain upon the heart, but it often causes serious injury to the joints of the knees and hips and to the spine. The muscular and nervous exhaustion, due to long continued jumping, must also be injurious.

To Tie the Cotton Crop.

About seventy-five thousand miles of hoop iron—enough for a three-fold girdle around the earth—will be needed to bind the forthcoming cotton crop, if it reaches the number of bales predicted by statisticians, or 6,000,000 bales. The number of bands required is six to a bale, or 36,000,000 in all. They are of uniform size, 11 feet in length, and 1,200 weigh a ton. Hence there will be required 30,000 tons of hoop iron, with a total length of 396,000,000 feet. The cost of ties will be about $3,000,000.

Correspondence.

A Light Road Locomotive Wanted.

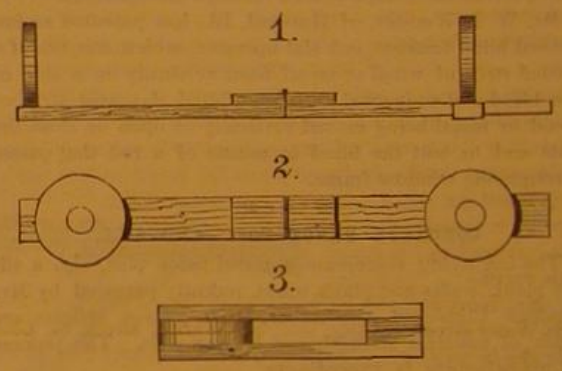
To the Editor of the Scientific American:

The bicycle, as now made, is a practical, and, to many, a valuable invention. Now, whoever will bring out a three-wheeled machine, that shall not weigh over two hundred pounds, that is driven by a neat, safe, and light motor, will not only realize a fortune, but confer a benefit on the race. We need a machine that can be started under full headway in five minutes or less from the time a match is ignited, that can run over our country roads as fast as ten miles per hour. D. H. S.

Folding Telescope.

To the Editor of the Scientific American:

It is rather singular that the spy-glass described in your paper (No. 5, Vol. XLIII.) should not long since have come into general use, and that it should so long have been considered necessary to have the lenses inclosed in a case and with so small an aperture in the eye-piece as is generally used. I have made spy-glasses with but two lenses, by fitting the lenses into flat wooden disks and hinging them to a flat bar a little wider than the lenses, the bar being made of two pieces connected together by a hinge, so that they could be folded together with the lenses between them, thus:



But no good effect can be produced with lenses of short focus, as the greater the length of focus the greater will be the magnifying power; convex lenses of not less than forty inches focus producing the best effect, with concave lenses anywhere between nine and fourteen inches, and with an aperture of sufficient size to allow of being held at a short distance from the eye.

JAMES A. BAZIN.

Canton, Mass., July 27, 1880.

The Accident at the Hudson River Tunnel.

To the Editor of the Scientific American:

1. In your excellent paper of August 7, I find a diagram of the tunnel disaster (page 80) which differs some from other sketches, in that the break occurred at the commencement of the tunnel, while in other representations it occurred at the end of the air lock. Which is correct?

2. Why was the *bottom* of the air lock placed on a level with the *top* of the tunnel?

3. Why was the tunnel *commenced* thirty feet from the shaft?

Doubtless some good reason exists for the plan, and I, for one, would like to know what it is.

4. Could the accident have occurred if the tunnel had been built square out from the bottom of the shaft, and the air lock put in on the floor of the tunnel?

I have conversed with many practical Colorado miners, and none can give a reason for the peculiar manner in which the tunnel is started. E. W.

Boulder, Col.

[ANSWER.—1. At the time of the accident it was not known exactly where the break first started; it was given to us, by Col. Haskins himself, as starting at the place shown in our diagram. 2. The location of the air lock was arbitrary; in the haste, after legal interferences, to test the compressed air system, it was placed where it now is—simply for convenience at the time. 3. The tunnel was commenced at the distance it now is for the reason that the limit of tests was reached; then the practical portion commenced. Col. Haskins says the New York end will be started as they are now arranging the New Jersey end—from a caisson with air locks from the top. 4. It is impossible to say if the accident could have occurred with the tunnel projected directly from the shaft, with the air lock at the bottom of the tunnel; but it is reasonable to suppose it would have been the strongest possible method.]

AMERICAN INDUSTRIES.—No. 55.

THE MANUFACTURE OF PUMPING ENGINES AND WATER METERS.

Perhaps no department of invention has developed more rapidly than the one we now illustrate. When the attention of Mr. Henry R. Worthington was first turned to the subject such a thing as an independent steam pump was hardly known. Steamboats and steamships had no provision for running either fire, bilge, or boiler-feeding pumps when the main engine was at rest—a condition of helplessness and danger hardly to be imagined at the present time. Steam pumps for mills, factories, hotels, office and public buildings, and the thousand and one uses to which they are now applied were not then known.

The Worthington steam pumping engine, in its latest and best form, has two steam cylinders and two pumps, which are cast together to form one machine, and the pistons and valves of the two engines are so connected that the right-hand division moves the steam valve of the left-hand one and *vice versa*. No tappet, crank, or other rotary device is employed. As the right-hand piston nearly reaches the end of its stroke the other starts, in such time as to keep the water flowing in a constant and unvarying stream. The plungers are thus permitted to halt momentarily, and allow the water valves to seat without slamming, while by the combined action of the two pistons a uniform pressure and velocity of water is maintained. In all other forms of steam pumps, especially when applied to heavy resistances, or run at quick speed, there is more or less concussion of the water valves at each stroke. In a number of important services this objection has led to the exclusive adoption of the Worthington. On oil pipe lines, for example, any jar strains the joints in the pipe and causes heavy losses from leaks. In this service Worthington pumping engines are entirely successful. Some of them now at work have a capacity of 1,500 barrels of oil per day, forced through 100 miles of pipe against a pressure of 1,500 pounds per square inch—equal to a vertical lift of 3,400 feet. This is the most severe pumping service yet undertaken in this country.

The arrangement of this engine allows the use of the ordinary slide valve, such as is found on locomotives and other forms of crank engines. Single cylinder pumps are usually constructed with auxiliary piston valve throws, more or less complicated in detail. The slide valve, on the contrary, is the simplest form of steam valve known to engineers. It has no cavities in which water can collect and freeze; no tight-fitting surfaces to become rusted or adhesive; no leaks resulting from wear, or trouble from unequal expansion of the parts. As one or the other of the steam valves must be open always, there can be no dead point in the stroke. The pump is therefore ready to start when steam is admitted, and is managed by the simple opening and shutting of the throttle valve.

Mr. Worthington's offices are at 239 Broadway, New York; 83 Water street, Boston; and 709 Market street, St. Louis. In the factory, which covers an area of nearly two blocks, in South Brooklyn, L. I., there are about 500 men employed at present, working full time, and large extensions of the works are now in progress to meet the unusual demand which has succeeded the long period of commercial depression. The increase in the demand for small steam pumps for ordinary work, such as hydraulic elevator service, fire protection, railway water stations, boiler-feeding pumps, etc., has been especially remarkable.

A large force of workmen are also engaged in the construction of Worthington water meters. These machines, of which there are now over 20,000 in daily use, have been adopted by all the principal water works in the United States and Canada.

In a pamphlet published by Mr. Worthington, we find a full and interesting history of the rise and progress of his pumping engine, from which we make a brief extract. It was written at the request of the Society of Civil Engineers for use at the Centennial Exhibition. He says:

"Somewhere about the year 1840 I was engaged in experiments with a steamboat designed for canal navigation. It frequently happened that the boat was suddenly stopped by unexpected impediments in navigation or detention at locks. This often brought a hand pump into lively requisition for keeping up the boiler supply, and naturally turned my thoughts toward a labor-saving method. The result was the independent feeding pump, patented on the 7th day of September, 1844. In the course of my experience I made many arrangements for using the spring, other than that exhibited in the patent of 1844.

"This, so far as I know, was the beginning of that numerous class of following inventions for storing power to act upon the steam valve, when the momentum of the moving parts was insufficient to throw it through its full distance of travel.

"The step from this spring motion to the use of an independent piston for driving the valve was obvious enough, and very soon made.

"I should weary you by undertaking to set forth any considerable part of the numerous engines made on the general basis here indicated. I believe almost every change was rung upon a steam valve throw, but in those days the amount of refinement and complication attending their construction and management seemed to be an insuperable bar to their rapid introduction. Upon the smallest provocation the use of a steam pump would be abandoned and the old well-tried arrangements resumed; for no work was fitted up with reference to the exclusive use of a steam pump—it was always secondary. Even so good an authority as the late Mr. James P. Allaire nearly reduced me to hopeless inaction, by saying he considered it his duty to tell me that I was trying to invent a machine that was not wanted; that no part of the machinery, either for steamboats or factory purposes, was more satisfactory and complete than that for pumping. And this appeared to be the opinion of almost every engineer. Another opinion expressed by a prominent engineer of the day, Mr. Alfred Stillman, of the Novelty Works, was sufficiently discouraging at the time, yet of great value, as compelling me to look still further. He came to my works one day to inspect the last and best arrangement of piston valve throw. After a careful and quiet consideration of the case for a few minutes, instead of the approval which I not only expected but needed, he said: 'This is all very well and very ingenious, but if you expect to bring these things into general use you must contrive to have a man see something he has seen before in his life, when he takes the cover off from a steam chest.' There was no appeal in those days from the decision of the Novelty Works, and this one might well be called conclusive.

"The desideratum of a direct-acting steam pump with a simple ordinary slide valve was at last accomplished, and from its discovery may date the real introduction and popularity of a class of machines which now covers the length and breadth of the land.

"I would call attention to a principle of construction first adopted in a pump used on board the steamer Washington in 1850. Up to that time my practice, and I believe the concurrent practice of the day, was to make a large water valve with considerable lift. A moment's reflection will show that when the motion of a pump changes, the valves are in a wrong relation thereto, and must be immediately changed. For an instant of time, therefore, the resistance is suspended much as in the case of a gear suddenly reversed and producing back lash. My idea was, by the employment of a large number of diminutive valves, each one insignificant, and with but a small fraction of an inch of lift, but aggregating in an ample water way, to reduce this lost interval and keep the valves nearer to their seats, thus enabling them to get home in less time. The valve adopted was a plain India-rubber disk half an inch thick, and working upon a central stem over a series of half inch holes, with a lift of not over a quarter of an inch. There were nine of these in each chamber of the Washington pump, making thirty-six in all. I offer a drawing of this pump with its valve arrangement, not only as marking the time of its introduction, but because it represents my present views in the construction of all pumps designed for important purposes.

"I come next to a point in my experience of great importance, involving new considerations and justifying much greater cost and complication of engineering than any hitherto called for in my business. I refer to the department of water works for cities and towns. My first connection with any important enterprise of this kind was at the city of Savannah in the year 1854.

"A duplicate of the Savannah engine was erected at Cambridge, Mass., in the year 1856. This engine was first tested by Messrs. W. E. Morris and Samuel McElroy, with the result of 70,463,750 pounds duty.

"From the time of its first introduction the progress of this engine toward its present popularity has been steady and rapid. They are now found in more than 200 water work stations in this country and Canada, numbering 230 engines, and aggregating, in a delivering capacity, 430,000,000 gallons per day. It may be said, without fear of contradiction, that they have been successful and well approved. Nothing approaching even an inconvenient stoppage of a water supply has yet been traced to their failure. While trivial breakages or the necessity for larger or more permanent repairs has occurred, no breakdown or disaster has ever taken place.

"The remarkable exemption of these engines from the numerous accidents to which ordinary pumping engines are liable, leads to a consideration of the philosophy of their action and cause of this immunity.

"How should a pumping engine be made to reciprocate quietly? A careful consideration of the causes at work suggests the answer. To think of the difficulty is almost to find the remedy.

"I claim that it should be accepted as proved that the cessation of motion at the end of the stroke, for a length of time sufficient to allow the seating of the valves by gravity, instead of by the action of the return currents, will completely obviate noisy, imperfect, and injurious action."

Mr. Worthington concludes this communication as follows:

"I have endeavored to touch upon every point upon which I depend to prove that I have made an important, radical, and permanent improvement in the hydraulic machinery upon which towns and cities depend for their water supply. If the question were only to decide between a durable and reliable engine, or one of opposite characteristics possessing great refinements of construction, it would be without doubt speedily answered in favor of the first-named engine, regardless of relative cost. On these points I trust I have shown that the engine which bears my name has taken and maintained the highest ground, and unless the calculations which I have offered as to the cost of investment be impeached and finally rejected, I may claim to have further shown that the engine is also superior in point of economy, commercially and practically considered. In addition, the size and cost of the requisite buildings are reduced at least twenty-five per cent, and the cost of foundations in much larger proportion. The necessity for stand-pipes or similar provision for softening the shock is obviated. In a word, I am able to point to a record of almost unqualified success in the performance of more than 200 large and important water work stations, unbroken by disaster or change. No water work engine of mine has yet been superseded by one of another form of construction, either for fault or by the demand for increased supply. I therefore respectfully ask that my case may be considered with care and candor, hoping that you will substantiate my claim to the high honor of having originated a pumping engine which is worthy to be mentioned as constituting a part of American progress in this most useful and arduous department of mechanical engineering."

Our first page represents various departments of these immense works, and the works themselves are shown in one of the upper views in the engraving. The central view represents the fine compound pumping engine of the Newark, N. J., water works, having a capacity of 8,000,000 gallons daily. On the right is shown one of the smaller pumping engines, and on the left a water meter. The lower view shows the department in which the heavy work is erected. The work in progress at the time of the sketch and shown in the engraving is one of the heavy engines for pumping oil under great pressure.

Grimmer's Prophecy.

An anxious reader submits a reprint of an extended and direful prophecy made about a year ago by C. A. Grimmer, of Kingston, Jamaica, and asks our opinion of it.

Mr. Grimmer professes to be an astrologist, and to base his predictions upon the position of the four great planets, whose conjunction in 1880 will produce "one universal carnival of death" from 1880 to 1887. During this period the elements are to play high jinks; things will be turned upside down generally by earthquakes and frightful storms, which will convert the whole world into a universal Sodom and Gomorrah. Famines, plagues, inundations, wars of mutual extermination, and other unpleasantnesses will conspire to exterminate pretty much all the animal and human life that escapes the elemental cahobbery, until August, 1887, when the Star of Bethlehem will arise, and things be worse than ever. "After that," the precise time being unhappily not stated, good times will come again, and whoever is lucky enough to remain alive, will live twice as long as he ever did, "owing to the healthy electricity or magnetism that will surround the globe."

This general outline is filled in by Mr. Grimmer with a parade of learning and a wealth of horrible detail well calculated to deceive and alarm the timid and superstitious. The circumstance that his astronomy is as wild as his insane imagination takes somewhat from the edge of his prophecy in the minds of the cooler and more intelligent. Comfort may also be drawn from the fact that the larger part of 1880 has already passed away, and yet the malefic influence of Saturn, Uranus, and the rest of the planetary malefactors, has not been able to inaugurate any of the pestilential storms, famines, civil wars, and other horrors predicted. If the rest of the seven years are off the same pattern, as they promise to be, a fair proportion of those now living will be able to look back upon them, by and by, with reasonable satisfaction. Anyhow, it is too early and too late to be badly scared.

An Exhibition of Gas and Electrical Appliances.

The Philosophical Society of Glasgow, Scotland, propose to have an exhibition of apparatus for the utilization of gas, electricity, etc., during the month ending October 25, next. The exhibits will include apparatus, models, and drawings relating to or illustrating:

1. *Coal Gas.*—Its manufacture, purification, storage, distribution, regulation of pressure and measurement. Its utilization in lighting, heating, cooking, ventilating, and as a motive power. Photometric testing of gas or other sources of light. Residual products of gas manufacture, coke, tar, benzole, aniline dyes, ammonia salts, etc.

2. *Oils, Oil Gases, Candles.*—Their manufacture and use for lighting, heating, cooking, and motive power.

3. *Electricity.*—Its generation and application for lighting, telegraphy, motive power, etc.

4. *Hydraulic Appliances.*—Motors suitable for comparison with gas motors, and apparatus for the measurement and regulation of the flow and pressure of water.

5. *Architectural Appliances.*—More especially those which relate to lighting, ventilation, heating, and lightning conduction, and architectural ironwork and sanitary appliances, such as can be exhibited in the open grounds.

6. *Miscellaneous Apparatus.*—Gas lighted buoys, fog horns, miners' safety lamps, fire damp indicators, and apparatus for lighthouse illumination, ventilation of mines, etc.

Hop Growing in the United States.

At a recent annual meeting of the Hop Growers' Association of Central New York, one of the speakers called attention to the remarkable growth of the hop industry of this country, as shown in the following statistics:

Total hops grown in the United States in 1839, 6,193 bales; in 1859, 55,055 bales; in 1879 (estimated), 110,000 bales.

The estimate for the current year runs between 120,000 and 125,000 bales. With the increase in quantity grown there has been a considerable increase in price, the average for the decade just ended being 8½ cents a pound more than the average of the decade just preceding the war.

The English Patent Laws.

The engineering journals and nearly all classes of industrial newspapers of London are seriously advocating a change in the English patent laws whereby the cost of patents shall be so reduced as to enable British workmen to secure to themselves their inventions. Under the present law, which seems to have been enacted for the sole benefit of the capitalist and manufacturer, the rights of the inventor are disregarded. The employer patents for his own benefit his workman's invention, and some of the newspapers find fault with Her Majesty's Parliament for the lack of interest which the members manifest on the subject in not bringing up the new patent bill for discussion.

The *Chemical Review*, lamenting over the inertness of Parliament on the proposed amendment bill, says the subject is attracting no attention within that body, and adds:

"As a nation we forget the old proverb: 'For want of a nail the shoe was lost, for want of a shoe the horse was lost, for want of a horse the rider was lost, and overtaken by the enemy.' A good patent law, which shall enable even the poor man to protect his right to his own ideas, is the nail. May we not then say, 'For want of a good patent law invention was lost, for want of invention our industrial pre-eminence was lost, and for want of industrial pre-eminence the nation was lost, being overtaken by its enemies, or, as they are called in the dialect of the day, its competitors'?

"It is sad, and at the same time almost farcical, to see what 'trifles light as air' engross public attention in preference to what is, in fact, the very key not merely to our prosperity, but to our very existence. The interests of invention ignored, and crowded meetings assembled to protest against the monument to the late so-called Prince Imperial! Surely John Bull must for ever abandon his old claim to practical common sense, and be content to rank for the rest of his days as a maudlin, moon-struck, hysterical sentimentalist!"

ENGINEERING INVENTIONS.

Mr. Marshall Wood, of Alderson, W. Va., has patented an improved railway switch which is adapted to be opened and closed by the passing engine, and it dispenses with the frog usually placed at the crossing of the rails of the switch and main track.

Mr. Eugene H. Angamar, of New Orleans, La., has patented improved apparatus for removing snow and ice from railroads and streets by heat; and the invention consists in a double furnace mounted on wheels, the wheels being incased within the fire boxes of the furnace, so that when used the whole apparatus will become highly heated, and the snow and ice melted by radiation of heat and contact with the heated surfaces.

Mr. John G. Curtis, of Ludlow, Pa., has patented a sectional boiler. The object of this invention is to provide a simple and inexpensive boiler, designed especially for burning wet tan, sawdust, etc. It is so constructed that the tubes may contract and expand without straining the joints, and so that any of the tubes may be removed for repairs and replaced without disturbing the others.

Mr. Junius Poitevent, of Ocean Springs, Miss., has patented an improved traction engine, so constructed that it may be used at will with full power for traction purposes, or as a stationary engine. The engine is especially adapted for plowing.

The Mexican Calendar Stone.

A Mexican archæologist, Señor Alfredo Chavero, has written a book to prove that the famous Aztec "calendar stone" was never intended or used as a calendar. His study of Aztec hieroglyphs leads him to the conclusion that the stone was an altar of the Mexican sun god, and the characters, hitherto supposed to be signs of the zodiac, are records of Aztec cosmogony and theogony. When they are fully interpreted, he says, we shall know positively what progress the Aztecs had made in science and religion.

Platinum and Iridium in Maine.

The list of metals now found in native condition in Maine comprises copper, silver, gold, antimony, bismuth, platinum, and iridium. The last two have recently been found in the Rangeley Lake region, associated with gold, by Mr. R. B. King, of Portland. In reporting upon some of the specimens furnished by Mr. King, the State Chemist, Mr. F. L. Bartlett, says:

"My analysis proved the compound to be gold, platinum, and iridium, and possibly osmium and some others of the rarer metals, although no tests were made for anything but gold, platinum, and iridium, the quantity not being large enough to operate on in testing for other metals, which at best occur only in minute quantities, yet usually associated with the platinum ores."

Mr. King also submitted for analysis some peculiar black sand, suspected to contain tin. It proved to be menaccanite or titaniferous iron, containing over twenty-five per cent of titanium. The finding of so many rare elements together, adds Mr. Bartlett, is interesting, and calls for further exploration. Platinum is a rare and valuable metal, and it appears to be quite abundant in the sands from Rangeley; it is not at all improbable that it may yet be worked to advantage in this region.

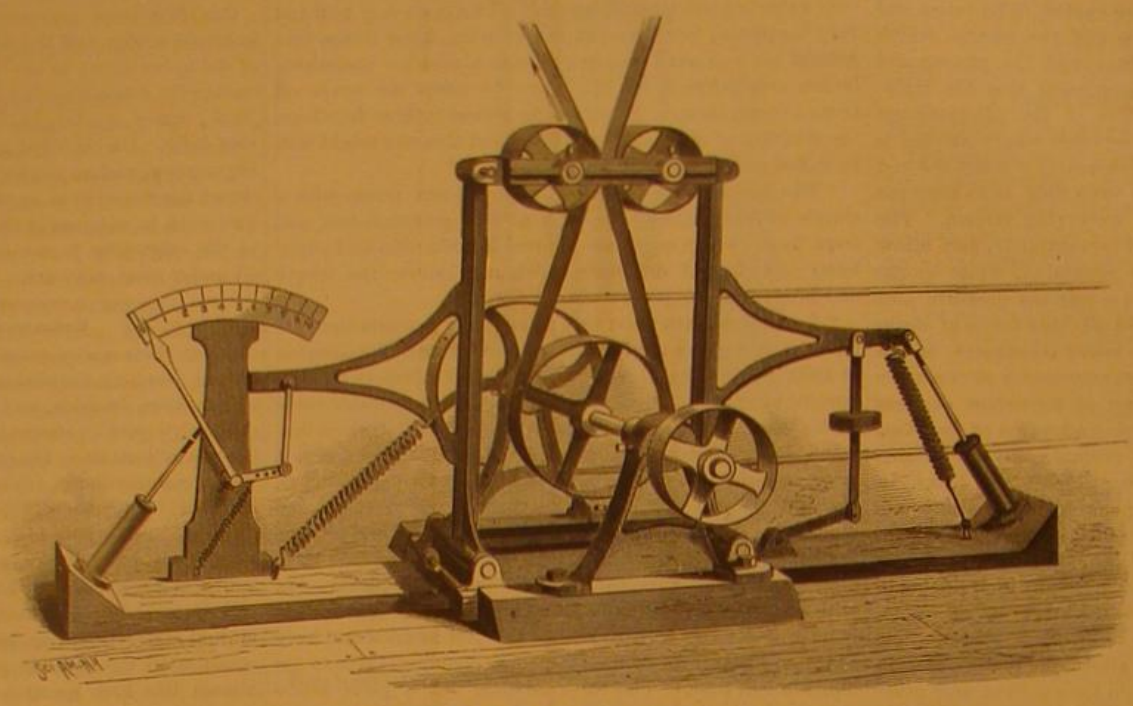


Fig. 1.—MAXIM'S DYNAMOMETER.

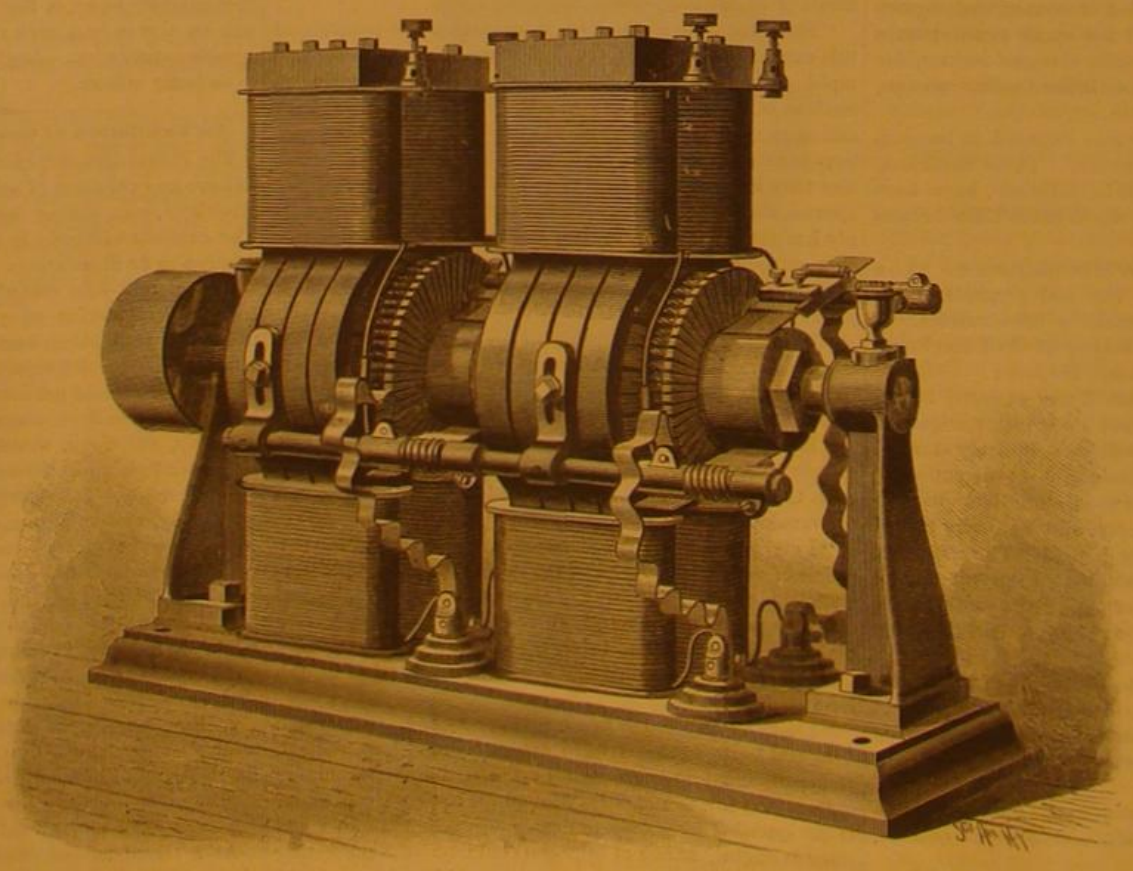


Fig. 2.—MAXIM'S DYNAMO-ELECTRIC MACHINE.

SOME NEW ELECTRICAL MACHINERY.

We give engravings of electric light machinery lately perfected by H. S. Maxim, M.E., of this city.

Fig. 1 represents a double current machine, so constructed that it furnishes two separate currents entirely independent of each other, that may be used to produce two large electric lights, or may be coupled for quantity in one very large light, or may be coupled for tension in one strong current of great electromotive force. It is, therefore, not only well calculated for the electric light, but makes an admirable machine for scientific and experimental purposes. Mr. Maxim calls machines of this kind dynamo-magneto-electrical, as they convert dynamic energy through the agency of magnets into electrical energy. In the construction of these machines great care is required to so arrange and proportion the parts that the greatest possible amount of the energy consumed appears in the electrical current. Not only must the current be accurately measured, but the power employed to produce it must also be measured.

Mr. Maxim has constructed a peculiar dynamometer, shown in Fig. 2, to measure the power consumed in these machines. It is driven from above by a large pulley, not shown. The two small pulleys that hold the belt together are mounted on a vibrating frame, pivoted at the bottom and operating freely. The belt for driving the machine is run from either pulley of the countershaft. When no load is on, the pull on both sides of the belt is the same, and there is no tendency to move the framework in either direction; but whenever anything offers resistance to the rotation of the countershaft, one side of the belt is pulled, while the other is correspondingly slackened. This, of course, draws the pulleys in the direction of the taut side, and just in proportion to the difference in the stress between the taut and slack sides of the belt. The greater the resistance to the rotation of the countershaft, the greater will be the deflection of the framework carrying the small pulleys. A weight and spring are provided for pulling against the belt. Dash pots at each end prevent a too rapid motion of the parts. The pointer is so connected with the frame that it moves through a considerable distance, so that a small fraction of a horse power may be noted.

In experimenting with the electric light in connection with this delicate dynamometer the following phenomena have been noticed: When two carbons, carefully filed to the shape ordinarily assumed in the process of consumption, were placed in a lamp and the machine started, the recorded power would go up to four (horse power). If they were drawn apart in the attempt to diminish this power, the light would go out; but when they became considerably heated, the power required would drop down in some cases to 1·75, only to remain for a few moments, when a slight evolution of gases would diminish the resistance in the voltaic arc, and the pointer would go up to 2·50, while a hissing sound would be produced and a considerable augmentation of the flame of the arc.

At times, when the light was perfectly steady and the play of the voltaic arc was confined to the points of the carbons, with no hissing and very little flame, the power required was the lowest. An iron wire touched to the positive carbon for only a moment would keep the pointer up to 4 for fully half a minute. It was found that pure carbons caused but little variation, while metallic vapors in the flame required the most power. Every fluctuation of the flame or change in the pitch of the note emitted was accompanied by a corresponding fluctuation in the power required to operate the

machine. When one machine, weighing 450 lb., driven from the dynamometer, was connected with another exactly like it, the current of electricity from the first machine would drive the second backwards, and the power recorded was 0·25 of a horse power. Any friction on the second machine showed instantly on the dynamometer, while to stop it completely sent the needle up to 7·50. Some points in this dynamometer resemble Edison's; but, we are informed, Mr. Maxim had his in operation some months before Mr. Edison made his.

Fig. 3 shows a new electrical lamp designed for use in stores, factories, etc. It is nicely incased in ornamental bronze work. One novel feature of this lamp consists of telescopic side rods, which facilitate the dropping of the bottom to remove or replace the glass globe.

The United States Lighting Company, 120 Broadway, New York, are the owners and manufacturers of Mr. Maxim's inventions.

THE SPOTTED TRITON.

BY C. FEW SEISS.

The spotted triton (*Diemyctylus viridescens*, Rafinesque) is of an olive green or brown color above and yellow beneath. On each side of the body is a row of three or more vermilion spots, each encircled by a black ring. These spots vary greatly in number and distribution. Thus, in specimen No. 1, there are two spots on the head, two on one side of the body, and five on the other; in No. 2, there are four on the head, and three on one, and four on the other side of the body; in No. 3, two on the head, and four on the right side and two on the left; No. 4, which is much darker in color, has seven spots on each side, three of the spots being double on one side, and one spot on the occiput; No. 5 has two small spots on the occiput and three on each side of the body. The throat, abdomen, legs, and tail are generally studded with black dots. The hind legs are twice the size in bulk of the front. The latter has four digits and the former five, the first and fifth being rudimentary. The tail is compressed laterally, of natatory form. The length of our largest specimen is $3\frac{3}{4}$ inches; of the medium, $3\frac{5}{16}$ to $3\frac{1}{8}$ inches.

The spotted triton is an aquatic species, but it must be remembered that it has lungs and is an air-breathing animal, and consequently is obliged to come frequently to the surface of the water for fresh air. The immature tritons or larvæ are gill bearers like other urodelans; they are of a dirty brown color, and the vermilion spots are wanting.

The food of this triton consists of insects and worms. The stomach of one which I lately dissected contained two mosquito larvæ. Our aquarium specimens have seemed to thrive on small bits of raw meat. In the aquarium they are sometimes attacked with a fungoid disease, which is common to many water animals in captivity. They become greatly emaciated, and at length are unable to eat, and subsequently perish.

At the pairing season the male embraces the female in a peculiar manner; not with his arms or forelegs, as might be supposed, but with his stronger posterior extremities he clasps her firmly immediately back of her forelegs. The female fastens her roundish jelly-like masses of eggs, which somewhat resemble frog spawn, to water plants, where they remain until hatched.

I agree with Dr. Hallowell and others in considering the yellow-bellied salamander, *D. miniatus*, Rafinesque (*Salamandra symmetrica* of Harlan), as merely a terrestrial variety of the present species.

The insect above the triton in my drawing is the *Prionotus novenarius*. I can find no English name for it, but as I have from childhood called it the *Devil's camel*, it may be well, even if it is not a pleasing name, to retain it. It is of a dark ash color and pubescent; its long cylindrical head is armed with a strong curved beak or rostrum; its thorax is arched, compressed laterally, and deeply serrated, and its abdomen is flattened above and turned up at the sides. With its forelegs, which are raptorial, it catches caterpillars and other insects, and inserting its beak sucks all the juices from the caterpillar's body before it will drop it. It inserts its beak into the different segments of its prey to make sure no good is lost. Three or four different kinds of caterpillars I have seen it devour; it is, therefore, beneficial, and should be protected.

The devil's camel is most numerous about Philadelphia during the month of September. I have a note of one that was captured as late as the 5th of November, 1879. The young are wingless, and have the abdomen turned upward and forward. I have never felt the evil effects of his rostrum, but Dr. Horn says, when it is caught by one not expert, it inserts its rostrum into the hand, causing a feeling of acute pain which may last for some hours, but gradually passes away, leaving a feeling of numbness in the part bitten.

THE SPOTTED TRITON.

A Large Importation of Percheron Horses.

Ninety-seven horses of the Percheron breed, the largest lot ever brought to this country, recently passed through New York on their way to Wayne, Du Page County, Illinois, where their owner, Mr. M. W. Dunham, has a large stock farm. About one-fourth of them were colts, the rest were full-grown stallions, ranging in weight from 1,400 to 2,000

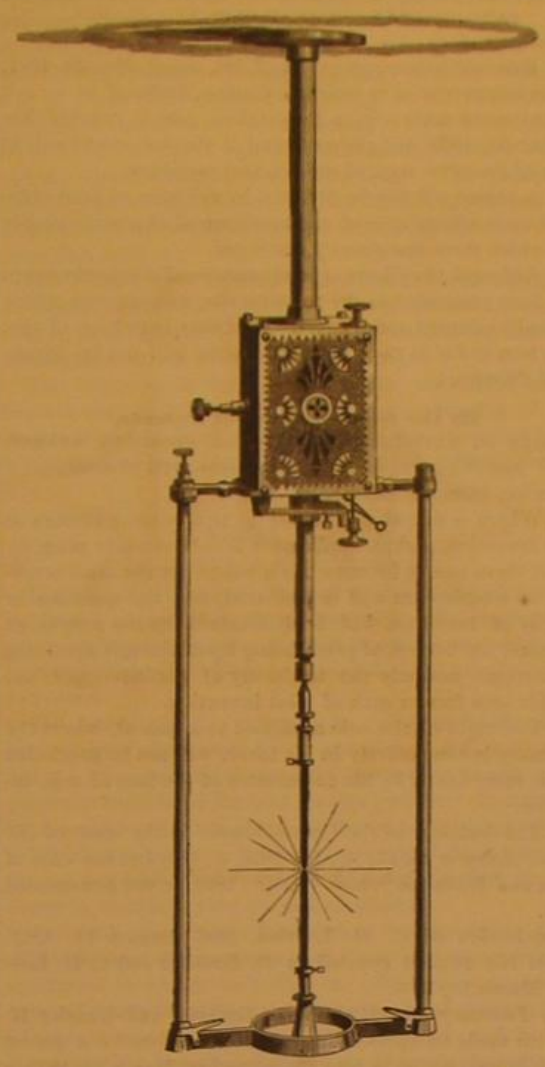


Fig. 3.—MAXIM'S ELECTRIC LAMP.

pounds. They cost in Perche, France, from $800 to $2,000 each, and were conveyed to the sea coast in a special train, the first ever run on a French railroad. To a reporter of the *Tribune* Mr. Dunham said:

"In 1873 it cost me $500 for every horse I brought across the ocean. Now, however, when I bring them in large numbers it costs only a little more than half as much for each. It will cost me $100 a car for my special train to Wayne. I put six of the horses in a car. I insure them when I start, and I have to pay four or five per cent on the insurance. You see there are large risks in this business. When I sell these stallions, however, I will get from $1,500 to $3,000 each for them."

The first Percheron stallions ever brought to this country were imported by Mr. William Harris, of Moorestown, N. J., in 1839. Mr. Charles Fullington, of Ohio, imported the next lot in 1851. In 1856 one of the stallions imported by Mr. Fullington was sent to Illinois, where for twelve years he was the only one of the kind in that State. In 1868 Mr. Dunham imported two Percheron stallions, and in 1872 went regularly into the business. Since then he has brought over between three and four hundred of them.

Drying a Specific Gravity Bottle or Flask.

It not unfrequently occurs that a clean, *dry* sp. gr. bottle or flask is wanted for use, and in hurried drying sometimes gets cracked. The following little device has been found useful: Wash the bottle or flask with distilled water and drain it for a moment or two. Then wash with a little strong alcohol and drain the bottle a second time. The alcohol need not be wasted, as it is but slightly diluted with the residual water from the first washing. When the bottle is again drained it remains wet with the diluted alcohol. Pour in a little dry ether and wash the bottle out with this. Again drain, and the warmth of the hand or very little extra heat will then completely dry the bottle or flask. The alcohol must of course be *strong*, and the ether *dry*, or the device fails.—*J. Shea, M.D.*

Evolution of Species in Butterflies.

As well known, many butterflies have two or even three broods in a year; one brood appears in spring, their larvæ having fed during the preceding autumn and passed the winter in the pupa state, while the others appear later in the year, having passed rapidly through all their transformations and thus never having been exposed to the cold of winter. In most cases the insects produced under these opposite conditions present little or no perceptible difference; but in others there is a constant variation, and sometimes this is so great that the two forms have been described as distinct species. In order to learn something of the origin and nature of the latter curious phenomenon, Dr. Weismann, of Freiburg, has, for many years, carried on a variety of experiments, breeding the species in large numbers, and subjecting the pupæ to artificial heat or cold for the purpose of hastening or retarding the transformation. The result of these experiments is, that by subjecting the summer brood to severe artificial cold in the pupa state, it may be made to produce insects, the great majority of which are of the winter form; but, on the other hand, no change of conditions that have yet been tried have any effect in changing the winter to the summer form. Taking this result in connection with the fact that in high latitudes, where there is but one brood a year, it is always the winter form, Dr. Weismann was led to the hypothesis that this winter form was the original type of the species, and that the summer form has been produced gradually, since the glacial epoch, by the summer becoming longer, and thus admitting of the production of the second or summer brood. This explains why the production of the winter form from summer larvæ is easy, it being a reversion to the ancestral type; while the production of the summer form from autumnal larvæ is impossible, because that form is the result of gradual development, and processes of development which have taken thousands of years to bring about cannot be artificially reproduced in a single season. Dr. Weismann lays great stress on the varied effects of temperature in modifying allied species or the two sexes of the same species, from which he argues that the essential cause of all these changes is to be found in the peculiarities of physical constitution, which causes different species, varieties, or sexes to respond differently to the same change of temperature; and he thinks that many sexual differences can be traced to this cause alone, without calling in the aid of sexual selection. The general result arrived at by the laborious investigation of these phenomena is that "a species is only caused to change through the influence of changing external conditions of life, this change being in a fixed direction which entirely depends on the physical nature of the varying organism, and is different in different species, or even in the two sexes of the same species; and, he adds: "According to my view, transmutation by purely internal causes is not to be entertained. If we could absolutely suspend the changes of the external conditions of life, existing species would remain stationary. The action of external exciting causes, in the widest sense of the word, is alone able to produce modifications; and even the never-failing individual variations, together with the inherited dissimilarity of constitution, appear to me to depend upon unlike external influences, the inherited constitution itself being dissimilar because the individuals have been at all times exposed to somewhat varying external influences." Almost exactly similar conclusions to these have been arrived at by Mr. Alfred R. Wallace, from a study of the geographical distribution and specific variation of animal forms.

To RELIEVE CASKS FROM MUSTINESS.—Burn a little sulphur in the empty casks, bung, and let them stand for a day.

FURTHER NOTES ON THE NORTHERN ARMY WORM.

BY PROF. C. V. RILEY.

HOW FAR IS BURNING OVER A PREVENTIVE?

That fields which have been burned over in the winter are free from the destructive presence of the worm is a fact in the history of its visitations. But opinion has varied as to the precise effect produced by the burning over. I have shown that it destroys the appropriate nidus for the laying of the eggs by the moth in the spring. Now that larval hibernation is established, we can readily see that the fires would destroy these hibernating larvæ and prevent the appearance of the moths and of a second destructive brood from them. But we must not suppose that the burning over would prevent *all* appearance of the worm; it merely prevents its appearance in destructive numbers. The moth will, when exceptionally numerous, lay her eggs without concealment and upon plants, such as clover, which the larva does not relish.* In such cases of exceptional abundance we may well suppose that the moth will fly into fields which had been burned over and supply them with eggs, but the instances in which this would result in material damage to the crop would be very rare.

CONNECTION OF WET AND DRY SEASONS WITH ARMY WORM INCREASE.

That the army worm appears in destructive numbers after a period of dry seasons is a fact already recognized, and is in accordance with the experience of the present year. The portions of our country visited by the worm this year were afflicted with drought last summer, and the winter was remarkable for its mildness and the slight fall of snow. Fitch's theory of the appearance of the worm required that this spring should be a wet one in order to drive the moths from the swamps and cause them to lay their eggs on the upland. But the facts are just the reverse. Farmers from Virginia to Vermont have complained loudly of the excessive drought. Rivers in some of the Atlantic States have not been so low for a generation, and alluvial meadows which have been subject to a spring flooding have this year remained dry. These facts clearly disprove Fitch's theory, and we must believe that the army worm is most likely to appear after dry seasons, *regardless* of the wetness or dryness of the season in which it occurs. A critical examination of Fitch's arguments in support of his theory shows that he not only had no personal acquaintance with the worm, but also made some astonishing errors in meteorology, such as comparing the rainfall of India (?) with the appearance of the worm here. With equal reason might we argue that 1879 was wet in our Atlantic States because of the excessive precipitation in the British Islands during that year. It is evident that Fitch was hard pressed for arguments to support the theory. That the season of 1861 was remarkably wet in the Eastern States Fitch gives no evidence. From the well known connection of the presence of plant lice with dry seasons, and from the memorable depredations of the grain aphis in that year throughout the Middle and New England States, it is very questionable whether 1861 was wet. It is far more probable that the season was a dry one like the present, in which also various plant lice have done great damage.

The view that the army worm has its proper home in the wild grasses in the swamps, as Fitch has assumed, must also be considered erroneous. The moth prefers matted grass amid which to lay its eggs, and the more tender grasses are those first selected by the worms. Old neglected fields, whether their location be low or high, are the most natural breeding places for the insects. That the worms most often appear in low lands, or in the neighborhood of such, doubtless finds more correct explanation, first, in the highly probable fact that the parent moth gets more appropriate food at such places, either in saccharine exudations, the natural "sweat" of the plants, or moisture from the ground; secondly, in the well observed fact that such lands afford the greatest extent of neglected meadows where the insect has opportunity to multiply unnoticed and undisturbed.

Dangerous Freight.

A case marked "benzine" or "benzoline" exploded with terrific force on the Pacific Steam Navigation Company's steamer Coquimbo, at Valparaiso, recently. A breach nearly twenty feet in length was made in the side of the vessel, fortunately above the water line. One man was killed. The immediate cause of the explosion is not given. The carrying of such dangerous freight may have something to do with the too frequent disappearance of ships at sea.

American Ironware in New Zealand.

A former resident in Birmingham, England, writes from New Zealand: "I was much interested in noticing how your staple trades were represented here. One article your town stands unrivaled in—lamps; but in every other branch of the hardware trade the vigorous Yankees beat you. In agricultural and gardening implements, stoves, domestic notions, and the thousand and one articles of hardware, English makers are nowhere here. For quality, adaptability, and price, the American articles bear the palm. I was one day in the store of one of our leading hardware merchants, when a miner came in for a pick and shovel. He was asked which he would look at, English or American. 'Oh, Yankee tools for me,' said the man; 'English are too clumsy.' My friend explained that the English will persist in making the tools their grandfathers used."—*N. Y. Sun.*

* I have recently received from Professor Lintner, State Entomologist for New York, what are apparently the pressed eggs and egg shells of this moth, thickly covering clover leaves, and mixed with an abundance of white gummy matter with which the moth usually secretes them, all indicating that in this instance the moths (doubtless from excessive numbers) had "slopped over." Professor Comstock likewise informs me that he has found the eggs laid between the folded lobe of a clover leaf.

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court—Northern District of Illinois.

WHITTLESEY *et al. vs.* AMES *et al.* SAME *vs.* ZIMMERMAN. SAME *vs.* DEAN.—PATENT BEDSTEAD FRAMES.

Blodgett, J.:

1. Reissued letters patent No. 7,704, dated May 29, 1877, for an improvement in bedstead frames, declared to be for the invention embraced in the original patent, granted November 30, 1869, and claims 1 and 2 thereof construed, in view of the prior state of the art, and sustained.

2. A patent will not be defeated by evidence of prior similar devices which were of an experimental character simply and which were susequently destroyed.

3. Although the efforts of prior unsuccessful experimenters may have suggested to the patentee the construction which he finally adopted and perfected, and may have been of profit to him as far as they went, his patent will not be invalidated thereby.

By the Commissioner of Patents.

LOVRIEN *vs.* BANISTER *et al.*—APPEAL FROM THE EXAMINERS-IN-CHIEF.—INTERFERENCE.—PIPE TONGS.

Marble, Commissioner:

1. Where a patent has issued to two or more persons as joint inventors, and an application is subsequently made by one of them as sole inventor for a patent for the same invention, an interference will be declared, and the question of priority of invention will be determined by the weight of evidence, the burden of proof being upon the sole applicant to overcome not only the testimony of his adversary, but also his own former oath of joint invention.

2. The right of the sole applicant to a patent, where the testimony is conclusively in his favor, will not be precluded by the mere denial by his co-patentee of the fact of sole invention.

3. The decisions of the Commissioner in the case of *De Lill vs. Avery & De Lill* (C. D., 1870, p. 128) and the case of *Chase and White vs. Chase* (C. D., 1873, p. 99) commented upon.

Application of C. H. Lovrien, filed August 14, 1879. Patent No. 213,376 granted to H. Banister and C. H. Lovrien, March 18, 1879.

On February 10, 1879, Henry Banister and Charles H. Lovrien made an application as joint inventors for a patent for an improvement in pipe tongs, and on March 18, 1879, a patent was granted to them.

Charles H. Lovrien, one of the joint applicants and patentees, on August 14, 1879, filed an application as sole inventor for a patent for the invention already patented to himself and Banister jointly, and on September 16, 1879, an interference was declared between Lovrien, sole, upon the one part and Banister and Lovrien upon the other.

It is contended on behalf of Lovrien that the entire invention embraced in the patent and in this application was made by him alone; that he desired, however, that Banister, for a consideration, should have a half interest therein, and that by reason of his own ignorance of patent matters he allowed Banister to attend to the procuring of the patent, and supposed that the joint application, which he claims not to have carefully considered, simply secured to Banister his interest. Banister, on the other hand, claims that the invention was a joint one, and that it was so regarded by Lovrien at the time the joint application was made. The Examiner of Interferences decided priority of invention in favor of Lovrien, while the Board of Examiners-in-Chief held Banister and Lovrien to be joint inventors of the matter at issue, and decided in their favor.

The question to be determined in the case is clearly one of originality rather than of priority of invention. It is urged by counsel for patentees, and such appears to have been the ground taken by the Examiners-in-Chief, that where a patent has issued to joint applicants, and a sole application for the same invention is subsequently made by one of them, a patent cannot issue upon such application if the fact of sole invention is denied by the other party. Two decisions are cited in support of this position. In the first of these (the case of *De Lill vs. Avery & De Lill*, C. D., 1870, p. 128) the following language occurs:

"It is a matter of grave doubt whether one who joins another in an application for a patent, which he declares under his signature, verified by his oath, to be the joint production of himself and his co-applicant, ought ever be permitted to deny that oath and seek a sole patent. It would appear that a sound public policy would require that he should suffer the consequences of his mistake, even if it be innocent. But however this may be, it may be stated as a rule that wherever the facts are disputed the joint patent will not be disturbed. In the present case the burden of proof is of course upon De Lill to show that he was the sole inventor of the improvement covered by the joint patent. He must overcome his own oath, which cannot be treated as a nullity, and he must overcome the oath of Avery."

In the subsequent case of *Chase and White vs. Chase* (C. D., 1873, p. 99), Mr. Commissioner Leggett, in commenting upon the above decision, said:

"It was held by Commissioner Fisher in a similar case (*De Lill vs. Avery & De Lill*, decisions, 1870, p. 128), in substance, that a party to a joint patent was estopped from asserting his sole proprietorship where it was denied by the other party. I have no doubt of the soundness of this opinion. But certainly if this were not the case it ought to be clearly proved on the part of such an applicant that he was in fact a sole inventor. I concur with the board that 'Chase is very far from proving himself to have been the sole inventor.' The weight of evidence is decidedly the other way."

While from these cases it would appear that the ruling urged by counsel for the patentees was there made, yet in these very cases it is also seen that it was not followed, for in each a decision was rendered against the sole applicant, not upon the mere denial of the fact of sole invention by his co-patentee, but because the weight of evidence was found to be against him. Were I to give to these decisions the construction asked for by counsel for Banister and Lovrien, I should feel but little hesitancy in departing therefrom, as I fail to find, either in law or reason, any warrant for so arbitrary a rule. The Supreme Court of this district, in the case of *Ex parte L. O. Crocker* (MS. Appeal Cases, vol. 4, p. 269), held that where a patent had issued to two persons as joint inventors, and an application was subsequently made by one of them as the sole inventor of the same subject matter, the doctrine of estoppel did not apply, but the proper course for the Office was to declare an interference between the parties to determine the question of priority of invention, as in other cases.

In the late case of *Barsaloux, James & Lyon* (16 O. G., 233) the Attorney General used the following language:

"After a joint patent has once been issued upon an application of two or more persons as joint inventors, if the application erroneously described the invention as joint instead of sole, it is not, as I have just intimated, within the power of the Department to remedy the matter by changing the term of the patent already issued. The parties interested may file a new application, which, if seasonably done, can be made the basis for the issue of a new patent; but such new patent will not retroact by way of confirmation of the original."

If, then, a sole inventor is not estopped from making an application by reason of the fact that through mistake he has already applied for and obtained a patent for the same invention jointly with another, and if, as held by the court in the above cited case, an interference proceeding is the proper one in which the fact of such mistake can be determined, there can be, in my judgment, no sufficient reason for allowing the issue in such interference to depend upon the mere denial of one party, no matter how conclusive may be the proofs introduced by the other to rebut the same. The mistake of supposing that joint interest in an invention is the same as joint invention is a common one, to guard against which the Office has found it necessary to give notice in the rules that "the fact that one furnishes the capital and another makes the invention will not entitle them to make application as joint inventors; but in such case they may become joint patentees." Should a meritorious inventor, having made this common mistake, seek to have the same rectified by means of a sole application, the Office would readily declare an interference, which, under the ruling asked, would prove a mere nullity, if his co-patentee should prove dishonest enough to deny his rights. If the decisions cited are precedents for such a ruling, I must decline to be governed thereby. Undoubtedly, under familiar rules of evidence, the burden of proof is upon the sole applicant to show conclusively his right to a patent, and he is to overcome not only his adversary's testimony, but his own former oath of joint invention.

It appears from the evidence in the case that on the 23d or 24th of January, 1879, Banister and Lovrien first discussed together the invention in controversy. With regard to what occurred at this meeting the testimony is conflicting. Banister claims that Lovrien at that time suggested the cubical bit or block, while the adjusting screw and holding pin, both essential features of the device at issue, were supplied by himself. Lovrien, on the other hand, swears that he made the entire invention in controversy as early as the summer or fall of 1877, and at that time embodied the same in an operative device; that early in January, 1879, prior to his meeting with Banister, he disclosed such invention to others, and that on January 24, 1879, he fully communicated the same to Banister. This testimony of Lovrien as to the fact of his disclosure of the invention to Banister is contradicted by the latter, but is supported by the testimony of a party who was present at the time and who claims to have heard the conversation and to have seen the drawing made by Lovrien to illustrate his device. Further testimony is introduced by Banister to show that Lovrien regarded him as a joint inventor, and that he carefully considered and fully understood the joint application before the same was filed. This testimony, however, is not of a conclusive character, and is far from sufficient to overcome the direct and otherwise uncontroverted testimony of the several witnesses introduced by Lovrien to show that he had completed and disclosed to others the invention prior to his meeting with Banister, and which is fatal to the latter's claim as joint inventor. The weight of evidence is, in my judgment, clearly and conclusively in favor of Lovrien, and shows, beyond any reasonable doubt, that he had completed the invention long prior to his meeting with Banister, and such work as was done by the latter was but that of a mechanic and not of an inventor.

The decision of the Board of Examiners-in-Chief is accordingly reversed, and judgment is rendered in favor of Charles H. Lovrien.

Aurora Borealis.

BY PROF. E. R. PAIGE.

The cause of this singular phenomenon has been a prolific subject of both scientific and unscientific discussion for many years.

To the mind educated in cause and effect the canopy of night, lighted up by the dancing specter, presents a most alluring sight. While the unenlightened are filled with dark forebodings of a visitation of God's wrath, the scientist sees only the grand workings of the immediate laws of nature. The heavens illuminated with red light is to the superstitious a sure harbinger of impending wars. While the careful observer looks with delight upon the scene, and is impressed only with the sublimity of nature, poor unreasoning man is tortured with fears of coming evil.

In the slow development of scientific knowledge many and varied have been the theories put forth as to the origin of the Northern Lights, as we in this hemisphere call them. It is the reflection of sunlight by the ice at the pole, says one, while another contends that it is produced by great and internal fires whose chimney occupies the space devoted by Dr. Kane to an open polar sea; but the more patient observers have pronounced it electric light. It is my present purpose to look out through the light of a few known facts in search of the origin of this great wonder. Not that any direct good will follow a successful inquiry in the matter of utilizing the light for street purposes or for private illumination, but if we can find the cause to be natural, and not supernatural, then one more old superstition that has haunted the memory and made life unhappy is gone—one more bugbear of tormenting fear is consigned to the shades of past ignorance. Newton discovered the law that controls the universe, and every child should be taught this law, for without it we can comprehend nothing in nature. How life is produced, how worlds, how suns and planets are formed and held in their orbits, is known only through this law.

"Each atom has an attraction for each other atom in the universe, and the attraction is proportionate to their size, and is lessened as the square of the distance which separates them increases." Late developments in scientific research lead to the conclusion that all the varied original elements in nature, so-called, are resolvable back to one, and that one to energy; also, that light, heat, electricity, and sound are only different phases of motion.

Heat is the arrest of motion, and all the warmth we get from the sun is produced by the stoppage of the heat waves sent out by its throbbing power. Chemical heat is created by the clash of little worlds of gas beating together, and no exception is known to the rule that heat is the arrest of motion.

All the heat and all the energy we get on the earth come from the sun. The rain clouds are lifted from the ocean; the winds sweep over the mountains and across the moors; the blood of life, the sap of vegetation, all propelled by the power of the sun. The visible power expended on our little globe passes all efforts of comprehension, but it is naught compared with the latent hidden energy. The decomposition of one drop of water produces a power equal to the most terrific thunderstorm ever witnessed, while the decomposition of one grain of water produces a force equal to the discharge of 800,000 Leyden jars. All this but shadows the vast amount of energy that comes to us from the sun. Our earth is but a speck in space, and not a two-thousand-millionth part of the energy thrown off by the sun strikes us, but is expended out in dark, empty space. This involves a vast waste by the sun, and experiments show that the sun would be exhausted and cooled down in 5,000 years if not replenished from some source. The earth is passing around the sun once a year over a path of 555,000,000 miles long, traveling at the rate of 68,000 miles an hour. The speed of our flight is eighty times more rapid than the swiftest flying cannon ball. If the globe should strike a dead wall passing at this great speed, the concussion, we are told, would burn it instantly, creating a heat of which we have no comprehension; and yet the heat produced by such a catastrophe would not be sufficient to last the sun's waste for a period of thirty days.

We are taught, however, that if the earth should let go its place in space and be attracted into the sun, that body being 325,000 times more than the earth, and, therefore, possessing 325,000 times more power of attraction, its immense pull would draw us in with such a velocity that the kinetic force gathered in the passage would produce an impact in striking that would give off heat sufficient to last the sun's waste for a period of ninety-one years.

In any hour of a clear night that we watch we shall see at least six or eight stars fall. These stars are simply small pieces of iron gathered and formed in space that have fallen into our atmosphere in our flight around the sun; that is, have been attracted into the orbit of the world and picked up. Coming into our atmosphere when it is passing with such velocity creates a friction—a concussion—an arrest of motion, that immediately burns the iron. We see the explosion and call it a falling star. If an unaided eye can see six fall in one hour of the night, then what a vast shower must be constantly attracted by the whole earth. If the little earth, with its slight power of attraction, brings in such a constant shower of cosmic matter, how much more would be attracted by the sun, possessing 325,000 times more power of attraction than the earth. Such is the case, we are told, and our grand constant shower of cosmic matter is constantly falling into that body, forming a vast corona extending out from the sun 800,000 miles, by the clashing and impinging of particles and resultant burning. Thus, by virtue of the law of attraction, one constant stream of matter, which is energy, is pouring into the sun to replenish its waste. This matter must be formed in space, and is simply an aggregation of energy, or fire-mist, that pervades the atmosphere.

The cosmic matter that falls on the earth—that is, meteoric matter—is about 85 per cent iron, and is merely an aggregation of iron dust, which is itself an aggregation of invisible fire-mist. Great clouds of this fine iron dust gather in the heavens, and are occasionally attracted into our orbit. On striking our atmosphere, flying with such great speed, the concussion, the arrest of motion, instantly burns the iron dust and produces light colored according to the surrounding conditions that produce the refraction. This theory is not without its objections, and the chief one is, perhaps, the fact of these lights occurring toward the poles. This objection, I think, can be met, however, in the conditions that produce refraction of light, but our article affords no space to enter upon that field.

The facts I have alluded to as a basis for reasoning are, of course, not my own, and I shall not be deemed immodest, I hope, in saying that they are all well established and may be accepted as true grounds of reasoning.

This being so, it does seem that the wonderful aurora borealis may be fully accounted for in the burning of iron dust that gathers into great clouds, and floats into our flying atmosphere to be burned by the concussion.—*Inter-Ocean.*

NICKEL PLATING.

THE PLATING BATH.

The nickel salts commonly used are the nickel-ammonium sulphate (called double sulphate) and the corresponding chloride. Other salts, such as the nickel potassium cyanide, the acetate and sulphate, have been used, but not so successfully as these.

The double sulphate bath may be prepared by dissolving three-fourths of a pound of the salt in each gallon of water (soft). The salt costs about sixty-five cents a pound, and is generally considered the best for this purpose. It should be kept neutral and up to about six degrees of hydrometer.

The double chloride bath requires about four ounces of the salt per gallon, and works better slightly acid, the tendency in working being toward alkalinity.

The bath should be filtered when freshly prepared, and should be kept in a separate room, or at least away from the apartment in which the buffing or polishing is performed, to avoid contamination by dust as much as possible. Exposed to the air the bath (the water) evaporates, and the water thus lost must be replaced from time to time. To retard this and keep out dust as much as possible, it is well to cover the bath when not in use. Its surface should be skimmed occasionally, and it should be frequently mixed together to preserve a uniform degree of strength.

The tank or vessel in which the bath is contained is usually constructed of smooth two inch white pine stuff, grooved and well bolted together, and coated on the inside with good asphaltum, applied in the melted state.

Instead of this form a clean tub or a half barrel or hogshead, with an extra hoop, may be used, though from the shape of such a vessel there is necessarily much waste space to be filled with useless liquid.

For small baths a neat form of vessel consisting in a square porcelain-lined (enameled) iron tank of suitable dimensions is sold by some of the dealers in electroplating materials.

ANODES OR FEEDING PLATES.

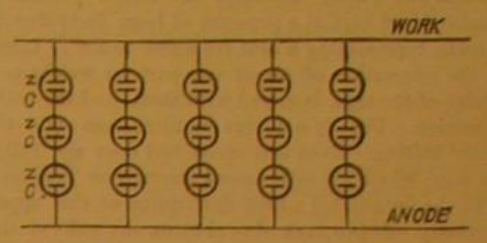
Good pure cast nickel anodes are now obtained at a moderate cost ($1.85 lb.), and are preferable to grain metal anodes. They usually come in sizes ranging from 1¾ x 4 inches, ⅛ inch thick, to 8 x 12 inches, ⅝ inch thick.

They may be suspended around the sides of the tank or across and facing the work (care being taken to avoid bringing them into such close proximity to the work that contact is likely to occur under any circumstance). They may be suspended by clean copper trusses or hooks—which should not be permitted to touch the liquid—from stout copper rods, to which connection with the battery is made.

THE BATTERY.

In nearly all large electroplating establishments some form of dynamo-electric machine is now used instead of the battery. They are cleanly, require little attention and space, and afford a current more easily adapted to the work, and at a much smaller cost.

But as their first cost is considerable, and they require power to operate them, the old battery is still in requisition in smaller establishments. The carbon or chromic acid battery* is more commonly used, as it admits of more rapid work with a smaller number of cells; but as it supplies a very intense current it often becomes necessary to introduce resistance coils to reduce it where small work is on hand. Some of the best work we have ever seen has been produced with the current derived from two or three Smee or sulphate of copper cells (in series). The amount of battery power for a given amount of work should be in zinc surface (exposed) about equal (when in proper working order) to the surface of the work exposed in the plating bath, with care to preserve the tension. If one cell has a zinc surface (exposed), of, say, one hundred square inches, and the work, say, five hundred, the one cell will require to be multiplied by five for quantity and (if the original tension was, say, three) by three to preserve the tension. Thus:



Of course this is equivalent to three large single cells, each exposing five hundred square inches of zinc (equal to a plate about sixteen inches square, exposing both sides). Large batteries of the dipping form, admitting of the immersion of the proper quantity of zinc, are often convenient.

If the current is too strong the deposited metal will present a dull (commonly termed burnt) appearance; if too weak it is apt to be imperfect, granular, or semicrystalline.

For practical purposes the electricity may be said to proceed from the copper or carbon pole of the battery, and care should be taken that this pole is invariably connected (by stout copper wires or rods) with the anodes or feeding plates in the plating bath, for if misconnected damage is done both to the work and the bath by the corrosion or partial solution of the former in the latter.

PREPARING THE WORK.

Before work can be plated its surface must be freed perfectly from all traces of oil or grease, oxides, lacquer, and other impurities. Oil, grease, etc., are removed by contact with a strong, hot aqueous solution of caustic potash, and, after rinsing off the adhering alkali, from oxide by an acid bath; or, if of brass, copper, or German silver, by scouring with fine pumice stone and strong aqueous solution of cyanide of potassium. Iron is pickled in dilute sulphuric or muriatic acid (acid 1, water 5 to 15), and scoured with fine white silicious sand or pumice stone. Brass or copper is sometimes brightened before entering to the plating bath by dipping it momentarily in nitric acid diluted with about twenty parts of water, and quickly rinsing it in running water. It should be placed in circuit immediately after this.

The hand must not come into contact with any part of the work after removal from the alkali, as the slightest touch may spoil all.

On removal of the plated work from the plating bath it should be quickly rinsed (without handling) in cold water, then transferred to hot water, which will cause it when taken out to dry quickly and perfectly. If the finished work is to present a smooth polishing surface it must present such a surface before entering the plating bath. Nickel is hard and will not readily submit to a burnishing tool.

When the work is placed in circuit in the plating bath (and it should not be permitted to remain many moments in the bath without being placed in circuit) it should be moved about to free it from bubbles.

The process of nickel plating is a simple one, and by a little practice and proper attention to the requirements the bath may be worked month after month, and the metal deposited smoothly and with certainty.

*See SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 157, 158, and 159, for descriptions of batteries.

Paper.—How it is Made.

The antiquity of the paper manufacture is, says the Boston *Journal of Commerce*, probably excelled by but few other products of civilization, Chinese historians carrying it back to a point far in the twilight of our history. In England it was first introduced near the close of the fifteenth century, and in this country in 1693, at Germantown, Pa. The materials from which paper is produced are numerous, but wholly of vegetable origin, neither wool nor hair possessing the capability of being reduced to fibrous pulp, a prerequisite to the formation of paper. Linen and cotton rags, straw, the leaves and stalks of the okra plant, jute stalks, manila, hemp, and even wood fiber, are all used in the manufacture of paper. No substance, however, can equal good linen rags, of which the toughest and finest paper is made. Next in rank are cotton rags, from which the best writing and note paper is made. In this manufacture great care is taken in the selection of the material and in every process.

Gathered from all parts of the country by tin peddlers and by peripatetic ragmen in cities, the rags arrive at the mill in bags, a portion of the stock, perhaps, coming in pressed bales from over the sea. The first process is sorting, and then the rags are cut, usually by girls, by means of a fixed blade in a bench, like a short upturned scythe, the operator picking them up by handfuls and drawing them over the edge of the blade. Each girl is furnished with a sandstone rifle, and when a large roomful of girls are at work the sounds remind one strongly of a gang of mowers at work before the days of the mowing machine. A second sorting, for the removal of all buttons, hooks and eyes, and hard seams, follows, and the rags are then dusted. The duster is a large cylinder, the surface of which is of fine woven wire, inside of which is a shaft carrying arms set around it in a spiral form, and revolving at a higher rate of speed than the cylinder. This difference in speed gives the rags a thorough stirring, while the spiral arrangement of the blades facilitates the exit of the rags, which traverse the cylindrical sieve from end to end. White paper can be made from colored as well as white rags, and for the removal of the color as well as the dirt they are submitted to a boiling with lime water. The

rags are placed in a large rotating boiler made of half-inch plate, mounted on journals and driven by proper gearing, as a worm and wheel. Through the hollow journal steam is admitted and kept at a pressure of from forty-five to sixty pounds, representing a heat from 292° to 308°. Lime water, in the proportion of about one part by weight to ten or twelve of the rags, is mixed with them, and the boiler is set in motion. Usually a charge requires from eight to twelve hours' boiling. Even this severe test does not fully purify the rags, which are next passed through an "engine."

To the uninitiated a brief description of this apparatus is necessary. It is a tank of oval form, the walls or sides rising two and a half feet from the floor. This is partially divided longitudinally by a straight upright partition, not extending to the ends, however, but leaving a space between its ends and the tank's sides, of a width corresponding to that between the sides of the partition and those of the tank. On one side of this partition, across the center of the tank, is a toothed drum, the teeth or blades of which alternate with fixed teeth at the bottom. These teeth tear the rags to tatters, but without destroying the fiber. A stream of water is constantly passing through the tank, and is constantly removed. This is done by a wheel of fine wire netting that revolves on the side opposite to the toothed drum, taking up the mass, but detaining the pulp, the water running off through the shaft of the wheel, which is hollow. Thus the water is used only while making a single passage around the tank, the current being produced and maintained by the rotary movement of the beater or tearer. The condition of the rag material when it comes from this cleansing engine is that of a coarse pulp, technically known as "half stuff," which is subsequently submitted to the action of another engine, known as a beating engine, but essentially the same as the cleaning engine.

But still further cleansing is necessary. The material is next mixed with chloride of lime and again passed through the engine. It is then heaped upon drainers, and looks like a mass of half-melted snow. The white, however, is a dead white, having no brilliancy. To receive this quality it must literally be colored. As the laundress blues her clothes to make them whiter, so must the paper stuff be blued, and when so tinted it has that same quality of whiteness as wind driven snow, which always shows a bluish tinge. This is quite different, however, from the blue writing paper so affected by the fashionable twenty and thirty years ago, and now the favorite tint in the South and in England. That is really blue paper, while our usual white paper is merely tinted sufficiently to remove the dead, yellow, lusterless appearance of absolute whiteness. The bluing is ultramarine, as used in calico printing and for other manufacturing purposes, made from silicate of soda, alumina, sulphurets of iron, and carbonate of soda, and not from lapis-lazuli. This is mixed in powder with the half stuff just before the final beating.

After the final beating the material is apparently a thin, milky fluid, having no trace, to the unaided eye, of the fibrous character that it really possesses. Formerly the paper was formed by hand, the workman dipping a rectangular sieve into the fluid pulp, and depositing the sheet of pulp on a piece of felt to dry. But very little paper is made so now, the Fourdrinier machine having taken the place of the hand workman. This "machine," as it is called *par excellence*, is a wonderful production of skill; it is almost wholly automatic in action, and works with marvelous exactness. It is scarcely possible to describe it without detailed engravings, but a brief account of its work may aid in its comprehension. Some of these machines are not less than six feet wide and seventy-five feet long, requiring a building by itself, and making a sheet of paper over five feet in width. The pulp is pumped into an elevated tank, from which it is delivered to the machine through an adjustable gate opening from a reservoir. The amount of pulp fed to the machine regulates and determines the weight of the paper, and of course it must be governed absolutely and exactly, the speed of the machine being a constant. The pulp flows on to a roller, which deposits it on an endless apron of fine woven wire, which has a constantly jarring motion, tending to shake out the water and aid in the homogeneous union of the particles. Thick rubber straps on each side of the endless apron determine the width of the sheet. Passing between rollers which compress it, the sheet of pulp goes over perforated boxes from which the air is exhausted by a pump, and much of the remaining moisture is driven out by atmospheric pressure. A bath of liquid glue gives a proper sizing to the sheet after it is fully dried by cylinders heated by steam. The sheets, dampened by glue, are taken to a drying room, from whence, all wrinkled, they are submitted to a calender consisting of a stand of rolls, three of chilled iron and two of paper. These latter are made of manila paper cut in disks, with a hole for the axis or shaft, and compressed by hydraulic pressure. When turned and finished, these paper rolls are as smooth and almost as hard as iron, presenting a highly finished surface. The sheets are then trimmed by a machine suggestive of the guillotine, and ruled. The pens used on the ruling machine are of peculiar form, made of sheet brass and fed with ink by a wick. Most of those used in this country are made by one concern in Harrisburg, Pa.

Book paper is made of old paper entirely. The processes are similar to those employed in making paper from rags, except that, owing to the more pliable nature of the material, they are not so long continued.

Juted is used for making coarse paper, such as is used extensively for flour bags, for which it is well adapted, being very tenacious of fiber, a full grown man having been carried by four persons, each lifting a corner of a sheet of jute paper from which bags are made, designed to hold a quarter of a barrel of flour—forty-nine pounds. The jute stalks come in lengths of from ten to fourteen inches. They are imported from Calcutta, and are the same material from which gunny cloth and gunny bags are made. The stalks pass through a rotary cutter, with stationary knives and knives set in a cylinder, by which they are torn to coarse shreds. A boiling under steam pressure, in a rotary boiler, with lime, follows, when the mass is heaped and allowed to "sweat" a few days. It passes through the cleaning engine, as do the rags described above, is bleached with chloride of lime, and sized with a size made of rosin and washing soda. The after machining is similar to that used on writing paper.

Envelope paper and fine wrapping papers are made from old manila rope, and paper for paper collars from cotton rags. In both cases the processes are of a similar character to those employed in the manufacture of paper for writing purposes. A necessary requisite for paper making is pure water; so paper mills are never found on the banks of sluggish streams or the shores of a marshy, muddy pond. The coloring matter for tints is introduced into the beating engine when finishing the half stuff.

Petroleum as Fuel.

The mail steamer Cesarewitch is described by the special correspondent of the London *Daily News*. It is English built, and is the swiftest mail steamer on the Caspian, being only surpassed in speed by the Nasr Eddin Shah war steamer. To convey it from the Baltic to the Caspian, it was necessary that it should traverse the whole of the Neva ship canal, and afterwards descend the Volga to Astrakan. On the Neva Canal are fifty-four locks, and the Cesarewitch's length was too great to allow of her entering them. Her present chief engineer, Mr. Vine, an Englishman, cut her into two pieces amidships, and filling up the open extremities with iron bulkheads, floated her in this guise through the canal. At Astrakan the same gentleman put her together again, and has remained ever since in charge of her machinery. Her boilers are heated by petroleum refuse instead of coal, a system which effects an enormous saving of expense and labor, the heating apparatus being as thoroughly under control as a gas jet, and requiring but one man to manipulate it. It consists of two tubes, about an inch in diameter, terminating at the same point in a small oblong brass box. Through one of these tubes the black residual naphtha (*astatki*) drops slowly, being blown into spray by a jet of steam from the boiler, conveyed through the second tube. This spray, when ignited, forms a great sheet of flame, which is projected into the hollow of the boiler. It has the immense advantage of requiring no stoking, as no ashes are produced; and by turning down the flame to the required degree, the steam can always be kept up to the pressure required for immediate starting without the tedious and more or less wasteful process of "banking" the fires. An arrangement like this is invaluable for cruisers lying off an enemy's port, and requiring to hold their steam in readiness. It is intended to apply the same system of heating to the locomotives on the Tiflis Baku Railway, when completed; and it will, doubtless, play an important part in the steam communications destined at no distant period to traverse the Steppes to Khiva and Samarcand.

Pork Making in Brief.

A correspondent of the London *Miller* describes his visit to a Chicago pork packing establishment as follows:

The place where I was to witness the prosecution of one of the greatest of the industries of the latter city was Union Stock Yard, where I arrived by street car at 9:5 A.M., and was introduced to one of the pig killing establishments. The animals to be operated upon are driven up an incline, for which, if they suspected to what fate it was the introduction, they would have no inclination. This leads to a large pen, from which they are driven into a smaller one, where a man is placed for the purpose of slipping a chain on one of the hind legs of the unsuspicious porkers, which are hauled to a position whence they slide to the sticker, who dispatches them while hanging. The stuck pig is then passed on to a man who unhitches the leg, and the animal falls into the scalding tank, which holds twenty at a time, and three men are there engaged stirring the carcasses up with long poles, so that the bristles which are to be removed are acted upon by the scalding water. At the end of the tank there is a sort of scoop which the pigs slide into, and are lifted out of the water to a bench, where they are subjected to the scraping and shaving process by the active hands of a dozen men. They are then passed to a functionary by whom they are decapitated, after which they are cut open and disemboweled by other practitioners, the division of labor principle being carried out there to the letter. The cutting up process follows the whole operation, taking a great deal less time than I have taken to describe it. A pig is killed and made ready for the market in a few minutes. At the Messrs. B. F. Murphy Packing Company they now employ 210 men, have a 24 horse power engine and four 50 horse power horizontal boilers, eleven lead tanks, 8 feet by 6, and three 24 feet by 6. They kill 1,600 pigs a day, and in winter twice that number. After being cut up the pigs are salted and put in icehouses.

I also visited one of the cattle killing establishments, where the work of slaughter is conducted with equal dispatch, the mode of killing being the cutting of the spinal cord at the back of the head by means of a steel pointed spear sharpened somewhat like a drill, the animal falling instantaneously and without a struggle. Every part and product of the animals, I may mention, is utilized, nothing here being allowed to go to waste.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they are sufficiently accurate to enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR SEPTEMBER, 1880.

Mercury.

Mercury rises before the sun on September 1, and may possibly be seen in the early morning.

On September 30 Mercury sets so nearly with the sun that it cannot be seen.

Venus.

On September 1 Venus sets at 7h. 6m. P.M. It is in conjunction with the crescent moon on the 5th.

The "Nautical Almanac" gives the conjunction of Venus and Mars on the 7th at 1 P.M., Venus being 31′ north of Mars in declination.

Mars.

On September 1 Mars sets at 7h. 12m. P.M. On September 30 Mars sets at 6 P.M.

On September 7 Mars and Venus pass the meridian very nearly at the same time. Mars precedes Venus by ten seconds.

Jupiter.

Jupiter is becoming more and more brilliant.

On September 1 Jupiter rises at 8h. 2m. P.M. On September 30 Jupiter rises at 6h. 2m. P.M.

It passes its perihelion on the 25th. The near approach of Jupiter to the earth will give amateur astronomers an excellent opportunity to watch the motions of the moons and the changes on the surface of the planet. A good opera glass will show the moons.

If we take the hour from 9 to 10 P.M. for our watch, the first satellite may be seen to come out from behind the planet on September 1; to move into the planet's shadow on the 15th; to pass from the planet's face on the 16th, and to enter upon the planet's face on the 23d.

During the same hour the second, or smallest satellite, is hidden by the planet on the 7th; is in eclipse, by the falling of Jupiter's shadow upon it, on the 14th; is near the limb of Jupiter on the 23d, having left the disk, and will be unseen because projected upon the disk on the 30th.

The third satellite in the order of distance from Jupiter, which is the largest and which will be most easily followed by amateurs, may, on September 3, be seen to go behind the planet, and on 28th may be seen to pass on to the disk of the planet, coming between the earth and Jupiter. September 23 will be the most favorable for watching the changes of the satellites, as one of the moons may be seen to move off from the face of Jupiter, and another will be seen to move toward the planet and to enter upon its transit across the disk almost at the same time. Jupiter is in conjunction with the moon on the morning of the 20th.

A close study of Jupiter during the month of September will be the most instructive as well as the most pleasing occupation to which young astronomical students can give their evenings. If no means of measurement are at hand, careful drawings should be made of changes on the surface of Jupiter.

Saturn.

Saturn follows Jupiter throughout the month of September.

Saturn rises on the 1st at 8h. 32m. P.M., and on the 30th at 6h. 34m. P.M., between 3° and 4° north of Jupiter in declination.

Although Saturn is not, like Jupiter, at perihelion, it is approaching its best position for this year, and should share with Jupiter the attention of observers.

Saturn is in conjunction with the waning moon after midnight of the 20th.

Uranus.

Uranus rises nearly with the sun in the early part of the month; on September 30 it rises at 3h. 44m. A.M.

A Table Land Across the Gulf Stream.

In a recent dredging expedition from Charleston, S. C., across the Gulf Stream, Commander Bartlett, of the United States Coast Survey steamer Blake, was surprised to find the depths much less than he expected. This induced him, although the trip was one primarily for dredging, to extend the work of sounding; and he accordingly ran a line of soundings nearly along the warmest band of the Gulf Stream, commonly called the axis of the stream, for a distance of 150 miles from latitude 32° to latitude 33° 30′ north, on which he obtained depths varying from 233 to 450 fathoms, where it was supposed that the depths would range from 600 to 1,000 fathoms. At the northeast end of this line, in about latitude 33° 30′ north, the depth suddenly increased, in a distance of 15 miles, from 457 to 1,386 fathoms.

These depths obtained by Commander Bartlett appear to indicate that a submarine table land may extend from the coasts of North and South Carolina across to the Northern Bahamas. The development of this table land Superintendent Patterson proposes to have completed next spring, when the weather will be better adapted to such work than in the autumn and winter months.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

NEW BOOKS AND PUBLICATIONS.

A SELECTION OF SPIRITUAL SONGS WITH MUSIC, FOR THE SUNDAY-SCHOOL. Rev. Charles S. Robinson, D.D. New York: Scribner & Co. Price 50 cents.

An exceptionally judicious collection of Sunday-school hymns. Dr. Robinson's pure taste leading to a rigorous exclusion of the rant and doggeral unhappily so popular in many Sunday-schools.

MICROSCOPISTS' ANNUAL FOR 1879. New York: The Industrial Publication Company. Limp cloth, pp. 48. Price 25 cents.

Contains tables, rules, formulas, and memorada of use to microscopists. Also a list of American and European microscopic societies, with officers; a directory of prominent makers, dealers, and importers of microscopes; postal information for microscopists, etc.

DIE RADREIFEN-BEFESTIGUNGEN BEI EISENBAHNWAGEN-RAEDERN. EINE SAMMLUNG PATENTERTES CONSTRUCTION. Von C. Kessler, Civil Ingenieur. Berlin: 1880. Polytechnische Buchhundlung (A. Seydel). (Tire Attachments for Railroad Wheels.) 63 p.

This work consists of a digest of the English and German patents granted for improvements in attaching tires to railroad car wheels. Three hundred and twenty-one illustrations of patents are shown, arranged according to date and provided with a brief description or note. This publication will be of great value for the railroad engineer, car builder, and machinist.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) A. S. asks: What is the office of a check valve? A. It performs two offices: 1. It relieves the pump valves from the pressure. 2. It permits of opening the pump for examination without blowing off steam, and it retains the water in the boiler in case of the bursting of the feed pipe.

(2) S. R. asks how to letter with gold and silver leaf on glass. A. The size is prepared by dissolving one ounce isinglass in just enough water to cover it; when dissolved add a pint of rectified wine spirit and make up to a quart with water. Give the clean glass a flowing coat of this, and carefully lay on the leaf which will then readily adhere to the glass. Let it remain twenty four hours to dry. The design or letter is drawn on paper, and the lines pricked with needle holes. Place this against the gilded surface and dust it thoroughly with powdered whiting. When the paper is removed there will remain a correct copy of the design or letter on the gold. Now fill up the outline with oil gold size in which has been ground some orange chrome, thinned somewhat with boiled oil and turpentine. When this has thoroughly dried wash off the surplus gold with water, applied with a tuft of cotton.

(3) B. S. T. asks: 1. For a satisfactory process for waterproofing cloth. A. Saturate the fabric with a strong hot aqueous solution of soap, press out excess, and transfer to a second bath consisting of a strong aqueous solution of sulphate or acetate of alumina or acetate of lead, for several hours. Repeat if necessary, press out excess of liquid, and dry, not too rapidly, in the air. 2. Can you give me a process for determining quantitatively the presence of cinchonidine as an adulterant of quinine? A. Five to ten grammes of the mixed alkaloids are mixed with fifty grammes of ether, and the mixture, after well shaking, left at rest until next day. By this operation the alkaloids are separated into two parts: one soluble in ether, and another insoluble in that liquid. The part soluble in ether contains the quinine, while the insoluble part contains the cinchonidine. These two parts are separated by a filter, the insoluble part washed with some ether, and the ethereal solution evaporated. This insoluble part is now mixed with forty parts of hot water, and converted into neutral sulphate by careful addition of diluted sulphuric acid, so that a solution is obtained having a slight alkaline reaction upon red litmus paper. To this solution a solution of tartrate of potash and soda is added in sufficient quantity to convert the sulphates into tartrates, and after stirring with a glass rod, allowed to remain for twenty-four hours. If cinchonidine be present in appreciable quantity, its tartrate will be found separated in crystalline form. The tartrate of cinchonidine is collected upon a filter, washed with a little water, and dried on a water bath. One part of this tartrate represents 0·804 part of cinchonidine.

(4) A. R. G. asks how to detect small quantities of gold in sulphurets. A. Reduce the whole of a sample of several ounces of the ore, by grinding, to an impalpable powder, that will pass readily through an 80 mesh sieve; mix about a drachm of the well mixed powder with ten times its weight of pure lead and one or two fragments of borax glass the size of peas, place in a scorifier and expose in a closed muffle to bright red heat until the lead is all fused and the ore floats on top; then open the muffle and let a current of air pass slowly over the red hot scorifier and its fused contents until the ore has been absorbed and the fused metal has disappeared beneath a covering of litharge; then remove, cool, break, remove and clean the lead button, and place it carefully in a heated cupel weighing somewhat more than the bead; when the lead has melted the muffle is opened and the air allowed to pass over the fluid mass until the lead has all been converted into litharge, and the litharge absorbed by the cupel, leaving the gold and silver behind; if the bead is white, silver is present; add about twice the weight of the bead of pure silver, fuse together with the blowpipe flame on a charcoal support, flatten while hot on an anvil, and heat for some time to boiling with pure nitric acid, which dissolves the silver, leaving the gold, if any were present in the ore, as a brownish black mass, which shows the characteristic luster when pressed with a knife blade, and when brought into contact with a drop of aqua regia, and then with a crystal of stannous chloride, develops a purplish-red, violet, or brownish-red coloration—purple of Cassius.

(5) W. T. R. asks if a ground connection for a lightning rod will be a good one if soldered or attached to a gas pipe (iron) underground. Will it be attended with any danger to the occupants of house if struck with lightning, pipe full of gas? Will a lead water pipe do for ground connection for lightning rod? A. The rod should be soldered to the gas pipe, and that forms a good ground connection. No danger from the gas. A lead water pipe would do for ground connection if the rod is soldered thereto; but an iron pipe is much better. Lead is a poor conductor of electricity.

(6) D. P. asks for the proportion of chemicals used in the mixture of white or flint lime glass. A. Flint glass is composed of 300 parts of pure white sand, 200 parts of minium, 100 parts refined pearl ash, and 30 parts of niter. Crown glass consists of 22 per cent of potash, 12·5 per cent of lime, and 62 per cent of silicic acid.

(7) L. D. C. asks: 1. Suppose the motive power for an electric light should suddenly stop, would the lights immediately go out? A. Yes. 2. If they would, is there any known means by which the electricity or power could be stored or accumulated, so that the lights would not be impaired? A. No. 3. What I wish to know is, to make plainer, is there any way that electricity, as a motive power, can be stored up, the same as can be done by compressing air or raising water to a height? A. No.

(8) T. W. McN. writes: In the SCIENTIFIC AMERICAN, No. 26, June 26, 1880, page 404, is an article headed "Lunar Caustic for Purifying Spirits." Can you give me the full particulars as to the manner of treatment, or can you tell where to find them? A. According to M. Berlieu the silver nitrate is dissolved in 10 parts of soft water, and about one-quarter ounce of the solution is added to each 100 gallons of the spirit before rectification. The silver remains in the still.

(9) M. J. D. asks how to put up green corn and lima beans in glass fruit jars. A. Fill the cans completely, immerse them nearly to the top in boiling water for an hour or more, or until the contents are thoroughly cooked. Seal while hot.

(10) H. S. asks for a composition to make jars that will hold acid, beside clay, glass, or metal. A. For the stronger acids (nitric, hydrochloric, and sulphuric) the only suitable vessels are of glass, porcelain, stoneware, or enameled iron, excluding the metals, platinum, gold, lead, etc. When the muriatic or sulphuric acids are diluted with water, vessels of wood or *papier mache* coated with gutta-percha, rubber, or asphaltum, answer very well.

(11) W. H. S. writes: I have been informed that a few years since there was sold in London a prepared paper for making duplicate copies of manuscript by electricity. The mode of using it was to place the paper upon a metallic surface connected with one pole of a battery, while the writing was done with a metallic stylus attached to the other pole of the same battery. The electricity passing through the paper changed the color of the paper at every point the stylus touched. Can you tell me how the paper can be prepared to produce this result? Can it be done with dry paper? A. Saturate the paper (unsized) with a dilute aqueous solution of iodide of potassium, and dry. It should be slightly moist when used.

(12) S. asks how to make dry, black, typewriter ribbons. There are two kinds in the market, one known as "copyable" and one as lithographic. A. Triturate fine lamp black (or ivory black) and warm lard together to form a thin paste and stiffen with a little wax; or triturate fine (soluble) nigrosine with hot glycerine to form a smooth sirup. Fill the ribbons with either, and, with a light pressure, remove any excess.

(13) C. J. H. writes: I inclose an analysis of Massena water, and would be glad to have you state whether the introduction into it of the ordinary carbonic acid gas with which soda water is charged would at all injure the medical properties of the water; whether this water could be put into the tin-lined copper fountains and drawn up through, as soda water ordinarily is, without injury to the fountain or fixtures? If so, how the fountain could be afterwards cleansed, to rid it of the sulphurous smell? Would an ordinary whisky barrel be strong enough to charge with enough carbonic acid gas to force the water up to a floor above—say, 12 feet—to be drawn in the way mentioned? How much pressure would it require? A. The water may be charged with carbonic acid without danger of affecting any of its constituents. It is not safe to use a barrel in the manner proposed. Better use a porcelain-lined iron cylinder, if obtainable. Such water should not be drawn through tin pipes.

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

O. P.—The stone probably contains nothing of value—a variety of serpentine.—H. S.—Calcium carbonate—of little value.—B. M. L.—Hornblende rock containing pyrrhotine—a sulphide of iron. The pyrrhotine probably contains a little nickel.—G. R.—Nodular iron pyrites. It probably carries a trace of gold.—J. B.—Yes, it is horn silver—silver chloride.—E. M.—The green stone is phospho-calcite—phosphate of copper. The other, chalcopyrite—sulphide of copper and iron.—T. O. D.—1. Chrysolite—silicate of magnesia. 2. Chlorite—silicate of magnesia, alumina, and iron. 3. Biotite (hexagonal mica). 4. Fluorspar. 5. Quartz, feldspar, and iron pyrites.—D. F.—1. A fair quality of hematite iron ore. 2. Serpentine and quartz.

COMMUNICATIONS RECEIVED.

On Lightning and Lightning Rods. By E. G. A.
On the Chemistry of Electricity. By W. H. G.
On New Use for Spent Fruit Cans. By S. W. R.
On Track Straightening. By S. W. R.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 3, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Addressing machine, T. A. Edison	230,621
Animal trap, A. Goodwin	230,628
Auger, earth, E. A. Smith	230,830
Baby jumper, C. H. Land	230,797
Bag or satchel, D. Wilhelmi	230,847
Bag tie and tag holder, B. L. Myers	230,647
Bale band, wire, E. S. Lenox	230,789, 230,790
Bale tie, P. K. Dederick	230,630
Baling press, A. Buckman	230,736
Bath tub, T. M. Armstrong	230,684
Beer cooler, J. C. De La Vergne	230,694
Beer cooler, A. D. Puffer	230,815
Bird cage fastener, T. L. Maxheimer	230,795
Birds as decoys, frame for supporting dead, F. A. Allen	230,600
Boot and shoe seam, J. Popham	230,654
Boot treeing apparatus, J. A. Ambler	230,601
Boot treeing machine, Cri p & Copeland	230,752
Boring and mortising machine, C. R. Brinckerhoff	230,735
Bottle stopper, T. G. Austen	230,730
Bottle stopper and fastening, J. M. Lewin	230,791
Bottle wrapper, Mark & Martinek	230,710
Bottles, jars, and similar vessels, stopping or closing, H. Barrett	230,605
Box fastener, A. J. Millard	230,799
Bricks, coloring and hardening, J. Ambuhl	230,729
Bridle loop, G. L. Smith	230,831
Burglar alarm for safe, electric, E. J. Leland	230,788
Button, D. S. Porter	230,814
Candy, device for packing, W. B. Howe	230,778
Cap, P. Goldmann	230,770
Cap and scarf, convertible traveling, A. Weller	230,843
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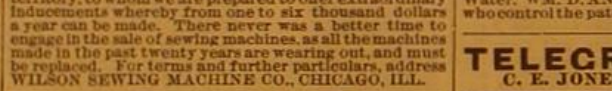

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