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## IMPROVED SHEARS FOR CUTTING BAR IRON.

The ordinary method of cutting bar iron or railroad rails is by means of the cold chisel and hammer, a tedious and at best inaccurate operation, involving the labor of three men and no small expenditure of time. It is hardly necessary to point out that an efficient device for the same purpose would possess considerable economical value; and for this reason, in addition to that of its producing superior work, its substitution for hand labor may be urged.

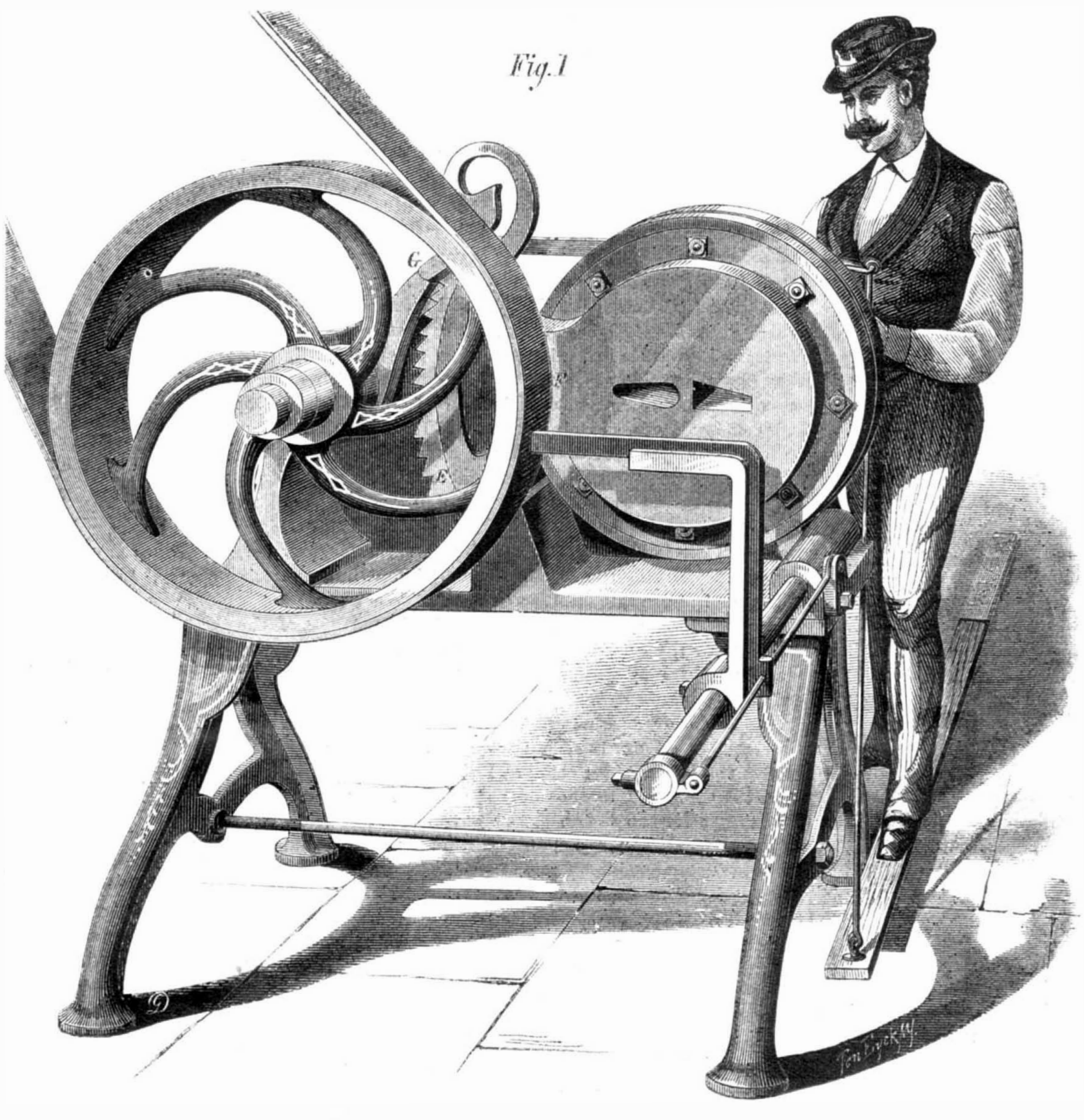
The subject of our illustration is a power shears, of the size adapted to cut round iron of all sizes up to two inches. It is also provided with blades to cut flat iron as large as one by four inches, and square iron up to one and one half inches, without alteration. The machine is well adapted for the use of chain or bolt makers, and for general machine shop work. Smaller shears are made for lighter work, and larger ones for cutting up old rails and scrap for rolling mills. The size herewith represented, which cuts 2 inch iron, weighs only 2,000 lbs., and occupies a space of 3 by 5 feet on the floor. A hand machine weighing but 470 lbs., worked by two men, we are informed, has repeatedly cut off rails of seventy-two inches sectional area, requiring 360,000 lbs. pressure.

The pressure required to shear off two inch round iron will average 157,000 lbs., and the means whereby so much force is concentrated in so little space, and so much strain resisted by so little weight of cast iron, involves two principles in mechanical construction. The first principle consists in fastening the blades, A, B, and C, of the shears within the circumference, C', of its bearing of oscillation, in such manner that the largest bar to be cut is placed close to the axis or actual center of the shears. This is claimed to secure the shortest possible unit of leverage for the resistance, and at the same time the resistance or strain on the machine is located so near the center as to allow the iron, which must support said strain, to be distributed in a circle. Second, since the work is intermittent, a fly wheel may be advantageously used. And since the power that may be accumulated in fly wheels is proportional to the square of the velocity of their rims, the weights being equal, a good speed to the wheel is the first requisite.

The shears shown has a three feet wheel, weighing 630 lbs., with eight inches face, running 120 turns a minute. As two inch iron cannot be handled to cut chain links faster than 15 or 18 times a minute, the power of the wheel may be multiplied about 8 times, by such mechanism as will give the shears blade 15 strokes to the wheel's 120 turns.

In this machine the power of the fly wheel is communicated directly to the moving arm of the shears, by means of an eccentric, D, on the hub of said wheel, driving a pawl, which engages teeth in a circular arc, E, at the outer end of the shear arm, F, thus raising said shear arm one tooth at each revolution of the wheel, an attendant pawl, G, supporting the arm by each tooth as it rises. A stop dog, H, which may be fastened between any two teeth, on arriving beneath the pawls, disengages them, and the shear arm drops back to its normal position, where it is received on a cushion, I, to avoid noise.

Thus, by dividing the angle, through which the shears must move to cut two inch iron, into 8 teeth, and by placing said teeth far enough from center so that each tooth may be thick enough to bear its load with safety, the whole problem, the inventor claims, is solved with light parts, and almost no power wasted in friction. The eccentric is so proportioned to the teeth that the fly wheel is at work only one quarter of each turn, leaving three quarters of the working time and all the time between work for it to accumulate power. The body of the machine has a trunnion projecting from its face, on which is a circular flange, behind which a collar, J, takes a facial bearing. The moving arm, F, containing one pair of steel shear blades, B, has its bearing of oscillation on the circumference of the flange, and is secured so that the blades work in facial contact with the opposite blades, A, C, by means of bolts and the collar. When the pawls are thrown out by the stop dog, the lever holds them out, so that the shears is still, with its mouth open to receive iron, until it is purposely started. This may be done by either the hand or foot of the operator. This is a point of great value to prevent accidents in cutting rails and other heavy iron, as it allows any desired time to get the bar in place, and (when started) cuts it off as quickly as those shears do that keep the jaw always in motion.

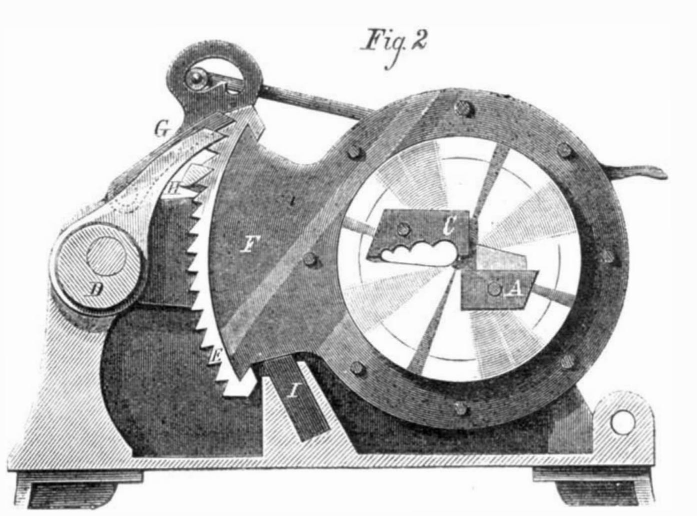


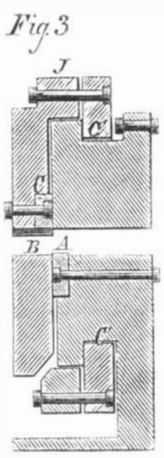

STEVENS' IRON-CUTTING SHEARS.

For bolt and chain makers, a gage is supplied, that regulates the length of the piece cut, with precision. And this gage has a very ingenious mechanism, whereby the very act of pushing the bar against it starts the machine. The notches made in the blades for cutting round iron are so arranged as to cut the smallest iron at the farthest point from center, thus requiring only the motion of one tooth. Allowing a little time for the arm to fall, the shears will cut 100 pieces of one half inch iron, 75 pieces of three quarter, 50 pieces of one inch, or 15 pieces of two inch iron in one minute, while the fly wheel continues at the speed of 120 turns per minute. Its great firmness causes the blades to wear a long time. An opening from the joint allows the scale and rust to fall out.

These machines, we are informed, have proved by use to be very efficient, reliable, and extremely cheap, as their first cost is not one half that of other shears capable of the same grade and amount of work. The principal features of these shears are soon to be adapted to a combined shears and punch for boiler plate work. The device has been patented in the United States, Canada, Great Britain, France, Belgium, and Austria.

For further information, address the inventor and manufacturer, W. X. Stevens, East Brookfield, Mass.




### A Railway on the Sea Bottom.

Dr. Lacomme's project might, perhaps, be termed more fittingly a marine railway, or a rail way for the marines. He proposes to lay a submarine line of rails at the bottom of the Straits of Dover between England and France, upon which a weighted chariot or platform is to run, and upon this platform is to be placed a submarine boat, composed of galvanized iron, and hermetically sealed, propelled by compressed air.

### Steel Rails.

We had a conversation with the president of one of our largest railroads the other day, in which he said, speaking of the relative merits of steel over iron rails, that he believed that it was better economy for any railroad doing a large traffic to pay the present price for steel rails than to lay down iron, even if the latter were delivered free of cost. We thought at the time that the assertion was pretty strong; but on inquiry among other practical railroad men, they confirmed the first gentleman's assertion.

A recent number of the *Railroad Gazette* contained an engraving representing the wear on a steel rail, laid down in 1865, on the single main track in Clark street, Chicago, where nearly all the trains of the Chicago, Rock Island, and Pacific and the Lake Shore and Michigan Southern railroads passed over it, and where engines were constantly shifting. Iron rails in similar positions were renewed as often as once in six months, the steel rails having outworn sixteen of the iron rails. The steel rail was gradually worn down on one side, but there was no splintering, as in iron rails.

It will be observed, on reference to the list of Canadian patents published in these columns weekly, that the number of patentees is largely increasing. The last week's issue numbered forty-eight. In the corresponding week of last year, only half this number was issued.

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(Illustrated articles are marked with an asterisk.)



## THE GENESIS OF INVENTORS.

In the symbolic representation of the ages, the characteristic human type of one period is the hunter; of another, the shepherd; of another, the farmer At one stage of the world's development, the soldier is the prominent man, at another the priest. Now the leading man is the builder; now the adventurous sailor; again the studious philosopher, the far-seeing patriot, the irrepressible reformer, is the commanding spirit of his time.

Of the nineteenth century, the typical man is the inventor. He is at once the leading factor and the peculiar product of modern civilization. He it is that has introduced the elements which chiefly distinguish the life of to-day from that of any and every other period. The hunter, the farmer, the soldier, the sailor, the priest, the philosopher, the statesman, the artist—each fulfils his function; but in no way do they surpass the achievements of other ages, in no way do they help to make our life different in kind or different in character from the lives of our ancestors. The work of the inventor does.

Subtract from the means and methods of our daily life all those elements which are or have been patented, or are the products of patented applications and appliances, and how much—how everything, in fact—that gives distinction to our age will be taken away! Pull out from our houses all the parts save those not now or ever patented, all those that have been formed or put together by patented means, and what a wreck would be left! Take from our tables all the articles, food, and furniture, in whose production and carriage patented inventions have been essential, and how meager our diet would be! Strip from our bodies every article of clothing save those in whose preparation patented inventions have not been employed, and how scant would be our attire! Deprive the wealthy of all the luxuries which invention has brought within their reach, the poor of the comforts and conveniences which the inventor has provided or made possible, and how much of use and enjoyment would go out from their lives!

Just now we are commemorating the brave deeds, the unconscious heroism and wisdom of the founders of our Republic. In no respect can it be said: "They builded better than they knew" than in the provision they made for the encouragement of invention and protection of inventors, then, like themselves, a slender and struggling band of pioneers on the border of an unbroken continent, a new and unexplored field of effort for the amelioration of human existence. It was not a matter of climate or race, it could not be the conditions incidental to the conquest of a new country, that made the Yankee an inventor above all other men. The same race had undergone similar experience before, perhaps a score of times, yet it did not develop inventors except sporadically. It was not necessity, the reputed mother of inventions, that started our fathers on the course which has wrought a revolution, a multitude of revolutions, in the productive arts. The original need of labor-saving devices in America was no greater than had prevailed the world over since human life began; always and everywhere humanity has stood in want of the beneficent products of the inventor's art, and everywhere it has stood ready to turn such products to good account.

Why then were not more inventions made? Simply because the true parents of invention—encouragement of inventors and protection to their productions were lacking. Those provided, their legitimate issue followed, genius for invention was developed, and its progeny increased in geometrical progressive. Every new contrivance gave birth to many, inventive competition set in, and ultimately improvement became watchword the in every department of productive labor.

It is true, the student of pure science comes in for a share, a large share, of credit for making modern life what it is. Very largely he has led the van of discovery and made invention possible. But it must be remembered that it is their practical application that gives material value to such discoveries; and that where such applications are not directly favored, the progress of pure science contributes little to the advancement of human well being. In Germany and in England, the progress of scientific discovery is very rapid, yet invention lags. In this country invention leads, and frequently we take from them the barren scientific fact and return an application which gives it the highest value. It cannot be because the Germans have little inventive genius or practical skill, that they invent so seldom. They turn inventors quickly enough when they come here; an examination of the latest weekly index of inventors, containing some 250 names, shows that fully twenty per cent of those are unmistakably German. That a large percentage of our inventors are of British birth is too well known to call for investigation.

The secret of the superior inventiveness of the Americanized European lies in the fact that here his efforts are encouraged, there systematically repressed. Here we know the inventor's value, and appreciate him accordingly. We know that a fertile soil gives us far less advantage in the markets of the world than the time-saving and labor-saving implements which enable us to win our agricultural products easily and quickly—implements which we owe to our inventors. We know that our commercial superiority and the immense development of our manufactures rest very largely upon the genius and labors of inventors. But a little while ago England led the world in these departments of human activity, To-day her foreign and coastwise commerce falls below ours by an aggregate of over ten million tons annually; while our manufacturing establishments, notwithstanding high priced labor and the predominance of machinery, give employment to nearly a million more operatives than those of Great Britain. How many of our six and half million mechanics could pursue their labors in default of patented inventions? How much of the five thousand million dollars worth of manufactured products, which they turn out a year, would be possible without the inventor's aid? We know our indebtedness to inventors, we welcome them as public benefactors, as prime factors in our industrial system; we protect them in the development and application of their ideas, and reap our reward.

In Europe the contrary custom prevails. In Switzerland and Holland, the inventor is refused any property right in his invention whatever; in the other States, the right is granted as a favor and weighted down with costs and conditions. The inventor is treated as an invader of vested rights, an enemy to trade, a disturber of the peace of the community. The good he may do to the multitude is less considered than the inconvenience he may occasion a few manufacturers by compelling them to improve their wares or cheapen their prices. Patents are regarded not as mainsprings of mechanical progress, but as "fetters" imposed upon industry, as "dragnets" spread to entangle manufacturers and curtail the area of their operations. The rich manufacturer, satisfied with his plant and his profits, calls the poor inventor a "nuisance" or "gambler," who, "instead of contenting himself, like other men, to work and accumulate money by industry, is always scheming, and dreaming, and wasting his time and his money." If successful he becomes sometimes worse than a nuisance. The Lord Chancellor of England, expressing the feeling of the dominant classes of Europe as well as of Great Britain, calls him by implication a black mailer, a sort of mechanical pirate, who robs the manufacturer when he can, and hampers him when he cannot rob; and the leading journals, like the *Times*, rejoice at every prospect of reducing the number of patents and patentees as a relief to productive industry. Under such condition it is no wonder that inventors as a class do not thrive, or that they bring their inventive talents where they are appreciated.

## DEATH IN THE SALT CELLAR.

We are not of a morbid turn of mind; as a general rule, we believe that there is nothing to be gained by constant meditation on the uncertainties of human existence; but occasionally something occurs which reveals death lurking in some unthought-of ambush, which presents the idea of mortality in a form which fairly startles one into somber reflections. If a boiler blows up and kills its attendants, or a sailor is drowned, or a miner suffocated, the circumstance, though we deplore it for the time, leaves no impression on the mind, for it is tacitly expected; but when an hotel full of people, as at a prominent watering place last summer, began to die off like sheep, killed by the water which was necessary to their existence, or the pedestrians in a public street are suddenly hurled to the ground by an explosion of presumably harmless objects, or a bit of color in wall paper or dress carries disease or death, then we are forced into the disagreeable belief that our lives are our own only in a very limited sense.

We have been led, perforce almost, into this train of thought, by the realization of how closely the community has escaped a calamity which might have carried mourning and death into hundreds of homes. The Niagara, a large sailing vessel of the Anchor line, recently reached this port from Liverpool, after a stormy passage of thirty-three days The cargo of the ship consisted of 1,950 bags of salt of the finest quality, such as is sold for table use. This filled the hold, and the 'tween decks space was devoted to chemicals and general merchandise, the former including about a hundred kegs of arsenic. During the bad weather, the cargo shifted, the arsenic kegs broke adrift, and, pounding against the ship's side, speedily became sufficiently injured to allow of the leakage of their contents. Meanwhile the seams of the vessel, opening, admitted water, and this, mingled with the arsenic, poured down into the salt.

On the arrival of the ship in New York, the chemicals, etc, were taken out in damaged condition, and then the salt bags were removed and delivered to the consignees, who in course of trade lost no time in disposing of the salt, or rather of a portion of it. At this late hour, the thought occurred to the captain of the vessel that the arsenic solution might have poisoned the salt; and acting thereon, he at once telegraphed far and wide to stop its sale and consumption. Professor Doremus was sent for to analyze chemically the material; and from his report, based on the examination of a large number of samples, it appears that the arsenic was present in such considerable quantities as to render the salt utterly unfit for use for any kind of food.

It is stated that the warning has been given in sufficient time to prevent the sale of any of the poisoned substance, the telegrams reaching the parties before the salt itself. But the contemplation of what might have been the result, were such not the case, is enough to cause even the most indifferent to shudder. The salt is said to be still of use for manufacturing purposes, and hence will not prove a total loss. The question of value, insurance, etc., is the gist of a triangular fight between the custom house people, the insurance companies, and the owners; and here we suppose the matter will end. It seems to us, however, that it should not be allowed to drop here. The fact that the lives of perhaps hundreds hung on the memory of one man, and that it was nothing more than mere luck or chance which caused that individual to bethink himself in time, is entirely too serious to be passed lightly by.

The public would like to know who is responsible for such criminal stupidity as the stowage of a terrible poison in a locality where, even by the merest limit of possibility, it could get mixed with a staple article of food; also whether it is customary to pack arsenic in vessels capable of smashing by rolling about the decks. There are plenty of laws regulating the sale of poisons; it might be well, if such are not already there, to embellish the statute books with laws governing their transportation.

## THE AGRICULTURAL DISPLAY AT THE CENTENNIAL.

A circular signed by the Chief of the Bureau of Agriculture of the Centennial Exposition, Mr. Burnet Landreth, has recently been issued, directing public attention to this very important portion of the national exhibit, and requesting, from agriculturists generally, aid to ensure its completeness. As the time in which the labors of the Bureau must be perfected is now less than a year, we need hardly point out that hearty practical coöperation is what is wanted from the public, and not mere approval of its ends and purposes. As we have already strongly urged, the period for discussion regarding the Centennial has gone by. The project is to all intents well matured, and is being carried into execution as fast as circumstances will admit. The way to accelerate its progress, therefore, is for each individual to make up his mind as to the part he proposes to take, and to set about preparations at once; or if he is not interested in directly participating, but yet is sufficiently patriotic to desire lending to the show his best aid and comfort, now is the time for him to consider how many ten dollar bills he can afford to withdraw from his business or income to exchange for shares of stock. The investment is said to be a safe one, and the managers of the Exposition believe that a handsome dividend will be returned. Regarding preparation of exhibits, it may be well for farmers to remember that, if they propose displaying specimens of crops, such must necessarily be of the present year's harvest, and sown during the present spring, so that the dressing of the soil, selection of seeds, and other especial cares must be attended to now. Live stock intended for exhibition will also require early attention, although this class of the display will not be exhibited until the months of September and October of next year. The Bureau publishes the following information regarding the time allotted to the various varieties of animals, etc. Horses, mules, and asses will be exhibited, as one group, from September 1st to 15th; horned cattle, from September 20th to October 5th; sheep, swine and goats, one group, from October 10th to 25th. All animals entered, except trotting stock and fat cattle, must be of pure blood and, besides, highly meritorious in condition, etc. Only the best of each kind is wanted. Exhibitors must furnish attendants, and feed their own stock, for which ample accommodation and good forage at cost price will be provided. Animals will be inspected by a competent veterinary surgeon before admission, and those which become sick subsequently to entry will be isolated and carefully treated. Applications for space must be made at once (address the Chief of the Bureau of Agriculture, Philadelphia), in order to enable the officials to form a proper estimate of space, etc., required. We would remind farmers generally that the liveliest interest is taken abroad in the subject of stock-raising in this country, as witness the large attendance of foreign buyers at the great sale at which the famous $60,000 cow was diposed of, a year or so ago, and that without doubt the representatives of the Earl of Leicester, Colonel Towneley, the Earl of Radnor, the Dukes of Bedford and Rutland, Mr. Bakewell, and in fact of all the great English sheep and cattle breeders, will be among the most critical visitors and perhaps future purchasers of the animals displayed.

The entries which will represent the labor and skill of our agricultural population, as well as the products peculiar to our soil, are so numerous and varied that it would be impossible even to summarize them here. Cotton, corn, and tobacco, the marvelous fruit and vegetable productions of the Pacific coast, the yield of the maple trees of New England and of the orange groves of Florida, will be prominent in the general exhibit, and the lumber from our Northern States will be placed side by side with that from the vast Scandinavian forests. The necessity of a very complete display of the timber of all districts of the country may be especially urged. Samples of trees of all kinds are asked for by the Commission, and it is suggested that the bark of one or more of the giant trees of California (*Washingtonia gigantea*) be taken off the trunk in segments and sections, to be placed on arrival on a skeleton frame of the same dimensions as the original. The Agricultural Hall, having an extreme elevation of seventy-five feet, will afford ample room for at least a partial exhibit of one of these monsters of primeval forests. Thus also with other trees of the Pacific coast, hardly secondary to it, as *abies Douglasii* and *nobilis*, *librocedrus decurrens*, *pinus Lambertiana*, the white pine and hemlock of the North, the yellow pines in their several species, the live oak, the cypress (*taxodium distichum*) of the South, and a long list from every section of our broad territory.

In addition to specimens of trunks of trees should be exhibited timber and lumber in all forms; as samples of masts and spars, large and small; knees and square timber, as prepared for naval purposes; planks and boards exhibiting unusual breadth and character of cell and fiber: in brief, every description, quality, and form of wood used in construction and decoration.

We are gratified to note an increasing interest on the part of all classes of the public in the Centennial everywhere. Several prominent business houses have given generous subscriptions. A popular movement in New York toward the furtherance of the enterprise is about to be made. It seems to us that some grand representative structure from the metropolis, typifying its growth within a century from a mere village to one of the greatest cities in the world, would be appropriate and in harmony with the general surroundings, and might at the same time be a means of arousing a greater local interest. Boston is busily engaged upon something of the sort in the shape of a tower, which will be built wholly of iron and will rise to a hight of 200 feet, or 540 feet above the river level. It is to be used as an observatory, and elevators will transport visitors to the summit. The contracts for the iron work are already awarded, and the edifice is to be completed on July 4 of the present year.

## THE MANAGEMENT OF BOILERS AND ENGINES.

Extensive as is the literature connected with the steam engine, there is very little in print in relation to the practical management of steam machinery. It is not difficult to discover the reason for this omission. The practical details are so varied, for the different cases that may arise, that it is almost impossible to classify them. It is impossible so to foresee that the remedy for any emergency which arises can be prescribed in advance; and it is not desirable that the engineer should trust implicitly to a set of formal rules, which will leave him helpless to provide for a case which is not covered by the directions. At the same time, there are a number of general principles, which every engineer learns by experience, and their publication may be of use to those whose experience has yet to be acquired. Many steam users, recognizing the importance of having their machinery carefully managed, are in the habit of sending engineers and firemen to be examined in regard to their qualifications before engaging them. We give below an abstract of an examination recently conducted by a well known expert. The engineer who was examined was unusually well qualified for his duties, and a record of his replies may therefore prove very useful. Omitting the questions, the following summary gives a fair idea of the scope and character of the examination.

### THE ENGINE AND BOILER.

"I have not examined the engine and boiler very carefully, but there is a horizontal engine, with plain slide valve, diameter of cylinder, 12 inches, length of stroke, 26 inches. There is a horizontal tubular boiler, set in brick, diameter, 4 feet, length, 11½ feet, steam dome, 24 inches in diameter and 15 inches high, number of tubes, 65, each three inches in diameter. I have not examined the connections of the boiler, but I can tell you what they should be, if the boiler is properly set. There should be a feed pipe, 1 inch in diameter, with globe valve and a check valve, the former being nearest the boiler, so that the check valve can be examined at any time, if necessary. There should be a blow-off pipe, distinct from the feed pipe, with a plug cock, outside of the brick work. This pipe may be tapped into the boiler if attached to one of the heads; but if secured to the shell, it would be better to use a flange. There should be a safety valve, 2 inches in diameter, attached to the top of the steam dome, and a 2 inch steam pipe leading from this connection to the engine, with a stop valve close to the boiler. There should be 3 gage cocks, the bottom one about 3 inches from the top row of tubes, the distances between them being from 3½ to 4 inches. There should be a water gage, attached direct, if possible; but if this is not possible, the connecting pipes should be arranged so as not to be in contact with the flame or hot gases. There should be a steam gage, connected with the upper part of the boiler, and arranged with a siphon and drip cock. The grate bars should have a side play between each other, when cold, of from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch, and an end play of between $\frac{3}{8}$ and $\frac{1}{2}$ of an inch. The heating surface of a boiler is all the surface exposed to the flames and the hot gases, including that part of the shell in the furnace, the ends of the boiler, and the interior surface of the tubes.

### THE ENGINEER'S DUTIES.

"The ordinary daily duties of an engineer are as follows: On coming in the morning, he should first ascertain the amount of water in the boiler; and if that is all right, proceed to raise steam, either cleaning and spreading the fire, if it has been banked, or making it up, if it has been hauled. A fire is kindled in a boiler in essentially the same manner as in a stove, wood and shavings first being ignited, and then covered with coal. In starting the fire, it is a good plan to cover the back of the grate with coal, to prevent the passage of cold air through the tubes. In getting up steam, the safety valve should be raised a little, to permit the escape of air from the boiler. Having got the fire under way, the engineer should wipe off the engine, fill the oil cups, and make any adjustments that may be necessary, such as tightening keys, and screwing up joints or glands of stuffing boxes, and should see that the cylinder cocks are open. When steam is raised, he should open the stop valve, and start the engine; after which, if a part of his duty is to attend to the shafting, he should examine and oil it. Then he should get out the ashes, provide a supply of coal, and screen it if necessary, and proceed to make everything tidy around the engine and boiler. Throughout the day, he should keep a watchful eye on the fire, the water, the steam, and the engine. In managing the fire, care should be taken to have the furnace door open as little as possible; and if steam is formed too rapidly, the fire should be regulated by closing the damper and ash pit doors. In regulating the hight of the water, it is a good plan to keep a steady feed, and maintain the hight constant. If it is found that the water is falling, the engineer should discover whether it is caused by a leak, or by the refusal of the pump to work. He can tell whether the pump is working by the sound of the check valve falling after each stroke, or by feeling the feed pipe or check valve. A pump will not feed when the temperature of the water is very high, unless it is specially adapted for pumping hot water; and if it refuses to work from this cause, the temperature of the water should be reduced. A pump will not deliver water if the proper valves are not opened, if its passages are choked, or if its packing is defective. It would be necessary to examine the pump at once, and endeavor to discover and remedy the difficulty. If the water falls in the boiler on account of a leak, it can sometimes be temporarily repaired with a plug, or the pump can be run faster, so as to keep up the water until stopping time. If this is not possible, the fire should be hauled, and the engine allowed to run as long as there is sufficient steam pressure. In case the engineer finds that the pump is not feeding, and he has a fair supply of water in the boiler, he should at once examine the pump, and endeavor to remedy the trouble without stopping the engine. If he does not succeed, however, before the water falls below the level of the lowest gage cock, he should haul the fire, and let the engine run as long as the steam pressure is sufficient. If he has been called away from the boiler, and on his return finds that the water is below the level of the lower gage cock, he should immediately ascertain the steam pressure, and if it is rising rapidly he should haul the fire at once. If the steam pressure is about the same as usual, he should examine the pump; and if it is not delivering water, he should haul the fire. If the pump is feeding, he may run it faster, watching the steam gage carefully. If the pressure does not fall, he should stop the pump, and haul the fire. In any case the engine should not be stopped until the steam pressure is considerably reduced. The engineer should be very particular, on finding the water low, to examine the steam gage at once; and if the pressure is unusually high, he should haul the fire without delay.

"A boiler foams or primes, either because it has insufficient steam room, or on account of dirt or grease in the boiler or the feed water. The trouble is often experienced with new boilers, and disappears when they become clean. Priming is dangerous, if much water is carried over with the steam, as it is difficult to maintain the water level constant, and the engine is liable to be broken by the water in the cylinders. If the trouble is caused by insufficient steam room, it can sometimes be partially overcome by increasing the steam pressure, and throttling it down to the ordinary working pressure in the cylinder, but the only effectual way is to provide more steam room. If the priming is due to dirt or grease in the boiler, the engineer should blow off frequently, and clean the boiler every few days. In blowing off, it is well to raise the water level in the boiler by putting on a strong feed, and then blow down below the level that is ordinarily maintained. It is very often the case that the water level is higher, when the engine is running, than it is when none of the steam is being used. The engineer should ascertain how much higher the water rises in such a case, so as to have a proper quantity of water when the engine is stopped.

### CLEANING THE BOILER.

"The flues or tubes of a boiler should be cleaned about once a week, with a brush or scraper. In case incrustation has formed in them, they can be cleaned by a jet of steam from a rubber hose. A boiler should be blown down and cleaned, under ordinary circumstances, about once a month. The fire should first be hauled; and then, if possible, it is best to let the boiler stand until the water becomes tolerably cool, say for 12 hours, after which the water may be allowed to run out. Then remove the man and handhole plates, enter the boiler, and clean it with scrapers and brushes in every part that can be reached. It should then be washed out with cold water from a hose, and this washing with a hose is the only means of cleaning those parts of a boiler that cannot be reached by hand. There are many boilers into which a man cannot enter, and of course these can only be washed out. When the fire is hauled, all leaks in the boiler should be repaired. Leaky parts that are exposed to the fire must have patches riveted on; in other places patches secured with bolts can be used, each pitch having a lip around it, and the joint being made with a putty composed of red and white lead. Leaky rivets or seams can sometimes be made tight by caulking. Small leaks around the ends of tubes can often be stopped in the same way, but as a general thing a leaky tube must either be replaced or plugged. To plug a tube, drive a white pine plug tightly into each end, and cut it off even with the tube heads, then pass a bolt through the tube, with cup washers on each end, and screw it up tightly, putting putty under the washers.

### WATER AND STEAM GAGES.

"When a boiler is in use, the gage cocks should frequently be tried to see that they are not choked up, and the glass gage should often be blown out. After ascertaining the proper place for the weight on the lever of the safety valve, a stick should be secured to the lever with wire, so that the ball cannot be moved out any farther. A cord should be secured to the safety valve lever, within easy reach of the engineer, so that the valve can be opened by hand if it sticks, and the safety valve should be tried at least once every day to ascertain whether or not it is in working order.

"A steam gage should be tested at least once a year, and the engineer should frequently try its accuracy by allowing the steam to raise the safety valve, and noting the pressure shown by the gage. The hand of a steam gage sometimes sticks, and the engineer should tap the face of the gage lightly several times a day, to assure himself that it is in working order. He may also shut off the steam from the gage pipe, and open the drip cock, noting whether the hand goes back promptly to 0, and returns to the former reading when steam is again turned on.

"In testing a boiler, warm water should be used, and a better test, when this is possible, is to enter the boiler and make a thorough internal examination.

"In leaving a boiler for the night, the fire may either be hauled or banked. If it is to be banked, it should first be cleaned, and then pushed back and covered with coal, the boiler being left with the furnace door open, and the damper closed.

"The principal derangements of engines are hot bearings, loose keys, and leaky joints. If a bearing heats continually, when properly adjusted and well lubricated, it is too small. Sometimes bearings heat, on account of dirt or grit, because they are set up too tightly, or are out of line. A hot bearing can often be cooled without stopping the engine, by mixing sulphur or blacklead with the oil, or by turning on a stream of water from a hose. If a joint blows out, it can sometimes be wedged, so that the engine can be run until stopping time. An engineer should exercise all his ingenuity to overcome a a difficulty without stopping the engine, except in cases where it would be dangerous to continue to run. If keys or bolts become loose, it will generally be indicated by a thump in the engine. To prevent the freezing of pipes and connections in exposed situations, they should either be thoroughly drained, or the water should be kept circulating in them."

Our readers will scarcely need to be told that a man who could pass such an examination as this understands his business pretty well, and we think that the foregoing remarks will be read with interest and pleasure by all who manage engines and boilers.

### Photography of the Electric Spark.

Mr. Leo Daft, photographer, of Troy, N. Y., has sent us several photo stereos, recently made, of electric discharges between the terminals of the Holtz static electrical machines. In some of the examples, the picture shows the electrical flow divided into ten streams, which have the appearance of ten fine, white, zigzag wires, sharply defined and arranged in the form of an elliptical framework. It is probable that the metals used in the terminals had something to do in giving the remarkable actinic power to the sparks which these photo impressions indicate. Mr. Daft intends to continue his photo-electrical experiments, which are certainly very interesting.

Live fish (pickerel or trout) will keep a cistern free from worms and bugs.

## IMPROVED SURFACE PLANER.

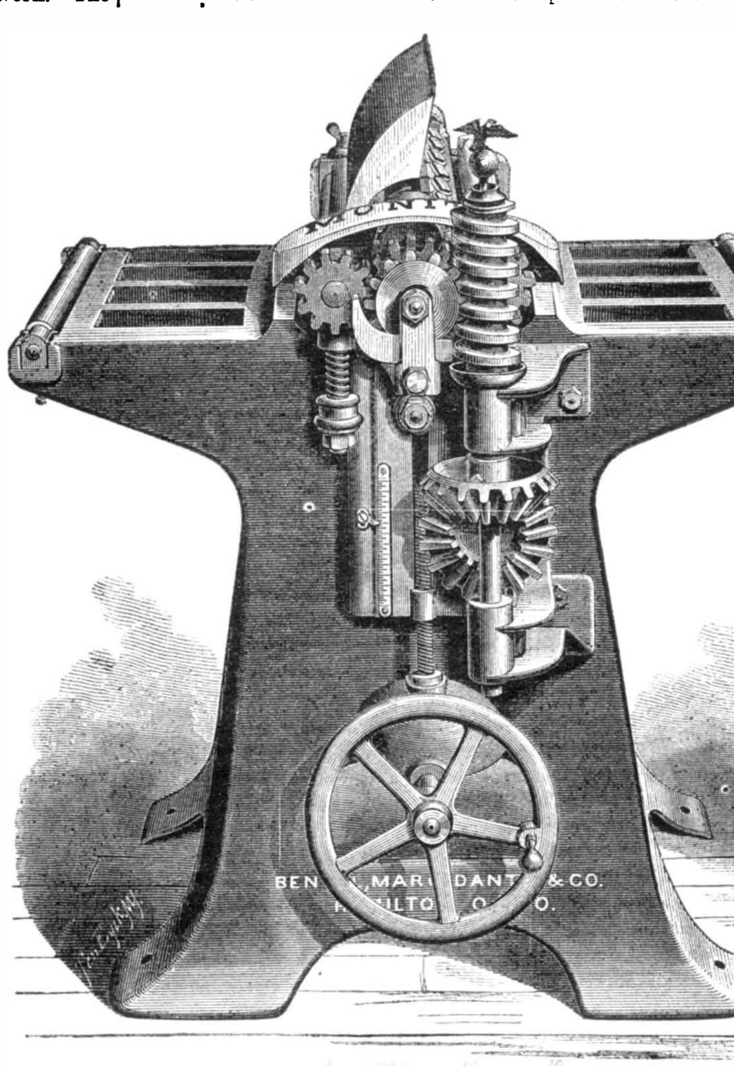
It is claimed this machine will plane or surface hard or soft wood from ⅛ to 6 inches thick and 24 inches wide, and in any quantity from 10,000 to 20,000 feet per day, and will plane smoother than the average large sized planers. It is very strong, and is capable of doing its work in the most thorough manner, being built entirely of iron and steel, heavy and substantial in all its parts, the proportions being such as to insure the greatest durability and strength.

The main frame or stand is a solid and strong casting in one piece, forming a rigid and solid support for the material to be planed, thereby insuring smooth planed work. The cutter cylinder has long steel journals perfectly fitted by scraping into self-oiling bearings lined with the best anti-friction metal, made for the purpose. The journal boxes form the upper part of strong adjustable slides with long gibbed bearings, and the cylinder can be raised or lowered, while in operation or not, by means of a hand wheel placed in a convenient position for the operator. Any wear of the slides can be taken up and nicely adjusted by the gibs. A graduated scale attached to the slides shows at a glance the distance between the table and cutter cylinder. The upper feed rolls are held down by cast steel spiral springs, which are very sensitive to the unevenness of the material, and act quickly and strongly.

The two driven feed rolls are in close proximity to the cutter cylinder; the distance between them is only 7⅝ of an inch, so that short and long stuff can be planed without clipping the ends. An adjustable roller scraper is attached to the back feed roller to keep it free from gummy matter. The feed arrangement is extraordinarily strong, and powerful; the gearing is of a small diameter, and is not at all liable to break. The feed can be instantly started or stopped, and the material returned if desired.

The machine has four idler rolls and two driven feed rolls, all of wrought iron, making in all six rolls which can be adjusted to take up the wear. The cylinder bonnet can be quickly swung back for the purpose of sharpening the knives, and the gearing bonnet can also be raised for oiling the parts.

For further particulars, address Bentel, Margedant & Co., Hamilton, O.



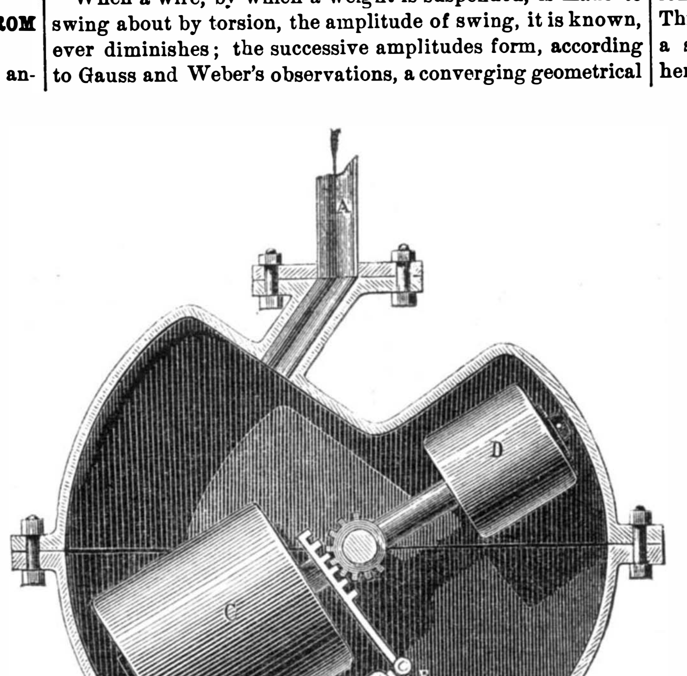

BENTEL & CO.'S SURFACE PLANER.

### Imitating Enamel on Iron.

F. W. Oliver's process consists in producing on iron various designs of different colors, and imitating vitro-enamel in the following manner: A crystalline appearance is given to tinned iron by means of a mixture of water and sulphuric and nitric acids, applied thereon, and afterwards washed off. An impression of a design is made on suitable transfer paper, on which coatings of solid white and silver bronze dust and colors are applied. The plate, prepared as above, is coated with a mixture of turpentine and copal varnish: it is then heated, and the design transferred thereon in the usual way, and the plate is baked and polished.

## APPARATUS FOR REMOVING CONDENSED STEAM FROM PIPES.

We extract from the *Moniteur Industriel Belge*, the annexed engraving of a simple device for removing water produced by the condensation of steam in pipes. The action of the mechanism is entirely automatic. A is the entrance pipe, and B the exit pipe of the water: C is a float balanced by the counter weight, D, and resting on the surface of water which accumulates in the lower part of the vessel. As the float is raised by the addition of water, a pinion on the shaft, on which its rod turns, engaging in a rack, elevates a slide valve. E, and so opens the escape orifice. The water then flows out until the float falls low enough to shut the valve once more. A device of this kind, attached to the steam heating apparatus of a building, would doubtless prevent that disagreeable clacking and hammering due to the water forming in the pipes, and the consequent injury to the latter owing to repeated strains.




APPARATUS FOR REMOVING CONDENSED STEAM.

### Supplying Caged Birds with Green Food.

"Among other advantages," says a correspondent in *Science Gossip*, "derivable from the regular supply of such plants as chickweed, shepherd's purse, and groundsel to caged birds, especially finches, I find that these almost always increase the appetite, leading them to eat more seeds, in cases when they appeared falling off a little from their ordinary food. In early spring the leaves of the plantain are much relished by bullfinches and canaries, and they seem to have a wholesome effect. I should like to hear the opinions of bird fanciers regarding the statement, often repeated in books, that birds derive no benefit, but rather the reverse, from green food given in frosty weather. I have not found any evil result, on a small scale, provided the food is not given too damp."

### Improved Method of Laying Underground Telegraph Lines.

Mr. A. Holtzman, of Amsterdam, Holland, is the author of a method which is alleged, after two years of trial, to give the most satisfactory results. But as there are no patent laws in his native country, he is obliged to seek for compensation and encouragement to extend his invention, to the more liberal institutions of foreign countries. The Holtzman plan consists substantially in providing a cast iron trough, which is filled with a peculiar bituminous insulating compound, which he terms *brai liquide*. The gutter rests in the bottom of a ditch in the earth. The compound is put in while warm and semi-liquid. The telegraph wires, insulated with gutta percha, are then submerged, separately, in the compound in the trough; the latter is then closed by a cover and the ditch filled with earth. The compound soon cools and solidifies, and holds the wires, in perfect insulation, unaffected by moisture, temperature, or decay. A telegraph line of forty miles length near Amsterdam, on the above plan, has proved an entire success. Although laid in bad swampy soil, no breaks have occured. It is alleged that this method of laying wires is economical.

### Metal Deadening.

When a wire, by which a weight is suspended, is made to swing about by torsion, the amplitude of swing, it is known, ever diminishes; the successive amplitudes form, according to Gauss and Weber's observations, a converging geometrical series, and the natural logarithm of the exponent of this series is called the *logarithmic decrement* of the arc of oscillation. We understand by the deadening of the swings, or oscillations, the phenomenon of their ever growing less. The cause of this *deadening* is partly in the resistance which the air opposes to the motion, but partly in the wire itself, the detortion of which also presents resistance to the motion.

This phenomenon of internal deadening (*dämpfung*) of the metal has formed the subject of a recent investigation by M Heinrich Streintz, described by him to the Vienna Academy The resistance which wires oppose to torsion within the limits of elasticity is less the oftener such torsions are produced, or (as the property is denoted) the wire "accommodates" itself to torsions. The same decrease of resistance is observed where the wire has been annealed. Now, a newly drawn wire is denser, it is known, than an annealed one; the mole, cules in the former are nearer each other, and are in a state of reciprocal tension, and so they must present a greater resistance to displacement.

When a newly drawn wire is heated, the reciprocal tension is still further increased: as we find indicated by the fact that the deadening becomes greater, and, at the same time, in consequence of this tension, an actual pushing asunder of the molecules takes place. If the wire is then allowed slowly to cool, the molecules go together again, but no longer in the way corresponding to their natural state of equilibrium—they do not now go into their earlier condition of tension; and we obtain a wire, consequently, in which the internal friction is less. Now, as through frequent turnings, within the limits of elasticity, the wire becomes softer for such turnings, the same occurs in other changes of form.

It is known that steel pens become softer through use, which involves continual slight changes of form within the limits of elasticity. A similar thing occurs in the seats of iron chairs, formed with tips of wrought iron or steel. They lose their hardness through use, and are ultimately bent.

Accommodation plays an important part in musical instruments. It is a well known fact that trumpets, before they can be employed in public performances, must first be blown in or used for a considerable time, in order to develop their full tone action, and make them capable of being easily blown. In fact, the deadening has first to be lessened for the tone vibrations (or the resistance of the metal to these), and this is effected by putting the metal frequently in vibration. A trumpet may also be blown out of tune. If, when quite new, it comes into the hands of an inexperienced performer, who often blows certain false notes, the trumpet is blown out of tune. This is to say, the deadening decreases for these particular tones, so that the trumpet is more easily thrown into these vibrations than into others, which are not so often excited; and it becomes, therefore, very difficult for even a practised performer to avoid these false tones. It would in this case be of no use to diminish the deadening of the trumpet metal by a temporary heating, for this process would affect all the tones similarly; only correct blowing will bring about the desired result.

A similar experience is had with stringed instruments. In these, it is not the strings that require long playing, for their resistance to the vibratory motion is (owing to the smallness of mass to be moved) unimportant; but the resonance ceases. However excellent the construction of the latter, a long continuance of good playing is indispensable for them. This is accounted for by the fact that the good player awakens a stronger tone, and so vibrations of greater amplitude; hence, also, for these, the deadening is diminished. Further, he excites only a certain kind of overtones, which determine the clang color, and for these overtones the deadening is diminished. Through long rest without use, the advantages of this playing-out are again lost, as the accommodation also partly disappears through rest. That pianos do not also grow better after long use is due to the fact that the mechanism of the piano wears out.

The circumstance that, with increasing temperature, the deadening grows so very quickly may perhaps serve somewhat to explain the process of hardening of steel. The soft steel is heated, and thereby the molecules are brought into a state of greater internal friction. If now, the hot steel is quickly cooled, the molecules have not time to part with this condition of greater internal friction; it still remains, in part, in the cold state, and we have then a hard steel. The steel, it is known, is harder the quicker the cooling occurs. The resistance of the molecules of hard steel to magnetization, and the greater magnetic residuum, wit ness also to the greater internal friction of its molecules.

### Dry Rot in Lemon Trees.

A malady has attacked the lemon plant, the origin of which is believed to be the forced cultivation of the fruit. The lemon plant is very hardy, and infinitely easier to cultivate than the orange, and this fact has probably induced a certain amount of carelessness in its treatment, from which growers are now suffering. The tree was originally a native of the dry and hot soil of Persia, whence it has been transferred to various other countries, where, under different circumstances of soil and climate, it has been made largely to increase its yield of fruit. The disease which has now made its appearance is called *la sécheresse*, or dry rot, and seizes the extremities of the plant, sometimes the roots, sometimes the branches, whence it gradually spreads through the wh tree, drying up its sap in its course.—*Nature*

### THE NEW YORK RIVER FRONT IMPROVEMENTS.

We publish herewith a view of a series of the arches which are to form the extensive improvements now being carried out on the North River front of this city. There can be but one opinion as to the efficiency and solidity of the construction, the design for which is the work of Mr. J. Newton, assistant engineer, and possesses several interesting and original features. The work which our illustrations (selected from *Engineering*) depict is now in progress on the west side of the Battery, where the river bottom is a hard, quartzose rock. Before the dredging was done, the rock was covered with a deposit of river sediment, in some places upwards of 12 feet in thickness, and varying in consistence from a thin silt to a tough, plastic, black mud. This was cleared away by the dredging machinery already described in our pages. The surface of the rock is jagged and very irregular, and the depth of water over the site of the pier is from 25 to 45 feet. The dimensions of the pier are 500 feet in length; 80 feet in width; hight of roadway above mean high water, 5 feet, and from mean low water, 9·58 feet. The mean rise and fall of the tide in New York harbor, as determined by a long series of observations, is 4·58 feet. The pier is composed of twenty full center arches of 20 feet span; the faces of these arches, exposed on the sides of the pier, down to 3 feet below low water, are of cut granite. The arches are supported by monolithic blocks of concrete, made to exact dimension by ramming the materials in strong wooden molds. These blocks are made with suitable grooves for chair slings: they are transported from the place where they were made, and placed in position in the pier, by the floating derrick previously described. These concrete monoliths are in two series: First, the base; these are 4 feet by 8 feet 6 inches by 13 feet; next, the piers which are placed on these. For the first three or four arches these are 14 feet in hight, 5 feet 6 inches thick, and 10 feet in length, eight being required to complete a pier.

When these tall monoliths are in position the work is so near the water line that it is an easy matter to place the centers which rest on them, and then set the granite voussoirs. The centers being set, the facing of granite is laid in cement; between the granite springing stones of the arches, concrete blocks are laid. These are made in molds to the curve of the soffit, and are plainly shown in the engravings; these blocks bring the work above low water. The joints in the granite being watertight, and the sheathing of the centers nearly so, the space thus inclosed between the stone sides of the pier, if not altogether watertight, is protected from the wash of the tidal current; this space is then filled with concrete, well rammed in, and the work by this means is rendered as solid as that formed in the molds.

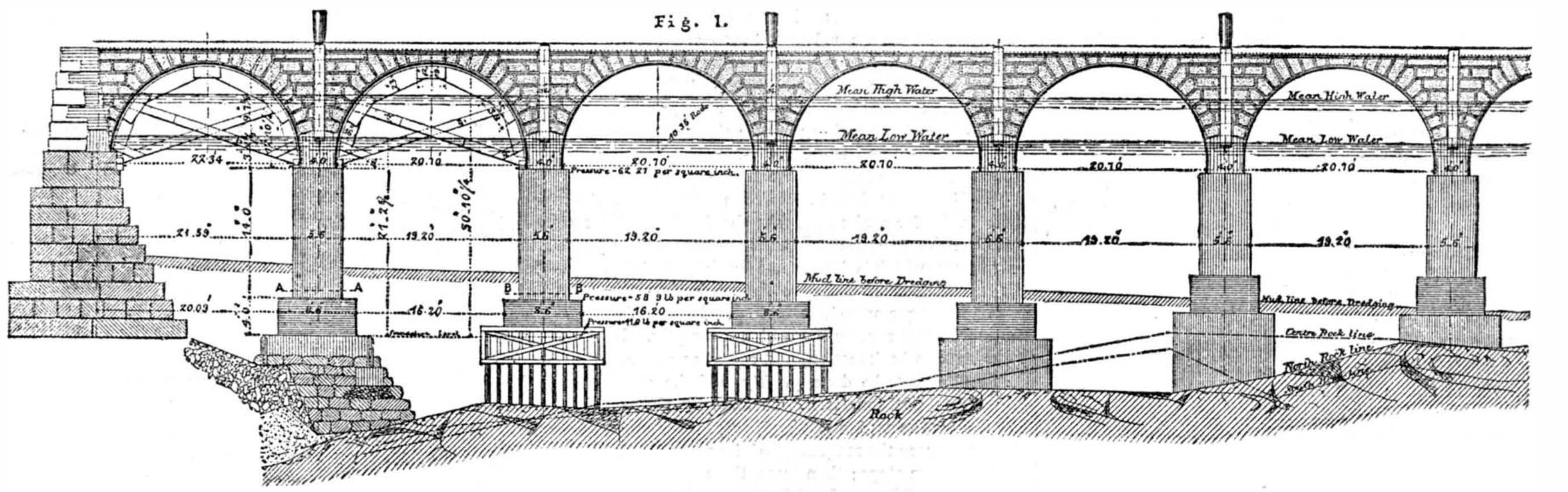
If desired, however, there is no difficulty in making this space perfectly watertight by caulking the sheathing of the centers, so that the concrete could be rammed in at all stages of the tide.

The foundations at formation level are 84 feet in hight by 12 feet in width, and vary in distance from datum according to the irregularity of the rock bottom. In all, except in the first pier from the river wall, they have been constructed by sinking a box the full size of the foundation. This box was weighted and sunk, then, by means of vertical timbers, chains, and screws, adjusted to the required hight. This box (see Fig. 2) was roughly fitted on the irregular rock bottom by means of planks sliding in appropriate guides, and it was lined with a heavy canvas sack to protect the concrete from wash; at the formation level, horizontal guides were secured. The box was then filled with concrete, lowered in buckets which opened at the bottom. When the concrete reached the guides just mentioned, it was leveled off by a heavy iron I beam placed on one of its sides, and pushed along the guides from one end to the other; by this means, if the guides are properly placed, the entire foundation is perfectly level. The voussoirs were cut before the foundations were begun, and the top of the pier came at the exact hight required above datum.

The first foundation, already alluded to, was put in by constructing a box or inclosure under water. A number of wrought iron standards (Fig. 2) were placed in line in the centers of the same number of molds on a level platform; these molds were then rammed full of concrete. The blocks, thus made, with the standards firmly imbedded in them, were then placed in line on the site of foundation. Planks were then placed between the standards, the top one, which formed the guide, being carefully placed at the required distance below datum. The filling then proceeded as in the others. Several of the foundations for this work were laid in from 25 feet to 30 feet of water, where the tide at certain stages runs with velocity sufficient to make it very difficult for divers to hold on. The water always holds in suspension so much mud as almost to exclude the light, even on a very bright day, at the depth this work was done; so that the whole of it was performed in what was practically total darkness. On one or two occasions, when the sun was high and the atmosphere perfectly clear, a plumb bob, some 8 inches in diameter and painted white, was barely visible.

The use of concrete in monolithic masses, as above described, enables work of this character to be erected in very much less time and cost than would be required with coffer-dams and ordinary masonry. The preparation of the bed for the monolith, as is evident from the above description, is in fact the only portion of the work which is at all difficult. Under favorable circumstances, with respect to weather, after the foundation is ready, the arch piers, 80 feet in length, were set in 30 feet of water, ready for the superstructure, in 2½ days. It required scarcely ten minutes for the derrick to lift and place a monolith of some 30 cubic yards, but setting it exactly in place occupied longer. It may be observed that, within the capacity of the derrick, the size of the monolith has but little to do with the time required for placing it.

The concrete of which the monoliths are made is composed of the best Portland cement. When the wooden molds are removed, which may be safely done in twenty-four hours after they are filled, they present a smooth and hard surface, and more accurate than it is possible, in practice, to cut the beds and builds of natural stone suitable for hydraulic work. A cube one foot square formed of this concrete, seven days old, did not yield until the pressure brought upon it by a hydraulic press was 80 tuns, and then the concrete in the middle of the block was found to be somewhat damp.




NEW YORK RIVER FRONT IMPROVEMENTS—THE ARCHES.

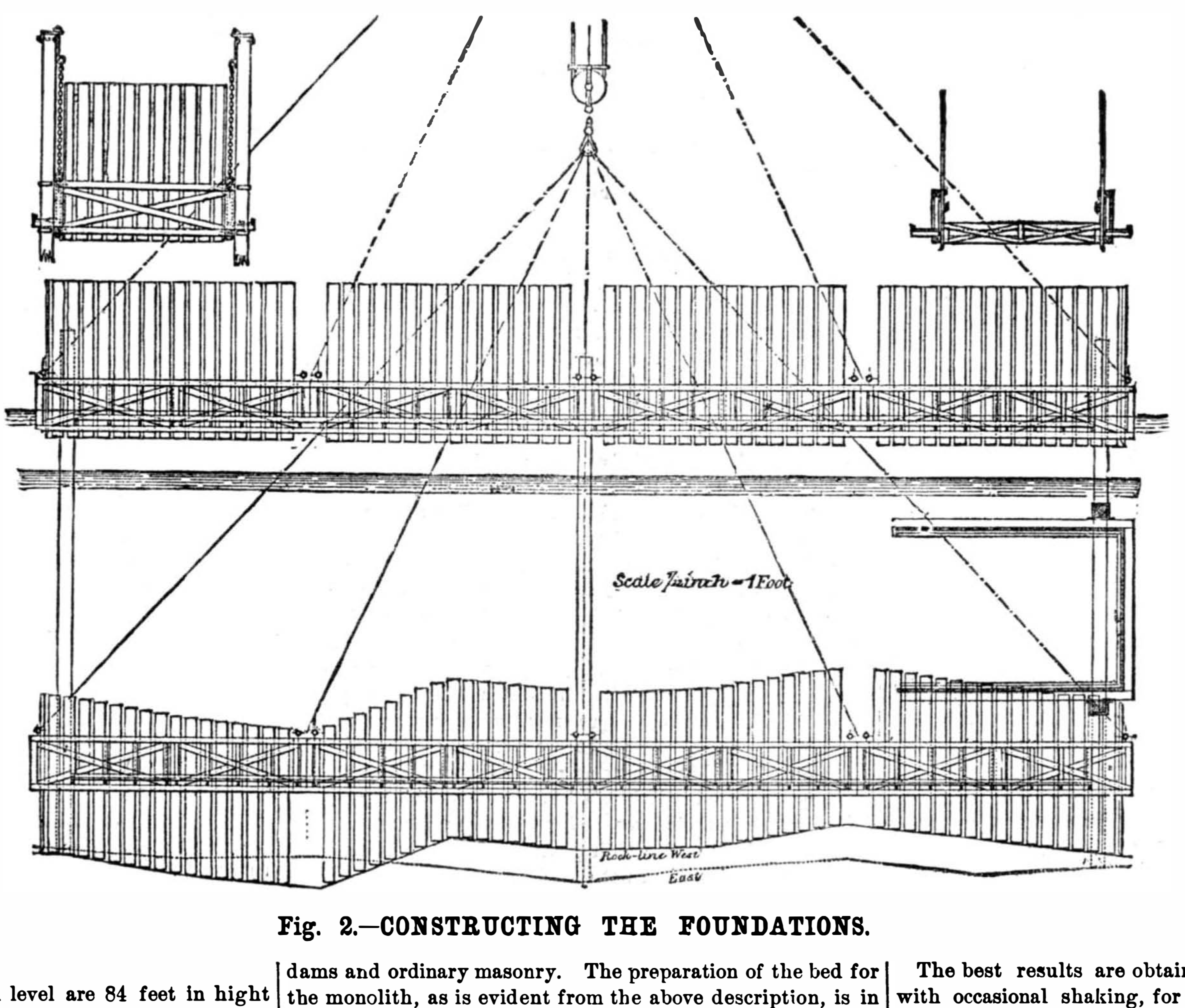



Fig. 2.—CONSTRUCTING THE FOUNDATIONS.

#### A New Dry Photo Process.

I propose, says M. Carey Lea, to make public a process which, I think I may venture to say, possesses a very high interest; in fact, no photographic work in which I have ever been engaged has appeared to me comparable with it.

The method gives, by simply pouring an emulsion over glass, not only a high but, I may say, an intense sensitiveness. Moreover, by virtue of the silver iodide which they contain, these plates need no backing. They develope with great rapidity and need no intensifying, so that the whole operation, from first to last, is reduced to the most absolute simplicity. The advantages in the way of facility of management and the high degree of sensitiveness are such that I should not be surprised to see these dry plates largely supersede the wet process; in fact a beginner will more easily work this dry method than the wet when the emulsion is to be obtained commercially, which it soon will be, as I do not propose to place any restriction upon its manufacture by any one who may choose to prepare it.

COLLODION.

To each ounce of solvent, consisting of alcohol and ether in equal parts, take ordinary crystallized cadmium bromide, 6½ grains; ammonium bromide, 2 grains; ammonium iodide, 1½ grains; cupric chloride, 1½ grains. About eight grains of intense pyroxylin to the ounce, with two drops of *aqua regia*. Sensitize with silver nitrate, using from twenty to twenty-five grains to the ounce. The first-mentioned quantity is excellent for ordinary work; when a very high degree of sensitiveness is desired, the larger quantity may be used.

For the reason that the emulsion is to be dried, some economy may be practised by making a more concentrated emulsion, as follows: ordinary cadmium bromide, 9 grains; ammonium bromide, 2½ grains; ammonium iodide, 2 grains; cupric chloride, 2 grains.

Use about ten grains of intense pyroxylin. The silver nitrate must be increased in the same proportion as the salts, so that twenty-five to thirty grains to each ounce of concentrated collodion will be proper. Three ounces of this collodion will, after treatment, give four ounces of finished emulsion.

The best results are obtained by keeping this emulsion, with occasional shaking, for from twenty-four to thirty-six hours. It is then to be poured out into a flat dish and allowed to set. Particular care is needed in this part of the operation; the preservative must be applied just at the right time—neither too soon nor too long after the pouring out. The emulsion must be occasionally examined and moved about in the dish to promote equal drying. As soon as a skin forms on it, holes must be made through it, and the collodion underneath be made to flow out and over it. If this be ne lected, the surface will become hard and leathery before the emulsion is set underneath. The object is to keep the whole mass as nearly uniform as possible, and, as soon as it is gelatinous, to apply the next treatment. The proper condition can be judged of by touching with the tip of the finger; as soon as nothing comes off upon the finger the emulsion is ready for the preservative.

Any preservative may be used. As to the effects of different preservatives, I will speak presently. If the lesser quantity of silver be used, the preservative may generally be applied in its ordinary condition: but if the larger, then it will be well to add to the preservative one tenth of its bulk of ordinary acetic acid (No. 8 or Beaufoy's).

The preservative is to be poured into the dish, and then immediately the film is to be plowed up with a porcelain, horn, or glass spatula (not a metallic one), and reduced into small pieces; and the whole, preservative and film, is to be transferred into a convenient glass jar—not too small. The flakes of emulsion are to be occasionally stirred and left in contact with the preservative for fifteen minutes from the time when it was first poured over the mass. (In operating upon a large scale, commercially, it will probably be found better to leave a little longer in contact with the preservative, and *always* to acidify. For working with a few ounces, the foregoing is the right way.) The preservative is then poured off and water poured on, the flakes well stirred up, and the water changed several times. The flakes are then left to stand under clean water for about an hour; then several more changes; then stand another hour; then several more changes. By this time everything soluble is extracted from the flakes; indeed, after the first hour no silver can be found in the wash water. We have now only to dry. This may be done at ordinary temperatures, or the vessel may be set over a stove, provided its bottom be not allowed to become hotter than the hand can bear. The drying must be thorough; the flakes shrink wonderfully, and curl up like tea leaves. They are not white, but of a medium grey color, notwithstanding which they make a pure cream-colored emulsion.

To re-emulsify, the dried flakes are put into a bottle and are covered with one third ether, one third alcohol, and one third plain collodion. They must be well shaken at intervals. The new emulsion is not in good order till after, at least, forty eight hours, and is better at the end of a week. When it has once been thoroughly mixed with the liquids, and has been shaken at intervals for some days, it seems to lose all disposition to settle, and makes a most excellent emulsion. There is no reason why it should not keep indefinitely. Or it may be preserved in the dry state and emulsified at any time, using from twenty to twenty-five grains of the dry emulsion to each ounce of solvents. Three and a quarter ounces of collodion, formula No. 2, will yield about one hundred grains of dry flakes.

PRESERVATIVES.

The character of the image will depend very much upon the preservative used.

*Albumen Preservative.*—This gives an exceedingly sensitive and delicate plate, with much less density than most of the other treatments. For this reason I prefer it to the rest, as tending to give detail in both lights and shadows, with great varieties of half tone. My formula is: Water, 12 ounces; thick gum and sugar solution, 1 ounce; prepared albumen, 1 ounce; sixty-grain alcoholic solution gallic acid, 1 ounce; sixty-grain tannin solution (in water), ½ ounce. *To be added in the order named.* If rather more density be required, double the tannin. I use it as above. This preservative works very cleanly and satisfactorily: I use it exclusively.

*Gallic Acid and Coffee.*—A mixture of gallic acid and coffee, using about two ounces of sixty-grain solution to twelve ounces of infusion of roasted coffee, gives very good results; it should, however, be acidified with acetic acid, using about half an ounce of Beaufoy's (No. 8) to the above quantity. It gives a blacker image than No. 1, and more intensity. It will probably be useful when the pyroxylin is deficient in intensity. It gives excellent transparencies by exposure under a negative, but too intense for lantern work, for which No. 1 is much better, as well as for negatives.

DEVELOPMENT.

For a 6½x8½ plate pour four ounces of water into a 7x9 dish, add half a drachm of sixty-grain solution of pyrogallic acid in alcohol, and put in the plate. Mix in a bottle equal quantities of a fifteen-grain solution of potassium bromide and an eighty-grain ammonium carbonate. Of this mixture pour one fluid drachm into the dish. When the detail appears add another drachm, and later, if necessary, a third; or add half a drachm of the ammonium carbonate solution without bromide. The two first additions must have bromide; the third is best without for a negative—best with for a transparency. Fix in hyposulphite solution of the same strength as used for wet plates.

I should have mentioned that I always keep the collodion for a month—for several if possible. The plates should be edged with a solution of india rubber in benzole.

The principle of applying a preservative to a mass of material at once and then washing it out again could be patented. This is common to the new processes. The plan of applying a silver bath to a mass of partially dried collodion is also new and patentable. Convinced as I am of the very great usefulness of these processes, I believe that such patents would be very valuable. I prefer, however, to give them freely to anyone caring to use them, asking only, in return, to have them ascribed to their author and not appropriated by hose who may make trivial modifications on them."

A glue which will resist the action of water is made by boiling 1 pound of glue in 2 quarts of skimmed milk.

# Correspondence.

## Adjusting Locomotive Valves.

*To the Editor of the Scientific American:*

I will give you a method for setting slide valves of locomotives, which is practical and easy. Make a steel tram, about 5½ inches long, with two points at right angles with the straight bar, one point to be 2¾ inches in length and the other 1½ inches. Both points are to be sharp. Take a centerpunch, and make a center mark on top of the steam chest packing box; then take a strip of tin and put it in the steam port. Draw the valve slowly back until you can just move the tin between the edge of the valve and the edge of the steam port (which is now closed, except as to thickness of the strip of tin). Take the tram, place the short point in the center mark on the packing box; then make a scratch on the valve stem, and go through with the same process with the opposite steam port. Now you have marks on the valve stem just where the valve begins to open. The valve stem must next be got into radius (as we term it), which is to show the proper length for the valve stem. It is done thus: Cover the steam ports equally with the valve, put the center of rock shaft and the rocker pin at a right angle with the bore of the cylinder; and when the valve stem is adjusted to this, it is of the proper length and should not be altered.

To adjust the valves in forward motion, hook the reverse lever in the forward notch, take the dead points for centers, and alter the eccentric rods until the spaces are equal on the valve stem, which is determined by the use of the tram. Take the forward centers and give $\frac{1}{16}$ inch lead to the valve, for either passenger or freight engines. By adopting this plan the engine will reverse her action promptly. Hook the reverse lever in back motion, and repeat as above.

If the job is to be done quickly, and the eccentrics are in the proper position, it can be done by the travel, in this way: Move the engine slowly forward with steam, take the tram, and trace the movement of the valve on the valve stem until the stem stops; then trace the return movement until that stops. Take a pair of dividers and measure each distance from the valve mark on the stem, to the extreme of the travel line (or where the valve stopped). Alter eccentric rods until the spaces are equal. By these means, you do not require to take the steam chest covers off.

East Saginaw, Mich. THOMAS M. HAYES.

## An Invention Wanted.

*To the Editor of the Scientific American:*

I would invite the attention of inventive minds to the subject of respirators for miners, to protect them from the foul gases which trouble so many men, especially in coal mines. An invention that would protect them when laboring to subdue a fire in a coal mine would certainly prove a very valuable one, and be the means of saving many lives, and millions of property.

Hazleton, Pa. C. F. H.

## The New British Patent Bill.

The Lord Chancellor's new Patent Bill, briefly described by us a few weeks ago, meets with vigorous opposition in some of the English papers. Among the ablest remarks upon the subject are those given in *Engineering*. In a recent number the editor says: "Contrary to our anticipations, the Patent Bill has passed through committee with all its powers of mischief intact. In spite of the almost unanimous opposition which it has met with out of doors, the only modifications which have been introduced merely relate to matters of detail. Instead of four examiners we are to have six, the referees are to be appointed by the Commissioners of Patents alone, without the concurrence of the Board of Trade, as was at first suggested, and their services are only to be called in when necessary, and not as a matter of course.

The radical vice of the measure still remains; and although it is pretended that the examination clauses have been framed to meet a universally expressed wish, we are quite sure that nothing of this kind was ever asked for by the general body of inventors. It is perfectly notorious that the idea has been fostered chiefly by a small knot of shameless placehunters, who will not be satisfied with any system which leaves them unprovided for. By dint of appearing now as members of this society, now of that, and by reading papers here and delivering lectures there, a delusive impression has been created that inventors are really desirous of seeing the system of preliminary examination introduced. We do not for obvious reasons mention these persons, but a careful examination of the various propositions for patent law reform put forward during the last ten or fifteen years will reveal their names. There are of course some advocates of preliminary examination who are perfectly disinterested, having only joined in the cry on purely theoretical grounds. These goodnatured individuals have in all probability never made a search in their lives, and are totally unaware of the enormous difficulty of deciding whether an invention has really been anticipated or not.

The Lord Chancellor has been at great pains to explain that he does not propose any examination as to "utility;" but what is the meaning of "frivolous" if it does not include projects which are "useless," in other words, void of "utility"? It is the same thing in another form—an old friend with a new face. Lord Cardwell sneers at an invention (of American origin) which consisted in placing a piece of india rubber at the end of a pencil, so that the person using it could rub out with one end what he had written with the other. This may be "frivolous" or not, but it was a sufficiently valuable patent to be worth a very costly lawsuit, which is well known as the "india rubber tip case." Those who have followed the question need scarcely be reminded of the case of Smith *v* Buller, which occupied the Court of Chancery for many days, the costs amounting to about $20,000, and in which the matter in dispute was a very minute improvement in swivels. So small was the improvement that ordinary observers would not have detected the difference between the old swivel and the new. Large fortunes have been made out of "solid headed" pins, and buttons have raised many to affluence. Only the other day a large technical college was founded and endowed by a philanthropic manufacturer who stated that a very large portion of his princely fortune had been amassed by making steel pens and split rings. The question of frivolity is in some respects more delicate than that of novelty; and when the examiners have once tasted blood, we shall probably find them rejecting as "frivolous" contrivances which, though seemingly insignificant, may have cost a man years to invent, and which the whole of a trade has been in vain endeavoring to produce.

For years past we have done all in our power to warn inventors as to the almost certain results of an arbitrary system of preliminary examination like that embodied in the present bill. We showed some time back, in a series of articles on "Anticipated Inventions," how some of the greatest inventions of the day would most certainly have been refused by any moderately well informed examiner. If inventors permit this bill to pass in its integrity, they will find themselves in the position of the man who made a monster, and was in due time destroyed by it. For a few years we shall have chaos, soon to be followed by the entire abolition of those laws which have done so much to foster inventive talent, and have borne no inconsiderable share in bringing the manufacturing industry of this country to the high position which it now occupies."

## The Heliograph.

Through the general introduction of electric telegraphy, and the all but universal adoption of the Morse alphabet, it occurred to Mr. Mance to produce an instrument which is very compact, very portable, easily set up, and easily worked. Although he was first in favor of larger instruments (which are still preferable for permanent stations), he is now convinced that an instrument of the size here described is all that is requisite. The chief objection to the adoption of the sun telegraph is that we cannot command the sun to shine in the same manner that we can control a galvanic battery; and it must be understood that Mr. Mance advocates his system only as an auxiliary to other systems of field telegraphy.

The instrument consists of a light, but firm, tripod stand, similar to those used for prismatic compasses. On the top a plate is moved by a tangent screw which admits of quick and slow motion, and the plate carries on a pin a semicircular ring, which again carries on pivots the round mirror, the silvering of which is removed in the center for the space of a circle about 3-16 inch diameter. To the plate is also attached a simple key, which is pressed down and springs back like an ordinary Morse key. This key is connected with the top rim of the mirror by a steel rod, which can be lengthened and shortened—as occasion may require—by turning the handle and screwing the rod through the small brass ball which secures it to the edge of the mirror.

By means of the last named adjustment and the tangent screw, the glass can be altered, as the ever-changing position of the sun may require.

From 12 to 15 yards in front of the instrument is placed a sighting rod. This rod is to mark a spot exactly in a line with the center of the heliograph and the distant station. A metal stud marks the spot, and a wooden cross piece marks where the flash rests when not directed on the opposite station.

The instrument can be set up ready for working in a few minutes. When the exact position of the distant station is not known, a flash of sunlight must be thrown in the direction of the most likely points, and this must be continued till it is answered by a flash, which indicates that a distant signaling party is on the lookout. Then, after releasing the tangent screw, the glass must be turned to a convenient angle, and the sighting stick must be directed in a line with the distant station by looking through the small aperture in the center of the mirror. When this is effected, the stud must be raised or lowered till it is in the line of vision on a level with the center of the glass and the distant flash, and the short cross piece must be placed at right angles to the upright, about a foot below the stud. After being thus adjusted, the instrument must not be moved.

The spot will be observed gradually to rise or fall, according to the direction in which the sun is apparently moving. The handle of the key, or the tangent screw, or both, as the case may be, must be turned slightly after every two or three words, to ensure, as far as possible, that the center of the spot shall be on the stud when the key is pressed down.

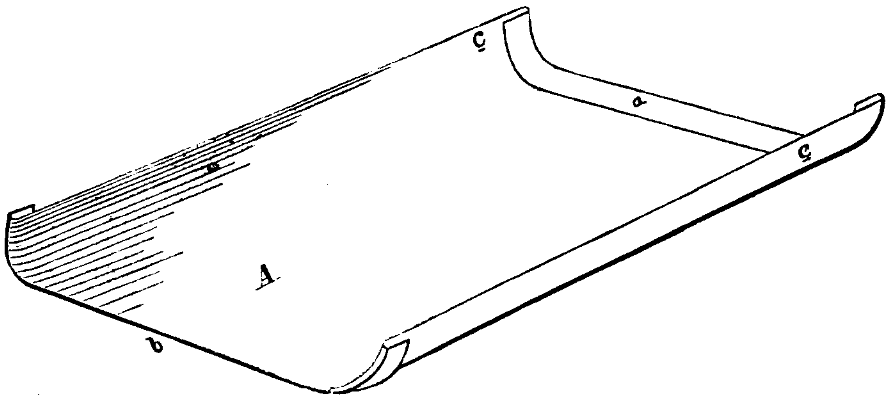
When the sun is rather low in the heavens, and behind the signaler, it becomes more difficult to direct the flash with accuracy. In consequence of the obtuseness of the angle, the spot loses its circular form, and becomes rather dim when reflected on the stick. If it is required to work frequently with the sun in this position, the employment of a second glass on a light tripod stand is recommended.

But it would be useless here to enter more into the minutiæ of working the instrument: suffice it to say that, in experienced hands, twelve words and more per minute have been obtained, while others state that men—after a fortnight's practice—could attain only from four to five words per minute. As to the distance, 10 and 20 miles—and in very close weather 40 miles—have been obtained.—*Telegraphic Journal.*

### SCOTT'S PATENT SHEET IRON ROOFING.

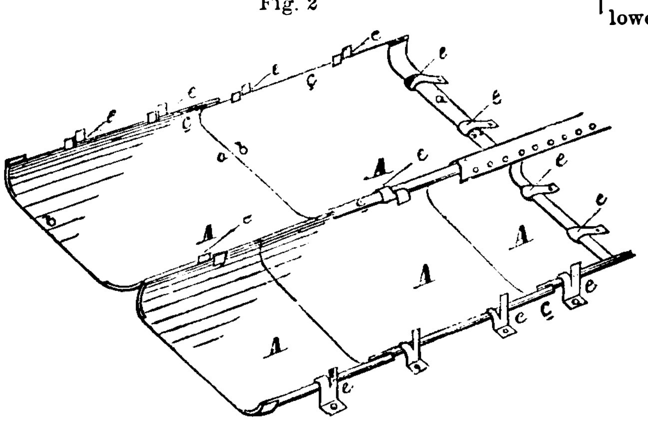
So many conflagrations have been caused by sparks from chimneys, or from adjacent burning buildings, falling upon roofs, that the safety offered by a covering entirely of iron, and consequently fireproof, is by no means unimportant. The device herewith illustrated, while securing that advantage, presents a variety of others which, in brief, render it a most efficient protection. It is portable, and is supplied in plates of eight feet in length by two in width, which are trimmed to fit with accuracy, so as not to get out of line, no matter how great the distance over which they may be run. These plates are provided with side and end connections complete, so that the work of laying them is greatly facilitated. The joints are strong and windproof, and rust or wear by weather is prevented by coatings of pure iron oxide and linseed oil. Finally, it will be noted that nails through the roofing plates are absent, and a frequent cause of leakage thus avoided, and that the peculiar arrangement of plates and seams provides fully for the contraction and expansion of the metal.

A sheet, as supplied by the makers, is represented in Fig. 1. The ends, *a* and *b*, are folded over in opposite directions, the former being uppermost when the plate is in position. The mode of locking together those ends is shown in Fig. 5, from which it will be seen that a continuous water shed is made. The device for attaching the plates to the roof is represented at *e*, in Fig. 5,and also in Fig. 2. This, at the sides of the plates, is an upright iron strip, split part way at the top to hook over the side of the sheet. To admit of this engagement the sheet is bent upward, as represented in Fig. 1, and the curve is such that the edges of adjacent sheets may be in contact and parallel for a short distance. The end cleat is also nailed to the sheathing. To finish the work, the sides are



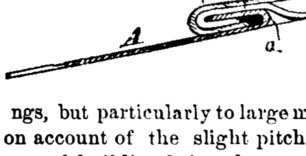
SCOTT'S SHEET IRON ROOFING.—Fig. 1.

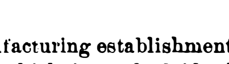
Fig. 2



rought together square at the eaves, and the comb formed, the same as in a standing seamed tin roof, by turning up a two inch standing seam with roofing tongs. In the engraving, Fig. 2, the cap, *f*, which surmounts the adjacent sheet edges, is drawn to the top, so that the fastenings, *e*, can be seen where the sides of the plates meet. The method of securing the parts by countersinking is represented in vertical section in Fig. 3, and Fig. 4 is a horizontal section of the same.

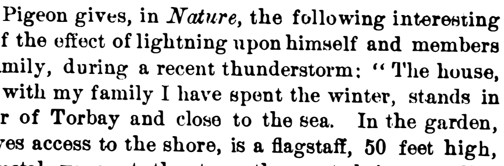
Fig. 3. Fig 4





After the roofing plates are all in position, the joints across the ends are closed and compacted by beating the folds together The invention is applicable to any class of build-

Fig. 5



ngs, but particularly to large manufacturing establishments, on account of the slight pitch at which it can be laid, the cost of building being thus materially decreased.

Further particulars may be obtained by addressing the manufacturers, Messrs. Scott & Co., 75 East Front street, Cincinnati, Ohio.

### Struck by Lightning.

Mr. D. Pigeon gives, in *Nature*, the following interesting account of the effect of lightning upon himself and members of his family, during a recent thunderstorm: "The house, in which with my family I have spent the winter, stands in the center of Torbay and close to the sea. In the garden, which gives access to the shore, is a flagstaff, 50 feet high, with a metal vane at the top, the mast being steadied at about 25 feet from the ground in the usual way with iron wire guys. About a foot above ground, each wire rope terminates in a ½ inch chain, which is anchored a few feet in the soil.

February 25th, 1875, was a rainy day during the forenoon, with heavy wind from the southeast; but in the afternoon the sky cleared. There had been no sign of thunder all day. At 5 P.M. my wife, my son, and myself were standing under the flagstaff and within 10 feet of a mooring chain, watching the bay, when the vane was suddenly struck by lightning, which broke the mast short off in two places, tearing and splitting the wood between the vane and the iron guy ropes. Through these the discharge then passed to the ground, but three out of four mooring chains were broken.

The broken mast and vane fell to the ground close to us. Heavy hail followed the flash, the wind falling instantly to a dead calm; a second but distant flash was seen twenty minutes later, after which there was no more lightning. The discharge startled the whole village of Paignton; the coast guard officer compares the explosion to that of a 300-pound gun; and at Torquay, 3½ miles distant, a scientific friend speaks of both flash and crash as most terrific.

I must now attempt to describe the effects on ourselves and the impressions on our senses. Of the three, my wife only was "struck," and fell to the ground, my son and myself remaining erect, and all three retaining consciousness. For more than half an hour my wife lost the use of her lower limbs and left hands, both of which became rigid.

From the feet to the knees she was splashed with rose-colored tree-like marks, branching upwards, while a large tree-like mark, with six principal branches diverging from a common center, thirteen inches in its largest diameter, and bright rose red, covered the body. None of us are certain of having seen the flash, and my wife is sure she saw nothing. As to the noise, my wife heard a "bellowing" sound and a "squish," recalling fireworks; my son also heard a "bellow," while I seemed conscious of a sharp explosion. My wife describes her feeling as that of "dying away gently into darkness," and being roused by a tremendous blow on the body, where the chief mark was afterwards found. My son and myself were conscious of a sudden and terrific general disturbance, and he affirms that he received a severe and distinctly electrical shock in both legs. My left arm, shoulder, and throat especially suffered violent disturbance, but I did not think it was electrical. As I turned to help my wife, who was on the ground, I shouted, as I thought, that I was unhurt, and hoped they were also, but it seems I only uttered inarticulate sounds, and my son, in his first attempt to answer, did the same. This, however, was only momentary; in an instant we both spoke plainly.

Neither of us referred the occurrence immediately to its true cause, but the idea of being fired at was present to all our minds, my wife indeed remained of opinion that she was shot through the body until she heard me speak of lightning. An infinitesimal lapse of time enabled my son and myself to recognize lightning; but I cannot say whether I did so before or after my first glimpse of the wreck on the ground. Neither of us heard or saw the mast fall, though it descended fifty feet, and fell on hard gravel close to us. My son and myself both experienced a momentary feeling of intense anger against some "person or persons unknown," further showing that we preliminary referred the shock to some conscious agency. I ought perhaps to add, that neither of us felt any sensation of fear at the time; but we were all nervous for several days after.

I have endeavoured to keep to fact throughout, but I venture to add a remark made by my wife as we raised her from the ground: "I feel quite sure that death from lightning must be absolutely painless;" and I offer it as an unconscious corroboration of views on this subject which our experience seems to strengthen.

### The Use of the Hand as an Optical Instrument.

Dr. F. Thomas, of Uhrdorf,observes that, although artists are well aware of the advantages of monocular vision and the use of the hand as an impromptu stereoscope for the inspection of pictures, the public generally knows nothing of them. Any one who carefully watched the crowds that daily thronged the avenues of the late Vienna Exhibition might have seen how very, very few persons amongst them ever availed themselves of this ready resource.

And yet, how different is the appearance of a really good picture thus seen and the same viewed in the ordinary way by binocular vision! Regarding it with a single eye through the hollow of the hand as through a stereoscope, we get a relief, a substance, which otherwise is more or less wanting; in a word, we get the third dimension, depth, which is indispensable to realistic effect. Nor is the method applicable to the contents of picture galleries alone; every photograph, every engraving and print, of correct design, may be beneficially treated in the same way. As with the stereoscope, so with its impromptu substitute, we get increased focal length, and with it the several artistic advantages thence accruing. On the other hand, defects in drawing are ruthlessly exposed by the same means. Trifling errors in perspective, which might have passed unnoticed under ordinary circumstances, stand revealed in their full deformity.

With juster perceptions of the magnitude and relative dimensions of objects, monocular vision, combined with the stereoscopic use of the hand, gives us, also,a correcter appreciation of the effects of reflected light. And this applies not only to the confused appearance occasioned by the interposition of highly reflective media between the object and the observer, but also to artificial reproductions of the same effect.

A point ignored in every treatise to which Dr. Thomas has had access is the effect of the hand, when thus used, in modifying or correcting our perceptions of color. The rays of the setting sun are flooding the landscape with golden light. Prominent in the distance stands forth a church tower lighted up with a rich orange glow. By regarding it attentively through the hollow of the hand, and opening and closing the latter suitably, the tower can be made to assume any intermediate tint between the white it really is and the orange it has assumed in the rays of the western sun. The woods, too, dark, somber, and night-like to the unaided vision in like manner can be made to resume the hues they wore in the broad light of noonday. A bright patch on the far distance shows a soft subdued white, and we notice then for the first time that to the unassisted eye it presents a bright golden color.

Indeed, our conceptions of color are mainly dependent on comparison—contrast. But these are quite inadequate to enable us, under all circumstances, to detect and discriminate between minor differences of shade by ordinary unaided binocular vision. For that purpose, we must have recourse to the hollow of the hand, looking through it at the object with one eye, and comparing the effect observed with that produced on the other and unshaded eye. Both eyes may be open.

In such cases, the chief point is not monocular vision, but the shading of the eye by the hand thus applied. As with a Nicol's prism, we thus restore the equilibrium of the blue light diffused through the atmospheric regions—which in the landscape above referred to was overpowered by its complementary color, the orange emanating from the sinking sun —and are so enabled to see objects under the hues they would present when viewed by the white light of a noontide sun.

### Phosphureted Steel.

A year or two ago, it was generally admitted that a pure ore or pig iron, and especially one containing less than 0·03 to 0·05 of phosphorus, was absolutely essential to the production of a good Bessemer steel ; the consequence has been that many of our richest iron ores, most cheaply mined and supplied, have been ruled out as unfit for Bessemer work. Such are most, if not all, of the limonite and fossiliferous ores of Pennsylvania, Virginia, Tennessee, Georgia, and Alabama, in which the percentage of phosphoric acid runs usually from 0·05 to 0·15 per cent, corresponding to about double these amounts in the pig iron. This small percentage of phosphorus has been a perfect bugbear to iron manufacturers, and so important was it considered that one of our large steel works imported 10,000 tuns of ore from Algiers at a cost of about $16 per tun, because it was, at that time, impossible to procure ores here sufficiently free from phosphorus for use in the manufacture of steel rails. Innumerable efforts have been made to get rid of the phosphorus in the several processes through which the iron passes in its manufacture, but these efforts have been but partially successful, and then only in the puddling process, and, consequently, of no use in the manufacture of Bessemer steel.

Investigations which have been made during the past two or three years have developed the fact that, by a kind of homeopathic treatment (*similia similibus curantur*), certain substances which themselves give hardness and brittleness to steel may be in part substituted for other ingredients having a similar tendency, to the great improvement of the resulting metal. It has thus been found that, by securing proper relative proportions of carbon, phosphorus, silicon, and manganese, a steel of great softness and strength can be obtained, while the same percentage of phosphorus in ordinary steel would have indicated very different properties.

There is no longer much doubt of the fact that manganese exerts upon steel a body-giving and toughening influence, as well as a neutralizing effect, on the hardening or cold-shortening due to phosphorus. Though these properties of manganese have been blindly suspected for some time, the mutual dependence and, to a certain extent, interchangeability of carbon and phosphorus were not fully appreciated till the success of M. Tessié Du Motay, in producing, with ferro-manganese, a good rail steel containing about 0·12 carbon, 0·25 phosphorus, and 0·75 manganese, was fully established.

The secret of success appears to be in putting into the metal from three quarters to 1 per cent of manganese without bringing the percentage of carbon above 0·16, while the metal contains the ordinary amounts of phosphorus and silicon, or, say, 0·25 to 0·29 of the former and 0·03 of the latter. When the percentage of phosphorus is diminished, that of carbon should be increased, and *vice versâ*, within certain limits. Steel is undoubtedly destined to supplant iron for almost every use where the latter is now adopted. Our ironmasters should apply those improvements that will place us in a position to compete successfully in other markets than our own.—*Engineering and Mining Journal.*

### IMPROVED WASHING MACHINE.

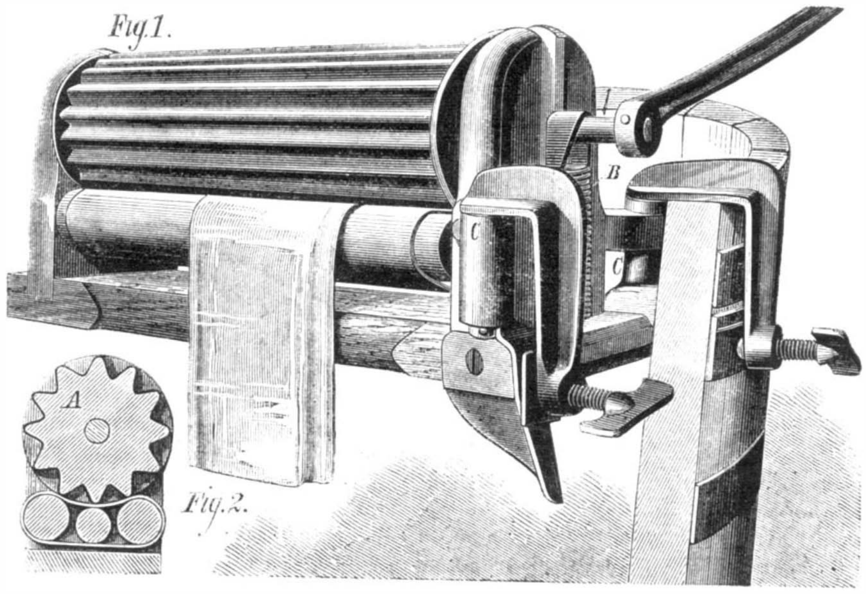
The annexed engraving represents a new washing machine which may be readily attached to any kind of tub. It is operated by passing the clothes between a corrugated roller above and an endless belt, which envelopes smaller rollers, beneath, the upper roller being held in its place and against the garments by stout spiral springs, and rotated by the handle shown.

In the illustration, A is the upper roller, which is faced with sheet metal. In Fig. 2, the arrangement of the smaller rollers and belt beneath is clearly shown. One of the springs which hold the roller, A, down upon the clothes is represented at B, and the simple screw clamps, by which the device is attached to the tub, need no special description, except to note the fact that they, in common with other metal work of the machine, are strongly constructed of galvanized iron, and are pivoted to the frame portion at C, so as to be adjusted on the circular edge of a tub.

The garments, as they pass between the rollers, are thoroughly rubbed by the upper one, receiving the same scouring as if rubbed by hand upon an ordinary washboard. The springs admit of the upper roller adjusting itself to any thickness which may be passed beneath it.

This machine is also claimed to wash the lightest fabrics with much less wear than is produced in washing by hand.

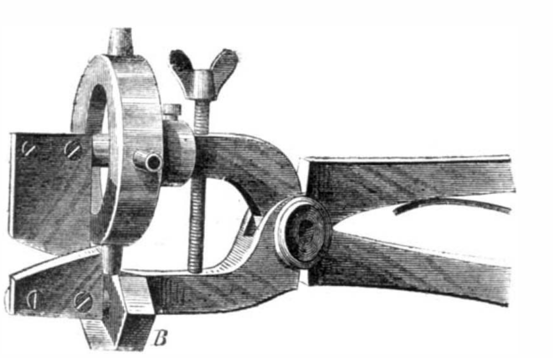
Patented February 24, 1874. For further particulars relative to sale of State, county, and town rights, address Mr James Taylor, P. O. Box 44, Otter River, Mass., or Box 577, Stamford, Conn.




TAYLOR'S WASHING MACHINE.

### WOLFF'S BUTTON HOLE CUTTER.

The device represented in the illustration is a handy little instrument which cuts a slit for a buttonhole and, at the same time, punches the rounded end of the same. The handle resembles an ordinary pliers, and at the ends of the jaws two curved cutting blades, A, are attached. Just inside the blades, and on one jaw, is a circular head, attached as shown, and carrying several punches of various sizes. On the other jaw is a rotary anvil, B, corresponding in its sides to the shapes of the punches. The length of the button hole depends upon the distance to which the curved blades are permitted to pass each other. The length is regulated by the punches being adjusted in their head, so that, if one of them is brought opposite to the anvil, it will strike the




same and prevent the cutting blades passing beyond the desired distance. In one of the jaws is secured a set screw, C, which is so adjusted that it keeps the punches from striking too hard against the anvil. When buttonholes are to be made without eyelets, the punches are turned out of the way, and the length of the cuts determined by the screw, C. Both the cutting blades and the punches can be easily removed for sharpening or replacing them by new ones. Patented April 7, 1874, to Mr. Raphael Wolff, of New York city.

### New Process of Dental Surgery.

Mr. Napier, an English dentist, announces what he considers to be something new in dental surgery, especially in a case where the teeth were extremely sensitive, and it became necessary to file them down for the purpose of introducing artificial teeth on the stumps. For the sake of avoiding pain in the operation as far as possible, ether spray was first made use of in reducing the sensibility of the teeth; a piece of cotton, dipped in ether, and laid first on the teeth and then on the instrument, being found to answer a still better purpose. While engaged in this operation it occurred to Mr. Napier to avoid the usual practice of dentists (of extirpating the nerve), with which object he took a bit of hard wood, dipping it in nitric acid, and with this cauterizing the exposed portion of the nerve in each tooth successively. He then filed the teeth down to the level of the gums without producing any pain whatever. He found that in this way the stump of the tooth remained perfectly healthy, giving no pain of any kind; and the subsequent experiences of the patients were of the most satisfactory character.

PROFESSOR SERGIUS KERN, of St. Petersburgh, finds that the explosive properties of nitro-glycerin nearly disappear if the substance is highly heated.

### The Siemens Furnace Anticipated.

Some two years ago, we gave a drawing of the medical warming apparatus, which the Prussian patent authorities decided to be an anticipation of Dr. Siemens' regenerator. A recent number of the *American Gaslight Journal* contains an article by Professor B. Silliman, who certainly ought be made a Patent Office examiner on the spot, in which he endeavours to show that the gas furnace was foreshadowed in Dr. Hare's oxyhydrogen blowpipe! "Properly considered," says Silliman, "the fundamental principle which led Hare to the oxyhydrogen blowpipe has also led Siemens, in our time, to the invention of the regenerative gas furnace, by which, as Hare says in his memoir, 'to avoid these evils,' that is, the contact of solid fuel and the loss of heat consequent on its conversion into gas, it was thought desirable that means might be discovered of clothing the upper surface of any body which might be subjected to this species of operation with some burning matter, of which the heat might be equal to that of the incandescent carbon with which the lower surface might be in contact; or by which bodies might be exposed on solid supports to a temperature equal or superior to that of the porous charcoal uniting with oxygen. It soon occurred that these desiderata might be attained by means of flame supported by the hydrogen and oxygen gas. In the Siemens furnace the objects to be heated are sustained on a solid support in an atmosphere of burning gas, the oxygen of the atmosphere arriving by one inlet, and the combustible gases by another, and the two uniting in a true Hare's blowpipe flame to do their work. The necessary contrivances for the alteration of the flow of gas and air through the regenerative cellular flues of firebrick are evidences of a high degree of inventive skill, applied to the solution of a problem which, in its essential features, was clearly set forth by the American philosopher, Robert Hare, in 1802."—*Engineering.*

### Electrical Colored Shadows.

Six Grove's cells were connected with one of Ladd's large induction coils, and the secondary current, condensed by two large Leyden jars, was sent, in the usual way, between two pairs of metallic electrodes, in order to examine their spark spectra.

Two of the electrodes were of platinum: these may be called pair A.

Of the other pair, B, one electrode was of platinum, and the other of the metal to be examined.

Place a piece of white paper equidistant from, and on one side of, the two sparks. Hold the finger so that a shadow of it maybe cast by each spark. The two shadows will be seen to be most beautifully tinted with different delicate colors, varying according to the metal inserted in B.

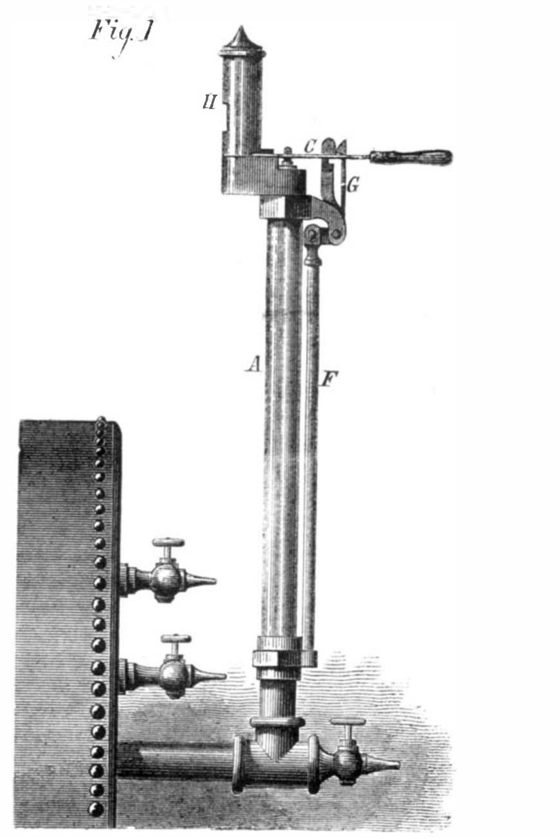
It will be seen that the shadow thrown by A is lighted by B, and is seen on a ground jointly illuminated by A and B; while B's shadow, lighted by A, is soon on the same common colored ground as before. Without these considerations, it might have been supposed that the shadow thrown by B, and lighted by the unchanging spark A, would itself have remained unaltered. "I saw it of the colors, pink, light pink, dim pink, light green, nearly white, and yellow green; corresponding to the introduction into B of Bi, Ag, Sn, In, Al, and Mg respectively."—*C. T. L. Whitmell, in Nature.*

### IMPROVED LOW WATER INDICATOR.

The invention illustrated in the annexed engraving is a new low water indicator which, it is claimed, can never get out of order so as not to give an alarm. The foaming of the boiler, it is stated, in no wise prevents the proper action of the device. The apparatus is, besides, simple in construction and possessed of various other advantages which will be readily understood from our engraving and the following description.

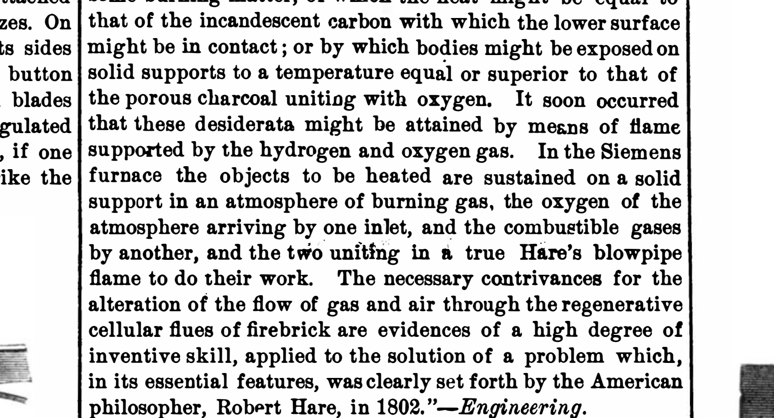
Fig. 1 shows the indicator as attached to the boiler and Fig. 2, the mechanism of its upper portion. A is an expansion tube connected to the generator at the alarm line, and provided at its upper extremity with a valve, B, the stem of which runs through a spring, C, Fig. 2. One end of the latter is fixed, and across a slot in its forward portion a bar, D, is placed. E is a detent or right angled lever, pivoted as shown in Fig. 2, one arm of which connects with the rod, F. The long arm extends upward through the slot in the spring, and is notched in such a way that, when the expansion tube, A, is cold, the crossbar, D, rests in the recess, thus retaining the spring, C, when depressed, and consequently holding the valve in its seat. To the lower part of the lever, E, is fixed a spring catch, G, which has its nib a very small distance below the notch in said lever. Rod, F, is fixed in a casting in the lower end of the expansion tube, and at H is a whistle.

The operation of the device is as follows: When the water is at its proper hight, the tube, A, remains cool, the crossbar, D, rests in the notch of the lever, and the spring catch, G, rests against the side of the bar. On the water in the boiler falling below the alarm line, the water in the expansion tube runs out and steam takes its place, expanding said tube which, in lengthening, raises the lever, E. The short arm of the latter being held by the rod, F,




the long arm is thrown over, the notch slips off the crossbar, the spring raises the valve, and the steam, escaping, sounds the whistle.

To stop the alarm it is only necessary to depress the spring by means of its handle. The catch, G, then engages with the crossbar, D, and, retaining the spring, holds the valve to its seat. When the water in the boiler again reaches the proper level, the tube, A, quickly cools, and in contracting throws the lever, E, over, so that the notch engages with the crossbar. At the same time the catch, G, is displaced, and the spring is thus allowed to rise sufficiently to admit of the engagement just mentioned. If it is desired to blow dry steam through the whistle, the upper end of the pipe, A, can be plugged and steam taken through a separate pipe below the valve. The device may also be placed in a horizontal position, and the whistle dispensed with, a nozzle being used in its place. The apparatus then becomes an automatic gage cock.




HOPKINS' LOW WATER INDICATOR.

Patented November 10, 1874. For indicators or for further information address Messrs. Hopkins & Tytler, manufacturers, Albion, N. Y.

THE meeting of the British Social Science Association will be held at Brighton in October next, and there will be an exhibition of appliances and apparatus relating to the sanitary and educational systems.

## NOVEL DEVICE FOR PREVENTING RUNAWAY HORSES.

The annexed engraving, for the description of which we are indebted to the Pesth *Wochenblatt für Land und Forstwirthschaft*, represents an ingeniously simple device for checking runaway horses. A A are stout rings, of sufficiently large diameter to slip over the fore legs of the animal and close up to the body. They are held in the last mentioned position by lines, B, which lead up through leaders on the saddle, and are joined to a single ring which slips over a hook, C, on the dashboard. Thus arranged the device forms no impediment to the horses' motion, as the rings, though connected together between the legs, are joined by a sufficiently long bond. In case of the animals' running away, however, the driver has merely to lift the ring for the hook, C, and allow the large rings, A, to descend lower down on the legs. This of course interferes at once with the horse's stride. If it be necessary to bring them to a sudden halt, to avoid immediate danger, the supporting lines are let go altogether. The rings then fall to the horses' feet, restricting their further progress, and perhaps throwing the animals. This would probably result in injury to the latter, but it would not be employed except to prevent instant accident to the occupants of the vehicle; and it is possible their lives would be more imperiled by the sudden stoppage than if the appliance were not used. But the idea is novel, and some one, no doubt, considers it practicable, and perhaps it is.

DEVICE FOR CHECKING RUNAWAY HORSES.

### The Tallest Chimney in the World.

The tallest chimney in the world is the Townsend chimney, Glasgow, Scotland. It was built by Robert Corbett, of Glasgow, for Joseph Townsend, of Crawford Street Chemical Works. The total hight from foundation to top of coping is 468 feet, and from ground line to summit, 454 feet; the outside diameter at foundation being 50 feet, at ground surface 32 feet, and at top of coping 12 feet 8 inches. The number of bricks used in the erection were as follows: Common bricks in chimney, 1,142,532; composition and fire bricks for inside cone, 157,468; common bricks for flues, etc., 100,000; total, 1,400,000. The weight of bricks at 5 tuns per 1,000 is equal to 7,000 tuns. When within 5 feet of completion, the chimney was struck by a gale frcm the northeast, which caused it to sway 7 feet 9 inches off the perpendicular, and it stood several feet less in hight than before it swayed. To bring back the shaft to its true vertical position, "sawing back" had to be resorted to, which was performed by Mr. Townsend's own men, ten working in relays, four at a time sawing, and two pouring water on the saws. The work was done from the inside on the original scaffolding, which had not been removed. Holes were first punched through the sides to admit the saws, which were wrought alternately in each direction at the same joint on the side opposite the inclination, so that the chimney was brought back in a slightly oscillating manner. This was done at twelve different hights, and the men discovered when they were gaining by the saws getting tightened by the superincumbent weight.

## THE LITTLE DODO OR DODLET.

A great many very interesting additions have recently been made to the collection belonging to the Zöological Society of London, and are now to be seen in their renowned gardens in the Regent's Park. Among them is a bird variously styled the didunculus, dodlet, little dodo, and toothed billed pigeon, the scientific name for which is the *didunculus strigirostris*, which was brought from the Samoan Islands. The bird was not unknown in Europe, a specimen having been sent thither in 1864; and from its size, dark plumage, and terrestrial habits, it might be mistaken, at a little distance, for some species of moorhen, but a closer inspection of its structure convinces one of its relationship to the pigeons.

The head and upper portion of the neck and breast, says the London *Field*, to which we are indebted for the annexed engraving, are of dark slaty green color, the primaries the same, but somewhat paler; the rest of the plumage chocolate brown; the face and throat bare, and of a dark flesh color in the young bird, approaching to orange in the adult. The bill, which is remarkably deep, and with the upper mandible dentated, is orange yellow in the young bird, and red in the adult. The legs and feet are also red. In the contour of the bill, the form and position of the nostrils, and several other characters, the didunculus differs from any other living species at present known; and, although a smaller bird in size, it approximates most nearly, in all its characters, to the extinct dodo, and, like it, combines the character of a rapacious bird with that of the harmless pigeon.

It will be seen that the mandibles of the didunculus are powerful in structure, yet, according to Dr. Bennett, the beak is never used as an offensive weapon; for when the hand is placed in the cage, or the bird is seized for removal from one cage to another, it never attempts to bite its captor, but, on the contrary, is so timid that, after fluttering about or running into a dark corner of the cage in its efforts to escape, it soon becomes subdued, and is easily taken. This statement, however, requires some modification; for, according to the Rev. S. J. Whitmee, a resident at Samoa, who has kept the bird in confinement there, it is sometimes "exceedingly savage. When any one approaches the cage," he says, "it ruffles its feathers, trembles, apparently with rage, and tries to bite. If it gets hold of one's finger," he adds, "I know from experience that it gives a severe gripe."

In size, the bird may be compared to a large pigeon, which it resembles in some of its habits, and in the nature of its food. Like some of the Australian pigeons, it flies with a loud noise, which is especially noticeable as the bird rises on the wing. Like the ground pigeon, it nests or roosts on bushes or stumps of trees, and feeds on the ground. Its food consists of plantains and the fruit of the *soi*, a kind of yam, not unlike a small potato.

THE LITTLE DODO (*didunculus strigirostris*).

### Preventable Diseases.

It being conceded by every sensible person that good health is paramount to all other human blessings, we take frequent occasion to transfer to our columns (from reliable sources) practical information tending to promote and preserve the blessing so essential to all. To *The Herald of Health*, for April, we are indebted for the following:

"The range of what are called preventable diseases is now known to be very wide, and all such diseases it should be the first duty of man to prevent. Much of this—that for which I especially wish to ask attention—is not only preventable disease, but is disease that is called into existence only by the act or by the neglect of man; and it is not too much to say (after the thorough investigations of the subject that have been made by sanitary authorities) that there has never been a case of typhoid fever that was not almost directly caused by the ignorance or by the criminal neglect of some person whose duty it should have been to prevent it. Such disease never comes without cause; and its cause is never anything else than organic poisoning, arising from organic decaying matter or from the spread of the infection directly from a patient suffering from the disease.

Typhoid fever has many names, all of which are suggestive of its origin. It is called "drain fever," "sewer fever," "cesspool fever," "foul well fever," "nightsoil fever," etc.; and it is never caused except by the introduction into the system of the germ of the disease—which can originate only through the operation of neglected organic wastes, or by communication through the lungs or stomach by means of foul air or foul water, or from germs arising from the persons or from the excreta of typhoid patients. So far as its contagion is concerned, ample ventilation of the sick room and the immediate removal or disinfection of the feces are ample preventives. It is not contagious, as smallpox is, but is spread by the action of germs which infect the locality of the patient, and extend more or less widely according to the precautions used to confine it. There is not necessarily the least danger that the disease will attack even the constant attendant of the patient, if proper care is taken. With the householder himself rests the entire responsibility of the origin of every first case breaking out in his household. This is a certain and thoroughly well established fact, and there attaches to him the full measure of guilt for every such case. This is a responsibility for which the community should hold him strictly accountable. It would really be as correct to ascribe a red-handed murder to Providence as to attempt in this way to console ourselves for a fatal attack of typhoid fever. We are taught that we shall not cleave our child's skull with an ax, and that if we do, death will surely result; but we are no less absolutely taught that we shall not poison our child's blood with the foul emanations of our house drains and with the contamination of our drinking water wells, lest the same fatal result follow. We may ignorantly load the water with which our families are supplied with lead poison, and so be without the guilt of intention; or we may ignorantly poison our wells by the infiltration of infected organic matter, and in this case, as in the other, be acquitted of the charge of criminal intent. But in these days, when so much has been published concerning the origin of diseases of this class, however free we may be of all criminal intent, the serious charge of criminal neglect must surely lie at our door.

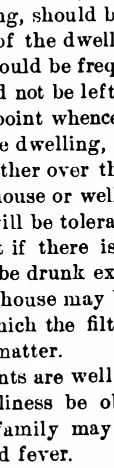
It may be assumed, without hesitation, that, whenever a pronounced case of typhoid breaks out in an isolated country house, or when any form of low fever occurs, though it may fail to assume a distinct typhoid character, there is in that house, or about it, or in connection with its supply of drinking water, some accumulation of neglected filth, some pile of rotten vegetables in the cellar, some overflow from a barnyard, some spot of earth saturated with the slops of the kitchen or some other form of impurity, to which the origin of the disease may be distinctly traced. The spread of typhoid is very generally occasioned by germs contained in the bowel discharge of fever patients; but the disease is constantly originating itself where no such cause exists, and every first attack is a plain indication that either at home or in some house at which the patient has visited, one or two things has occurred: (1) there has been an exhalation of poisonous organic gases from a kitchen yard, from a neglected cellar, or from some other source of bad air, which has entered the lungs and planted there the germs of the disease; or (2) either in the food or in the drink of the patient, these germs, originating in the same organic putrescence, have found their way to the stomach. In either case the blood is attacked; the subject may have been sufficiently robust and vigorous, or sufficiently unsusceptible to infection, to have avoided a serious or fatal illness; but in every instance the danger has been incurred, and, when incurred, the risk must be the same as in taking any other form of slow poison. This is not theory, but simply a well established fact, demonstrated by long, careful, and frequently repeated investigation. The precise character of typhoid infection and the exact manner of operation when introduced into the blood, are not known; but that it always originates in the way described, and that it may invariably be prevented by the use of proper sanitary precautions, is absolutely known.

This being the case, it lies perfectly within the province of every farmer (and if the farmer will not attend to such matters of his own accord, his wife has a way of urging him into it) to remove, while it is yet time, any source of infection to which his house may be liable. Vegetables in any considerable amount should not be kept in the house cellar, and at least once a week the floor of the cellar should be swept and every shred of waste vegetables removed. Even when this is done, the cellar should be ventilated by a window or other small opening toward the quarter least exposed to cold winds (and in summer on every side); the privy, if a privy is used, should be well away from the house, and especially far from the well, unless its contents are received in a tight box and entirely absorbed by dry earth or ashes, and even then frequently removed; the chamber slops of the house should never, under any circumstances, be thrown into the privy vault, nor into a porous cesspool, from which they can leach into the ground and through the ground for a long distance into the well, or into and around the foundation of the house. The same disposal of the liquid wastes of the kitchen is desirable, but not so absolutely important. It is, however, important that this should be led by an impermeable drain to a point well away from the house and from the well; swill and all manner of nondescript refuse material, such as is sloughed off by every household in the ordinary course of its living, should be removed at least daily from the near vicinity of the dwelling, and the vessels in which it accumulates should be frequently cleansed and aired; manure heaps should not be left to ferment and send off their exhalations at a point whence frequent winds waft them toward and into the dwelling, nor should the barnyard be allowed to drain (either over the surface or through a porous soil) toward the house or well. If all these precautions are taken, the well will be tolerably safe, and in most cases absolutely safe; but if there is any doubt on the point, then let no well water be drunk except after boiling; or the drinking water of the house may be taken entirely from a filtering cistern, of which the filtering bed is sufficient to hold back all organic matter.

If all these points are well attended to, and if the ordinary rules of cleanliness be observed in the household, the members of the family may be considered as safe against attacks of typhoid fever.

## THE MEIDINGER BATTERY.

The Meidinger element is a modification of the Daniell battery; but it has no porous cell, and possesses greater durability and constancy of current. It consists, as shown in the engraving, of a glass vessel, A A, 8 inches high and 5 inches wide, in the bottom of which is placed a small glass vessel, *d d*, of half the dimensions of the larger glass, cemented in with rosin. A zinc disk, Z Z, which is supported upon a ledge of the outside vessel, surrounds the smaller glass. The inside wall of the smaller glass, *d d*, is covered by a sheet of copper, *e*, on the lower end of which an insulated copper wire, *g*, is riveted. The mouth of the vessel is closed by a wooden or tin plate having an opening in the center for the reception of a glass cylinder, *h*, 1½ inches in diameter and 8 inches high, narrowing towards the lower end, which is rounded and in which a hole is made. This tube is sunk to the center of the small glass, *d d*. The entire vessel is filled up to the zinc disk, about 1½ inches below the upper brim, with a diluted solution of Epsom salts. The glass cylinder, *h*, in place of which a glass funnel can be used, is filled with crystals of sulphate of copper, forming a concentrated solution, which, being a heavier fluid, sinks down through the small hole in the glass tube, and fills the small glass, *d d*, to the center.



There is very little diffusion of the copper solution upwards, or out of the little glass vessel, *d d*, to the zinc disk, Z, even when the battery is not in operation; so that, after the lapse of several weeks, the zinc scarcely shows any signs of being affected by the copper. The battery is therefore much superior to the ordinary Daniell battery, which, when the circuit is open, produces a great diffusion of the sulphate of copper through the porous cup.

The zinc is usually amalgamated on its inner side, enabling its impurities to be easily removed, which would otherwise form a hard crust. If the copper wire, *g f*, which is riveted to the copper sheet, *e*, is connected with a small strip of copper, *c k*, soldered to the zinc disk, we obtain a galvanic current having an electromotive force equal to that of a Daniell cell, and it remains constant as long as there is sulphate of copper in the glass tube, *h*; and the zinc, Z, is not dissolved. During the activity of the battery, in fact, the solution of sulphate of copper increases a little in quantity, in consequence of a diffusion which is caused by the overflowing (in the smaller glass, *d d*) of the heavier sulphate of zinc solution formed by the dissolution of zinc. By the action of the current, the greater part of the copper is deposited on the upper half of the copper plate. A trace of copper, however, appears upon the zinc, but frequently this is after several weeks' operation. The duration of the battery depends on the size of the glass vessel. A battery of the size described (according to Meidinger's statement) ought to be taken to pieces and the solution of Epsom salt and sulphate of zinc drawn off, and pure water put in it as soon as it has consumed 3 lbs. of sulphate of copper, which, however, may take a year.

The resistance of this cell considerably exceeds that of the Daniell battery with porous cells; but for a line battery, where the resistance in the wire is very considerable, this is of no special importance. Meidinger recommends, for main lines, cells 5 inches high and 3 inches wide; while the battery of the size depicted in our engraving is intended for local use and for line batteries of small resistance. As a local battery for the Morse telegraph, it is best to use six cells, two of which are connected with like poles, so that we have, practically, three elements with enlarged surface and conductivity.

Generally, in charging the Meidinger element, a solution of 1 part Epsom salts to 4 or 5 parts of water may be used. In proportion to the activity of the battery and the consumption of the sulphate of copper, fresh crystals of this salt should be added to the contents of the glass funnel. But when the surface of the fluid has sunk by evaporation, soft water only need be added to the glass funnel. An improvement has been obtained in this element by having the funnel-shaped sulphate of copper vessel entirely closed at the top. After the jar, *h*, has been charged with crystals of sulphate of copper, a solution of Epsom salts (sulphate of magnesia) is added thereto.

The Meidinger battery is valuable wherever long duration and a current of moderate but constant strength is required, and especially for operating the Morse telegraph, electrical clocks, hotel telegraphs, and electric bells. The chief condition for its successful use is that it shall not be shaken, as shaking causes a mixture of the fluids, and in this way destroys its action and the constancy of the current. Its faults consist in the liability that the tube, *h*, may be filled up with sulphate of copper (either from impurities of the salt or from precipitation of metallic copper) or crystals of sulphate of zinc, so that the action of the element ceases; and partly because the flow of the solution of sulphate of copper from the tube to the lower edge of the zinc cylinder rises, and then, at the least diffusion, the sulphate of copper at tacks the zinc. When this happens, the sulphate of copper is decomposed by the zinc, a superfluous quantity of sulphate of zinc is formed in the fluid, and metallic copper is precipitated in the form of a brown, spongy powder upon the zinc cylinder. This battery is extensively used upon the Austrian telegraph lines.

## Useful Recipes for the Shop, the Household, and the Farm.

Beef bones, boiled in water for some hours with rock salt and a little alum, yield a size which can be used in the preparation of cotton and silk goods.

The clatter and risk of glass in carriage windows can be prevented by placing, at the bottom of the casing, an arched piece of india rubber.

Unless the mouth is frequently and carefully cleansed, it becomes infested with vegetable and animal parasites. These cause decay of the teeth. Soap is the best material for preventing the development of the fungi and for neutralizing the acid. Precipitated chalk mixed with the soap assists the cleansing action.

The following practical hints on ballooning are published by Donaldson the aeronaut, in a little paper edited by him and named the *Aerial*. The lifting strain of a balloon is principally on the net. If a balloon will stand inflation, it is safe in mid-air. In winter, the atmosphere is warmer one mile above the clouds than it is at the earth's surface. The weight of a balloon to carry one man, including net and basket, should not exceed 80 lbs. A cotton balloon will last for about sixty ascensions. A balloon thirty feet in diameter undergoes a strain of 1½ lbs. to the square foot of surface. Gas, which at the earth fills the bag only half full, will, at an elevation of 3½ miles, expand so as to fill it completely. One thousand feet of coal gas will raise 38 lbs. Gas which gives a poor light is the best for aerostatics. Kites can be used to steer balloons by sending them up or lowering them into currents of air traveling in different directions from that in which the balloon is sailing.

To make green gold, melt together nineteen grains pure gold and five grains pure silver. The metal thus prepared has a beautiful green shade.

The following recipes for metals resembling gold are said to produce a metal which will so nearly approximate the genuine as almost to defy detection without a resort to thorough tests: Fuse, together with saltpeter, sal ammoniac, and powdered charcoal, 4 parts platinum, 2½ parts pure copper, 1 part pure zinc, 2 parts block tin, and 1½ parts pure lead. Another good recipe calls for two parts platinum, 1 part silver, and 3 parts copper.

Cement for sealing fruit cans is made of resin one pound, talllow one ounce.

## DECISIONS OF THE COURTS.

### United States Circuit Court---District of New Jersey.

PATENT HARNESS TRIMMING.—WILLIAM M. WELLING *vs.* THE RUBBER-COATED HARNESS-TRIMMING COMPANY, ANDREW ALBRIGHT, AND LUTHER C. VOORHEIS

[In equity.—Before Nixon, J.—Decided May, 1874.]

NIXON, J.:

This is a suit for an alleged infringement of letters patent No. 37,941, and bearing date March 17, 1863, granted to the complainant for "a new and useful improvement in rings for martingales;" and the questions in issue are determined by the construction and scope to be given to the specification and claim of said patent.

The schedule annexed is dated April 8, 1862, and the complainant therein states his invention as follows:

"In letters patent granted to me August 4, 1857, a composition and mode of making factitious ivory is set forth, and out of said materials I have manufactured billiard balls, rings of various kinds, etc. My present invention does not relate to any particular composition, as that in the aforesaid patent, or any similar compound, may be employed.

The nature of my said invention consists in the employment of a metallic ring within a ring formed of artificial ivory or similar materials, for giving strength to the same, thereby producing a new article of manufac ure, and one that is stronger than an ivory ring, and possesses all the beauty of appearance, and can be afforded at a very much less cost. Ivory rings—particularly such as used for martingales—require to be made out of very solid ivory in order to be sufficiently strong, and hence are quite costly.

In order to make my improved rings, I take a ring of metal such as shown at A; or said ring may be formed by punching out a washer from a sheet of metal or in any other suitable way. I take the amount of ivory composition and, by dies or by hand, cause the said composition to completely envelope the said ring with as much uniformity as possible, and, to give the exterior finish to the same, press and solidify the mass of composition around the ring by means of dies, and in so doing, any plain or more or less ornamental shape may be given to the said ring or the surface thereof. My ring is thus made of the desired ornamental appearance, while great strength is attained at very little cost.

What I claim, and desire to secure by letters patent, is the ring for martingales, etc., manufactured as set forth, with a metal ring enveloped in composition, as and for the purposes spec[illegible]"

It is insisted by the defendants that, if the patent is valid at all, it must be limited to a "martingale ring intended to imitate ivory, and made by covering a metallic ring with artificial ivory, such as is described in complainant's patent of 1857, or some similar compound." Bearing in mind the established American rule that patents are to be construed liberally, and are not to be subjected to a rigid interpretation, I think that the construction is too narrow, and does not give to the patentee all that he is entitled to under the specifications and claims of his patent. It is quite clear, indeed, that factitious ivory was the composition uppermost in his thoughts. Having the partiality of a parent for his offspring, he naturally imagined that no superior compound could be formed or used. It may be conceded that the full extent of his invention had not dawned upon him. Men often build better than they know; but where the fair interpretation of the words employed to describe an invention or discovery includes matters not in the mind of the patentee at the time, he is as fully authorized to claim the unlooked-for as he is the anticipated results. *

I am of the opinion, on the whole case, that the claim of the complainant's patent, fairly construed, is not to be limited to the use of factitious ivory; that it is broad enough to include the comp sition of rubber or gutta percha, and that there should be a decree for the complainant according to the prayer of his bill.

[*Frederic H. Betts*, for complainant.
*J. C. Clayton*, for defendants.]

PATENT HARNESS TRIMMING.—WILLIAM M. WELLING *vs.* THE RUBBER-COATED HARNESS-TRIMMING COMPANY, ANDREW ALBRIGHT, AND L. C. VOORHEIS.

[In equity.—Before Nixon, J.—Decided February, 1875.]

NIXON, J.:

This is an application for an attachment against the defendants for violating an injunction issued by this court, June 12, 1874, restraining them from making, using, or vending to others to be used, any harness or carriage trimmings containing the invention of the plaintiff, and secured to him by letters patent, to wit, "a ring manufactured as set forth substantially," with "a metal ring enveloped in composition, as and for the purpose specified."

The injunction followed the decree of the court, sustaining the validity of the complainant's patent, No. 37,941, for "an improvement in rings for martingales;" and the question now suggested is the scope of the said patent.

In the course of the accounting before the master, it was insisted by the defendants that the patent of complainant referred only to the use of certain compositions in the manufacture of rings for martingales, and hence that the decree compelled them to account only for the manufacture of rings; whereas the complainant claimed that all the articles used in harness and carriage trimmings which have been treated by the process described in his letters patent, such as terrets, buckles, and hooks, should be included by the master.

I have examined the bill, answer, proofs, arguments of counsel, and the opinion heretofore given in the case, and this examination has confirmed the strong impression in my mind, when this application was made, that the complainant is asking that a wider scope be allowed to the claims of his patent than has yet been distinctly given to it by the court.

I do not mean to be understood as saying that it will not admit of such scope and meaning; but that the question has not been presented, and that the patent has not been considered in reference to such construction. *

All that the complainant is permitted to claim, under the decisions of the court as it stands, is a specific article of manufacture, to wit:

A metal ring, coated with any plastic composition capable of being compressed and solidified by the use and action of dies, whereby a ring is produced with an exterior surface more durable and more highly polished than has before been obtained by different processes of manufacture and at greater cost.

Such a construction, obviously, relates to the product. The complainant's patent is held to be good for the product resulting from a new combination of old instrumentalities. His claim on this application is understood to be for the process, and that the invention includes that as well as the product. Doubtless both may be covered by one patent, as was held by Judge Grier, in this court, in the case of Goodyear *vs.* The Railroads, (2 Wall, p. 356;) but in such a case the description of the invention in the specification and claims should disclose that the inventor had both results in his mind.

But the grave doubt here is whether the specification and claim of the complainants's patent are broad and full enough to cover a new process as well as a new product.

It is a well settled principle that a patentee may so limit his claim as to deprive himself of the full benefit of his invention or discovery. It was to remedy such a difficulty or omission that the privilege of surrender and reissue was granted in the patent laws. Patentees often fail to realize any substantial advantage from some of the most useful inventions, owing to their too narrow claims, until such surrender, amendments, and reissue have been made.

The complainant is entitled to be protected only in the rights which the letters patent cover and secure to him. I incline to the opinion that the specification and claim of the patent under consideration will be found too limited in their scope to admit of the construction now claimed for them by the able counsel for the complainant; but without expressing any decided conviction on the subject, I shall, at this stage of the case, deny the application for an attachment, and direct the master to proceed with the accounting.

Under the reference already ordered he may take an account—

1. Of the rings coated and finished by the defendants, according to their methods as described in the proofs.

2. Of the terrets, buckles, and hooks, as claimed by the complainant.

He will make up the two accounts separately, so that the aggregate of each may be readily distinguished; and when his report is made, the parties will have the opportunity of obtaining the judgment of the court in this new, and as yet unconsidered, construction of the specification and claim of the patent, after their views are more fully presented, as they may be, on exception to the report.

[*F. H. Betts*, for complainant.
*J. C. Clayton* and *A. Q. Keasbey*, for defendants.]

## NEW BOOKS AND PUBLICATIONS.

THE PHILADELPHIA LEDGER ALMANAC. G. W. Childs, Philadelphia, Pa.

At the commencement of the year 1870, Mr. Childs, publisher of the daily *Philadelphia Ledger*, issued an almanac which contained not only the calendar and a great deal of statistical information of a local interest, but also several pages of practical household recipes, and other information of general value. One hundred thousand copies were printed and presented to the subscribers of the *Ledger* in that year. The first issue proving so acceptable as a book of reference, Mr. Childs was induced to continue the publication and gratuitous distribution among the *Ledger*'s patrons, and each successive year has the work improved. By the favor of the publisher, we have before us, neatly bound, six years' numbers of his almanac, which make a handsome volume of 350 pages of very valuable information, on both local and general subjects, not attainable in so complete a form in any other work.

LEFFEL'S MILLING AND MECHANICAL NEWS. Fifty cents per annum. James Leffel & Co., Springfield, Ohio.

To persons interested in milling machinery or water power, this paper issued each month, possesses especial interest. The editor is an admirer of the SCIENTIFIC AMERICAN, and in his April number promulgates the fact as follows: "It is a matter of just congratulation to Americans that, whatever may be the assumed superiority of European standards in art and literature, this country has at least one scientific journal which so signally eclipses any foreign publication of the kind that a comparison can scarcely be made. We refer, of course, to the SCIENTIFIC AMERICAN, published by Messrs. Munn & Co. 37 Park Row, New York city. Besides being a recognized authority and inexhaustible medium of information in the whole domain of practical science, it is faultless in its appearance, and its illustrations are works of art. Its subscription price is $3.20 per annum, postage prepaid, and the immense circulation it has reached is a proof of the advancing intelligence of the American people."

ORNAMENTAL DESIGNS FOR FRET WORK, FANCY CARVING, AND HOME DECORATIONS. Price 60 cents. New York city: Henry T. Williams, 46 Beekman street.

This book contains a very varied and extensive assortment of original designs, and will be found useful by the numerous workers with the band or jig saw. Our correspondence shows that many of our readers devote their spare hours to this occupation, which is a pleasing manner of passing the time, and occasionally a source of profit, as well as a means of adding to the interior decoration of a home. To their attention, we commend the numerous patterns given in this volume.

THE FIRESIDE ASTRONOMER, a Plain and Familiar Description of All the Most Important Facts relating to the Heavenly Bodies. By S. N. Manning, A.M. Kankakee, Ill.: Times Office.

This unpretending little pamphlet deserves to be widely circulated, for it contains a very clear and succinct explanation of the general plan of the sidereal universe and of the science of astronomy by which its laws have been defined. Free from algebraic and trigonometrical formulæ, it is written throughout in a simple and clear style, which lacks nothing in precision or accuracy. We cannot expect that our tyros in the sublime science will find a book better suited to their needs.

PAPERS ON THE TAILS OF COMETS, AND ON THE LOSS OF LIGHT IN ITS TRANSMISSION THROUGH SPACE. By Henry M. Parkhurst, New York city.

This is a reprint of a very interesting paper read by the author at the Hartford meeting of the American Association for the Advancement of Science, in August last.

NOTES ON EXPLOSIVES. By Walter N. Hill, S.B., Chemist, U. S. Torpedo Station, Newport, R. I.

This pamphlet is a useful and compendious account of the constitution, action, and effects of the various explosives now in use in engineering operations and in warfare. The information in it has never, we believe, been collated before, and it is likely to be valuable to several important interests.

LECTURE ON THE WHITEHEAD TORPEDO. By Lieut. F. M. Barber, U. S. N., Torpedo Station, Newport, R. I.

A readable account, historical and descriptive, of an engine of destruction which now occupies the attention of naval men, as likely to play a most important part in future warfare.

A PRACTICAL TREATISE ON FRICTION OF AIR IN MINES. By the late J. J. Atkinson, Government Inspector of Mines for the County of Durham, England. Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

This little book throws much light on a subject little noticed in popular treatises on mining engineering: and it deserves to be attentively read, for it shows how readily the whole system of ventilation of a mine may be disturbed, and its efficiency destroyed, by the very currents intended to ensure a supply of pure air and free exit for foul gases.

INTEROCEANIC CANAL (Route of Paya). By L. Lacharme.

The author of this work desires to call public attention to the Pass of Paya as a route for the much discussed ship canal between the Atlantic and Pacific Oceans. He states that the Pass has always been followed by the Indians crossing the Isthmus, and claims, with apparent reason, that, by following it, a canal can be quickly and cheaply executed.

THE DENTAL SCIENCE AND QUARTERLY ART JOURNAL. Conducted by Dr. A. P. Merrill. Volume I, No. 1. One Dollar a year. New York city: E. Richards & Co.

This new-comer appears to be well and carefully edited, and is altogether a promising magazine for the use of the dental profession.

JOURNEY IN HONDURAS AND JOTTINGS BY THE WAY. By R. G. Huston, C.E., Honduras and Interoceanic Railway. Price 50 cents. Cincinnati, Ohio: Robert Clarke & Co.

A pleasant account of a country which attracts a great deal of attention just now, but the physical features of which are little known.

THE GRAHAMITE ASPHALT PAVEMENT ON FIFTH AVENUE, NEW YORK CITY. New York city: Francis and Loutrel, 45 Maiden Lane.

Mr. J. L. Graham invites public attention to this pamphlet, in which the facts as to the durability and excellence of his system and material for paving are duly set forth and verified by testimonials.

ANNUAL REPORT OF THE CHIEF ENGINEER OF THE WATER DEPARTMENT OF PHILADELPHIA, PA., FOR 1874.

CATALOGUE OF THE OFFICERS AND STUDENTS OF THE SCHOOL OF MINES, COLUMBIA COLLEGE, NEW YORK CITY, FOR 1874—1875.

SCRIBNER'S MONTHLY for May contains the first illustrated and complete description of the new opera house in Paris which we have seen published on this side of the Atlantic. There is, besides, an electro-mechanical romance, which tells how two lovers, one a railroad engineer and the other a telegraph operator, utilized an abandoned wire to make a circuit which the passing locomotive closed, and so rang a bell in the operator's office, thus warning her of the approach of her John's engine. This neat little contrivance, while a special train full of railway magnates is standing at the depot gives unexpected warning of the coming of a lightning express. The young lady rushes frantically up the line just in time to stop the approaching train and arrest a horrible accident—and of course, in the sequel, she and her intended are bountifully rewarded. It is a pretty little story, charmingly told, and, besides, conveys a possible hint for an invention. The rest of the papers are of the usual standard of excellence, and the illustrations plentiful and good. Jules Verne's "Mysterious Island" is continued, and there is a valuable illustrated article on "Drainage in Holland." Scribner & Co., Publishers, 743 Broadway, New York. $4 a year.

THE ECLECTIC MAGAZINE for May offers a well varied and excellent table of contents, selected from the foremost of contemporary periodicals. Professor Huxley's "Results of the Challenger Expedition" is given in full. The Professor arrives at the conclusion that "all the chief known constituents of the crust of the earth may have formed living bodies; that they may be the ash of protoplasm, and consequently that the time during which life has been active on the globe may be indefinitely greater than the period, the commencement of which is marked by the oldest known rocks, whether fossiliferous or unfossiliferous." This paper will repay careful perusal, as will indeed the other scientific essays, notably the "Limits of Science," and the "Reproduction of Organisms," with which the present number is rich. Thomas Carlyle's "Early Kings of Norway," and Julian Hawthorne's "Stone and Plaster" are continued; and there are the usual serial and other stories and editorial summaries. E. R. Pelton, Publisher, 108 Fulton street, New York city. $5 per year.

## Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 30 to April 13, 1875, inclusive.

BOOTS AND SHOES.—L. Heath, Boston, Mass.
BRICK KILN, ETC.—E. W. Bingham, Portland, Oregon.
CAR DRAW AND BUFFER.—A. B. Pullman (of Chicago, Ill.), London, Eng.
CUTLERY, ETC.—O. W. Taft, New York city.
DERAILMENT INDICATOR.—J. Turner (of Chicago, Ill.), London, England.
FRICTION MATCH MACHINERY.—McC. Young, Frederick, Md.
GRADUATED RULE, ETC.—Hastings & Co., Granby, Conn.
LOOM.—J. F. Wicks, Providence, R. I.
LOOM PATTERN CHAIN.—J. F. Wicks, [illegible]dence, R. I.
MAKING SUGAR.—F. O. Matthiessen, New York city.
NUT MACHINERY.—W. Charles, Chartiers, Pa., et al.
PAPER BOX.—L. A. Kettle, Philadelphia, Pa.
RAILWAY WHEEL.—R. N. Allen (of Hudson, N. Y.), London, England, et al.
RECORDING STEAM GAGE.—M. B. Edson, New York city.
SUSPENDERS.—S. W. Fisk, New York city.
TRAMWAY, ETC.—A. S. Hallidie (of San Francisco, Cal.), London, England

# Recent American and Foreign Patents.

### Improved Ore Separator.

Thomas B. McConaughey, Newark, Del.—In using the machine, water is admitted at the upper forward end of a wash trough, and the ore is fed in at its lower rear end. The ore is moved through the channels of the trough against the stream of water by shovels, and is pushed by said shovels from the forward end of the said trough. The ore falls upon the screen, and the fine ore passes through the holes. The coarser ore and the rubbish are carried across the screen by its motion, and fall upon the apron of the carrier. The coarser stones and rubbish are removed by hand from the carrier apron as the stream of ore is being carried forward, and the remainder falls from the carrier into a receiver.

### Improved Loom Shuttle.

James M. Peckham, Fall River, Mass.—This improvement consists in a metallic holder for the tension cloth and grooves cut in the shuttle from the shuttle opening to the eye recess. These grooves allow the holder containing the tension cloth to be shoved in to hold the tension cloth in the proper position. The holder is made of a single piece of sheet metal having two tongues doubled over on the plate. The cloth is slipped in between the plate and the tongues. The holder is slipped into the grooves, and the thread is passed over the cloth, which affords the necessary tension.

### Improved Laboratory Gas Burner.

Charles D. Cheney, Canandaigua, N. Y.—The base is of concavo-convex form, having a hollow center extending down below its lower side. A small tapering tube receives the gas from the gas pipe, and delivers it in a small jet into the center of the burner tube, entering through an aperture in the hanging center. It is provided with a dovetailed lug, which fits a corresponding notch, the form of the notch being such as not to prevent sliding the tube endwise sufficiently to release the lug. A valve is made to close over the end of the center by means of the rod to which the valve is attached, which rod extends up through the base, with the lever on its upper end. This lever is moved back and forth between stops, and the extent or size of the flame is regulated thereby.

### Improved Oiler.

Isaac Levy, Ellaville, Fla.—This oiler is so constructed that it may be first used for blowing off the dust, shavings, etc., from the places where the oil is to be applied, and afterward may be used for applying the oil. It is made in two parts—one made of sheet metal, for the oil, and the other made of india rubber, for the air—said parts being separated by a division plate, and each part being provided with its own nozzle.

### Improved Bench Plane.

John E. Norwood, Boston, Mass.—The stock is provided with side openings, through which the cutting iron, which is made with side extensions, is permitted to pass out flush with the outside. The cutting iron is rigidly fastened and adjusted, and allows of the use of the plane for cutting rabbets, or as a block plane, for truing up miter joints or cutting across the ends of the wood.

### Improved Comb.

Elias Brown, Wappinger's Falls, N. Y.—This is a neat and convenient comb for holding the ringlets or curls at the back of the head and preventing their falling forward; and it consists of two symmetrically arranged combs with curved connecting arms, which are pivoted together, to be introduced sidewise into the hair.

### Improved Clothes Wringer.

Israel F. Brown, New London, Conn.—This invention consists of a shaft with anti-friction rollers interposed between the journals of the squeezing rollers and their bearings, so that the journals turn upon the faces of the rollers, while their shafts turn on the bearings, so as to diminish in large measure the resistance due to the great pressure of the journals on the boxes, and thus enable the machine to be turned much easier than the wringers usually are.

### Improved Vulcanizing Apparatus.

William J. Birdsall, Naugatuck, Conn.—The rubber goods are vulcanized in a steam-heated chamber, and are thus rendered soft and silky to the touch, and superior to those vulcanized in dry heated air.

### Improved Platen for Lever Presses.

John F. Taylor, Charleston, S. C.—This invention rests in the construction of a compound platen for a progressive lever or toggle joint cotton press, and it consists of a stationary part and a movable part, one part having cylinders and water ways, and the other part having rams or pistons and a suitable packing. It also consists in the method of regulating the space between the two parts of the platen by forcing water in, and letting the same out from between the stationary and movable portions of the said platen.

### Improved Steam-Encased Engine Cylinder.

James E. Taylor, Westminster, Md.—This invention relates to certain improvements in steam-encased engine cylinders, and it consists in the peculiar construction of the steam dome in combination with the steam-encased cylinder, whereby the latter is relieved from the direct pressure of the entire subjacent body of steam, the tendency to become strained and loosened from the dome obviated, and the consequent leakage of steam prevented.

### Improved Self-Raising Seat for Water Closets.

James E. Walter, Baltimore, Md.—This invention relates to certain improvements in seats for water closets, whereby the same are rendered self-raising. It consists in two hinges having a common pintle, upon which, between the hinges, two parts of a spiral spring are wound in opposite directions from the middle, the central portions of the spring being secured to the frame work of the basin or closet, and the two extreme ends of the spring being inserted in holes in the edges of the seat to elevate the same. It consists also in the combination with the said spring and hinge of a cylindrical protective casing of sheet metal.

### Improved Railway Safety Switch.

Edward A. Trapp, Davenport, Iowa.—This invention relates to certain improvements in railway safety switches, and it consists in a main rail having its bottom flange cut, flared inwardly, and bent up to form a horizontal guide, in combination with leading tongues, a volute spring, and a spring rail having its bottom flange extended so as to move under the guide formed by the cut portion of the main rail. By means of the peculiar construction of the switch, guard rails are dispensed with, the switch made self-adjusting in one direction, and a continuous line of rails always insured to and from the switch.

### Improved Cooler for Lard, etc.

Frank C. Pray, New York city.—The essential features of this invention consist in devices whereby the lard is bleached, after having been cooled, by being separated through the perforations of bottom sieve and caused to drop in small globules through the air. The invention is also intended for cooling milk and any oleaginous matter, and may be seen in operation at the store of the inventor, 383 West 12th street, as above.

### Improved Piston Packing.

James L. Sherman, Cassville, Wis.—This invention consists in the construction and arrangement of divided and grooved rings to form the packing of a steam piston rod, and a cup-like device for containing said rings and receiving the steam, which acts on and compresses them upon the rod.

### Improved Pen Holder.

John Boyd, New York city.—This is a flexible connection of the pen to the holder, made by connecting the tube of the penholder to the handle by a rubber band at the upper end, and a spring below, so that the point of oscillation is at the upper end of the tube. This is said to give better results than when the pen is connected to the lower end of the tube by a spring, so that the axis of motion is at the lower end. A further improvement on the penholder in common use is effected by placing an eccentric spring tip on the spring, which fills the hollow tube of the penholder. The pen is placed between the tip and the tube, at the smaller diameter of the latter, and bound in its place by turning the tip.

### Improved Twine Holder.

Jonathan Hill, Stanhope, N. J.—The twine box contains the ball, from which the twine is passed along a hollow axle, out through the side, around a drum, thence to the guide eye in the ceiling, from which it is to be suspended over the counter. It passes also through the guide eye of a trip lever, so that when it is pulled off the ball the tension will lift the lever, and, by swinging the axle support, shift the drum out of gear with the regulating device, which is intended to act when the recoil takes place to slow the action of the spring. When the twine is pulled off from the drum, it will wind up the spring, to turn the drum back to wind on the slack again.

### Improved Machine for Crushing Oleaginous Seeds.

Alfred B. Lawther, Chicago, Ill.—This machine has crushing rollers of great power, to which the seed is fed, under certain pressure, by an upright supply pipe, of suitable hight, having a fluted feeding roller and hopper at the top end. The oil seeds are forced through the feed pipe, and compelled to pass through the rollers, which, by the uniformity and power of their motion, crush the seeds and break the oil cells completely, without reducing any portion to pasty condition, leaving also the husks or bran comparatively coarse, so that it may be seen in the cake after pressing. The crushed seeds are then passed to the mixing and moistening machine, doing entirely away with the muller stones, and producing a greater yield of oil with less power, less labor, and less pressure on the oil-extracting presses.

### Improved Chuck for Making Swelled Tenons.

Alexander D. Ruff, Owingsville, Ky.—This invention consists of a pin and a lever, combined with a sliding tool in a revolving chuck, in such manner that the end of the piece on which the tenon is to be formed forces the tool, having an irregular edge for making swelled tenons, down against the side to dress off the tenon, by pushing the pin backward as the piece enters the cavity of the chuck. The invention also consists of a spring, combined with the sliding tool, the lever, and the pin, so as to push the tool back out of the way of the swelled portion of the tenon when it begins to withdraw from the cavity of the chuck, and allow it to pass out without the swell being cut off.

### Improved Ventilating Attachment to Hearths.

William S. Winfield, Cross Plains, Tenn.—This invention consists of a box-shaped attachment, with hinged and concaved lid and cinder basket, set into the floor below the grate, to communicate either with the story below, or by a pipe with the outside air, for supplying the required ventilation on the opening of the lid for the ready kindling of the fire, etc.

### Improved Tongue Support for Vehicles.

James McCarter, Frankfort, Ind.—This is an improved spring support for wagon tongues, by which the jerky action of the tongue and the strain on the horses arising therefrom on the passage of the vehicle over rough and uneven ground may be to considerable extent avoided. The invention consists of a U-shaped piece of spring wire, which carries, at the front part, a tongue-supporting pulley, being bent spirally around side pulleys of the pivot bolt, connecting tongue, and hounds, and applied with the rear ends equidistant from the king bolt to the front axle.

### Compound Switch for Fire Alarm Telegraphs.

Samuel Weeks, New Orleans, La.—This is a compound switch for fire alarm telegraphs, for throwing by one movement a series of switches into circuit. It is composed of a series of upper switch fingers, establishing and breaking circuit of main alarm battery, and of a set of lower spring fingers for closing and opening the local batteries, in combination with an intermediate insulated crank shaft, and with opposite non-conducting cam extensions. The whole is so arranged that a turn of the crank shaft causes simultaneously the contact of the upper fingers and the disconnecting of the lower, or the breaking of contact of the upper and the closing of the lower.

### Improved Screw-Cutting Die Plate.

Horace Griffing, New Haven, Conn.—This consists of two separate dies fitted in a recess in the side of the plate by being boxed thereto and bolted fast, so that they can be readily taken off, by removing the bolts, for changing and sharpening. The dies are provided with slotted holes for the passage of the bolts by which they are fastened to the plate, to allow them to be adjusted to suit the size of the pipe to be cut. The screws for adjusting the dies are fitted in hollow handles, which are also jointed near the plate, and the detachable portions have a socket in the end to receive the projecting shank of the screw when screwing into the portion formed on the plate.

### Improved Miter Box.

Theodore C. Lawrence, Ladoga, Ind.—This invention consists of a metallic recessed guide casing, in which the saw runs by means of detachable clamped extension strips, a central wooden strip preventing the getting dull of the teeth. Wing-shaped side plates of the casing bear pivoted clamp plates, which may be set to any angle on the supporting wing plates. The clamp plates are provided with sliding and guided strips for fastening the molding securely by strong clamping screws, to expose it to the saw or connect the corners. The solid metallic construction of the miter box produces the permanent and accurate working of the same without the inaccuracies of the variable wooden boxes.

### Improved Steam Brake.

Thomas F. Fouts and Elijah Planck, Burlington, Iowa.—This is a steam cylinder and piston, arranged transversely of the locomotive, and geared by a toothed rack attached to the piston rod with a revolving line shaft, which extends along the train from car to car, and winds up the chains which work the brakes. The steam is supplied from the locomotive boiler, with which the engine is connected by a pipe, to admit steam at one end for applying the brake. Springs are used to force the piston back. The line shaft is in sections, one for each car, which are coupled by socket couplings, which slide forward and backward as the train slacks and extends.

### Improved Machine for Coiling Metal Rods.

Philander H. Standish, Jefferson City, Mo.—The mandrel consists of a plain flat bar of steel, wide and thick as the largest coil to be bent, with an oval tapered point, graduated from the size of the largest to that of the smallest coil to be made. The bar is fitted in the hollow shaft of the driving wheel, so as to be shifted along it, to cause the tapered point to project under the bending wheel more or less, according to the size of the coils to be made. A collar at each end of the hollow shaft holds it wherever it may be set, to utilize the same machine for coils of all sizes.

## Notes & Queries

A. A. can separate aluminum by the process described on pp. 99, 116, vol. 32.—T. H. Y. can make garden walks by the method described on p. 50, vol. 32.—E. L. S. can silver plate his iron knobs by using the preparation described on p. 187, vol. 30. It would be better to copper them first, see p. 90, vol. 31.—M. J. G. will find directions for bronzing on iron on p. 283, vol. 31, and on brass on the same page.—J. D. C. can raise water by the device described on p. 259, vol. 31.—H. E. L. will find a recipe for a dip for gilding brass on p. 362, vol. 30.—H. D. G. can solder iron to iron by the method described on p. 123, vol. 30.—E. B. can construct a continuous battery by following the directions on pp. 315, 362, vol. 31.—E. C. B., H. M., and others can cement brass lamp fittings to glass by using the preparation described on p. 27, vol. 30.—M. A. G. can make condensed milk by the method described on p. 343, vol. 30.—F. E. W. can remove mildew from cotton cloth by washing with soap. A recipe for acid dip for castings is given on p. 107, vol. 31.

(1) C. J. M. asks: In burglar alarms, how is the gas lighted when an alarm is given? A. By a friction match, in many kinds of alarms.

(2) C. H. A. asks: 1. What is the meaning of the word ohm, in electrical science? A. A unit of resistance. 2. I am making the positive element of a Smee's battery (the silver plate) by depositing the silver on tin foil. How can I get the foil off the plate? I cannot remove it successfully by melting. What acid will dissolve it without affecting the silver? A. Cover the foil with plumbago before depositing the silver. 3. I have made several Leyden jars lately, but they do not work properly. The foil was attached to the inside and the outside of the jars with ordinary flour paste. The machine (plate 16 inches, 4 rubbers) works admirably, giving a spark of from 3 to 4 inches, but I cannot accumulate a particle of electricity on the jars. A. Connect all the outer coatings together for one side and all the inner coatings for the other. 4. How can I manage to deposit a film of silver on polished copper, so that it can be removed without solution of continuity? A. Cover with plumbago.

I have a coarse-grained grindstone which, with considerable labor, I had fitted to my lathe. Owing to the swelling of some wooden wedges near the center, the stone split into two pieces. What cement can I use to repair the damage? A. Try a mixture of black japan varnish and white lead.

(3) J. B. C. asks: How are steel magnets, to retain a large quantity of magnetism, made? What kind of steel is used, and how is it tempered? A. Steel magnets designed to possess strong magnetic power should be made in sections and fastened together. In order to retain their power the poles should be connected together by an iron keeper.

(4) W. E. D. asks: 1. Is the Smee battery a good and desirable one for running a short telegraph line? A. Yes. 2. What is the best solution to use with the above battery, the zinc plates being amalgamated? A. 1 part sulphuric acid to 20 water. 3. How often would a battery of 5 one quart jars of the Smee pattern require cleaning and fresh solutions, in running a line one mile long in close circuit? A. If you use magnets of 200 ohms resistance, probably the battery would run six months. 4. Would the above battery be sufficiently strong for nickel plating? A. Yes. 5. We have a telegraph line nearly one mile in length, with eight offices; would it not be best to have all the batteries of the line divided and half of them placed at each end rather than have three or four at each office on the line, it being a close circuit? A. It makes no difference where you put the batteries in the line. 6. I had occasion to repair a small sounder; and on taking off the paper covering of one of the spools, I found the spool was wound with No. 26 wire, not insulated; but between each layer of the wire was a piece of paper to insulate the layers from each other. Please explain the *modus operandi* of this. A. The wire is wound in such a manner as to keep the different turns from touching. Many regard this method as better than insulating the wires with silk or cotton.

(5) C. J. H. says: You give a recipe for making a blue black ink which calls for sulphate of indigo in the form of a thinnish paste, and which should be neutral, or nearly so. Please give me the formula for making this ingredient for this purpose. I have made the sulphate of indigo as follows: 8 ozs. sulphuric acid (commercial), and 1 oz. indigo in powder, carefully mixed. With what shall I neutralize the acid? I have tried carbonate potassa, powdered chalk, and marble dust; either will neutralize the acid, but on filtering out (after mixing with water) the chalk or marble dust preparations, the coloring matter combines with the lime, and the liquor passes off clear, leaving the coloring matter in the filter. If I use the carbonate of potassa to neutralize the sulphuric acid, the soluble sulphate of potassa goes into the ink: and in using a steel pen, the sulphate attacks the pen and leaves an annoying crust upon it. Can you help me out of my difficulty? A. Add small quantities of indigo until the solution is neutral, or nearly so.

(6) W. B. H. says: I wish to bring a stream of water from a reservoir, in 3 inch pipe, down a hill, and across a wide ravine, and up an inclined plane on the other side. The fall from the reservoir to the bottom of the ravine is 150 feet, and from the bottom of the ravine, up the hill on the other side, to the discharge is 50 feet rise. 1. What would be the pressure to the square inch at the bottom of the ravine? A. About 65 lbs. when the flow of water is stopped at the outlet, and 22 lbs., *plus* the friction, or say 25 lbs., when the water has free discharge. 2. Would the pressure be greater in consequence of the rise of the pipe on the other side? A. Yes, when running free; no, when stopped. 3. Would material that would make a pipe one inch in diameter, that would sustain a pressure of 150 feet fall, make a three inch pipe that would sustain the same pressure, or must the strength of the pipe be increased in the proportion that the size is increased, to enable it to sustain the pressure of the same fall? A. No; the strength must be increased in proportion to the diameter of the pipe. 4. How high would it throw water from a common hydrant through an ordinary hose pipe? A. From 40 to 75 feet, according to the material of which the pipe is made and the number and abruptness of the bends in it. 5. Would 50 feet rise on the one side be exactly equaled by 50 feet fall on the other, leaving, at the discharge, the full force of the remaining 100 feet fall, or would the force of the remaining 100 feet fall be made less by the effect of 50 feet rise? If so, how much? A. The force would be less in consequence of the friction in the extra length of pipe. How much less will depend upon the velocity of discharge, the material of the pipe, and the care with which it is laid.

(7) T. H. R. asks: Has electricity ever been used as a motive power for running light machinery, such as printing presses, sewing machines, etc.? A. Not with any practical success.

(8) B. J. A. says: I have seen attached to the guards in front of show cases a class of electric machines for giving shocks, constructed in the following manner: The guard (generally of wood) is covered with metal or some other conductor, and, as far as I could see, one pole of a cell of battery was connected with one end of the guard, and the other pole with the other end. A person putting both hands on the metal would instantly receive a shock. I have constructed one on the above principle, and it will not work. Can you inform me where the trouble lies? A. The circuit must be so arranged that the current shall pass through the person.

How much nitrate of silver can be made from one ounce of pure silver? A. One ounce of nitric acid will dissolve one ounce of silver.

(9) W. L. R. asks: What size of insulated wire is the best to make electro-magnets for attracting weights? A. No. 16. 2. Will cotton-covered answer as well as silk-covered? A. Yes.

(10) A. B. asks: 1. How shall I proceed to set up a Callaud battery? A. To set up the battery, place the coppers in the bottom of the jars, fill with blue vitriol to a level with the tops of the copper; suspend the zincs in position so that the bottom of each shall be about two inches from the top of the copper. Connect the copper of each cell to the zinc of the next, fill the cells with pure soft water to cover the tops of the zincs; then put the battery on short circuit for twenty-four hours, or until the solution immediately under the zinc appears clear and white, when the battery will be ready for use. No acid or quicksilver is used. The zincs must not be amalgamated. After the battery has been in use a few days, the zincs may be lowered half an inch to an inch, care being taken not to allow them to touch the blue solution. Lowering the zincs decreases the battery resistance, and is only necessary where a number of wires are worked from one battery. About two pounds of sulphate of copper per cup is required to charge the smaller cells, and four pounds the larger. A little oil poured upon the surface of the solution in the cells prevents evaporation and creeping over of the zinc solution on the edge of the jars. When oil is not used, it is better to charge the battery with a smaller quantity of blue vitriol, a little being added from time to time, as the supply is exhausted. 2. Please explain the meaning of the word ohm, as applied to telegraphy. A. The ohm is a unit of resistance. 3. I have a sounder marked 6 ohms. Will this work on a metallic circuit of 1,700 feet with 3 cells of a Callaud (local) without a relay? A. Not very well. You will require about 10 cells. You will achieve success if you persevere. Reading by sound requires a great deal of practice.

(11) A. N. W. says: I am making an electrial alarm clock to be operated from the front door of the house. The circuit is about 60 or 70 feet, with No. 20 copper wire supported on wooden brackets, with one Callaud's cell. The magnet consists of 2 pieces of soft iron ⅝ inch diameter, 3 inches long, screwed into one piece (2½x½x⅝ inches). I have about ¼ lb. very fine insulated silk wire coiled on magnet; but it will not work. Can you tell me the reason? A. Use No. 20 wire for magnets. Put armature within sixteenth of an inch of poles, and use ten cups of battery arranged in two series.

(12) G. asks: How many cubic feet of gas will one gallon of gasoline make at ordinary burning gas pressure? A. The quality of gasoline varies greatly; but 200 cubic feet would be a fair average.

(13) X. Y. Z. says: I have a block of buildings, 28 feet deep, with a roof of slate of 7 feet pitch. During the winter I have been extremely annoyed by the snow and ice crowding over the eaves. It seems as if the sun softened the snow and partially melted it, and saturated that in the gutter with water. At night it would freeze into ice, and again melt upon the roof next day. The snow would slide off, and crowd this gutter ice until it would project a foot or more over the eaves, and produce a very unpleasant drip, besides being absolutely dangerous in case of falling. What is the best and at the same time economical remedy? A. Take a plank 12 inches wide, set it up vertically about 6 inches back of the gutter, block it up about 3 inches, and brace it with iron braces from the top back to the roof; this will hold the snow and let the water run through. But the snow will cause some of the water to remain on the slate, to make its way through the joints thereof by capillary attraction. It will therefore be necessary for you to take off the lower corners of slate for about 4 feet in hight, and relay this portion with tin only.

Can anything be put into white lead paint to prevent its turning yellow? A. Enough blue paint is sometimes put into white lead, at the time of mixing, to give it a slightly bluish cast, and to counteract its tendency to turn yellow.

(14) T. B. asks: 1. What is the best paint or other substance, to put on a smoke stack where the heat has heretofore burned off everything we have tried? A. Coal tar, commonly called black varnish. 2. Would tubes put into a boiler, parallel with the central flue, be likely to make it generate steam more quickly? A. Yes, if put in by a good boiler maker.

(15) C. M. A. asks: I propose to put in a cistern, the water of which is to be used for drinking purposes. What is the best kind of filter to use? It strikes me that a wall across the cistern, of porous brick, would be the cheapest. How would it answer? How thick should it be? A. Brick is frequently used for this purpose; the wall may be built across one side of the cistern, and, as the water will be always of nearly the same hight on both sides of it, 4 inches thick will be sufficient. 2. If I put the cistern in my cellar, would any ill effects arise from dampness, etc., in the horse? A. Not if properly covered in and ventilated from the outside.

(16) M. A. says: I have an underground cistern, walled with brick laid in cement, and plastered in the usual way, Rosendale cement being used. At about 18 inches from the bottom there is a leak, the water rising in the cistern to about the hight of 1 foot. I have tried several plans, but have not succeeded in keeping the water out. In one instance I dug a hole, six inches in diameter, four feet below bottom of cistern, into which the water drained: into this I put a pump, and kept the water level below the bottom of the cistern. I now put another coat of cement on, keeping the water pumped out till the cement was well hardened, took out the pump, tamped the hole with clay to within 3 or 4 inches of top, and filled with cement; but it would not hold. The pressure of water broke the cement, which did not adhere to the old cement. What is the remedy? A. The best Portland cement is very much superior to the Rosendale for the purpose you refer to, but it should have a chance to set before it is immersed in the water. To do this, build the bottom and about 2 feet in hight of the sides of the cistern above ground; supply it with as much water as it will absorb easily in setting; let it stand until it gets as hard as stone; then lower it into the excavation and build the remainder of the cistern upon it. This bottom tub may be built of brick, well grouted in the cement, or with cement concrete, composed of broken stones, bricks, gravel, sand, and cement. The proportion of the ingredients may be as follows: 1 measure of cement powder, 3 measures of clean sharp sand, and 3 measures of broken stone and gravel. To resist pressure, the bottom may be built of a concave or arching form, like a dome reversed. The following is an instance of the capabilities of concrete to resist the action of water: At the harbor of Cherbourg, France, the blocks, of 12 feet by 9 feet by 6½ feet, containing 712 cubic feet, and weighing 52 tuns, were built up of mortar and stone, like rubble masonry, with-out molds. The mortar contained one measure of Portland cement powder to three of sand, and occupied from ⅓ to ¼ of the entire mass. Blocks of this kind, 9 months old, showed a compressive strength of 113 tuns per square foot, which is but little inferior to that of Portland stone. Their cohesive force was about 200 lbs. per square inch. After becoming hard, they were slung to pontoons and thrown loosely into the sea. Some of the 52 tun blocks have in heavy gales been thrown up from the bottom of the sea (30 feet deep) and lodged on top of the breakwater, entirely uninjured.

(17) W. M. asks: 1. Our steam gage indicates 12 lbs. steam even when the boiler is cold, and there is no steam at all. Will the gage show 12 lbs. more than the true pressure when the steam rises? A. Yes. 2. We are running a 6 inch circular saw at about 500 revolutions per minute. We have gummed the saw twice, and have taken off about ⅛ inch in the diameter of it; but since we gummed it the last time we have been troubled by the saw running toward the log. What is the remedy? A. The saw ought to be hammered. 3. The saw is not flat: the side toward the log is convex about ¼ inch. Ought this to be so? A. No. It is the cause of the difficulty before mentioned.

(18) S. H. L. says: I have some very soft castings of iron; while cutting a thread on them, all the cuttings stand on end. What is the cause? A. Magnetism, created by friction produced by using a dull tool.

(19) W. H. G. asks: 1. What will be the effect of carefully retempering a good quality of steel, say a tap 1⅛ inches in diameter and 15 inches long, carefully repeating the tempering 5 times? Will the rise of thread be increased or decreased? A. No. 2. Will the cutting quality be affected? A. Yes, it will deteriorate.

(20) E. H. says: I am an engineer on a tug; her boiler is constructed in locomotive fashion, with 42 flues 2¼ inches in diameter; firebox is 4x3 feet. The flues in the firebox end leak constantly. If I stop them and blow out, they stop leaking, but commence to leak again as soon as I have occasion to carry a hot fire. A. Probably the tubes are too close together, so that the circulation is imperfect. If so, more moderate firing and steaming will doubtless be the only remedy.

(21) O. G. B. asks: What is the best mode of constructing a firebox under a horizontal tubular boiler to burn slabs and sawdust? The boiler is 48 inches in diameter and 10 feet long, with 36 three inch tubes. What length and width of grate surface would be required? A. Make the furnace from ¼ to ½ larger than for burning wood. See p. 59, vol. 30.

(22) J. C. C. asks: 1. What disadvantage is there in a small upright double cylinder engine with both cranks on one shaft? I do not hear of any such being made. A. There are many such engines in use, but ordinarily a single engine is considered simpler. 2. What power could I get from such an engine, the cylinders being 2 inches in diameter and of 4 inches stroke? A. Horse power=pressure on piston in lbs. per square inch× speed of piston in feet per minute÷33,000. 3. What would be the best way to set the valves to get the most power? A. Cut off steam at about ¾ of the stroke. 4. In what relation to each other would it be best to set the cranks? A. At right angles. 5. Will brass wear as long, for the cylinder and other working parts, as iron? A. Yes. 6. Will the double cylinder engine give more power than one cylinder, of the same piston surface as both? A. No. How can I make a writing fluid that is green when first written with, but turns black on drying? A. Take 15 parts by weight bruised gall nuts, and 200 parts water. Boil for an hour, and then add 5 parts sulphate of iron, 4 parts iron borings, and 1 part indigo dissolved in 3 parts sulphuric acid.

(23) H. H. H. asks: What is the weight on the crosshead of a 10x20 inches engine, with connecting rod 60 inches long and pressure 50 lbs.? Please give the rule. A. The pressure of the steam in lbs. per square inch, multiplied by the area of the piston in square inches. To this must be added the weight of the moving parts, when they act so as to increase the strain.

(24) B. R. F. asks: What is the best means of cleaning a basement of roaches? A. Put 1 drachm phosphorus into a flask with 2 ozs. water, plunge the flask into hot water, and when the phosphorus has melted pour the contents of the flask into a mortar with 2 or 3 ozs. lard. Triturate briskly, adding water and ½ lb. flour, with an ounce or two brown sugar. This paste is said to effectually destroy roaches.

(25) H. J. M. says: I want to construct a small boiler for driving light machinery. Will tin plate stand a pressure of 15 lbs. per square inch, the boiler being 2 feet square by 6 inches deep? A. You can use tin if you make the boiler cylindrical, from 8 to 9 inches in diameter.

2. What are the yellow shining particles in the piece of stone enclosed? A. It is mica.

(26) M. A. J. asks: Will a wrought iron rod, after being heated a number of times from 70° to 212° Fah., cease to be affected as to contraction and expansion by the heat? A. Any material under these conditions will have its coefficient of expansion affected in time, and after long use may cease to be sensibly influenced by change of temperature. It is a general law that all machines, including animal mechanism, wear out in course of time.

(27) R. H. J. asks: How many gallons will flow per minute through a ¾ inch nozzle on a 3 inch hose, with 40 lbs. pressure per square inch? A. About 7 cubic feet. 2. How much will flow through a ⅝ nozzle on a 2 inch hose with the same pressure? A. About 1·5 cubic feet.

(28) D. C. C. asks: 1. I have been running an engine 22 by 24 inches stroke, with a 9 foot flywheel, making 120 turns per minute. How can I find out how many horse power this engine is? A. The only way to ascertain the power definitely is to make an experiment with a brake or dynamometer. 2. Can the steam make any difference in the power when it makes the same number of strokes per minute with 40 lbs. as with 80 lbs.? A. The steam is, no doubt, wire-drawn, if the engine does as well with 40 as with 80 lbs. of steam.

(29) C. R. asks: Can I burn a hole about 7 inches in diameter through a cast iron plate nearly 1 inch thick, by the use of the oxyhydrogen blowpipe? I cannot get at it to drill it. A. It could be done, but it would be very expensive. We think that if you can reach it with a blowpipe you can probably devise some arrangement to attack the material with a tool.

Will soluble glass do to coat a tin vessel with so as not to be corroded by sulphuric acid? A. Yes.

(30) H. B. B. asks: If the tensile strength of cast iron is 15,000 lbs. per square inch, how will a fly wheel rim of 1 square inch sectional area sustain 30,000 lbs.? A. If the 30,000 lbs. is tensile strain, and the tensile strength of the material is 15,000 lbs., of course the wheel would not resist it.

(31) H. W. G. asks: Why do kerosene lamps, especially those made of brass, sweat oil, or why does oil collect on the sides of lamps filled with kerosene? A. It is due to the evaporation of the oil drawn up through the wick by capillary attraction while the lamp is not in use, which is condensed in part upon the cold surfaces of the lamp. Try an airtight cap.

(32) H. R. E. asks: Can you give me a recipe for an ink for writing on zinc, that will stand the action of sulphuric acid? A. No. The sulphuric acid will dissolve the zinc at once.

(33) F. M. asks: Is there any way to temper machinists' tools, such as straight edges and squares, without warping them? A. Make them out of old saw blades, which require no tempering.

(34) F. B. S. asks: How can I make the eggs of Pharoah's serpents? A. These are little cones of sulphocyanide of mercury which, when lighted, give forth a long, serpent-like, yellowish brown body. Prepare nitrate of mercury by dissolving red precipitate in strong nitric acid as long as it is taken up. Prepare also sulphocyanide of ammonium by mixing 1 volume sulphide of carbon, 4 strong solution of ammonia, and 4 alcohol. This mixture is to be frequently shaken. In the course of about two hours, the bisulphide will have been dissolved, forming a deep red solution. Boil this until the red color disappears and the solution becomes of a light yellow color. This is to be evaporated at about 80° Fah, until it crystallizes. Add little by little the sulphocyanide to the mercury solution. The sulphocyanide of mercury will precipitate; the supernatant liquid may be poured off, and the mass made into cones of about half an inch in hight. The powder of the sulphocyanide is very irritating to the air passages, and the vapor from the burning cones should be avoided as much as possible. To ignite them set them on a plate or the like, and light them at the apex of the cone.

(35) W. S. H. asks: How can I temper a thin circular saw, about 2 inches in diameter and $\frac{1}{16}$ thick, without springing it? A. Heat red hot, place between two flat perforated iron plates, and lower into oil, quenching right out.

(36) N. R. asks: How are wood screws cut? I have made a die that cuts the thread well enough, but I cannot form a point. A. This is done by a special patented machine.

(37) H. P. G. and others ask: 1. What is the nature of an explosion of gunpowder? Does it press equally in all directions? A. The effect of an explosion of gunpowder is simply due to the sudden conversion of the grains from the solid into the gaseous state. With gunpowder we have a volume of gas, which would normally occupy a a space three hundred times as great as the grains occupied, liberated rapidly, but still in a perceptible interval, and for this very reason gunpowder is the safest projectile agent thus far discovered. For if, as in the case of nitro-glycerin, this large volume of gas were liberated all but instantaneously, the strain upon the gun would be so great that it would, in all probability, burst the breach before it started the ball. 2. Why does not the ramming, in blasting rocks, blow out before the rock splits, for it cannot possibly be made stronger than the rock? A. See answer to A. J. K., on this page.

(38) A. J. K. says: A sand blast is made by pouring dry sand upon the powder in a drill hole. When the powder is exploded, why is the loose sand not driven out, and the rock left uninjured? A. The pressure of the gas at the moment of its liberation is, of course, equal in every direction. It must also be borne in mind that before this volume of gas has expanded to the density of the atmosphere it must have displaced a column of air which exerts a pressure of something over a ton on every square foot of surface. With nitro-glycerin a volume of gas, 900 times that of the liquid used, is set free all but instantaneously. It can readily be seen that the sudden development of this large volume of gas, which becomes at once a part of the atmosphere, would be equivalent to a blow by the atmosphere against the rock; or, what would be a more accurate representation of the phenomenon, since the air is the larger mass, and acts as the anvil, a blow by the rock against the air.

(39) F. B. asks: Will an explosion of unconfined nitro-glycerin upon the surface of a rock split it? If so, why? A. Take a light wooden surface, say one square yard: the pressure of the air against the surface is equal to about 9 tuns, but the air presses equally on both sides, and the molecules have such great mobility that, when we move the surface slowly, they readily give way, and we encounter but little resistance. If, however, we push it rapidly forward, the resistance greatly increases, for the molecules must have time to change their position, and we encounter them in this passage. If now we increase the velocity of the motion to the highest speed ever attained by a locomotive, say one and one fifth miles per minute, we should encounter more particles, and find a resistance which no human muscle could overcome. Increase the velocity ten times, to twelve miles a minute, (the velocity of sound) and the air would oppose such a resistance that our wooden board would be shivered to splinters. Multiply again the velocity ten times, and not even a plate of boiler iron could withstand the resistance. Multiply the velocity once more by ten, and we should reach the velocity of the earth and its orbit, about 1,200 miles a minute, and, to a body moving with this velocity, the comparatively dense air at the surface of the earth would present an almost impenetrable barrier, against which the firmest rocks might be broken to fragments. Indeed this effect has been several times seen, when meteoric masses moving with these planetary velocities penetrate our own atmosphere. The explosions which have been witnessed are simply the effect of the concussion against the aeriform anvil at a point where the atmosphere is far less dense than it is here; so in the case of nitro-glycerin, the rock strikes the atmosphere with such a velocity that it has the effect of a solid mass, and the rock is shivered by the blow.

(40) E. W. P. asks: 1. What will dissolve gutta percha? I have tried naphtha, but without success. A. Gutta percha is dissolved readily by benzole, chloroform, bisulphide of carbon, oil of turpentine, and the essential oils generally. 2. Will it answer for mending rubber? A. Yes.

(41) J. H. H. asks: 1. Can you give me information as to the temperature required to melt copper, zinc, lead, iron, and brass? A. Copper 1990° Fah., zinc 773°, lead 617°, cast iron 2780°. The melting point of brass is variable, and depends altogether upon the proportion of its ingredients. 2. How can I make insulated wire for battery use? A. Coat copper wire with gutta percha.

(42) E. says: I have a fine oil painting of the Madonna and Child. It is 30 years old; and from age and ill usage it has become badly cracked. Is there any preparation by which these cracks can be hidden or taken out? A. Its appearance would be improved by careful retouching and varnishing. The taking out of a crack is not possible.

What kinds of colors are used for coloring stereoscopic views? A. Aniline colors are used.

(43) S. G. R. asks: 1. In preparing glycerin we make a lime soap. What is the cheapest and best way of converting that into soda soap? A. Who makes such a lime soap with glycerin? Glycerin forms soluble compounds with lime and soda. 2. What is the best work on the manufacture of soap? A. Morfit's book has a high reputation.

(44) A. S. M. asks: How can I make muffles for baking a charcoal composition in, to render it porous for filtering purposes? A. Muffles are earthenware ovens, usually formed with an oval top and flat bottom. They open at one end and are closed everywhere else, except a few narrow slits in the top and sides.

How is rubber made to retain flock, for piano covers? A. The flock is rolled on while the rubber is in a softened state, by passing between two revolving cylinders heated by steam.

(45) J. M. McC. says: We have a large cistern under a factory, for the purpose of holding rain water for scouring, etc., which has lately been filled partially with hard water, but principally by rain. After letting it stand a few days, we have used said water and it really seems as hard as the well water. Please to inform me why this is? We are confident that it is more than half soft or rain water. A. It is probable that there were sufficient lime salts in the hard water to make all the water in the cistern hard, when the waters mingled together.

(46) P. O. T. asks: In estimating the percentage of tannin in bark, leaves, etc., by means of protochloride of tin and muriate of ammonia, how is the resulting precipitate measured? A. By means of a glass-stoppered cylindrical jar, properly graduated to cubic centimeters.

(47) L. A. W. asks: What is the real cause of the fulling up of flannel by washing? A. It is due to a combination of causes, but principally to the rubbing; and where soap is used, this action is very much accelerated.

(48) W. A. P. asks: What is Berlin bronze, and how is it applied on cast iron? A. The trade does not seem to be familiar with the name.

(49) J. H. P. asks: There is something that is put in tincture of iodine, so that, when the latter is applied to the skin, it leaves no stain. What is it? A. The tincture (so-called) referred to may be obtained by adding, to the alcoholic solution of iodine, ammonia or hyposulphite of soda.

What can be put into ink that will give it a fine gloss, something like a varnish gloss? A. Add some sugar of milk.

(50) G. B. McD. asks: 1. Are platina and platinum the same? A. Yes. 2. If 10 ozs. 225·6 grains silver be melted with 28 ozs. 0·014 grains platinum, what will the nature of the alloy be as to malleability, ductility, and specific gravity? What will be the melting point of the above alloy? A. Only a trial will answer this, as the properties, etc., of the two bodies are not found in the alloy. 3. Can copper be successfully electro-plated with steel? A. No. 4. How can I procure a list of dates and number of patents issued by the Patent Office since 1858? A. This list will be found in the volumes of the SCIENTIFIC AMERICAN.

(51) P. S. asks: What is ground lime composed of? A. You probably mean sulphate of lime or gypsum, also known as plaster of Paris, which is a combination of lime and sulphuric acid. Gypsum, which has been dried at a temperature at from 400° to 500° Fah, and ground to a fine powder, has the peculiar property, when mixed with water, of recombining with the water, and binding or setting into a hard mass. To this property plaster of Paris owes its value in the arts.

(52) J. T. asks: Why does a sunbeam, admitted into a darkened room through a square, triangular, or other aperture of irregular contour, always form a circular or oval image on the floor or opposite wall? A. In case the opening is of sufficient size, the image will be of the same form as the opening; but when small, other rays enter besides those moving in parallel lines, and (by crossing) approximate the form of the image to a circle.

Observation seems to have given rise to and to confirm a theory that the nearer to the hour of noon the moon changes, the greater is the probability of foul weather; and the nearer to the hour of midnight this occurrence takes place, the greater the probability of fair weather. On what principle is this theory based? A. No satisfactory explanation of these phenomena is given, and the accuracy of these observations is open to grave doubts.

At a certain elevation, above the lower portions of the earth and beneath the summit of the higher portions, there is a line termed the thermal line, because the stratum of the atmosphere at that hight is warmer than the strata either above or below it. What is the cause of a greater heat in this stratum than is found elsewhere? A. The existence of this thermal line has only been made known recently; and until the investigations of Glaisher and others are more advanced, explanations would be mere guesswork.

Do rays of light from the sun approach the earth in straight lines? If they do not, in what kind of lines do they approach it? A. They move in straight lines until they encounter the earth's atmosphere, when they are bent into irregular curves by the different refractive powers of the various strata of the atmosphere.

(53) H. C. Z. asks: What am I to use to soften hard rubber balls? A. Boil them for some time in soft water.

What can I use to give old books a better appearance? A. We do not know.

### COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Proportioning Gears. By T. A. C.
On Parasites. By D. V. D.
On Tides. By E. S.
On Hard Rubber Thermometers. By J. M. B.
On Salicylic Acid. By G. H. B.
On Science and the Pope. By G. R.
On Dentistry. By S. B. P.
On the British Patent Laws. By A. H.

Also enquiries and answers from the following:
F. C. R.—T. F. W.—T. H. P.—E. G. W.—J. B. C.—W. B. H.—W. G.—O. B. T.—A. R. F.—J, W. N.—T. C—F. R.—S.—T.

### HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who sells insulated copper wire? Who makes woolen textile machinery (pickers, breakers, and finisher cards)? Who makes horseshoes with movable calks? Who makes balanced slide valves for locomotive use? Who manufactures toy balloons? Who sells platinum, and what is its cost?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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82,439.—PRESERVING FRUIT.—D. Mefford, Norwalk, O.

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8,262.—REFLECTOR.—C. M. Murch, Cincinnati, O.
8,263, 8,264.—CASSIMERE.—F. Bosworth, Providence, R. I.
8,265 to 8,268.—EMBROIDERY PATTERNS.—E. Crisand, New Haven, Conn.
8,269.—PIPE.—A. J. D. Henszey, Ashland, N. J.
8,270, 8,271.—OIL CLOTHS.—C. Meyer et al., Bergen, N. J.

TRADE MARKS REGISTERED.

2,362.—MOWER & REAPER.—Adriance & Co., Poughkeepsie, N. Y.
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2,365.—HARDWARE.—Clark & Co., Buffalo, N. Y.
2,366.—WHISKY.—A. H. Gillette, Syracuse, N. Y.
2,367.—PAPER.—R. J. Harp, New Orleans, La.
2,368.—BITTERS.—J. A. Jackson & Co., St. Louis, Mo.
2,369.—MEDICINES.—E. F. Kunkel, Philadelphia, Pa.
2,370.—CORSET STEEL.—Lessey et al., Philadelphia, Pa.
2,371 to 2,373.—WHISKIES.—T. E. Moore, Shawhan, Ky.
2,374.—ENVELOPES, ETC.—Porter et al., New York city.
2,375.—MEDICINE.—F. Spreen, Pittsburgh, Pa.
2,376.—JEWELRY.—Thayer Jewelry Co., Astoria, N. Y.
2,377, 2,378.—CORSETS.—U. S. Corset Co., New York city.
2,379.—CUTLERY.—W. Brokhahne, New York city.
2,380.—MEDICINE.—E. R. Burnham, Chicago, Ill.
2,381, 2,382.—MAGNESIAS.—C. Phillips, New York city.

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4,609.—Wm. Joslevn, Upper Bedford, P. Q. Combined grain separator and fanning mill. April 10, 1875.
4,610.—M. A. Johnson, Rochester, N. Y., U. S. Lamp chimney protector. April 10, 1875.
4,611.—J. H. Weare et al., Cincinnati, O., U. S. Inodorous cooking vessel. April 10, 1875.
4,612.—C. G. Imlay, Philadelphia, Pa., U. S. Fare device for street cars. April 10, 1875.
4,613.—H. Aitken, Falkirk, Scotland. Making illuminating gas. April 10, 1875.
4,614.—P. Charland, Stambridge, P. Q. Movable roof. April 10, 1875.
4,615.—E. Glendillen, Owen Sound, Ont. Force pump. April 10, 1875.
4,616.—C. Clamond, Paris, France. Thermo-electric generator. April 10, 1875.
4,617.—C. Wheeler, Jr., Auburn, N. Y., U. S. Cutting apparatus for harvester. April 10, 1875.
4,618.—P. Schofield, Philadelphia, Pa., U. S. Steam gage cocks. April 10, 1875.
4,619.—J. F. Cole, Sophiasburgh, Ont. Motive power for churns, etc. April 10, 1875.
4,620.—S. E. Griscom, Pottsville, Pa., U. S. Millstone dressing machine. April 10, 1875.
4,621.—W. S. Sampson, New York city, N. Y., U. S. Furnace or kiln with central draft flue. April 10, 1875.
4,622.—C. C. Parker, Aylmer, P. Q. Potato digger. April 10, 1875.
4,623.—E. Bartlett, Renfrew, Ont. Potato digger. April 10, 1875.
4,624.—J. Elliott, London, Ont. Straw and hay cutter. April 10, 1875.
4,625.—J. P. Abbott, Cleveland, O., U. S. Hanging device for eaves troughs, etc. April 10, 1875.
4,626.—J. Cowman et al., Rochester, N. Y., U. S. Artificial marble and ornamental stone. April 10, 1875.
4,627.—J. McKenzie, Kincardine, Ont. Churn. April 10, 1875.
4,628.—Wm. W. Ingraham et al., Chicago, Ill., U. S. Grain scourer and separator. April 16, 1875.
4,629.—J. Mattice, Chinguacousy, Ont. Alternating screw power. April 16, 1875.
4,630.—L. H. Hébert, St. John, P. Q. Cultivator. April 16, 1875.
4,631.—L. H. Hébert, St. John, P. Q. Mowing and reaping machine table. April 16, 1875.
4,632.—D. McCullough, Kemptville, Ont. Axle oiler. April 16, 1875.
4,633.—Wm. Bowes, Pinkerton, Ont. Windmill. April 16, 1875.
4,634.—T. De Witt, Chatham, Ont. Plow coulter. April 16, 1875.
4,635.—James E. Wisner, Friendship, N. Y., U. S. Horse hay rake. April 16, 1875.

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