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PATENT UNIVERSAL JOINTER.

Messrs. Bentel, Margedant & Co., of Hamilton, Ohio, are the inventors and manufacturers of so many excellent machines, which, from time to time, have found prominent places in our columns, that, in adding another invention to the list, we think that no higher commendation will be necessary to secure for the device the careful attention of the reader, than to refer to it as the handiwork of the above mentioned firm. In wood-working machinery, there is an abundant field for the resources of the inventor; but judging from the frequency with which improvements in that class of mechanism have, of late, been brought to our notice, it is evident that there is no lack of ability and genius being devoted to the production of not only new machines but useful and successful improvements on well known machines.

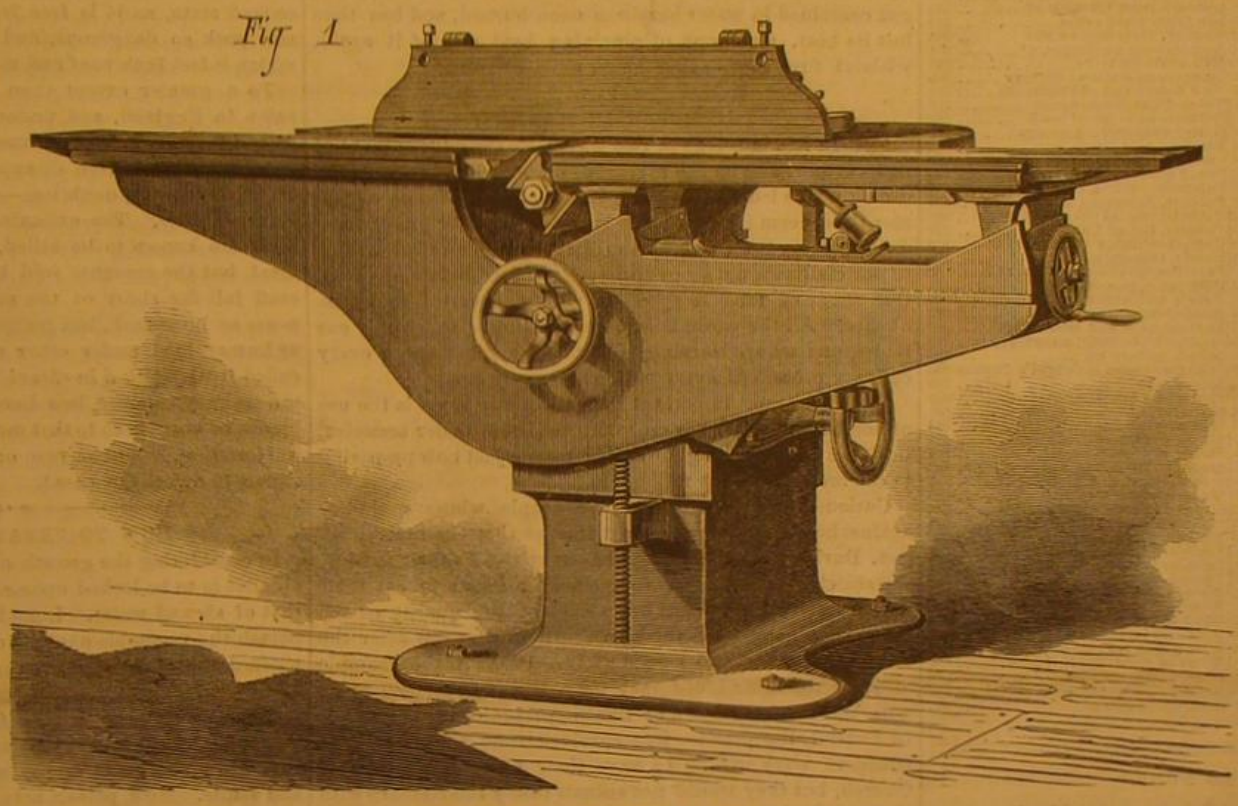
Among those who have done a great deal in this line of invention, the above mentioned manufacturers deserve to be placed foremost in rank. The device last produced by this firm is a planer, and is termed by the manufacturers the Universal Jointer. It will plane out of wind, parallel or taper, joint, square, bevel, and make a perfect glue joint, also a rolling joint. It will square; it will raise and finish one or both sides of a panel at the same operation with square, bevel, scotia, cove, or ogee raise; it will gain and plow, making a square, bevel, or round gain or groove, from ¼ inch up to 8 inches wide; it will make straight, bevel, and elliptical moldings, and rabbet any cut from $\frac{1}{16}$ to 1¼ inches deep, and 3½ inches wide. It will corner, bevel, hand match, smooth, bead, flute, chamfer, round, nose, saw, bore, and rout; and all of this work is done on the single machine by merely changing heads, the labor of a moment.

The heavy iron body of the tool is cast in one solid piece, and, while occupying very little floor room, is a rigid support of the machine. The table frame, although heavy, and also cast in one piece, can, nevertheless, be easily brought to any required hight, raising both tables of the machine at once, keeping, if required, the given attitude of the tables. The latter are both adjustable. The table in front of the cutter head, which is raised and lowered independently of the table in rear of the latter, or of the table frame, can be moved to or from the cutter head, and at any distance from the same, raised or lowered, or otherwise adjusted. The table, in brief, raises always towards, and lowers from, the cutter head. Back of the two front tables, there is a third table (also adjustable by means of a hand screw), which serves to rest long material upon when gaining, cross cutting, or sticking circular or elliptical molding. The same table serves as a rest for the adjustable fence or guide for planing square, or beveling, and for other purposes. The other side of this machine, shown in Fig. 2, is provided with a boring and routing table, which can be raised and lowered by means of a hand screw. The different kinds of boring and routing can be done here, it being no matter whether the front side of the machine is being used or not at the time.

The machine is suitable for light and heavy work, and therefore will be useful for railway car builders, agricultural carriage and wagon works, planing mills, house builders, sash, door, and blind, furniture, and cabinet, factories.

Two sizes are being made, the one to plane 6 inches and the other 8 inches wide, and are warranted and guaranteed in every particular as to the capacity, quality, and finish of the work. If required, countershafts for the same can be furnished. The pulley on the cylinder should make 3,800 revolutions per minute.

Fig. 1

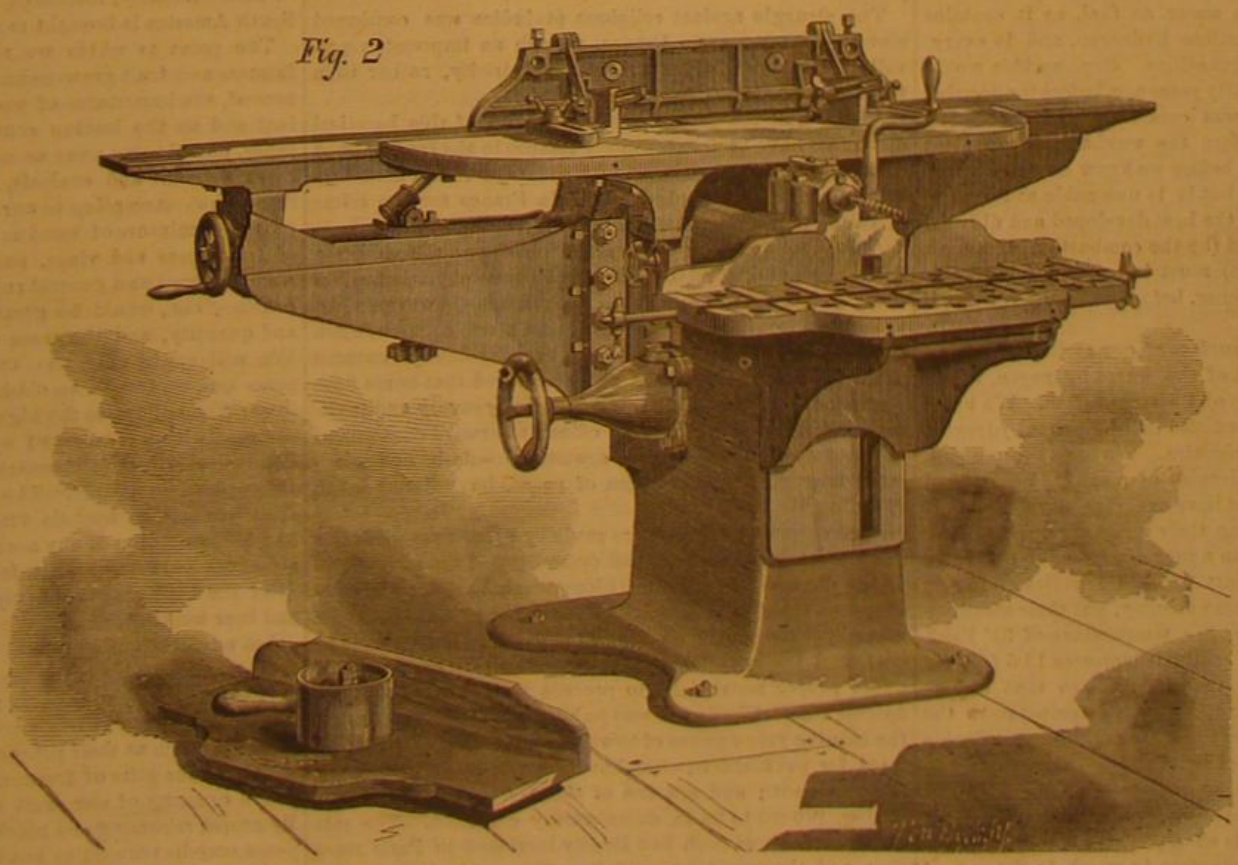


PATENT UNIVERSAL JOINTER.

The body of this very useful machine is so designed that the belt may be brought from below or from a different position on the side. This enables the tool to be placed in an upper story and the belt to be led up to it, thus economizing room, a point of considerable importance in many manufactories.

The device is covered by three patents, the latest dated April 7, 1874, and all obtained through the Scientific American Patent Agency. For further particulars, address the manufacturers as above.

Fig. 2



No two persons can actually see the same rainbow, as each receives the light from different drops of rain.

The Czar at Woolwich Arsenal.

The London *Telegraph* relates the following account of the Czar's visit to Woolwich arsenal during his recent stay with the Queen: The party made their longest halt in the factory where the Nasmyth hammer, the largest in the world—fitted with top steam—is worked. Adding to the forty tuns dead falling weight of the hammer the fifty-one tuns given by a full pressure of steam above, a blow equivalent to a weight of ninety-one tuns can be given by it with as much control as a child may exercise over a toy mallet. The Imperial party occupied a specially erected platform to witness the welding of the trunnion coil of a thirty-eight tun gun. The Cesarewitch last year witnessed a similar process with the trunnion coil of a thirty-five tun gun. The massive door of the furnace was raised, and, in a fire terrible from the fierceness of its golden glow, stood the white hot coil—a cylinder weighing twenty-three tuns and a half. This trunnion coil consists of two thicknesses of bar iron, coiled one upon the other, and the work of the steam hammer was to weld them into a homogeneous cylindrical mass. The powerful crane was set in motion, and the swarthy smiths sprung to the beautifully adjusted machinery by which the fiery mass was seized by giant tongs, swung glowing and hissing out of the fire, and placed under the hammer. Blasts of hot air rushed across towards the spectators, but the vast size of the building rendered eye protectors unnecessary. The coil, it is needless to say, was welded effectually; the very floor, although its foundations are on a rock, vibrating with the tremendous blows. The force, wielded by but a dozen men at the lever of the crane, was astounding; yet the hammer was subject to a steam power more formidable than itself. In their anxiety to see the next process, the visitors passed hurriedly through the heavy turnery and sighting room, where they might have seen thick slabs of metal peeled off the partly built guns, as apples are peeled by a dessert knife. The party, without bestowing more than a passing glance at the great guns on the lathes, went into the open air to witness the shrinking on of the breech coil of a thirty-five tun gun. Lying side by side, smiling in their new polish, lay a remarkable collection of guns ready for use. The largest cannon was the famous thirty-eight tun gun, the heaviest yet completed. The Woolwich infants (thirty-five tuns) were an interesting family of four; of twenty-five tun guns there were twenty-five, and twenty of eighteen tuns. After these frightful engines of destruction, no one troubled himself much with the smaller cannon, whose name was legion.

Remedy for the Colorado Potato Bug.—Mrs. Samuel Deforce, of Businessburgh, Belmont county, Ohio, writes us that her potato vines were very quickly and effectively cleaned of the above insect by a couple of guinea fowls, and she thinks that these industrious and persevering bug pickers might be very advantageously employed wherever potatoes are grown.

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Contents:

(Illustrated articles are marked with an asterisk.)

WATER AS FUEL.

Among the attractions at the Colosseum in this city, where the wonderful views of London and Paris are exhibited, are certain practical demonstrations of scientific phenomens, conducted in the side rooms. Here we found a lecturer who has the merit of successfully illustrating his points with some of the most striking standard experiments of the chemical lecture room, but the theories he propounds are not always consistent with the present state of scientific knowledge.

During one of his recent lectures, we heard him expound the idea that, at a future time, when all the wood and coal have given out, we shall use water as fuel, as it contains large amounts of the combustible hydrogen, and is everywhere present in unlimited quantities. Such an idea would have been pardoned forty or fifty years ago, before the doctrine of the correlation of forces was established, before the nature of heat was known, before the mechanical equivalent of heat was determined, and before we knew how to account for the heat of combustion; but it is untenable at the present day, when we know that the heat developed and diffused when the oceans were formed (by the combustion of almost all the hydrogen on our earth) must be given back to this hydrogen, in some form or other, before we can reconvert it into the combustible gas.

In fact, the waters on the surface of our earth are nothing more nor less than the result of the burnt hydrogen, which gave out its heat at the time of its combustion. We know at present that this heat pre-existed in the gaseous hydrogen, stored up in its atoms or molecules. We have become convinced that the atoms or molecules of a gas are not in fixed positions, but move in straight lines or elongated ellipses, hurrying to and fro, encountering their neighbors, rebounding and continuing their course in a new direction, according to the established laws of impact of elastic bodies. They do not move with exactly the same velocity, but their mean velocity is, for hydrogen gas at the temperature of 32° Fah., about 6,100 feet per second, while it increases 12·5 feet for every degree of rise of the thermometer; so that at 522° Fah. or 12,200 feet per second, at which temperature the gas must consequently, under the same volume, exert double the pressure, they will possess twice the velocity.

A pound of ice-cold hydrogen gas possesses, therefore, an internal energy as great as that of a pound ball moving 6,100 feet per second; and it is this energy which is taken from it when changed from its gaseous state, to which, in the case of combustion, is added the internal energy of the oxygen; hence the result that, by the combustion of every pound of hydrogen, an energy is developed of 62,030 units of heat, equivalent to 47,888,400 foot pounds, which means that it is sufficient to raise a weight of 23,944 tuns a foot high.

It is evident that this energy cannot be developed for the second time from the hydrogen in the water; but, on the contrary, it must be given back in case we wish to separate the two elements composing the water. One of the means of effecting the separation is great heat. By passing steam through a white hot platinum tube, it is decomposed into its elements, while a part of the heat applied totally disappears, to be changed into the molecular motion of the gases. A second method is the electric current. When we pass a sufficiently powerful current from a voltaic battery through the water, the latter will be decomposed into its separate elements; while the electric energy, apparently disappearing, becomes in its turn transformed into the molecular motion of the gases. The third method is found in the play of those energies which we call chemical affinities. In this case, the most simple illustration is the introduction of a piece of sodium amalgam under a bell jar containing water. The sodium oxydizes, and the energy developed by this oxidation is appropriated by the hydrogen, which thus finds the conditions under which it can assume again the hidden molecular motion necessary for its existence in the gaseous state.

It is evident from the above that it is as impossible to burn the hydrogen in the water, or in its vapor, as it is to burn the carbon in the lime rock or in the atmospheric carbonic acid. No fuel can be burnt up twice; and as the hydrogen contained in water has been once burned, and has thus lost its heat, any hope of obtaining heat out of it again, without first introducing heat, must be vain.

THE HORSE IN MARKET.

Modern life broadens in two ways: by the development of new customs and by the revival of old ones. Whenever the causes which led to the abandonment of the customs of former times seem insufficient or inoperative under present conditions, there is a tendency to rëestablish them, thus giving to our civilization a scope and variety never before enjoyed. Our range of food is specially wide and varied in consequence. All the world is laid under tribute to supply our tables, and we are learning to imitate or improve on every culinary process of every nation and every age.

One of the most important revivals of late years is the use of horse flesh, which for centuries has been under ecclesiastical ban except among the sturdy people just now preparing to celebrate their first millenium.

Curiously it was through the people whose prejudice against horseflesh remains most intense that the revival began. During the siege of Copenhagen by the English, in 1807, the scarcity of provisions compelled the Danes to eat their horses; and the practical knowledge of the quality of the meat thus gained led them to continue its use after the original necessity had passed away. Possibly the example of their Icelandic allies may have had a good deal to do with the breaking down of Danish prejudice in the matter. In Iceland, the practice had survived from the first. The islanders were willing to have their souls saved by the Church, but they would not submit to any interference with their stomachs; so, rather than lose them, the Church gave them special permission to eat the "execrable food," which they have continued to do to this day.

The first State to imitate the example of Denmark was Würtemburg, which legalized the sale of horseflesh in 1841. Bavaria followed in 1842, Baden in 1846, and Hanover, Bohemia, Saxony, Austria, and Belgium the year after. In 1853 the prejudices of Switzerland and Prussia were overcome, and two years later Norway and Sweden were added to the list of countries authorizing the sale of the long rejected food.

The struggle against religious prejudice was continued eleven years longer in France, though an impression prevails that the revival is a Gallic eccentricity, rather than the result of Germanic good sense.

At one time the feeling against the use of this heretical diet must have been exceedingly intense in the land of good cooking, for it is on record that as late as 1629 a man was condemned to death and executed in France for the crime of eating horseflesh on a Saturday in Lent.

A hundred and fifty years later, the use of the abhorred flesh was publicly advocated by a French physician. Not many converts to the doctrine were made, however, until the retreat from Moscow. During that terrible march, when the alternative was starvation, the French soldiery ventured to eat their disabled horses, and discovered that horse flesh would not only sustain life, but was really savory and inviting. Several of the surviving officers afterward endeavored to break down the prejudice against horseflesh, and advocated its regular use in times of peace, but without much effect.

More strenuous efforts were made by French savants after the surrounding countries had demonstrated the advantages of the change, and a grand hippophagic banquet was celebrated at the Grand Hotel in Paris early in 1865. In the meantime, the meat had begun to appear in the markets as beef, and the government was forced to authorize its sale under proper restrictions to prevent the exposure of uninspected cuts. The decree was published in 1866, and during the ensuing year upward of two thousand horses were slaughtered for the markets, after having been passed by a veterinary surgeon; and not one of them, on inspection after killing, proved to be in an unhealthy condition. The sale and use of horse flesh has largely increased in Paris since then, and the practice is equally common in all the countries of Northern Europe, save Holland and Great Britain, much to the benefit of the people and the improvement of the stock of horses. In Russia the custom has always prevailed, the Greek Church never having meddled with the matter.

The English, like ourselves, occupy an extremely absurd position in regard to the use of horse flesh. We both eat it in large quantities, yet profess to consider it unfit for food.

It is true that, of the thousands who give the meal a place on their tables as an imported delicacy, very few are aware that it is horse flesh. Possibly the most of those who use it would reject it if they knew its real character; nevertheless the fact remains that horse flesh is largely eaten here and enjoyed, and the inference is legitimate that the flesh of American horses would be found just as savory and just as wholesome.

We call the article, which is kept for sale by every first class grocer, Bologna sausage: so called for the excellent reason that it is manufactured at—not the Italian city of the name—but at Boulogne.

Originally the basis of Bologna sausage was asses' flesh, a more delicate meat than that of the horse, though not less obnoxious to common prejudice. Latterly, however, horse flesh has been its chief component, not used secretly, but openly, since at the place of manufacture the sale and use of horse flesh is as legitimate as the sale and use of mutton or beef. For sausage making, indeed, the flesh of the horse is a safer ingredient than any other meat. No other will bear so well to be eaten in a raw or partially cooked state, as it is free from the trichina which makes raw pork so dangerous, and the undeveloped tapeworms which infest both beef and mutton.

To a greater extent than here the abominated meat is eaten in England, and under less favorable conditions; for in addition to the wholesome Bologna, large quantities of suspicious horse flesh disappear—down the throats of deceived humanity, doubtless—every day in London and other English cities. The animals—broken down hacks and the like—are known to be killed, ostensibly for cats' and dogs' meat, but the amounts sold by the hawkers of that sort of stuff fall far short of the supply. The difference disappears as horseflesh, but reappears, there is reason to believe, as human food under other names. The Parisian caterers called it "*bifsteck à la cheval.*" It is altogether likely that the cockney caterers, less honestly, stop at beef, the resemblance of horse flesh to that much respected commodity being so close that, whether raw or cooked, it would require an expert to detect the cheat.

HOW TO TREAT FRUIT TREES.

In considering the growth of organisms, the action of the alkalies is to be looked upon as scarcely less important than that of air and water. Lime is the great animal alkali, and potash the vegetable one; its old name of vegetable kali expressed that fact, and all the potash of commerce is well known to be derived from wood ashes. The importance of potash as a manure has been frequently overlooked by farmers, who rarely know the large amount of this material found in grass, grain crops, leaves, barnyard manure, roots, and fruits. How potash acts in plants, in conjunction with carbon and silex, to form woody fiber, starch, sugar, and oil, is yet unknown to chemical observers, but the fact of its action is beyond a doubt. Liebig long since pointed out that the chief cause of barrenness is the waste of potash carried off by rich crops, especially tobacco, with no replacement by proper manure. How many millions of pounds of potash have been sent to Europe from the forests of America, and in the grain, tobacco, and hemp! Luckily one alkali may be replaced by another, and we have received a considerable quantity of soda from European seaweed and in the shape of salt. Latterly, nitrate of soda from natural deposits in South America is brought to us at a cheap price.

The point to which we now call attention is that our farmers and fruit growers have ignored, or rather been ignorant of, the importance of wood ashes as a vegetable stimulant and as the leading constituent of plants. Even coal ashes, now thrown away as useless, have been shown, both by experiment and analysis, to possess a fair share of alkaline value. According to our observation, if the practice of putting a mixture of wood and coal ashes around the stems of fruit trees and vines, particularly early in the spring, were followed as a general rule, our crops of apples, grapes, peaches, etc., would be greatly benefitted in both quality and quantity, and the trees and vines would last longer. We will relate only one experiment. Some twenty-five years ago, we treated an old hollow pippin apple tree as follows: The hollow, to the hight of eight feet, was filled and rammed with a compost of wood ashes, garden mold, and a little waste lime (carbonate). This filling was securely fastened in by boards. The next year, the crop of sound fruit was sixteen bushels from an old shell of a tree that had borne nothing of any account for some time. But the strangest part was what followed. For seventeen years after the filling, that old pippin tree continued to flourish and bear well.

Let us call attention to still another point of importance in fruit-raising. This is the bearing year for apples and fruit in general in New England; probably it is also in some other parts. Now when such years come, the farmers rejoice too much at their prosperity and abuse it, as nearly all people do the gifts of fortune. We should be temperate as to the quantity of our fruit as well as of our fruit juices. By proper trimming and plucking, the apple crop in bearing years may be reduced to but little more than half a crop as to number, but the improvement in size and price, and in the future effect, will more than balance the loss. Next February, March, or April, according to latitude, let the tree trimmer stimulate and nourish his trees and vines with a fair supply of ashes; and in nearly every case he will have a good crop of fruit in the non-bearing year.

COFFEE GROUNDS.

Not long ago, *Punch* figured that social bore, the chronic fault finder, in the guise of a complaining recruit. "Now then, Pat," says the sergeant testily, "what's the matter now?" "Sure, sor," the undeveloped hero replies, "they ch'ate me out of the thick of me choffee, sor!"

At sight, no complaint could seem more destitute of "grounds." To the average reader, none could be more absurdly ludicrous; for every one has learned by bitter experience what it is in the ordinary way not to be cheated of the "thick of the coffee."

Yet, without becoming the champion of cheap restaurants and boarding house madams, it is possible to argue seriously that Pat was the victim of a real wrong, that in losing the substance of the coffee berry he lost what would have been of actual service to him. The chemistry of the question is simple enough.

As commonly made, the infusion of coffee which we drink contains not more than twenty per cent of the substances which compose the berry. Of the remaining eighty parts, which we throw away as "grounds," about thirty-four are woody matter without nutritive value. The rest, or forty-six parts out of the hundred, contain in large proportions nitrogenous matters, fats and mineral salts, demonstrably useful for the nourishment of nerves, muscles and bones. In other words, by our mode of making coffee we lose more than half its available and valuable constituents. Considering the tuns of coffee imported every year, this wholesale wastefulness becomes a matter of considerable magnitude, this of course only on the condition that the rejected matter can be used with pleasure and profit. That it can be so used is shown by the practice of the Turks, who make coffee as we do chocolate. The coffee, finely powdered, is drunk with the infusion. In this way all the stimulating qualities of the infusion are secured, with the full aroma and all the nutritious elements of the berry. It is perhaps needless to add that, for use in this way, the coffee must be reduced to an impalpable powder.

To those unaccustomed to oriental coffee, the limpid infusion may seem much to be preferred. As a stimulating drink, it is undoubtedly preferable, but the good qualities of coffee are not exhausted with the infusion; and as a matter of economy, it may be worth while to sacrifice limpidity for nutrition. Besides, as one becomes accustomed to thick chocolate and learns to like it more than the clear infusion of the cocoa bean, so, it is claimed, the taste for *café a l'Orientale* may be acquired, with a corresponding improvement in the beverage.

EVERYBODY'S CENTENNIAL.

If we did not have a fair degree of confidence in the ability of our people to carry through any great enterprize in a very short space of time, after their interest and enthusiasm in its behalf is once thoroughly aroused, we should feel serious doubts regarding the certainty of the success of the Centennial, in view of the apparent apathy which now exists concerning that undertaking. We believe, however, that the present tendency, though it is perhaps to be deplored, is to procrastinate and to leave to the last few months the accomplishment of work which might be more leisurely if not more completely performed within the two years to come. While therefore the people as a nation should be urged to appreciate the necessity of early preparation for so important an event, it would appear advisable to encourage besides other plans, tending to what may be termed the individual celebration of the anniversary. In other words, while in no wise neglecting a national enterprise such as the proposed exposition, the commemoration of the day by separate States, cities, or towns, professions, trades, or individuals, by the erection of statues and monuments, or by the establishment of useful institutions, would we think, involve an idea which would meet with a universally favorable reception, and at the same time would evoke a more immediate and more direct interest in every class of the community. Such a scheme has already been suggested by Mr. W. S. Ward, of this city, and has encountered no small share of general approval. The plan is well calculated to excite a spirit of emulation and to arouse local attention. "It is proposed," says Mr. Ward, "that each class of artisans, artists, and students, and professors, scientists, and theologians, be requested to undertake the erection or endowment of some fitting memorial of the day, which should at the same time be of service either in educating and amusing the living or honoring the worthy and distinguished dead. Thus the artisans might, through their various organizations and in different localities, erect reading rooms, night schools, etc.: there might be art museums, law, medical, and theological libraries, museums of natural history, zöological and botanical gardens, aquaria, etc."

It is hardly necessary to descant upon the advantages of the scheme, which is at once practical and feasible, and at the same time free from the clog of politics. We would especially commend it to the classes to which the large majority of our readers belong. The mechanics, through their trade societies, might provide training schools for apprentices, establish centennial funds for the poor or unfortunate of their craft, and, in their various abodes, erect halls for meetings or educational uses.

As an instance of what the manufacturers might do, there is the proposed testing laboratory of the Stevens Institute, an establishment which they would find of constant benefit. Let them endow that, and half a dozen similar ones throughout the country. The wealthy in the same calling might found scientific scholarships, erect colleges, or additions to those already in existence. There is the Cambridge Museum, Agassiz's great work, now with an income inadequate for its support. The teachers' memorial subscription Plan, it is true, has met with a noble response; but cannot the Scientists, and the manufacturers who depend upon the teachings of Science, endow the institution with a centennial gift sufficient to place it above all possibility of future want? And speaking of Agassiz, who out of the many scientific men in this great city will contribute toward erecting a statue of him in Central Park? Are there not enough teachers and students of Science in the metropolis to raise the necessary sum by a very small subscription from each, and thus to provide a noble memorial both of the Centennial and of the great naturalist?

We might continue, and devote columns to suggestions similar to the above, did we believe the same were necessary to interest the people. That such interest has been aroused and has borne fruit is seen in the offer of Mr. Gordon Burnham to place a statue of Daniel Webster in our beautiful park, at his individual expense. Now let some of our millionaires help the people of the city to establish the Museum of Natural History, the corner stone of which has just been laid, or to found a free lending library, or to add to the Metropolitan Museum of Art, or to build the proposed aquarium in Central Park. Or perhaps we have another Peter Cooper among us, who will erect such another grand and enduring monument of whole souled charity, or a second Peabody who will give our working classes cheap and commodious homes and emancipate them from the miseries of the tenement house.

But it must be remembered that in thus honoring the past to serve the future, it will not do to delay. What is to be done, must be done now. Those first in the field will do the greater service in arousing others to like action. If every one, and the gift is purely a matter of individual choice, will determine to contribute something, whether a subscription of a few pence or a check for thousands, and carry out his determination right speedily, we shall have such a celebration for our hundredth birthday as the world never before saw, and besides shall have conferred upon posterity lasting benefits, of which as a nation we may well be proud.

THE AMERICAN MUSEUM OF NATURAL HISTORY.

"In this country, we popularize knowledge and give to Science a holiday air; and instead of putting our collection, as some have proposed, into cold catacombs of Science and long, gloomy galleries in which Nature is classified, ticketed, stuffed, and covered with dust, in a manner well adapted to create weariness rather than to attract people to the study of natural objects, it is our purpose to provide such structures as shall furnish agreeable entertainment to the general visitor, while at the same time affording valuable aid to common school education." We quote from the very able address of Mr. Salem H. Wales, read, in the absence of that gentleman, by Mr. Henry G. Stebbins, on the occasion of the recent laying of the corner stone of the Museum of of Natural History in this city; and the words, we are confident, will excite the hearty satisfaction not only of our own citizens, but of every advocate of popular science throughout the country. They denote the fact that the days when the people were content to read of the rare and wonderful in Nature, or when even their knowledge of her teachings was confined to the limited horizon of their daily existences and abodes, all else being but as abstractions, are passed. We are no longer satisfied with the claptrap of the showman and the presentation of Nature in connection with the tinsel of the arena; nor yet with the other extreme, as exemplified in the classic collections of the academy, which, buried under a mountain of technical knowledge, speak but to the erudite, and are dumb to the ordinary mind. With the growing taste for Science and her teachings, so palpably apparent in this country during late years, has arisen a desire for closer intimacy with the foundation on which our human learning is based, and in that spirit of inquiry the people demand to see more of Nature in intelligible form.

To gratify this thirst almost as soon as recognized has been and is the object of all thinking men, who, in the wider dissemination of useful and valuable knowledge throughout the masses, see the road to a higher national existence and prosperity. In this great movement the press is the pioneer; then follow the lecturer and individual teacher to expand and impress the ideas suggested; and lastly, as the outgrowth of the interest awakened, appears the museum, in which the public may study, in palpable shape, objects existing formerly but in the imagination. Here in the metropolis, the journalist and the teacher have labored long and faithfully, and it is to their lasting credit that, amid the whirl and confusion of a vast city, more rapid, more active in its business life than any other in the world, temples of Science, now nearly equal in magnitude to, perhaps in time to excel, all elsewhere, are slowly rearing their massive walls. New York, although at present behind some of her sister cities in devotion to scientific culture, will, be believe, eventually lead in the van; and the recent ceremonies initiating the construction of the first of her great permanent museums, to which the presence of the Chief Magistrate of the country lent a dignity and importance which they well merited, are but the presage of future and greater work which will more than cover past deficiencies.

The Museum of Natural History was incorporated by the legislature of this State some five years ago. Up to the present the trustees have been steadily at work securing collections and carrying into practical operation the object of their trust. Many contributions have been received from public spirited citizens, and with means mainly thus raised the extensive collection of mammals, birds, fishes, etc., belonging to the late Prince Maximilian, of Neuwied, the Elliott collection of birds, besides a large part of the celebrated Verreaux and other collections of specimens in natural history, have been purchased, the whole forming a large and sufficient nucleus for future additions. These objects are now temporarily deposited in the former arsenal within the limits of Central Park, a building too small to contain even the aggregate of all now in the possession of the institution. In view of the latter fact, as well as from the appreciation of the need of popular museums in the city, a number of influential citizens petitioned the legislature for a permanent and fitting structure, in response to which a large plot of ground, covering some four city blocks, known as Manhattan Square, and adjoining the Central Park on Eighth avenue, was set aside for the site of a substantial fireproof edifice, to cost $600,000. The basement of this structure has been completed, and the exterior walls rise, at the present time, to a few feet above. The materials used will be brick, granite, and iron, and the building will be four stories high, with mansard roofs and towers. The ground floor will measure 66 feet by 200 feet.

The proceedings incident to the laying of the corner stone were witnessed by a large gathering of the best known residents of the city. There was an address by the President of the Museum, Mr. Robert L. Stuart, giving the objects of the institution, followed by the speech from which, as above remarked, we extract the initial paragraph of this article. Mr. Stebbins, after reading Mr. Wales' written address, hinted that at some future time the Museum of Natural History, now begun on one side of the Central Park, together with the Lenox Library, nearly finished, and the Metropolitan Museum of Art, soon to be commenced on the other side, might be joined with other buildings to form a national university worthy of the greatest city on the continent. The idea is a lofty one, and, from its magnitude and grandeur, may well invoke serious consideration. Governor John A. Dix then made a few appropriate remarks, and an able and learned address by Professor Joseph Henry, mainly devoted to the subjects of endowments for fostering original research, and the value of popular museums as educators, closed the verbal portion of the ceremony. The stone, under which copies of the city papers, coin, currency, etc., had been deposited, was then lowered, the mortar being previously spread by the President. A promenade concert and inspection of the collections, at the Arsenal where they are deposited, completed the proceedings.

STEEP GRADIENTS.

We are indebted to Mr. Henry Handyside, of London, for a copy of a small publication entitled as above, containing a description of his newly invented method of surmounting steep railway grades, together with a statement of its merits and other facts relating to railways in general. Mr. Handyside's invention consists in attaching a drum and traction rope to the bottom of the locomotive or tender. When the train reaches the foot of a steep grade, the engine is uncoupled from the train, and runs up the grade, paying out the rope, one end of which is attached to the train. On reaching the summit the locomotive is locked to the track by means of a pair of griping levers, steam is applied to the drum, the rope wound and the train drawn up. By the use of this simple and cheap attachment, Mr. Handyside shows that any ordinary locomotive will readily draw the heaviest trains up grades of one foot in ten, or 528 feet to the mile, and he therefore proceeds to point a few of the advantages that would result in railway construction by the adoption of his plan of operation, among which are the following:

Saving in first cost of survey. Saving on embankments. Saving on face cuttings. Saving in the length of tunnels. Saving in the length and hight of viaducts. Materially shortening all lines which have high land between their extremities. A corresponding saving in length of rails. Any locomotive capable of hauling a given weight up a gradient of say 1 in 50 to be capable of hauling the same load up 1 in 10 or even 1 in 8. A much lighter class of locomotive necessary. A corresponding reduction in weight of rails. Simplicity of construction, inexpensive, and not easily deranged. Less friction and ware and tear on all steep gradients, of say 1 in 10, than on the generality of gradients now in ordinary use. No break of gage necessary, and applicable to any gage. Especially applicable to tramways, which as feeder lines will often penetrate into hilly districts. The carrying power along the whole line not limited by the frequent occurrence of steep gradients.

All of these are important points in favor of the invention which will be readily appreciated by railway engineers and projectors.

An application of steam to the towage of canal boats, somewhat analogous to the foregoing, was patented in this country last year, by G. S. Olin. He uses a light steam tug carrying a rope drum on deck, one end of the rope to be attached to a train of boats. The tug steams rapidly ahead, paying out the rope, then drops pole anchors, and winds up the rope, drawing the boats along at a good speed. The tug then starts ahead, unreels the rope, and, before the boats have lost headway, begins to wind up the rope again. In this way a small tug of light draft, burning but little fuel, may successfully tow several hundred tuns of freight through the canals, at the required average velocity of 3 miles per hour. This method appears capable of being worked out into a valuable system of canal navigation. It is worthy of careful attention and encouragement.

A WHALE, 60 feet in length and 10 feet in diameter, was recently captured in the Raritan river, near Perth Amboy, N. J. The fish accidentally ran aground, and was shot by a farmer.

A NEW DOMESTIC STEAM ENGINE.

M. Fontaine has recently received a prize of $200 from the French Société d'Encouragement, for the invention of the domestic steam motor represented in the annexed engravings. The boiler of the device contains enough water to furnish some 42 foot pounds, during the continuous period of work of a woman—some four or five hours; and the design is to renew the supply during meal hours, allowing such interval for the generation of steam, ready to begin work again. The device is composed of a generator—an engine and a gas furnace with automatic register. The engraving shows the exterior of the invention, and also a sectional view. A is the body of the boiler, in the lower side of which are twenty-four copper tubes, B, the upper ends of which enter the smoke box, C. D is a sleeve through which the gases of combustion descend to the chimney, and E is a superheating tube which is closed at the bottom and extends down through the smoke box, as shown. F is the feed water tube, closed by a screw plug, indicated by dotted lines. Water cannot be put into the boiler except when there is no pressure of steam. At G, dotted lines, is a cock which draws off the steam when water is to be supplied, through a pipe, H, and thence into the chimney. I is the flue connecting with the sleeve, D. J is the furnace composed of twenty five Bunsen burners. The gas, on leaving the meter, goes to the upper part of the machine and enters at L. Here it meets a flexible tube, M, which resembles a bellows, and forms a pressure regulator. N is a counterweight suspended to the tube, M, maintaining it at a length corresponding to the desired pressure. When the limit fixed is exceeded, the tube elongates and checks the flow of gas by closing smaller the orifice, L. K is the tube conducting the gas from this apparatus to the burners. Steam is taken from the superheating pipe by the tube, O, and is led to the slide valve, P, which communicates with the cylinder, Q. R is the slide eccentric, S the crank, T the belt wheel, U the exhaust pipe leading to the chimney, V the manometer, and W the supporting legs of the apparatus. X is the wooden envelope, having dilatable joints which surround the boiler and cylinder, and is lined with thick felting. Y is a small inclined mirror, which allows the operator to see a reflection of the gas burners, and so to judge of the heat of the fire.

Cylinder, valve, chest, slides, and frame of the engine are all cast in a single block, in which the necessary apertures are bored. No cores are used in the molding. Steam goes to a simple slide valve operated by an eccentric, and is admitted during one third, and exhausted during five sixths, of the stroke. The shaft, crank, and eccentric are cast in one piece. All rubbing surfaces are of steel. The piston is made in segments, of cast iron, on the Ramsbottom system, and all the ports are circular.

The object of the device is to do any light work now performed by hand, such as driving sewing or washing machines, turning wringers, operating pumps, etc. Its hight from floor to top of fly wheel is about 43 inches, and exterior diameter, 14 inches.

Wire and its Manufacture.

We extract from the *Commercial Bulletin* the following interesting facts regarding the manufacture of wire in New England, and the various uses to which it is employed:

There are now sixteen wire-drawing establishments in New England, of which two are located in Maine, two in Connecticut, and twelve in Massachusetts. Of these last, Boston claims two. Among the Massachussetts wire-drawing mills, that of the Washburn & Moen Manufacturing Company, of Worcester, is probably the largest in the country.

VARIED USES OF WIRE.

There are few branches of metal manufacture whose products are in wider use. Wire is employed for the thousands of miles of telegraph lines; it is woven by machinery, strong enough to make fences, and of such delicacy as to make the finest wire cloth; large quantities are used for galvanic batteries and for other scientific purposes; it is twisted into the powerful cables of suspension bridges, and furnishes cables for submarine telegraphs, and ropes for ships, for use in mines, and for other purposes. From steel are made crinoline wire and wire to be drawn into needles of all kinds. A large business has sprung up in the manufacture of wire for piano strings, and of the delicate plated wire for covering the strings. Tinned broom wire makes a considerable item. Of late years there has been a great sale for white wire culinary and ornamental table utensils. It is used in the manufacture of card clothing, heddles, reeds, and other machinery. Woven wire of iron, brass and copper, appears in flour, paper, and other machinery; it makes its way into baskets, screens, sieves, cages, fenders, dish covers, nets, and an infinite variety of similar forms. Coppered pail bail wire is a considerable product. Gold and silver wire is plated or woven into exquisite filagree work, into chains, and into threads for making gold lace; and wires of the various metals are employed for scores of other purposes, in articles useful and ornamental.

PROCESS OF MANUFACTURE.

The wire rods, varying from a quarter to a half an inch in thickness, which are received from the rolling mill in bundles, are heated and re rolled in grooved rollers, one above another, so that the rod can run from the first roll to the second, and so on, without reheating. The rollers run with great rapidity, and the final groove reduces the rod to a coarse wire, about one eighth of an inch in thickness, which is ready for the first hole in the draw plate.

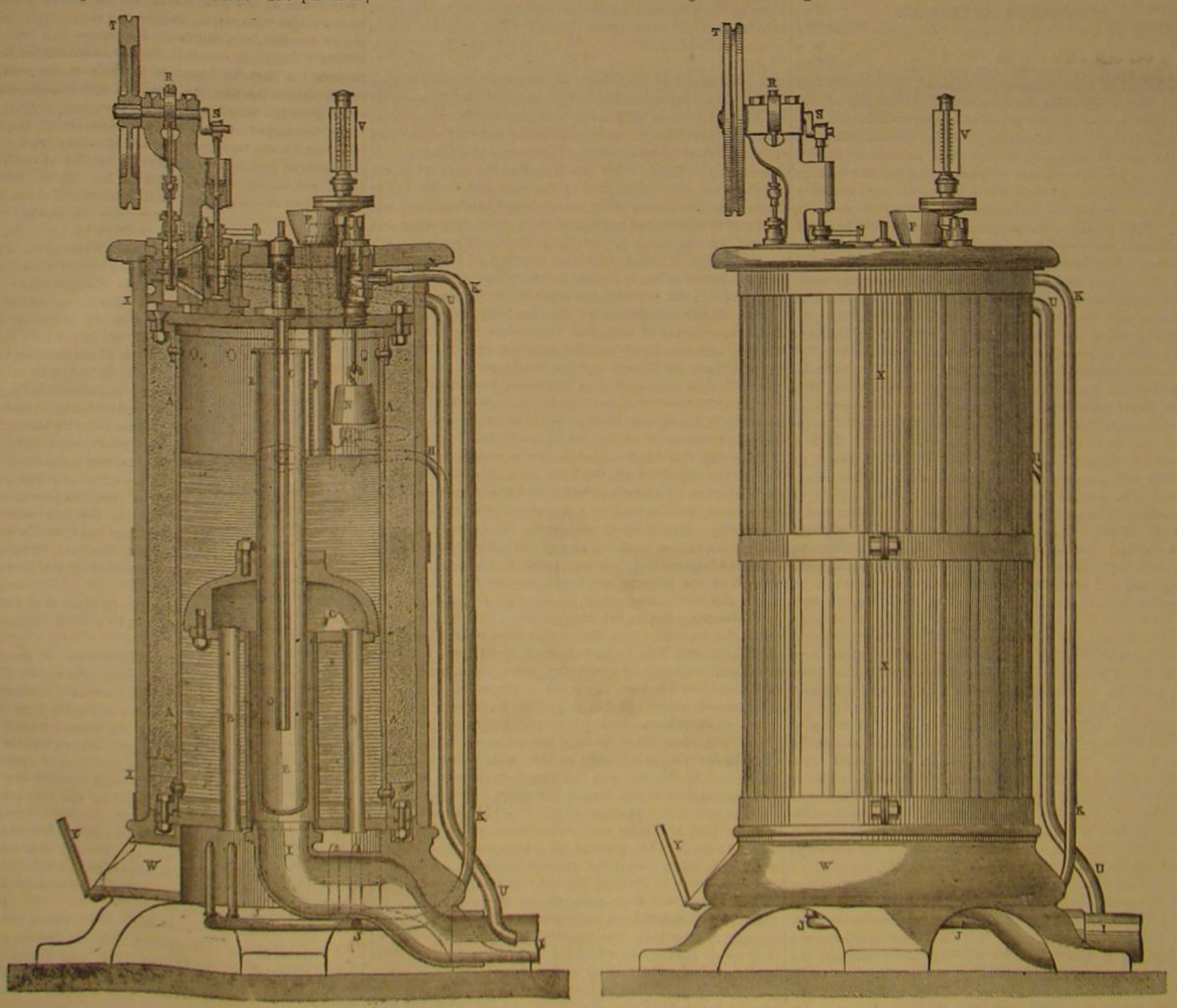
The draw plate, the most distinctive piece of mechanism in this manufacture, is a flat piece of hard steel, with holes corresponding to the various numbers or sizes to which wire for different purposes is drawn. The best ones are made of a combined plate of highly tempered wrought iron and steel, the steel face being on the side through which the wire is to come. The holes are tapering, the smallest end being on the steel side. For drawing very fine wire, in which the greatest uniformity is necessary, the plates are prepared with perforated rubies or other hard stones.

The wire is annealed and drawn cold. The machinery for doing this includes a draw bench, which lifts the wire from a reel to the first hole in the draw plate. The wire passes through this to another reel or drum, on which it is wound, ready for its journey through the second orifice. The same process is continued down the series, until the wire is reduced to the required size. The wire has to be often annealed and cooled during the process, since it becomes less ductile and more brittle as it is drawn down. Grease and wax are used for lubricating. A method has come into use lately of covering brass wire with a thin film of copper, which is of great help in drawing, while the copper can be wholly removed at the last annealing.

The ductility of the metal and the size of the wire regulate the rapidity of drawing. Zinc is the least ductile of the metals used, then brass, next iron, steel, copper, silver, platinum and gold. As the wire becomes attenuated the speed may be increased. Iron and brass, according to size may be drawn from twelve inches per second to forty-five inches per second and the finer sizes of silver and copper are drawn at the rate of sixty or seventy inches per second.

WIRES OF REMARKABLE LENGTH.

Silver wire has been run through plates of rubies to the length of one hundred and seventy miles, in which the most delicate test could detect no difference in diameter in any part. Gold and platinum have been drawn to a "spider line" for the field of a telescope, by coating the metal with silver, drawing it down to the finest number, and then removing the coating by acid, leaving the almost imperceptible interior wire, which, in an experiment made in London, was so attenuated that a mile's length weighed only a grain.



NEW DOMESTIC STEAM ENGINE.

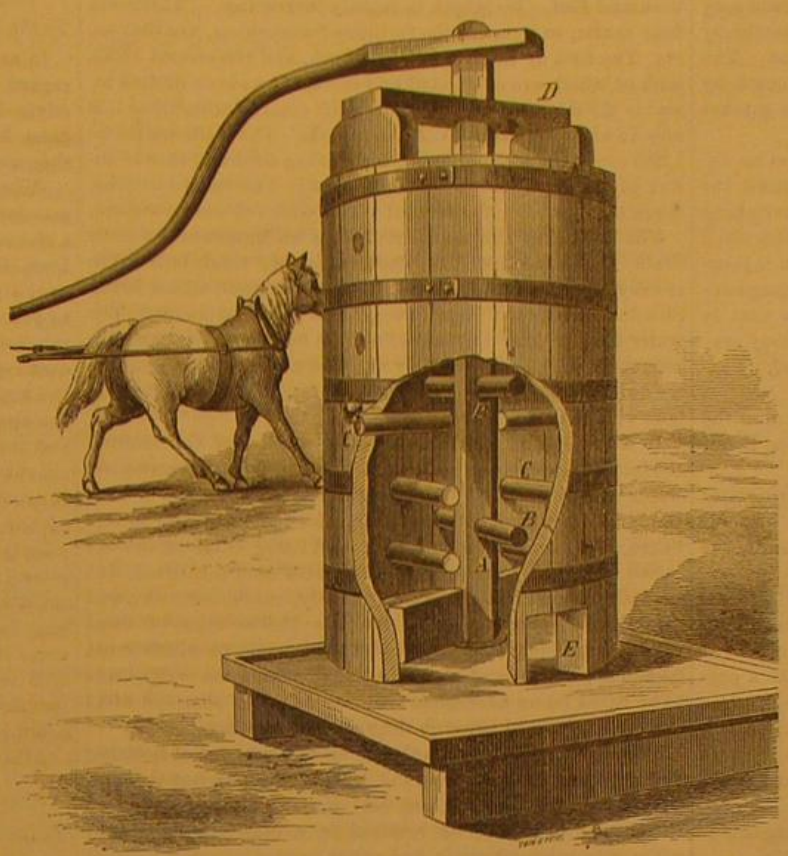
MAY'S PATENT BUTTER WORKER.

Our illustration represents a new butter worker, by the aid of which, the inventor claims, two or three men can work, rework, color, and pack ready for shipment from two to four thousand pounds of butter per day. The machine, it is stated, will work all colors of either soft or hard butter, mixing the same so thoroughly as to cause it to appear fresh ly churned. The sour milk and water are removed, and the butter, being solidified and condensed, is greatly improved, both in quality and in capability of preservation.

The cylindrical vessel shown is secured to the platform, and within it rotates a central shaft, A. On the inside of the body, and attached to the shaft, are placed, one above another, a series of horizontal and rounded arms, B, each pair of which is located at an angle to the couple next above or below. Across the interior of the vessel, and on opposite sides, are secured the stationary chord pieces, C, also made rounded. The shaft is journaled to the diametrical board, D, and power is applied to its upper extremity by means of a sweep, as shown. The vessel has at the bottom a discharge orifice, E, which is cut obliquely in order to allow the butter to escape freely, as the lower pair of rotary arms carry it around.

The mode of operation consists in placing the butter in the receptacle, where it is successively worked by the arms and bars until it reaches the bottom, whence it emerges by the aperture above referred to. It will be noticed that the entire working parts of the machine are of wood, and that no metal comes at any time in contact with the butter.

Patented, through the Scientific American Patent Agency, March 10, 1874. For further information address the inventor, Mr. Alexander May, No. 419 West Market street, Louisville, Ky.



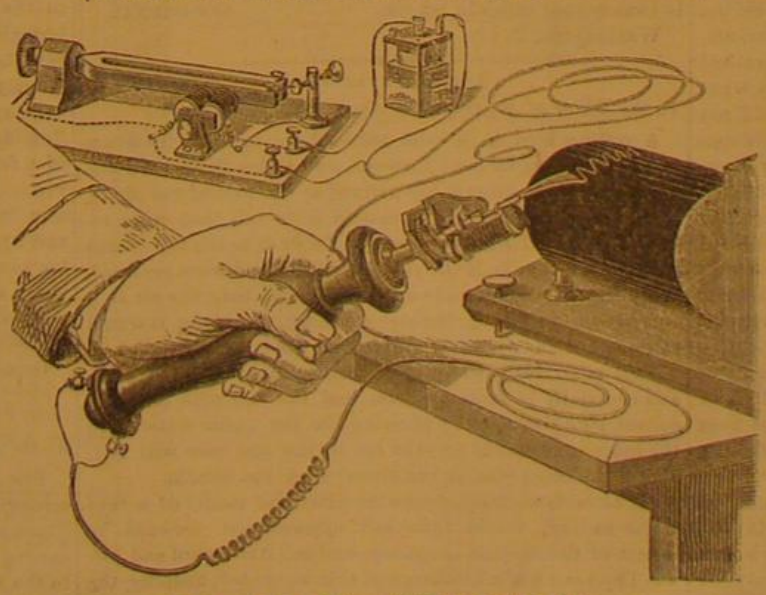
MAY'S PATENT BUTTER WORKER.

The American Tin Ware Trade.

For a long time past one of the best customers of the British maker for tin and terne plates has been the United States of America. At one time we were sending to that country great consignments of tin plate goods in varied shapes and of different values; lately the Americans have learned themselves to use up the tin plates, and now we have them shipping tin plate wares to this country, made from the tin plates with which we have supplied them. In America itself it was at one time thought an extraordinary thing for the Western and Southern States to send into the Northern States articles for which they had before been indebted exclusively to the latter. It was only a few months before that, in conversing with a manufacturer in the Western States of hardware goods at one time obtained by the new world almost solely from Birmingham, we were assured by the American that he should soon be forwarding this same class of goods to compete with those of the Birmingham district in their home market. The goods were not those which have tin plates for their fabric; but what the tin plate makers of the United States are doing would seem to imply that his assurance was something more than empty boasting. The United States manufacturer displays an amount of ingenuity in invention which is but seldom seen in England, and the handicraftsmen in the new world, unlike those of the old, are ready to adapt themselves to a new pattern so soon as it can be shown that it is at all probable to be a success. The American tin plate goods that are now being offered in Birmingham and South Staffordshire are described as simply marvelous, both as to the price of the articles and the ingenuity displayed in their construction. Surely there is something very wrong in this country when the Americans, after buying our tin plates and paying heavier wages for the manufacture of the article, are able to offer it here at prices much under those at which we can produce it.—*The Engineer.*

DR. MAREY'S CHRONOGRAPH.

The use of the tuning fork for the measurement of very short intervals of time presents certain advantages which have led to its extended employment in recent chronographic apparatus. Our illustration represents a new instrument of this description, which is an improvement on a device of M. Mercadier, or rather is an attachment to the latter for the purpose of ensuring greater accuracy. M. Mercadier's invention is shown in the upper portion of the engraving, and consists of a tuning fork horizontally placed. One branch is attracted by an by an electromagnet. Its movement toward the core, however, breaks the current, causing the arms to spring back. This phenomenon is repeated indefinitely, throwing the branch into very rapid vibrations, each of which causes the contact of a platinum wire with a small platinum disk communicating with the battery. Suitable registering devices were connected with this instrument which it is unnecessary here to describe, as Dr. Marey found that its employment was frequently difficult on account of the extremely small amplitude of the vibrations. In order to remedy this defect, the above inventor places, in the circuit of the electromagnet of the tuning fork, a second electromagnet which naturally becomes magnetized or demagnetized coincidently with the first. The second coil has a single bobbin, and attracts its armature a hundred times per second. The armature moves in a plane parallel to the polar face, and is carried by a spring. In order to obtain an absolute unison between the two vibrations, the spring is regulated to proper length by means of a delicate screw. The armature being attracted laterally, its sudden stoppage is avoided, and a much larger amplitude is obtained; and by means of a piece of quill, forming a prolongation, it traces curves corresponding to hundredths of seconds on a blackened surface. The electromagnet is carried, as shown in the principal figure, in a handle through which passes the conducting wires establishing the communication with the battery and tuning fork. These wires, which for convenience are united in a single cord, may be of suitable length to allow of using the instrument in any portion, for instance, of a room.



DR. MAREY'S CHRONOGRAPH.

If it be desired to measure the exact period of revolution of a pulley and its variations of velocity during its rotation, the face of the wheel is covered with lampblack, and the quill point of the chronograph brought in contact therewith. The tracing will show the angular movement during each one hundredth of a second, enabling the builder, for example, of a machine requiring delicacy of construction, to detect errors which otherwise might escape his notice. By the same means, suitably arranged, Dr. Marey is enabled to govern the movement of an escapement, and hence to regulate accurately the operation of a train of wheels, an application of value in telegraphic instruments.

Rattlesnakes and Tarantulas in Colorado.

The *Rocky Mountain Miner and Mechanic*, published at Denver, under the head of "Cyclopædia Colorado," devotes a column or two to describing some of the natural products of that wonderful region. In the last number, the editor speaks of rattlesnakes as venomous serpents, to be found in all parts of Colorado.

He says: "It is popularly supposed that the age of the snake can be estimated by the number of rattles; but this is a mistake, for though these may increase with age, their fragility is such that many may be lost by accident; and moreover, more than one may be added annually owing to the vigor, food, state of captivity, etc., of the reptile—twenty are not unfrequently seen in large specimens, but it would be incorrect to conclude from these that the snake was neither more nor less than twenty years old. As the bite of these reptiles is speedily fatal to small animals, it has been generally believed that the use of the rattles is to warn animals and man of its vicinity; but it is more likely that its use is to startle the creatures, upon which it preys, from their retreat, and bring them within the reach of its spring, or some other purpose for its own welfare rather than the safety of man. Dangerous as they are, they rarely attack man unless provoked, and are fortunately sluggish in their movements, unable to spring except from a coil, and are disabled by slight blows. They are viviparous, the eggs being retained until hatched, and the young expelled alive. In winter they retire to holes in the ground, and there remain torpid, several interlaced with each other. They are unable to climb trees in pursuit of prey, and do not follow a retreating animal that has escaped their spring. The most common of the rattlesnake tribe found in Colorado, the prairie rattlesnake (*c. tergeminus*), is a little over two feet long; it is cinorous above, with a triple series of dark brown spots, and a double series of dusky spots below; it is fond of hiding in the holes of the prairie dog

From the same source and under the same heading, we learn something of the tarantula or tarentula, "which," the writer says, "is a terrestrial hunting or wolf spider, belonging to the genus *lycosa*, the *l. tarantula* (Latr.) It is the largest of spiders, measuring 1½ to 2 inches in the length of the body; the color is ashy brown above, marked with gray on the thorax, and with triangular spots and curved streaks of black bordered with white on the abdomen; below saffron colored, with a transverse black band. It received its popular name from being common in the vicinity of Tarants, in South Italy. It makes no web—wandering for prey which it runs down with great swiftness, and hiding in holes in the ground and crevices lined with its silk; there is one spiracle on each side, one pulmonary sac, and eight eyes; it is very active and fierce, and the females defend their young and eggs with self sacrificing bravery. Its bite is supposed to be highly poisonous. The *l. Carolinensis* (Bosc.) is called tarantula in the Southern States; it attains a length of 2 inches, with an extent of legs of 4; it is mouse-colored above, with white sides and whitish dots and lines on the abdomen; below, blackish; legs whitish tipped with black. It makes deep excavations in the ground, which it lines with silk; the females carry their young on the back, giving them a hideous appearance, as if covered with warts; the young run off in all directions if the mother be disturbed. Its poison is active Both kinds are found in Colorado, but the latter are the most numerous. A favorite haunt is the hole of the prairie dog, where the rattlesnake, the tarantula, and the dog may generally be found sociably living together.

[It would seem from the above that the attractions of Colorado are not strictly confined to its grand scenery or its agricultural and mineral products, but that the naturalist may there find specimens venomous enough to gratify the ambition of the most enthusiastic student of Nature.—EDS.]

Expansion of Steam.

At a recent meeting of the South Midland Institute, Mr. Bernard Walker said that the subject of economizing fuel in the production of motive power, or, in other words, the principal points in the construction of steam engines, on which depended their wastefulness, was one of great importance, and nowhere more so than in that district. Professor Joule had calculated that the best engines at present in existence did not render available more than from one tenth to one twelfth of the motive force stored up in the fuel. Remembering that the ordinary steam engines used in manufactories, in mines, and on railways, consumed at least four times more fuel than if they had been made according to well known scientific principles, the national loss thus arising must strike every one as enormous, but the loss was far greater by the use of ill constructed engines. In this part of the country, in the past, consequent on low priced fuel, this matter had been disregarded. Now, however, with costly fuel, it behoved every one to consider the avoidance of waste. From considerable acquaintance with the kind of steam engine used in England, he assumed that few were taking less than from 7½ to 10½ lbs. of coal per horse power per hour. Those of the best construction, however, were being worked with as low a consumption as 1½ lbs. to 2 lbs. of fuel. Mr. Walker thought simple, plain, easily managed engines, that, with ordinary care, would not require more than 2½ lbs. to 3 lbs. of slack per horse power per hour, could be made. After pointing out the importance of all those numerous items included under the head of "good workmanship," and appealing to the members to detail the results of their observations as to the perfection being attained in these respects, he drew attention to the great saving that was being effected by what was termed working steam engines expansively, and the principles therein involved. Mr. Walker then showed cogent reasons for expecting better results from double than single cylinder engines. The drawback to their employment appeared chiefly due to their greater first cost and expense of maintenance, but in very many—nay, most—cases, the saving of fuel thereby gained far more than compensated for the interest on first cost and amount of repairs.

Correspondence.

Notes from Washington.

To the Editor of the Scientific American:

Since my last letter, several bills have been introduced in Congress, having a bearing on patent matters. One, by Henry B. Sayler, "to regulate the manufacture, use, and sale of patent right articles," enacts that every patent shall grant to the inventor, for two years only, the exclusive right; and on application before the expiration of this term, an extension of 15 years shall be granted without further payment, subject, however, to the condition that any person may manufacture and use such patented article or machine by paying a royalty of ten per cent of the market value. The same bill also allows the printing of any book protected by copyright on paying ten per cent of the wholesale market value.

A bill, introduced by Mr. McDougal, provides that no injunction shall be granted prior to final decree unless the complainant shall execute to the defendant an undertaking conditioned to pay to such defendant all damages which shall be sustained by him by reason of the issuing of such injunction, in case the court shall finally decide that said complainant was not entitled thereto; and further provides that in case of appeal from the final decree, the appellant may stay the effect thereof, during the pendency of the appeal, by executing a like bond.

Mr. Mills introduced a bill on the 18th instant to annul the patent No. 110,774, issued to T. W. Mitchell, of Fore Bend, Texas, for a cotton worm destroyer.

Another bill, introduced by Mr. Amos Clark, appropriates $100,000 to pay Montgomery & McClure for the use of their patent No. 24,947 for journal boxes, in the vessels in the United States service.

There was quite a discussion in the House on a bill to allow Norman Wiard to make a new application for an invention that has been forfeited under the two years' clause of the act of 1870. One of the members wanted to make a provision in the act that the United States should have the free use of the invention. Wiard's friends objected, and quite a spicy debate ensued, in which considerable personality was indulged in, after which the bill passed without the obnoxious clause.

One of the largest of the extensive jobs before Congress—the Atwood car wheel—has been reported unfavorably.

I understand that the House Committee on Patents decided on Tuesday last the course to be pursued with respect to the sewing machine extensions, but all information on this subject is denied.

The Senate Committee heard the argument to-day of John Pope Hodnett, counsel for the opponents to the extension of the patent of the Wilson sewing machine, when the Committee, at the request of the applicants, deferred the further consideration of the subject for two weeks. A large number of opponents were present, and much interest was manifested by the contestants.

As mentioned in my last, Mr. Sutro is giving a series of lectures on "Mines and Mining," but devoted mainly to a description of the Comstock lode, the Sutro tunnel, and the advantages that will result therefrom on its completion. These lectures are illustrated by a large number of photographic views, which are exhibited by the aid of a stereopticon and the calcium light, and, being free to all, are tolerably well attended.

The Sutro tunnel is designed mainly for an immense drain to carry off the water which is constantly accumulating in the mines of the Comstock lode, and also a means for removing the ore and providing proper ventilation to the mines. To thoroughly understand the importance and necessity for the tunnel, it will be advisable to give a brief description of the Comstock lode: This celebrated mining district is found at the foot of Mount Davidson, in the Washoe Mountains, and appears to have been formed by some terrible convulsion of Nature, which caused the separation of the surrounding greenstone formation from the mass of rock forming Mount Davidson, leaving a fissure, which became filled in the course of time with argentiferous rock and is now known as the Comstock lode. It was discovered by some poor miners, who were prospecting for gold, of which they had washed out a small quantity, but in washing were troubled by what appeared to be a heavy black sand, which they could not readily separate by the ordinary process, and which was consequently a great difficulty in their way. Happening, however, to subject some of it to the action of fire, they discovered that it was silver. Previous to this discovery, they had thrown away about five thousand dollars worth of this black sand. Directly after this the lode was quickly covered with claims, and mining has been pursued with so much success that about two hundred million dollars worth of silver has already been taken from it.

One of the greatest hindrances to the profitable operation of these mines is found in the immense quantities of water collecting in them, which requires a large number of very powerful pumps to keep them going, and in the difficulty of supplying fuel for the engines employed for working these pumps and raising the ore (of which there are not less than sixty on the Comstock lode alone), requiring, it is said, about six hundred cords of wood in each twenty-four hours. This wood has to be brought to the mines over a railroad which is probably the crookedest railroad in the world, as it pursues a waving course of twenty-three miles to reach a distance of about four and a half miles, owing to the necessities of the grade, there being something near twenty-five hundred feet rise in that distance.

The expense of operating this railroad, most of the fuel, and the great danger and delay caused by the mishaps to the pumping apparatus, whereby the mines are liable to be flooded, will be saved by the tunnel which Mr. Sutro is running to connect with the mines. It stands at a distance of over four miles from the lode, at a point more than two thousand feet below its upper surface, and is intended to run in a westerly direction until it strikes the lode, after which main branches will be run north and south, parallel with the lode; and from these main arteries smaller branches will be driven in various directions to connect with such mines as may be off the principal lines.

The main stem is now being run in and reaches about six thousand feet. Its length is rapidly increasing. There are four shafts, to increase the facilities for working, ventilation, etc. The first of these is 525 feet deep, and the second 1,042, both of which are completed, and the first has been drifted towards the mouth until it met the drift coming from it, so it is now in communication with the mouth. The third would be 1,385 feet deep if completed, but, owing to the immense influx of water, it had to be abandoned. The fourth will be, when completed, 1,500 feet, of which over 700 are now done.

The bottom of the tunnel will form an immense sewer or drain, above which will be placed a double track railroad to convey the mineral to the mouth of the tunnel, which being on a down grade will require very little power to operate. The water issuing from the tunnel will be used to drive immense reduction works conveniently situated at its mouth, and, after doing its duty there, will be employed in irrigating the land surrounding the town of Sutro.

In all those mines not sunk below the bed of the tunnel, the immense expense entailed by hoisting ore and pumping water will be avoided. A few figures will give some idea of the large amount of material to be raised. According to Mr. Sutro, 1,000 tuns of waste rock and 2,000 tuns of ore are raised each twenty-four hours; and with each tun lifted, five tuns of dead weight are raised, namely, cable four tuns, and cage and car one tun each, making 15,000 tuns of dead weight, and 3,000 tuns of ore and waste rock, to which must be added 8,640 tuns of water. All of this immense weight has to be lifted on an average to each tun of silver obtained after the ore has passed through the reducing process.

When the tunnel is completed, all this amount of hoisting and pumping will cease, as the water will run out through the tunnel, and the rock, ore, etc., may be allowed to fall to the bottom, or it may be lowered in a cage and its weight utilized in raising timber and other needed supplies; and it may even, with suitable machinery, be made to assist in pumping water from those mines which have been sunk below the tunnel. The water that now collects in such large quantities in the upper parts of the lode may be used in the same manner before entering the tunnel, by passing it through turbines suitably arranged above it. In this manner such mines as may be below the tunnel will be kept dry by the same water that is now such a trouble, thus turning a curse into a blessing.

In addition to the economic advantages thus obtained, there is another feature, which is the most important in a humanitarian point of view, namely, the ready means of escape the tunnel gives in case of fire in the shafts above the miners. One fire in the Yellow Jacket mine caused the loss of forty-two miners, who were burnt and smothered to death, but might have been alive at this day had the tunnel been in connection with the bottom of the mine.

In view of these advantages, the cost of mining will be so much reduced by the completion of the tunnel that it will pay to mine for low grade ores that are now passed by as useless. It is estimated by Mr. Sutro that, of the immense quantity of ore in the lode that can be profitably worked when the tunnel is completed, only one per cent will pay for working under the present expensive system.

The idea of tunneling for drainage is no new and untried idea, for it has been practiced in Europe for hundreds of years, where mining tunnels are of a length undreamed of as yet in the United States, there being two in the Hartz Mountains, the Georg and the Ernst-August, ten and a half and fourteen miles long respectively, besides several shorter ones. A still longer one may be found at Freiburg, which is twenty-four miles in length. OCCASIONAL.

Washington, D. C.

Aerial Navigation.

To the Editor of the Scientific American:

A sailing bird, in a calm atmosphere, spreads its wings and tail, throws its head forward, and slides downward and forward. Now, after it has arrived at the foot of the plane, if all the conditions which caused it to fall thus were reversed, it would slide upward and forward to the top of the same plane; that is, if the position of the bird were reversed, and every part of it made as much lighter than the air as it was heavier in falling, the size remaining the same, it would fall upward and forward, obeying all the laws of descent.

This same result will also be seen in many falling leaves, and especially in letting a palm leaf fan fall with its more convex side down, or by pressing the fan under water with the more convex side up; the fan in the one case will fall, and in the other rise, in the direction of the handle.

An aerial boat, built somewhat after the model of a bird while sailing, would thus sail upward and forward by reason of the surplus buoyancy, and sail downward and forward by reason of a discharge of this buoyancy, keeping the bow of the boat elevated while rising and depressed in falling, and thus in one ascent and descent a journey would be made. The angles of ascent and descent and the momentum will depend upon the amount of surplus buoyancy, the weight, and the size of the wings or resisters.

For the purposes of aerial navigation, we are at the bottom of a boundless sea; and in a boat constructed as I suggest, with surplus buoyancy, we will be pushed upward, and with weight we will be pushed downward, the forward movement depending upon the form of the boat and of the resisters, and on the elevation or depression of the bow, as stated. In a very imperfect model, I have secured, in a hall, a forward movement of thirty feet in rising or falling eight feet.

As this idea is new to me, I would like the opinion of some practical aeronaut as to its probable utility. LEE.

Wilkes Barre, Pa.

Combining Steam Engines and Water Wheels.

To the Editor of the Scientific American:

In an answer to N. P. S., page 363, issue of June 6, in regard to using a steam engine to assist a water wheel, it is advised to "use each separately, and divide the work to be done between them." In ninety-nine cases in a hundred this could not be done.

Wherever more power is needed, either constantly, or at seasons of low water, or when variable work is being done, a steam engine may be attached to the line shaft which leads from the water wheel, by means of its main band passing over a pulley on said line shaft (situated as near the wheel as practicable), said pulley to have such diameter as will permit both the engine and the water wheel to make each its own regular speed. The effect of this is as follows: When the supply of water is ample for the work, the governor on the engine will shut off its supply of steam or nearly so, and the steam will be retained in the boiler, little fuel being consumed. But when the supply of water fails, or the work is greater, for longer or shorter intervals of time, the speed of the water wheel is decreased, when this governor instantly opens the steam upon the engine, which in turn supplies just the amount of power needed to supplement and maintain the requisite speed of the line shaft. So that, as long as the power from the water wheel is sufficient to overcome its own friction and that of the line shafting, so long will its own water be utilized, even when it would be insufficient alone to accomplish any work at all beyond overcoming said friction. HORACE L. EMERY.

Albany, N. Y.

Steam Pressure on River Steamers.

To the Editor of the Scientific American:

I am glad to see, by your issue of June 6, that Mr. Little has called attention to the excessive steam pressure allowed tow boats on our rivers. I am informed that the new law allows an increase of steam pressure on our passenger vessels of 20 per cent for single-riveted boilers; in other words, instead of requiring one sixth of the tensile strength of the iron for the working pressure, it allows one fifth.

Under the present law, a cylindrical boiler, ¼ inch thick, 40 inches in diameter, of 60,000 lbs. tensile strength, single-riveted, is allowed a working pressure of 125 lbs to the square inch. By the new law it will be allowed 150 lbs.

If this be the case, we are going backwards. I have for many years investigated this matter of boiler explosions on our western steamboats, and am prepared to say that I do not know of a single instance (except in some cases where the flue collapsed) that the cause could not be traced to either the boiler being too weak or the steam too strong. Some of the oldest and most experienced river men have expressed the opinion that 100 lbs. per square inch should be the maximum. It is a matter of mere dollars and cents. By increasing the size of the cylinder, you reduce the pressure in the boiler, and the boat will run just as well. This has been tried. JAMES F. NOBLE.

Cincinnati, Ohio.

New Local Anæsthetic.

To the Editor of the Scientific American:

Noticing a paragraph with this heading in your issue of May 30, detailing the action of camphor rubbed up with a few drops of spirit in connection with chloral hydrate, it occurred to me to call the attention of your chemical readers to the action of chloral hydrate on gum camphor when brought in contact in the solid state. If a piece of gum camphor be placed in a phial in which there has been previously placed an equal amount of chloral hydrate, each substance begins slowly to deliquesce, forming a very limpid, viscous, and highly refractive liquid. In the course of a few hours, the solution of the two solids will be complete. I have used this camphor chloral, or chloral camphor, as a local anæsthetic in neuralgia, and also as an anterotic and hypnotic in the chordee of blennorrhagia with considerable success. I should be much pleased to have some of the many able chemists who read your paper examine and report on the compound. A country practitioner in these regions has neither the means nor the time to experiment.

Osceola, Ark. F. L. J.

Fish in Alkaline Waters.

To the Editor of the Scientific American:

The disastrous effects of alkali, with which our water it strongly impregnated, upon the finny tribe was strikingly illustrated during the past winter, when the thermometer ranged as low as 41° below zero Fah. The lagoons adjacent to the Humboldt river vary in depth from two to four feet at this season of the year, and are well stocked with fish. During the past winter, ice formed on many of them, 8 inches in thickness; as a result of the freezing process, the alkali was precipitated and formed so strong a solution that both fish and frogs all perished. F.

Elko, Nev.

PRACTICAL MECHANISM.

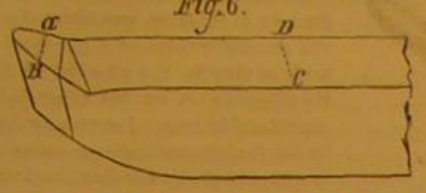
NUMBER II.

BY JOSHUA ROSE.

SIDE RAKE.

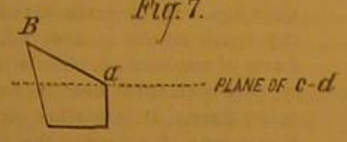
The power required to feed a lathe or other tool, which is moved into its feed at the same time that it is cutting, is considerable when a heavy cut is being taken, unless it possesses what is termed side rake, as represented in Fig. 6.

Fig. 6.



The edge, B, is here supposed to be the cutting one, the face from *a*, to B, being an inclined plane (as compared to the face C D) of which B is the apex, the sectional view at *a*, B, being as given in Fig. 7.

Fig. 7.



This form gives the tool a tendency to feed itself along and into the cut, the cause of which is that the pressure upon the top face, B, *a*, (the result of its having to bend the shaving out of the straight line) is placed, in consequence of the side incline, more upon the side and less upon the top of the face. It has, in fact, followed the direction of the rake, decreasing its tendency to run or spring in (as shown in Fig. 3), with a corresponding gain in the above mentioned inclination to feed itself along, or into, its lateral cut.

When side rake is called into use, a corresponding amount of front rake must be dispensed with, or its tendency to feed itself becomes so great that it will swing round, using the tool post as a center, and (feeding rapidly into the cut) spring in and break from the undue pressure, particularly if the lathe or machine has any play in the slides. So much side rake may be given to a tool that it will feed itself without the aid of any feed motion, for the force required to bend the shaving (in heavy cuts only) will react upon the tool, forcing it up and into its cut, while the amount of bottom rake, or clearance as it is sometimes called, may be made just sufficient to permit the tool to enter its cut to the required thickness of shaving or feed and no more; and it will, after the cut is once begun, feed itself and stop of itself when the cut is over. But to grind a tool to this exactitude is too delicate an operation for ordinary practice. The experiment has, however, been successfully tried; but it was found necessary to have the slides of the lathe very nicely adjusted, and to take up the lost motion in the crossfeed screw.

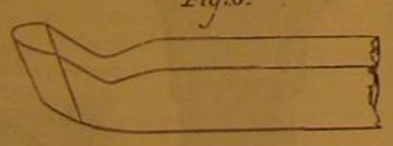
For roughing out and for long continuous cuts, this tool is the best of any that can be used; because it presents a keen cutting edge to the metal, and the cutting edge receives the maximum of support from the steel beneath or behind it. It receives less strain from the shaving than any other; and will, in consequence of these virtues combined, take a heavier cut, and stand it longer, than any other tool; but it is not so good for taking a finishing cut as one having front rake, as shown in Fig. 1.

Having determined the position of the requisite rake, the next consideration is that of the proper form of the cutting edge, the main principles of which are as follows

ROUND NOSED TOOLS,

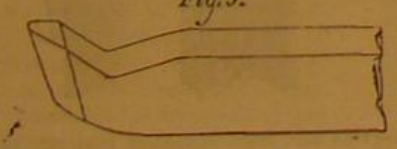
as shown in Fig. 8, have more cutting edge to them (the

Fig. 8.



depth of the cuts being equal) than the straighter nosed ones, shown in Fig. 9, receiving as the result more strain

Fig. 9.



from, and becoming more liable to run into or out from, the cut. If sufficient rake is given to the tool to obviate this defect, it will, under a heavy cut, spring in. It is, however, well adapted to cutting out curves, or taking finishing cuts on wrought iron work, which is so strong and stiff as not to spring away from it, because it can be used with a coarse feed without leaving deep or rough tool or feed marks; it should, however, always be used with a slow speed. On coming into contact with the scale or skin of the metal, in case the work will not true up, it is liable to spring away from its cut. If held far out from the tool post, it is apt to jar or chatter; and unless the work and the tool are both firmly held, it is liable to cut deeper into the softer than into the harder parts of the metal. The angles or sides of a cutting tool must not of necessity be quite flat (unless for use on slight work, as rods or spindles), but slightly curved, and in all cases rounded at the point, as in the tool shown in Fig. 9. If the angles were left flat and the point sharp, the tool would leave deep and ragged feed marks; the extreme point, wearing away quickly, would soon render the tool too dull for use, and the point would be apt to break.

For the finishing cuts of heavy cast iron work, which is not liable to spring, the broad square nosed tool, given in

Fig. 10.

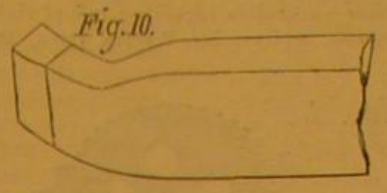


Fig. 10, is the most advantageous.

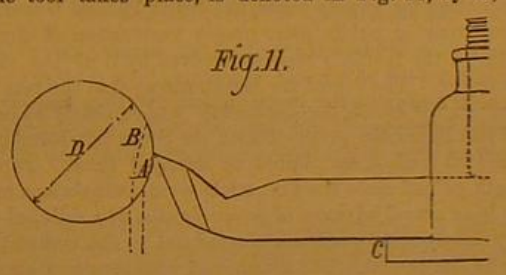
SQUARE NOSED TOOLS.

A feed can be used with this tool almost as broad at a cut as the nose of the tool itself, providing, however, that it is set in position with great exactitude, so that its flat nose or front will be even or true with the face of the work it is intended to cut, and that it is held as close in to the tool post as it can conveniently be, and that, if fed by hand, it be fed evenly, because all tools possessing a broad cutting surface are subservient to spring, which spring is always in a direction (as in this case) to deepen the cut; so that, if more cut is taken at one revolution or stroke than at another, the one cut will be deeper than the other. They are likewise liable to jar or tremble, the only remedy for which is to grind away some of the cutting face or edge, making it narrower. For taking finishing cuts on cast iron, more top rake may be given to the tool than is employed to rough it out, unless the metal to be cut is very hard; else the metal will be found, upon inspection, to have numerous small holes on the face that has been cut, appearing as though it were very porous. This occurs because the tool has not cut keenly enough, and has broken the grain of the metal out a little in advance of the cut, in consequence of an undue pressure sustained by the metal at the moment of its being severed by the tool edge.

HOLDING TOOLS.

All tools should be fastened or held so that their cutting edges are as near the tool post as possible, so as to avoid their springing, and to check as far as possible their giving way to the cut, in consequence of the play there may be in the slides of the tool rest; but if, from the nature of the work to be performed, the tool must of necessity stand out far from the tool post, we should give the tool but little top rake, and be sure not to place it above the horizontal center of the work. The point or fulcrum, off which the spring of a lathe tool takes place, is denoted in Fig. 11, by C, the

Fig. 11.



dotted line, A, indicating the direction in which the point of the tool would spring, and the dotted line, B, representing the direction in which it would spring if it stood at B; from which it becomes apparent that, if placed at the point, B, the spring would be more in a direction to run into the cut or diameter of the shaft, D, than is the case when placed at *a*.

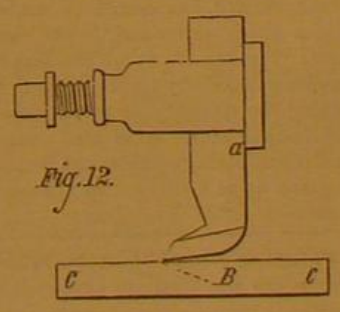
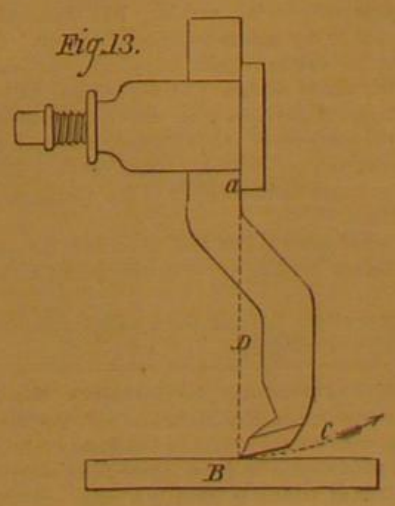


Fig. 12.

Cutting tools used in a planer are subject to the same conditions, as represented in Fig. 12. *a* is the fulcrum from

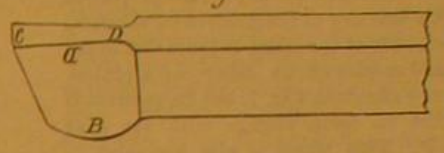
Fig. 13.



which the tool springs, C is the work to be cut, and the dotted line, B, represents the direction in which the point of the tool springs into the work, thus increasing the cut according to the amount of spring, as in the case of a lathe tool. This may be obviated, in a planer tool, by bending its body, as shown in Fig. 13. *a* is the fulcrum off which the tool takes its spring, B is the work to be cut; and the dotted line, C, is the line in which the point of the tool would spring (being in the direction denoted by the arrow) which is not in this case into the cut, but rather away from it, in consequence of the point of the tool standing back from a line perpendicular to the line of the back part of the tool, as shown by the dotted line, D.

Tools that are necessarily straight in form, especially those for use in a planer, are more subservient to the evil effects of spring than those of stouter body; and in light planers, when the tool springs in, the table will sometimes lift up, and the machine becomes locked, the cut being too deep for the belt to drive. The tool most subservient to spring is the parting or grooving tool shown in Fig. 14, which,

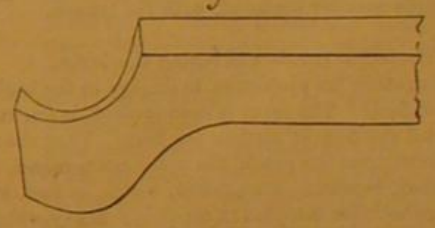
Fig. 14.



having a square nose and a broad cutting surface placed parallel to the depth of the cut, and requiring at times to be slight in body, combines all the elements which predispose a tool to spring, to obviate which, it should be placed at or a little below the center, if used in a lathe under disadvantageous conditions, and bent similarly to the tool shown in Fig. 13, if for use in a planer, unless under favorable conditions.

The point at C is made thicker than the width at D to give clearance to the sides, so that it will only cut at the end, C;

Fig. 14'.



and the breadth at *a*, B, is left wider than other parts to compensate in some measure for the lack of substance in the thickness. 'An excellent substitute for bending the body of the tool is to set the cutting edge of the tool back, as shown in Fig. 14', which represents a parting tool for wrought iron.

The Value of Oatmeal as Infants' Food.

In a communication to the *Société Médicale des Hôpitaux*, MM. Dujardin-Beaumetz and Hardy make known the results of the employment of oatmeal on the alimentation and hygiene of infants. According to them, oatmeal is the aliment which, by reason of its plastic and respiratory elements, makes the nearest approach to human milk. It also is one of those which contains most iron and salts, and especially the phosphate of lime, so necessary for infants. It also has the property of preventing and arresting the diarrhœas which are so frequent and so dangerous at this age. According to the trials made by M. Marie, infants from four to eleven months of age fed exclusively upon Scotch oatmeal and cow's milk thrive very nearly as well as do children of the same age suckled by a good nurse.

A Beneficent Californian.

We have heretofore published an account of the donation of Mr. James Lick to the public, consisting of a sum of money for the purpose of building the largest telescope ever known, the scheme for which has been much commented on in these columns. We now hear from San Francisco that Mr. Lick has deeded more than a million dollars additional, to be devoted to several most praiseworthy objects. The total amount of these benefactions is $1,780,000, and its distribution is as follows: $700,000 to the construction of the largest and best telescope in the world and for the observatory at Lake Tahoe; $420,000 for public monuments; 150,000 for public baths in his city; $100,000 for the Old Ladies' Home; $10,000 to the Society for the Protection of Animals; $25,000 to the Ladies' Protection Relief Society; $10,000 to the Mechanics' Library; $25,000 to the Protestant Orphan Asylum; $25,000 to the city of San José for an Orphan Asylum; $150,000 for the erection of a bronze monument to the author of the "Star Spangled Banner," in Golden Gate Park; $300,000 for the endowment of a School of Mechanical Arts in California, and the residue to the Pioneer Society. He makes ample provision for his relatives, and reserves a homestead and $25,000 per annum for himself.

Mr. Lick, by this judicious liberality, has the pleasure, perhaps the highest a man can attain, of seeing his wealth do good and fructify during his lifetime, instead of being a bone of contention to his heirs after his death.

To Build a Transverse Sled Body.

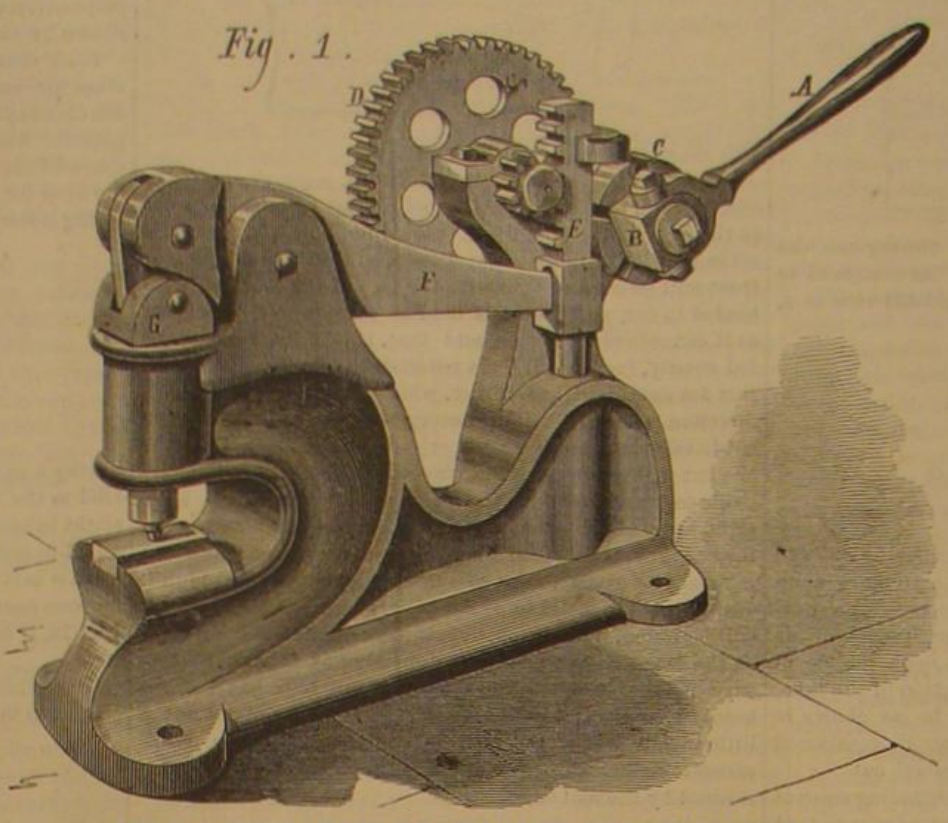
W. A. W. says: "The best way to build a traverse sled body is to make the sills out of one inch or three quarter boards, with cross pieces of the same thickness bolted between the sills, which are double. You can make these very light and limber. Now put on your side boards with a bolt down through the rave and sill, which will make it very stiff, and can be made very light, and with all the strength possible. This is the best form I ever saw in practice."

IMPROVED PUNCH AND SCREWDRIVER.

The invention which our engravings illustrate furnishes a method of applying power to two useful implements, so as to gain a strong purchase through the interposition of simple and effective mechanical contrivances.

Fig. 1 is a punch, such as may be used for piercing boiler plates or other metal. The construction is such that no long lever is required, and hence room is greatly economized; while the mechanism by which several movements of the short hand lever are transmitted to produce a very short motion of the punch, and to develop in the latter a strong power, is quite simple and readily understood. The hand lever, A, is provided with jaws which are pivoted to a block, B, which turns loosely and is secured by a nut on a horizontal shaft. Upon the latter is fastened a disk, C, the face of which is notched as shown. Upon the under side of the lever, A, and just at the throat of the jaw, is a projection which fits into any of the grooves on the disk, C. The shaft of the latter is journaled in the frame and carries on its other end a pinion. This is not shown in Fig. 1, but its position is such that its teeth engage with the gear wheel, D. This wheel is also journaled in the frame, and on the further end of its shaft carries a pinion, which, as clearly shown in the engraving, engages with the teeth of a vertical rack, E. The lower and plain portion of the latter enters a hole in the frame, so that by this means, together with a suitable guide grasping the rack above, the rack is kept perpendicular. Just below the toothed portion of the rack is a slotted enlargement of the same, through which passes loosely the diminished end of the punch lever, F. This is pivoted to the frame, and connects, in the simple manner depicted, with the punch bar, G.

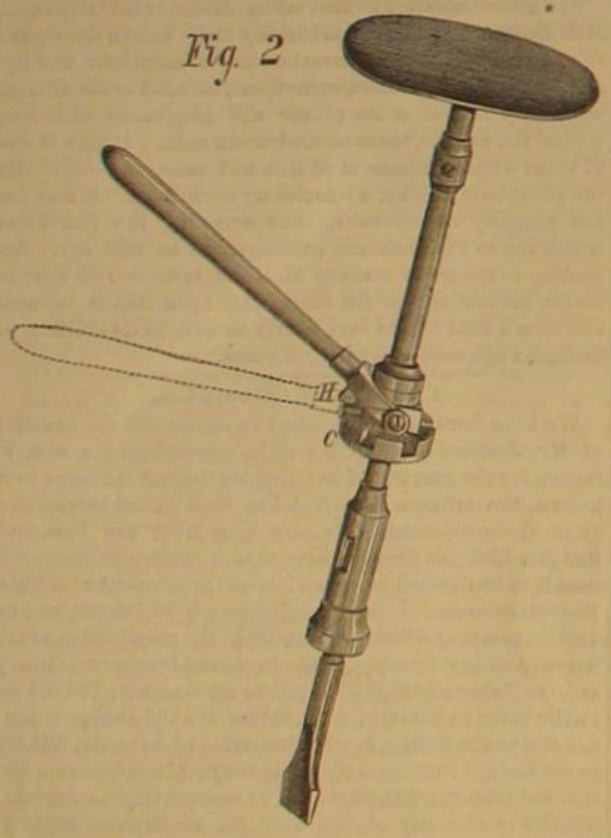
Fig. 1.



LYONS' IMPROVED PUNCH AND SCREWDRIVER.

The operation consists in lifting the lever, A, and causing its projection to engage in the highest notch on the disk, C. The lever is then pressed down, turning the disk until the former strikes the floor. Then the projection is removed from the notch, the lever again raised, and a new hold taken, repeating the process, which, in fact, is precisely the same as that adopted in moving a heavy weight with a crowbar. The workman lifts the load as far as possible with the latter, then blocks it in position, and shifts his bar for a new purchase, and so on until the labor is accomplished. By means of a crank to be placed upon the shaft of the disk, D (not shown in our engraving), the punch, after descending, may be raised very quickly. This avoids the delay of engaging the lever projection in the successive notches of the

Fig. 2



disk, and of turning the arm in the opposite direction from before.

We need not enter into any details of the inter-relation of the wheel, pinions, and levers, to show that an immense power may thus be applied piecemeal toward forcing down the punch; nor is it perhaps necessary to add that this machine, as is the case with many others which have appeared in our columns, is an ingenious plan for utilizing hand power where other motors do not exist or where their application would be inconvenient.

Passing to our second illustration, we have another adaptation of the device, to a screwdriver. Further description of the mechanism is not needed; so that in that connection it remains but to say that the dotted lines indicate the position of the lever when its projection, H, is engaged with a notch in the disk, and that the block to which the jaws are attached necessarily works loose on the shaft. The invention, as shown, is a convenient substitute for the unhandy combination of screwdriver and tongs commonly employed. The leverage is straight and applied at the best advantage. The instrument may be employed for cutting taps in corners, and it is constructed to hold screwdrivers of any proper form. It will, we think, prove of especial handiness in operating upon screws in positions difficult to reach by the ordinary tool.

For further particulars regarding sale of rights, in both inventions, etc., address Mr. Warren Lyon, Mamaroneck, Westchester county, N. Y. The tools will be manufactured by the Biddle Machine and Tool Company, of 164 West 27th street, New York city, at which establishment they will shortly be ready for examination.

The St. Gothard Tunnel.

In reply, no doubt, to rumors, circulated from French sources, that the St. Gothard tunnel was to be abandoned as a failure, its progress being so slow as not to promise its completion for twenty years, the Swiss Federal Government is now making public, after proper verification of their correctness, the monthly reports received by it of the state of the works. The report for March shows that the rate of advance of the boring for the month was as nearly as possible 500 feet linear, the proportion on the Swiss side being greater than that made from Airolo by nearly a third. The total length gained since the first trials were made sixteen months ago is an actual advance of seven eighths of a mile, of which very nearly 1,200 yards are cleared out to the complete section of the tunnel. The number of workmen now employed on an average daily is 1,380; but this appears to include the labor in extensive workshops outside each of the two openings. The boring from the Swiss end continues to be entirely through solid gneiss rock. The temperature is found remarkably equable within the tunnel, varying little during the month from 70°, while outside the average was 41°. At the southern end the mica schist, through which the boring has been carried, has ceased to contain quartz, and has become of a much softer and looser character as the work advances. The reports as to the leakage of springs into the tunnel are decisively contradicted in this report, according to which the quantity of water entering in March was perfectly insignificant. It is also announced that so far from the Belgian boring machines of Dubois and François having been given up as a failure, they are working on with the greatest success.—*Pall Mall Gazette.*

Painting Magic Lantern Slides.

The following are the methods employed by the artists whose profession is the painting of magic lantern slides:

1. Use transparent colors, like Prussian blue, gamboge, and carmine. These will give the three primary colors, and by their mixture the other tints. Apply with a brush, and a transparent drying varnish, like dammar varnish. Allow one coat to dry before applying a second. Considerable aid can be derived from stippling, the color being strengthened, where necessary, by applying it with the point of a fine brush. The colors must not be used too thin.

2. Flow the glass plate with albumen, after the manner of photographers, and paint with aniline colors. This process gives great softness and brilliancy to the pictures, but they are apt to fade.

3. Paint with water colors and then flow the entire surface with Canada balsam, covering the painted side with a glass plate.

4. Use water colors, but mix them with turpentine, instead of water, and work rapidly.

The Sphygmograph in Bright's Disease.

The investigations of Mr. Mahomed, of the fever hospital, Madras, tend to show that in the form of Bright's disease which follows scarlet fever, there is an early stage, the first indication of which is usually a pulse exhibiting high tension, though this may be preceded by dry skin and confined bowels. Next comes, as first in the order of changes in the kidney, a urine which contains no albumen recognizable by the ordinary tests, but some blood stuff, which yields the blue reaction with ozonic ether and tincture of guaiacum. If matters still go on, this is followed by the ordinary serum albumen, and when that is abundant no blue reaction can be obtained. Moreover, Mr. Mahomed says that he has only been able to get this blue reaction when the tension is arterial, not when it is purely venous.

Fuel in Furnaces.

M. Foucault, in a report to the Industrial Society at Rheims, combats the idea that the smokelessness of a fire can effect a notable saving in the amount of fuel burnt. He alleges also, on the other hand, that a considerable loss of economy is produced by smoke-consuming apparatus. He brings in support of his opinion the long series of observations made by the Industrial Society of Mulhouse, which have proved that, with the ordinary boiler furnaces, it is only necessary to consume from 125 to 150 cubic feet of air for each pound of coal, while for the most part furnaces pass twice that quantity. If the draft be reduced in quantity much smoke is evolved, but the products of combustion, circulating more slowly, part with their heat more readily to the boiler flues. It is further proved that the best means of reducing the loss of heat by the chimney is by the use of feed heaters in the flue, so as finally to reduce to 200° the products of combustion, which are often discharged as hot as 400°. Feed water heaters, well set, will produce an economy of from eleven to twenty per cent with a reduced draft.

The conclusion is that furnaces with large area and suitable feed heaters are the most economical in all respects. But in order to obtain the best results, much care is needed in stoking. A little at a time and often, should the coal be spread over the front of the fire, and the bright coal pushed back to the bridge. At the same time, the least possible quantity of cold air should be admitted.

IMPROVED HAMMER.

In drawing old or poorly made nails with the claw end of a hammer, it is a common annoyance for the heads of the former to be pulled off, causing considerable difficulty in extracting the remaining portion. Mr. Candidus Bilharz, of Pittsylvania Court House, Va., has recently devised an ingenious arrangement which, in connection with the ordinary hammer, is stated to obviate the trouble. The tool is represented in the annexed engraving, and the portion above referred to is shown in section in Fig. 2. At the base of the claws is an orifice, A, in which, by a pivot pin, an eccentric jaw, B, is attached. This jaw works in connection with the forward end of the orifice, and is pressed toward that end by a spring, C. Its face is notched or serrated to prevent slipping from the nail.

When the pull on the claw tears off the head, the end of the nail is made to enter the orifice, A, between the serrated side of the jaw and the body of the hammer, and, becoming thus tightly held, is drawn in the usual manner. The improvement will gripe and hold anything that can be introduced, and hence may be applied to other uses than simply extracting nails.

Fig. 1

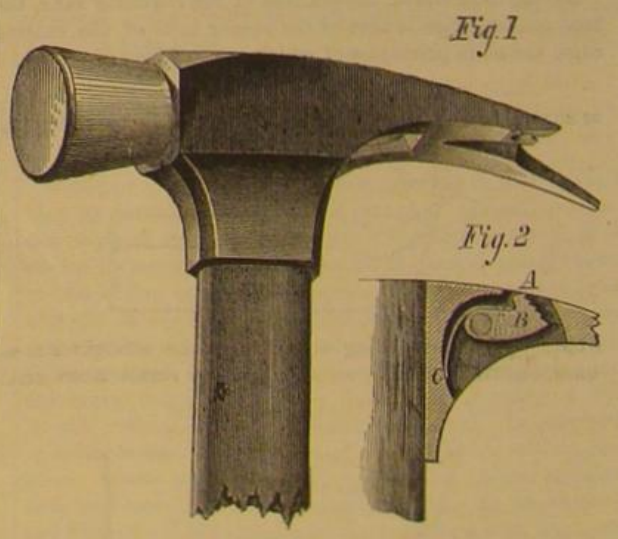


Fig. 2

The claw end of the hammer (Fig. 1), it will be noticed, is provided with one long and one short claw. At the extremity of the former is made a point in order to enable the operator to punch a hole in the wood in which the nail will stick without holding previous to driving. The short claw is suitably formed on its end for driving tacks.

This invention was patented through the Scientific American Patent Agency, April 21, 1874. Further particulars, as to sale of patent or rights to manufacture, may be obtained by addressing the inventor as above.

DYEING WITH MAHOGANY SAWDUST.—A Mr. C. Dreyfuss a correspondent of the *Farber Zeitung* residing in England, has patented mahogany sawdust as a ware for dyeing and printing browns on cotton. He mordants with tin, and uses a little lime and glue in the dye beck.

A MICROSCOPIC AQUARIUM.

Our engraving represents a microscopic aquarium, such as would be seen if there could be embraced, at a single view in the instrument, the majority of objects examined by the microscopist, when the wonders of the infinitely little world existing in stagnant fresh water are studied.

The illustration, for which we are indebted to *La Nature*, though presenting a somewhat fantastic appearance, is, nevertheless, simply a combination of separate observations. The objects were drawn from their images on the field of the microscope, and then grouped so as to show their positions during the natural state.

All have their names. At the upper portion of the picture is a scrap of reed stem, a thin branch like a stalk of straw, beneath which a crowd of *confervæ* have sought shelter against the agitations in the water. The parasite life of the latter is necessary for their existence, because of their extreme delicateness. The diatoms, which are placed beside the *confervæ*, are represented in their natural state, that is, pendent in bunches. The *diatoma vulgaris*, which is the variety shown, is found in so great abundance that hundreds of thousands are often united in a single group. They propagate themselves in indefinite clusters, united by delicate though strong membranes.

At the lower part of the aquarium are shown *confervæ* less elementary than those above. These do not become parasites, and, in fact, have some relation to aerial vegetation. Such are the *characæ*, the *batrachospermæ*, and the multitude of *algæ*, which are often taken for simple mold. In the midst of the vegetation, which appears to belong to another world, are infusoria of all sizes, from the proteus, a mere gelatinous mass, to the superior organisms furnished with exterior members.

If the infinity of forms which aquatic vegetables assume in some stagnant pool be examined, it will be found that all the floating bits of stick and the stalks of the weeds growing in the water are covered with a light brown and adherent slime. This is composed of a mass of *confervæ*. If one of these stalks be removed and placed in a flask of clean water, it may be transported and submitted to scrutiny under the microscope, when nearly all the species represented in our engraving will be recognized. Sometimes the observer will see a *spirogyra* with its heliocoidal shape of a brilliant green, sometimes scattered diatoms. Frequently hideous infusoria suddenly appear, a mass of gelatinous substance, in the midst of which something resembling viscera may be traced.

Microscopy is one of the most beautiful studies in the world; and to those of our readers whose coming summer will be passed in the country, we would recommend the purchase of a moderate priced instrument. To one not familiar with its revelations, the microscope opens a new world, and, in the drop of stagnant water, in the grain of earth, and in the leaf, shows wonders which are a constant source of surprise and admiration.

A MICROSCOPIC AQUARIUM.

REMARKABLE BALLOON ASCENT.

Aerial navigation, since Science has utilized the balloon for the purpose of observation and investigation, has received a fresh impetus. Though Biot and Gay Lussac, as early as the year 1804, gave the first impulse to the employment of balloons for scientific research, it was not until the British Association for the Advancement of Science laid down (in Leeds, in 1858) the first systematized plan that regular balloon ascents were undertaken. Among a number of very valuable results ascertained thereby, the existence of a warm current of air, which sweeps (at an altitude of about 18,000 feet, and with a vertical magnitude of 2,000 feet) from the southwest to the northeast, in about the same direction as the Gulf Stream, has been discovered.

The French have hitherto undoubtedly held the foremost rank in aerial navigation. They showed, during the siege of Paris, the practical value of the balloon. The French papers are now seriously discussing a proposition for transferring the work of the surveyor to the aeronaut. It has been found necessary to revise the real estate maps throughout France, and it is proposed that an aeronaut should take a photograph of each tract or section, which would, after being suitably enlarged, exactly indicate the contour and features of the district. This may be practically accomplished, as such photographs have already been made from a balloon; but the expense of carrying such a plan into execution, being estimated at about three and a half million dollars for the whole country, is so large that the work may at present be done at less cost by a surveyor.

MM. Croce-Spinelli and Sivel made, on March 22, a balloon ascent under the auspices of the Society for Aerial Navigation, to which we alluded on pp. 280 and 337 of our current volume. We give an illustration showing the aeronauts in the car. They carried with them, as we have stated, a considerable quantity of oxygen, inclosed in suitable vessels, and inhaled by means of a tube. By similar means life can be supported at an altitude where the rarity of the atmosphere is such as to make breathing impossible. This latter was the main obstacle to higher ascents, and it has now been successfully overcome, and it is possible to remain at altitudes of 30,000 feet as long as the oxygen lasts.

Of the many observations which were made by these aeronauts at hights up to 21,000 feet, we will mention only two. At 12,500 feet above the earth, they passed a cloud of suspended ice crystals, which glittered in the sun, but were so perfectly translucent that a clear view of the panorama below the balloon was seen, and it was not in the least blurred. The second point is one of great importance. The lines indicating water in the solar spectrum have created much discussion; and Father Secchi argued that they were watery evaporations from the sun, while others assert that they are moist vapors in our atmosphere. The latter view is now known to be the correct one, as the solar spectrum showed, in the dry air of the upper altitudes, no water at all.

THE BALLOON ASCENT OF MM. SIVEL AND CROCE-SPINELLI.

Stalactites from Masonry.

The North Bridge, which spans the deep valley lying between the Old and New Towns of Edinburgh, Scotland, was built upwards of a hundred years ago. Between the arches of the bridge and the roadway above are a number of chambers or vaults which have not been opened, till recently, since the bridge was built. One of them has been visited by Professor Geikie, who says:

"From the vaulted ceiling, and especially from the joints of the masonry, hung hundreds of stalactites—delicate spar icicles of snowy whiteness. In many cases they reached to the floor, forming slender thread like pillars. Usually they were slim stalks, somewhat like thick and not very well made tobacco pipes: but towards the sides of the vaults they became thicker and stronger, one which we carried off measuring about four feet in length, and as stout as an ordinary walking stick. The same material as that forming the stalactites spread in ribbed sheets down the sides of the vault. The floor, too, was dotted all over with little monticules of the same snow white crystaline spar.

"A more illustrative example of a stalactitic cavern could not be found. The whole process was laid open before us in all its stages. Along the joints of the masonry overhead could be seen here and there a drop of clear water ready to fall. At other places the drop hung by the end of a tiny white stone icicle, to which it was adding its own minute contribution as it evaporated. From the mere rudimentary stumps, the stalactites could be traced of all lengths until they were found firmly united to the spar hillocks on the floor. Every one of these hillocks, too, lay directly beneath the drip, catching the remainder of the stone dissolved in the dropping and evaporating water. In every case the stalactites were tubes; even the thickest of them, though it had undergone great changes from deposit on its outer surface, retained, nevertheless, its bore. Usually there hung a clear water drop from the end of the stalk, ready to descend upon its white stony mound beneath.

For a hundred years this delicate tapestry has been hanging and growing, and breaking and growing again, quietly in darkness, beneath the grind of our carriage wheels, and yet high in air, with the stream of human life flowing underneath it too.

"As the bridge is built of sandstone, wholly or almost wholly free from lime, it is evident that the material which has converted these vaults into such picturesque caverns has been derived from the mortar. All rain water, as is well known, takes up a little carbonic acid from the air, and of that acid there is in the air of a town usually more than the normal proportion. Filtering through the masonry, it dissolves the lime, carrying it downward in solution, and, if made to halt and evaporate, depositing it again in the form of the white crystaline substance which we call spar. It would be a curious question for the architect how long his masonry could resist this action. Certainly, in spite of what these vaults in the North Bridge reveal, the masonry of that structure is, to all appearance, as solid and firm as ever. It is evidently impossible, however, that the mortar, if necessary at all, can be piecemeal removed without in the end causing the destruction of a building."

Oyster Culture in America.

Frank Buckland, in *Land and Water*, says:—"As regards the cultivation of the New York oysters themselves, I must again hold up a warning hand to American proprietors. If they go on with the present system, the oysters will shortly run short. I protested, some months back, against burning the culch old shells for lime, instead of putting it back to catch spat; and now I find they are selling their broods attached to the parent shell. I have picked out specimens from the tub at Scott's, at the top of the Haymarket. On the two shells of one edible oyster there were no less than twenty-three spats. In another case I counted a "clump." Two edible oysters only were in this clump, but it was covered all over with spat; so that for the sum of 4 cents, between thirty and forty oysters were sold all at once, only two being edible. The tub at Scott's was piled with examples of this "economy." I trust the American oyster dealers will not take it amiss if I warn them that, if they sell their young stock in this wasteful manner, they will soon be suffering from an oyster famine."

Butterine---Artificial Butter.

J. Campbell Brown, D. Sc., says that a chemist, seeing the word butterine, would be apt to suppose that it is a misprint for butyrin, but it is not so; it is the registered name under which substitute for butter is introduced in this country from New York. [Known in New York as artificial or suet butter]. Its general appearance, taste, and consistence are very similar to those of ordinary butter; but notwithstanding that its solidfying point is lower than that of some butters, it retains much of the peculiar crumbly texture and fracture of dripping.

Examined, it gives the following results: It softens at 78° Fah., and melts at 86°; when heated and slowly cooled, it obscures the thermometer at 62°, and solidifies at 60°: It contains:

Water	11·25 to 8·5
Salt	1·03 to 5·5
Curd	0·57 to 0·6
Fat	87·15 to 0·6
Coloring matter	— —
	100·00

The fat consists of olein, palmitin, margarin (?), a trace of stearin, and about 5 or 6 per cent of butter. When dissolved in about four times its weight of ether, and allowed to evaporate spontaneously, it does not deposit any fat until more than half of the ether has passed off, and, if the temperature is not below 60°, the deposit is not solid. The first deposit, when dried, fuses at 108°; the second deposit fuses at 88°, and solidifies at 64°.

Under the microscope, butterine does not appear to consists of acicular crystals of fat, but of irregular masses containing a few butter globules, particles of curd, and crystals of salt. With polarized light, the irregular crystaline structure is beautifully seen, and is clearly distinguishable from butter which has been melted and recongealed. When old and rancid, it acquires the odor and taste of dripping, but it keeps longer undecomposed than butter. When fresh, it is a wholesome substitute for real butter; and if not brought into the market as butter, no one can reasonably take exception to its sale.

Butterine may be selected by the following characters:

1. Its crumbly fracture.
2. Its loss of color when kept melted for a short time at 212°.
3. The behavior of its etheeral solution.
4. Its action on polarized light.

Wheelerite, a new Fossil Resin.

During the past season's field work of the explorations and surveys west of the 100th meridian, under the command of Lieutenant George M. Wheeler, to which expedition I was attached as chemist, many interesting chemical facts were observed. Among these may be mentioned the occurrence of a new fossil resin, whose name heads this article. This resin, which is yellowish in color, was frequently found in the cretaceous lignite beds of northern New Mexico, filling the fissures of the lignite, and even interstratified in thin layers with the same. More of this substance was seen in the vicinity of Nacimiento than in any other locality. The strata of lignite, slate and clay, in the numerous sandstone mesas of this region, are plainly to be seen in passing by. The behavior of this resin with reagents and the analysis made proves this to be a new compound, heretofore undescribed.

On treating the resin with alcohol, the principal portion is readily dissolved, while a small part remains insoluble. The hot alcoholic extract of the resin deposits, on cooling, a few yellow flocculi. After the separation of the solution from these flocculi, there remains, after evaporation, a yellowish resin, which is very brittle and becomes strongly electric on friction. This resin melts at 309° Fah. At a higher temperature it emits an aromatic odor, burns with a smoky flame, and leaves a voluminous coal behind.

It is soluble in ether, less so in bisulphide of carbon. It dissolves readily in concentrated sulphuric acid, producing a dark brown solution. From this solution water precipitates it. It forms a compound with potassa in aqueous solution, and is precipitated by acids unchanged. Strong nitric acid readily oxidizes it, with the evolution of nitrous fumes.

0·106 grm. gave 0·284 carbonic acid and 0·076 water.
0·101 grm. gave 0·270 carbonic acid and 0·071 water.

The data give the formula C_5H_6O.

	Theory.	Experiment. I.	II.
Carbon,	73·11	73·07	72·87
Hydrogen,	7·31	7·95	7·88
Oxygen,	19·58		

The true molecule of the resin is probably 5-6 times larger than the above formula expresses. Many fossil resins have been investigated; but none identical with the above, so far as known, has been described.

The retinic acid of Johnson, which he obtained by extracting the retinasphalt of Bovey with alcohol, is the only combination that bears a resemblance to the substance under discussion. This has the formula $C_{40}H_{42}O_6$, is slightly soluble in alcohol, readily so in ether, and melts at 248° Fah.

I have taken the liberty of naming this new mineral after Lieutenant George M. Wheeler, Corps of Engineers, U. S. Army, the honored and energetic leader of the expedition to which I am attached.—*O. Loew.—American Journal of Science and Arts.*

GILDING ON ZINC.—C. D. Braun dissolves sulphide of gold in sulphide of ammonium, and deposits a layer of gold upon pieces of clean zinc plunged into it, the air being excluded as far as possible.

Acoustics in Public Buildings.

A. W. C. states the inability to hear distinctly in our public buildings is due to the architects, and that those gentlemen should remember that an ounce of prevention is worth more than a tun of cure. "Please advise any of your friends who contemplate building a church, hall, lecture room, or other public building, to observe the following rule, and they will find the principles thereof to be true:

"Let the whole structure be held in entire subserviency to the auditorium, regardless of needless ornamentation, and let the clear inside lines thereof be as follows: Make or take the whole length as one sum in feet, make the whole width one half that sum, and the whole hight, to the center of the ceiling, one half of the latter sum."

Interesting Legal Decision.

A St. Louis court, says *The Trade Bureau*, recently made the following decision as to how far an employer is answerable for injuries received by an employee in his service. The court said: While an employer is an insurer of the safety of his employee, as far as the apparatus and machinery are concerned, and for injuries received when the employee is unconscious of the defects in the apparatus, yet if the employee knows of the defects, and continues to work and incur the risk, he must take the consequence of his own negligence. This view is sustained by recent decisions of the Supreme Court, and by the General Term of the Circuit Court. In a case where a laborer was injured by the breaking of a worn out rope, it was decided that he could not recover, as he knew the condition of the rope, and continued to use it at his peril.

A MADEIRA correspondent of *Nature* writes concerning the damage caused to objects of natural history from cedar wood cases. A naturalist in Madeira, to do his collection of the remarkable land shells of the island more honor, had made for them a case of this wood. Unobserved for a month, the shells were found drenched with the turpentiny resin exhaling from the wood. Shells covered with a rough epidermis seemed to have attracted the oil less. *Craspedopoma* and the smooth fresh water shells had especially suffered; semi-fossils full of sand had escaped; all others, whether recent or semi-fossil, had suffered to such an extent that the cardboard to which they were attached was in many cases soaked. This occurred, however, only when the affixed shells offered the needful point of attraction and condensation.

DECISIONS OF THE COURTS.

United States Circuit Court.---District of Massachusetts.

PATENT RUBBER DENTAL PLATES.—THE GOODYEAR DENTAL VULCANITE COMPANY *et al. vs.* DANIEL H. SMITH.

[In equity.—Before Shepley, Judge.—Decided May 8, 1874.]

This is the famous patent which covers the manufacture of dental plates of rubber. It has for a long time been obstinately resisted by the dental profession, as the holders of the patent impose a high tariff upon practitioners who use it. Nearly all dentists find it necessary to employ the rubber plates, and the patent monopoly is considered burdensome and unjust. It will be seen that the Court again sustains the patent, and this decision will stand, unless reversed on appeal to the Supreme Court of the United States.

The original letters patent of the United States were issued June 7, 1864, to John A. Cummings for improvement in artificial gums and palates. The bill in equity in this case is filed against the defendant, alleging infringement of the letters patent which, upon a surrender of that patent in accordance with law, were reissued to the Dental Vulcanite Company, the assignees of the title in and to the letters patent, upon the 21st of March, 1865. This reissued patent, in the opinion of Judge Shepley, is for a new article of manufacture, consisting of a plate of hard rubber or vulcanite with teeth, or teeth and gums, secured thereto in the manner described in the patent. The patent is not for a process or art, but for the new product resulting from the manipulation by the described new process. It is one of those products, as will be seen by examination of the specifications describing the process of manufacture, in which the process so inheres that the described product can only be made by the described process. The patent is not for a dental plate of vulcanite or hard rubber alone; it is not the substitution of the old material, vulcanite, in place of the gold and other materials which have been before used in the same way; it is not, as claimed by defendant, for a dental plate of hard rubber vulcanized in molds in the manner described in the patent; but it is for a set of artificial teeth as a new article of manufacture, consisting of a plate of hard rubber or vulcanite, with teeth, or teeth and gums, secured thereto in the manner described in the patent, by imbedding the teeth and pins in the vulcanizable compound, so that it shall surround the teeth and pins while the compound is in a soft state before it is vulcanized, so that when the compound is vulcanized the teeth are firmly secured by the pins imbedded in the vulcanite, and there is a tight joint between the vulcanite and the teeth. This manufacture was a new manufacture, new as to the thing made, new as to the process of making it, considering that process as a whole. The invention is not like that of a machine, but is one in which the process by which it is made is a part of the substance of the thing made, the manufacture, and a characteristic feature of its construction. It is evident from an examination of the very brief and imperfect description of the invention given by Cummings in his caveat filed as early as May 14, 1852, that he fully appreciated the fact that the importance of his invention consisted not merely in the substitution of a material "rigid enough for the purposes of mastication, and pliable enough to yield a little to the mouth," in place of the "hard, unyielding" metals previously used, and not merely in the substitution of a material light and inexpensive in place of the expensive and heavy materials before used for the plate, but also in the additional fact, which he states, that "by this improvement the teeth can be easily baked into the gums, which form one piece with the plate." This statement at that early period sufficiently suggests that he fully appreciated the advantages of the material which he used, and which was capable of being so used in the process as to ensure that cleanliness and purity resulting from the absolutely perfect joint formed between the teeth and the plate, and the consequent absence of any crevices for the retention of food.

Upon a careful review of all the evidence in the record, I have no hesitation in coming to the conclusion that the invention of Dr. Cummings was a new and useful manufacture, that nothing appears in evidence to show that he was not the original and first inventor of the thing claimed by him, that the reissued patent in suit is a good and valid patent, and that the defendant has infringed the same, as alleged in the bill.

Decree for complainant for injunction and account, as prayed for in the bill.

NEW BOOKS AND PUBLICATIONS.

TABLES FOR QUALITATIVE CHEMICAL ANALYSIS. With an Introductory Chapter on the Course of Analysis. By Professor Heinrich Will, of Giessen, Germany. Edited by Charles F. Himes, Ph. D., Professor of Natural Science, Dickinson College, Carlisle, Pa. Price $1.50. Philadelphia: Henry Carey Baird, 406 Walnut street.

A concise statement of the characteristic results of all the tests in ordinary use for the purpose of qualitative analysis, which deserves, both on account of its authorship and the reputation of its editor, a place in every scientific library. It will be found useful to students as a manual, as well as for constant reference by experts in the laboratory.

AMERICAN NEWSPAPER DIRECTORY, containing Accurate Lists of all the Newspapers and Periodicals published in the United States and Territories, and in the Dominion of Canada and British Colonies of North America. New York: George P. Rowell & Co., Publishers, 41 Park Row.

The value of this elaborate volume is well known to the whole newspaper press and the advertisers of the country; and the new issue is the most complete manual of the subject yet published. It appears that there are published in the United States 654 daily and 5,626 semi-weekly, triweekly, and weekly journals; making, together with 1,577 monthly and quarterly publications, 7,303 issues open to advertisers. In the British Possessions, there are 46 daily, 348 weekly, etc., and 51 monthly, papers and magazines issued, being a total for the English-speaking portions of North America of 7,784. Most of this large number are separately described in detail; so that advertisers can find, in the pages of the *Directory*, the fullest information as to the circulation, politics, etc., of the various claimants for the title of "the best means of publicity."

THEORY OF ARCHES. By Professor W. Allan, formerly of Washington and Lee University, Lexington, Va. No. 11 of Science Series. Price 50 cents. New York: D. Van Nostrand, 22 Murray and 27 Warren streets.

These handbooks are uniformly excellent and valuable.

THE CONSTRUCTION OF MILL DAMS, comprising also the Building of Race and Reservoir Embankments and Head Gates, the Measurement of Streams, etc. Illustrated. Springfield, Ohio: James Leffel & Co., Authors and Publishers.

This thoroughly practical treatise will be accepted as an authority by all persons using water power or occupied in constructing apparatus for that purpose. The authors have dealt with all the difficult circumstances amid which dams have to be built, and the information, derived from practical experience, has been gathered from all parts of the country, its compilation having taken more than three years. Messrs. Leffel are the manufacturers of the well known Leffel turbine, and are also editors of the *Leffel Mechanical News*, a journal devoted to the flour mill and water power interests.

Inventions Patented in England by Americans,

[Compiled from the Commissioners of Patents' Journal.]

From May 8 to May 21, 1874, inclusive.

BALE TIE.—S. Parmly *et al.*, New Orleans, La.
BURNING PETROLEUM.—O. Sweeney (of Philadelphia, Pa.), Liverpool, Eng
BUTTONS, ETC.—R. H. Isbell, New Milford, Conn.
CENTRIFUGAL MACHINE.—S. S. Hepworth, New York city, *et al.*
COOLING DRINKS.—C. L. Ridgway, Boston, Mass.
DOG COLLAR.—W. T. Mersereau, Orange, N. J.
ELECTROMAGNETIC ANNUNCIATOR.—L. Finger, Boston, Mass.
FURNACE.—J. M. Ayer, Chicago, Ill.
GAME CARDS.—M. H. Cowell, Buffalo, N. Y.
IRONING MACHINE.—G. W. Cottingham, St. Mary's, Texas.
MAKING MAGNESIA HYDRATE.—C. H. Phillips, New York city.
PAPER PULP BOX.—S. Wheeler *et al.*, Albany, N. Y.
PLANE.—J. F. Baldwin, Boston, Mass.
PORTABLE FORGE.—D. W. C. Baxter, Philadelphia, Pa.
ROCK DRILL.—J. B. Waring, New York city.
ROTARY ENGINE.—A. C. Gallahue, Morrisania, N. Y.
SEWING AND MACHINE.—F. Curtis, Boston, Mass.
SEWING MACHINE FEED.—D. M. Smith, Lynn, Mass.
SHIP, ETC.—J. T. Parlour (of Brooklyn, N. Y.), London, England.
STEAM AND OTHER ENGINES.—W. Wallace, Brooklyn, N. Y.
STEAM INJECTOR.—Tube Works Company, Boston, Mass.
STOPPER FOR DRAWING LIQUIDS.—E. R. Wilbur, New York city.
SUSPENDING CROCKERY IN KILNS.—B. Jackson, Geddes, N. Y.
TELEGRAPH SIGNAL.—W. A. Camp (of New York city), London, England.
TICKET PUNCH.—Canceling Punch Company, Buffalo, N. Y.
TORPEDO BOAT.—J. L. Lay, Buffalo, N. Y.
TOY PISTOL.—C. B. Stephens, Plainfield, Conn., *et al.*
WIRE TUBING AND MACHINE.—H. O. Lothrop, Milford, Mass.

Recent American and Foreign Patents.

Improved Car Coupling.

John E. Stevenson, Wilton, Iowa.—A block is pivoted to the upper part of the drawhead, from which pivot it is suspended and swings in the cavity. A spring is attached to the pivot of the block, which serves to force the block downward. The pin is supported on the shoulder of the block, and the end of the link strikes the block and allows the pin to drop. The inner surface of the lower part of the drawhead is provided with stops, which receive the end of the link where it is supported by the block when the cars differ in hight. The drawhead is so constructed that the coupling pin may be supported when in the upper part by inclining it forward, the pin mortise allowing sufficient play for that purpose, while the end rests on a shoulder.

Improved Cotton Press.

William B. Hollowell, Nashville, Tenn.—This is a powerful hand press, adapted to be constructed and used on plantations without very skilled labor. The essential features of this invention are a lever and windlass for forcing the follower down by a vertically moving follower stem. The operation is accomplished by several movements of the lever, each one forcing it a certain distance, thus dividing the labor and increasing the power, so that the bales may be made as small and dense as by the ordinary power presses.

Improved Press.

John Gramelspacher, Jasper, Indiana.—This invention consists of a brake lever pivoted at the middle in the top of the follower stem, and having a fulcrum on each side of it on a rod working up and down through a guiding and supporting beam. The rod also works through a griping pawl, which allows it to descend freely, but gripes and holds it against rising, so that the fulcrum of one side descends while the other is holding the lever for pressing the follower down. This causes the follower to be forced down quickly by the vibrations of the levers.

Improved Sewing Machine Table.

Michael W. Murphy, Louisville, Ky.—This invention consists in supporting the hinged portion of the table by a section of the subjacent case. It is believed to be cheaper than the ordinary folding enclosing top.

Improved Composition for Cleaning and Polishing Metals.

Hosea Burrill, Lynn, Mass.—This is a composition for cleaning and polishing knives, forks, and all articles of cutlery, as well as all other articles for which it may be adapted, as surgical instruments, arms, and military equipments. It consists of emery, pulverized coal ashes, sawdust, and soap, molded into cakes, which become hard by exposure.

Improved Door Alarm,

Abraham Nevling, Glen Hope, Pa.—This is an improved door alarm, which in addition to striking a bell when the door is opened, as an ordinary or day alarm, may be set to sound a continuous alarm when the door is opened, and thus serve as a night alarm.

Improved Hay Knife.

Harrison R. Brown, Rochelle, Ill.—This invention is a hay knife having a triangular blade with smooth cutting edges, standing at an angle to the handle, and having a reversible stirrup attached by means of a tube surrounding the handle.

Improved Sash Balance.

William D. Goodnow, Rutland, Vt.—This invention consists in a case let into the top bar of the lower sash, flush with its surface, and provided with a pivoted bar, inclined block, and knob, whereby the cord that enters the weight grooves may be cramped, so as to connect and balance the sashes.

Improved Cattle Poke.

Warren L. Battle, of Geneva, Ga.—This cattle poke consists of a wood or metal bow, fitting and secured close to the head by a face and nose strap around the neck of the animal. The lower ends of the bow are connected together by a couple of pins, from the lower of which hangs a long curved rod of wood, whose upper end rises above and behind the upper pin. This causes the lower end, which is curved forward to some extent, to project still farther forward, so as to catch in the fence when the animal tries to jump. The pivot allows the rod to lie on the ground while the animal feeds, and said rod rises high enough above the ground when the animal holds his head up to clear it, so that he can walk about freely.

Improved Hand Corn Planter.

James Riebe, Cedar Lake, Ind.—A box is divided into two small compartments, and a seed bag is made long so as to come up under the arms of the operator. The lower end of the bag is attached to a short tube, which is secured in the upper part of the inner compartment of the box. From this point the corn passes into a cavity in a sliding bar, which fits into and slides up and down in the outer compartment of the box. A brush acts as a cut-off to prevent any more corn than enough to fill the cavity in said dropping slide from being carried out by said slide in its downward movement. The size of the dropping cavity of the slide is adjusted according to the amount of seed required for a hill by a plate, the upper part of which extends up along the inner side of the slide. The lower part of the plate is bent twice at right angles, so as to pass through the cavity of the slide, and extends down along the outer side of the lower end of the said slide. The plate is secured in place, when adjusted, by a clamping screw. To the dropping slide is pivoted a rod, to which is attached a block of such a size that when the dropping slide is pushed downward the block will push back a spring and allow the corn to drop into the ground.

Improved Lifting Jack.

Charles D. Aylsworth, Afton, N. Y.—In operating with the jack, the lever rests upon the ground, and its long end is lifted. The jack is raised in aising the axle of the wagon, the fulcrum being the floor or surface of the ground. When the lever is turned up, the weight is directly over the lower end of the lever, and the latter, with the jack, is maintained in an upright position. In bringing the lever to this position, its short end and a bar act as the members of a toggle joint, and with constantly increasing power, until the bearing points are in line with each other.

Improved Follower for Brine Barrels.

George Enoch Webber, Hinckley, O.—The object of this invention is to construct, for the purpose of holding meat, fish, vegetables, and other articles under brine, a follower which may be readily and securely adjusted in higher or lower position in the barrel. The invention consists of a follower which is attached to the side of the barrel by slotted arms with spike ends, which arms are guided by suitable pins and carried forward and back by being pivoted with their inside ends to a collar applied to and turned by a central shaft of the follower.

Improved Step Ladder.

Charles F. Barnard, New York city.—The side boards of the step ladder are connected with each other by steps, which are hinged to one side, so that the pivots of the said hinges may be a little below the under surface of the steps. The other ends of the steps are hinged to the other side. The arrangement is such that all the screws that hold the hinges enter across the grain of the wood, and thus take a firmer hold. The legs are pivoted, near their upper ends, to the outer sides of the stiles, and are made of such a length as to hold the ladder in proper position when extended. Their lower ends may be spread apart to brace the ladder when extended. To the legs are pivoted bars, which are made with a bend near said lower ends, and which are slotted longitudinally to receive a screw attached to the sides, the said slots being made so narrow that the heads of the said screws cannot pass through. In the bars, at the upper edge of the forward ends of their slots, is formed a notch to receive the screws, and thus lock the legs in place when extended. To the legs are pivoted braces, which, when the ladder is extended, cross each other, and their lower ends are secured to the legs by pivoted catches, the heads of which pass through slots in the plates, and, when turned one quarter around, securely lock said braces and legs together. These catches are so formed that they may be conveniently turned to fasten and unfasten the braces. To the inner surface of one of the sides, just below one of the steps, is attached a plate, which is bent at right angles, so as to lie along the under side of said step, and its end edge is notched to receive a screw, so that it may be secured by a hand nut. By this construction, the sides and steps of the step ladder will be held rigidly in place when said ladder is extended.

Improved Car Coupling.

John Stevens, New York city, and George J. Cave, Elizabeth, N. J., assignors to George J. Cave.—Two convex grooved jaws receive a link. Said jaws are connected, at the inner end, to a cross bar of a rod which slides forward and back, and has a long coiled spring on it to throw the jaws forward, and allow them to be pushed back out of the way of the drawhead of the car to be coupled on. Said rod also has a short strong coiled spring on it to ease the shock on the drawhead when the cars couple. The drawhead is arranged to go back a little when the cars meet. The spring latch for engaging the link by its hook is curved at the front, so that the link will force it up, pass under it, and couple automatically when the cars meet. Over the front end of the latch is a lever, to raise it up for uncoupling. To this lever a spring catch is provided, which is thrown back by the lever when pressed down against it, and springs forward after the lever has passed, and locks it to lock the coupling latch. It leaves the latch unlocked in case it is wanted to allow the cars to uncouple if one is thrown off the track. The jaws are curved outward considerably near the outer ends, to receive the link from either side of the center, as it will be presented when the cars are on a curved track.

Improved Isinglass in the Liquid Form.

Isaac Stanwood, Gloucester, Mass.—In preparing this liquid isinglass the sounds are steeped in the usual way, but the scum, instead of being taken off, is stirred in. The isinglass is then carefully strained through sieves and cloths. The effect of the scum upon the isinglass, when treated in this way, is to make it more limber than when it is skimmed off in the old way. In soaking the sounds, washing soda is added to each barrel of the cold water in which they are soaked, which removes the oil and gives the isinglass a better color and quality. The soda solution, after standing several hours, is poured off and thrown away; the sounds are then steeped in new clear water, after which the liquid is strained, has a small quantity of alcohol added to it, and is poured, while still hot, into tin cans, which are then sealed airtight.

Improved Dumping Car.

John E. Bemis, Chicago, Ill.—This invention consists of a movable platform, which is supported and firmly attached to trucks in such a manner that by turning a longitudinal rod with spiral shoulders the connection of platform and trucks is separated, and sliding cog wheel segments thrown into gear with pinion driven in connection with the truck axles. The motion of the trucks in either direction carries the platform sidewise till it tips by the weight of the load thereon for unloading, being carried back over the trucks by moving them in opposite directions, and locked automatically thereon by suitable mechanism, which releases the sliding segments and bolts.

Improved Steam Radiator.

Charles S. Smith, Westfield, Mass., assignor to the Novelty Steam Heating Company, same place.—The radiators are made in sections, each section consisting of two horizontal tubes connected at their ends by two short tubes. Upon the upper end of the outer side of the end tube of each lower section is formed a rabbet, into which fits a lug formed upon the lower end of the outer side of the end tube of each upper section; so that when the said upper section has been screwed down upon a nipple, the free ends of said sections may be secured to each other by a screw passing through the lug of the upper section, and screwing into the tube of the lower section.

Improved Hand Power Circular Saw.

Ole T. Gronner, Baltimore, Md.—This invention consists in combining the parts of a hand power circular saw frame so that the same is rendered readily portable, can be quickly thrown into working condition, and requires but little actuating force.

Improved Mortising Machine.

Harbert K. Forbis, Danville, Ky., assignor to himself and John W. Proctor, same place.—The mortising tool mandrel is fitted in bearings on a bar pivoted on the slide and pivoted near the other end by a slotted hole. The bar is pivoted at the rear on a stud, so as to have an endwise movement, to accommodate the movements at the other end on the slide, which works in a straight way parallel to the edge of the work, and thus causes the tool to cut the mortise the same depth throughout its length. The work table frame is pivoted to the tool frame, and arc-slotted, to be held to the latter at different points by a clamp screw.

Improved Cutting Pliers.

Van Allen Pugsley, New York city.—This invention consists in an improved cutting pliers formed of two parts or handles, having enlargements formed upon them at the bases of their jaws. A circular recess and a slot are made in the enlargement of the one part, and a cylindrical projection and a slot in the enlargement of the other part, and the parts are kept in place upon each other by a guard bar or plate.

Improved Nut Lock.

Loftus Sykes and Joseph Sykes, Philadelphia, Pa.—This invention relates to improved means for preventing the nuts of bolts from turning off by means of jar or concussion, more especially designed for fish plates at rail joints. When the nut is screwed down, the blocks are tightly compressed between the ends of strips of rubber, one end of the blocks being in the V shaped grooves of the nut. The other ends are held by ratchet teeth, which effectually prevent a backward movement of the nut; and a rib on the washer being fast in a groove of the fish plate, the connection is rendered permanent and safe.

Improved Cutter Bar Machine for Harvesters.

William M. and George H. Howe, Lansing, Minn.—This invention consists in providing a harvester wheel with studs and spokes arranged alternately, and entering near opposite edges of the rim, and combining therewith a bar and oppositely inclined plate.

Improved Tobacco Bag Attachment.

James Wright Chambers, Baltimore, Md.—This invention consists in a tobacco bag attachment formed of a metallic case having centrally apertured circular bottom with upper and lower outwardly obliqued flange, to receive an elastic stopper and allow the edge of bag to be conveniently tied.

Improved Hydrant.

Joseph V. Miskelly, Baltimore, Md.—This invention consists in combining the parts of a hydrant, so that not only is all drainage water excluded, but the working elements are easily and conveniently reached for examination or repair.

Improved Cutter Head for Moldings.

William Smith, Baltimore, Md.—This invention relates to molding cutters for bringing piano legs or other woodwork into some definite shape. The invention consists in combining, with the cutter shanks, the faces, and the flanges of stock, a series of plates and bolts for fastening the molding cutters to their stocks.

Improved Lard Lamp.

Charles A. Gabe, Sr., and Charles A. Gabe, Jr., Boonsboro, Md.—This invention relates to that class of lamps which are adapted to the burning of lard, and consists in a new and improved arrangement by means of which the lard is better reduced to a condition to be affected by capillary attraction and the manipulation of the wick facilitated.

Process of Making Calendering Rollers from Paper Pulp.

John O'Neil, West New Brighton, N. Y.—This is a novel method of manufacturing calendering rolls of paper pulp and other stock, whereby the operation of forming the roller is expedited, and a more perfect article is produced. The invention consists in molding the mass around a heated core and simultaneously applying external pressure to the same.

Improved Apparatus for Evaporating and Cooling Liquids.

Archibald Rogers, Hyde Park, N. Y.—This is an improved device for evaporating liquids, so constructed as to bring a very large heated surface in contact with the liquid to be evaporated, and which may be used with equal facility as a cooler for cooling liquids. The steam is introduced through a hollow hub, and passes through large pipes and out of smaller tubes radially attached to them. It thus enters a large drum, whence it escapes through a hollow hub. The water of condensation, as it forms, flows out of the pipes into the drum, where it is received upon a spout, and flows out through the hub. By shutting off the steam and forcing cold air or water through the device, it may be used as a cooler.

Improved Sawing Machine.

Winfield S. Gerrish, Hersey, Mich.—The object of this invention is to furnish a crosscut sawing machine which may be worked by one man with great rapidity, saving time and hands thereby. The invention consists of a crosscut saw which moves in a suitable stirrup, and connects by two curved plates with the rear of a carriage sliding on the supporting frame. A wheel with curved cams or wings is rotated by a hand crank, and acts on elastic rollers of the sliding carriage, producing thereby the rapid reciprocating motion of the sliding carriage and saw.

Improved Measuring Can.

Marshall M. Barney and S. L. Daily, Leon, Iowa.—Liquid is admitted from the cask to one of the chambers of the measure while being discharged from the other, by means of valves so arranged as to open the inlet orifice and close the discharge orifice simultaneously, and *vice versa*. The vent openings are closed and opened, as required, by a float which rises and falls with the liquid in either chamber.

Improved Machine for Bending Wood.

Barnabas A. Higgins, New Portland, Me.—This is an improved machine for forming the tops of shovel and fork handles, etc., which forms the tops rapidly, and at the same time so gently as not to break or split the handle, and will hold said tops in perfect shape until seasoned. The wood, being previously steamed, is by suitable mechanism forced into forms.

Improved Still for Refining Oils.

Cornelius J. Cronin, Rouseville, Pa.—This is an improved still, in which the process of evaporating and distilling of crude oil or petroleum may be carried on with a considerable saving of fuel, and with greater rapidity, and also the formation of sediment on the bottom of the still be effectually prevented. The cleaning of the still is greatly facilitated, and not required as frequently as in the common stills in use. The still is provided with end chambers extending below the bottom of the still, into which the sediments are carried by a lateral traveling piece with adjustable scrapers moving along a longitudinal guide screw turned by reciprocating gear.

Improved Carriage Curtain Knob.

Aaron T. Rice, Reaville, N. J.—This invention relates to the construction of carriage curtain knobs, and consists in a cross piece and spiral spring, and grooved button on the shank. When it is desired to turn the button, it is forced on the spring by pressure, and over a shoulder, which disengages grooves on the button from a cross piece, and allows it to be turned in either direction. When released, the spring reacts and throws the button outward; and when it is turned for fastening the curtain, the groove engages with a cross, and the button is securely held in position. When it is turned for unfastening, or given a quarter of a revolution, another groove engages with the cross piece, and the button is held in that position.

Improved Washing Machine.

Thomas Stumm, Ada, O.—By suitable construction, by sliding a rubbing board up or down, a presser board will be adjusted to leave more or less space between it and the dasher board, as the quantity of clothes to be washed may require. The clothes rest upon a curved perforated board while being operated upon, which slides back and forth beneath the said clothes as the frame is oscillated upon its shaft. In using the machine, the frame and its attachments are lowered into the suds box, and the clothes are placed in the space between the presser board and the dasher board, and the frame is oscillated, alternately pressing the suds from the clothes and allowing them to be again saturated. When the clothes have been sufficiently washed, the frame and its attachments are raised out of the suds and the water is pressed out of them. Suitable mechanism then furnishes a powerful leverage for pressing the water out of the clothes, and enables it to be done so thoroughly that said clothes may be hung upon the line directly from the machine.

Improved Combined Stock Feed Boiler and Trough.

Henry H. Smith, Smithborough, Ill.—A trough is attached to each side of the boiler. These troughs communicate with the boiler by means of apertures, which are closed by valves. The apertures are long slots at the bottom of the troughs, so arranged that the cooked meal or food, which is in a semi-fluid state, may flow from the boiler into the troughs, and thus come within reach of the stock.

Improved Washing Machine.

James King, Sucksasunny, N. J.—The tub of the machine is made with a flat bottom, vertical ends, and rear side and inclined forward side. The beater, which, when swung forward, raises the clothes from the bottom of the box, is rectangular. A corrugated angle block is fitted into the angle at the bottom of the inclined forward side of the box, and against it the lower horizontal bar of the beater strikes when swung forward. The rubber board is corrugated, and upon the lower parts of the end edges are formed pivots which enter grooves in the box, so that the said rubbing board can be removed and inserted at will. When washing, the corrugated board is turned back, and is secured in place by a button. The corrugated board and the beater, when swung forward, form a triangular space, into which the clothes are compressed by the forward movement of the beater, to fall back into the water, and be again saturated as the beater moves back. The beater may be operated from either side of the machine.

Improved Wrought Iron Grating.

Daniel D. Boyce, New York city.—This is an improved grating to cover openings in the sidewalk in front of stores and other places where they will be walked upon, which shall be so constructed as to prevent people from slipping upon them. The invention consists in an improved wrought iron grating, having the upper edges of its bars roughened by having projections and depressions formed upon them.

Improved Temporary Binder.

Charles W. Baird, Rye, N. Y.—This consists of two flanged strips—one on each side of the papers or pamphlets filed, or on the covers when the papers or pamphlets are bound—and two or more metallic fastening strips or wires. The flanges of these strips turn over on and hold the back. The broad portion of the angle strips rests on the papers when the file is being filled. The papers as well as the strips are perforated to allow the fastenings to pass through, when the ends are bent down to keep the angle strips securely fastened to the papers or covers.

Improved Churn Cover.

David M. Peaśe, Concord, Ohio.—This churn cover is locked on its seat by means of a set screw or spring, and is provided with a flaring cup to receive a dasher rod. It prevents spattering of the cream.

Improved Skirt Protector.

Richard H. Gardner, Troy, N. Y.—Rubber cloth, leather, or other material is attached so as to inclose the extreme edge of the skirt, and envelopes a cord, which gives a broad bearing surface and adds to the durability of the device. The upper edge of the protector is stitched to the skirt or skirt lining.

Improved Manufacture of Jewelry.

Charles A. Gamwell, Providence, R. I., assignor to American Enamel Company, same place.—This invention consists in producing the body of the jewelry of wood, clay, horn, *papier maché*, or other cheap plastic material, and preparing the outer surface of the same by sizing, and varnishing in bronze, gold, silver, aniline, or other colors, or producing by the use of emery, fine sand, or other material, and a second sizing, a frosted gold, silver, or other colored surface and finished appearance of the goods. Varied and neat effects are thus obtained by very simple means, especially as, by painting and varnishing the bronzed or other surfaces in aniline and other colors, any desired shade may be produced.

Improved Shirt Bosom.

Jonathan Ramsey, Jr., Middletown, Conn., assignor to himself and Middletown Shirt Company, same place.—This is an improved shirt bosom for shirts opening at the back, which is made of one continuous piece, and folded into regular plaits, so as to produce a neat outside appearance, retain its stiffness, and save material thereby. The invention consists of a shirt bosom folded of one piece, with side plaits and re-enforced middle plaits overlapping narrower plaits at the under side, and secured to the shirt by the stitching that defines the middle plait, and at each side of the bosom.

Improved Shingle Machine.

Spencer B. Peugh, Salem, Ind.—The shingle blocks are cut from the log in the size of the shingles required, firmly attached to a block fastening frame, and fed, by the motion of the carriage, to the saw. Each trip of the carriage cuts off a shingle from each block. The inclination of the block is then changed for the next trip by a lever, so that shingles with alternating butt and point ends are cut from the blocks. The regular size of the shingles is then produced from the sections so cut by ripping them to proper width by a smaller saw.

Improved Extension Table Slide.

Wilhelm Valentin, College Point, N. Y.—The rails are provided with small rectangular recesses along the edges, and to the middle of each rail are screwed metallic bands in such a manner that the outer edges of the same project over the recesses, while the space between their inner edges forms a groove. The connection of the rails is produced by one or more L-shaped guide plates, which are screwed to both sides of the rails, running with their projecting parts along the band, and serving also as stops for the rails when extending the table. The guide plates form also the bearings for small rollers, which run, with their conical ends, in similar recesses of plates.

Improved Bush for Mill Spindles.

Edward Deeds, Brighton, Iowa.—The bush is made with recesses, in which are fitted the boxing pieces, the faces of which bear against the spindle and support it. On each of the sides of these pieces is a rib, forming the bearing points of the sides, which come in contact with the sides of the recesses in the bush. A wedge-shaped piece is placed in the back of the recess, in rear of each of the box pieces. Set screws pass through the upper ends of these pieces, by turning which screws the boxes are forced up to the spindle, while at the same time they readily adjust themselves to the spindle. By this arrangement, the boxing is adjusted to the spindle-bearing in an accurate manner, while any looseness caused from friction and wear is easily taken up by turning the set screws.

Improved Machine for Making Metallic Shoe Shanks.

John Hyslop, Jr., Abington, assignor to himself and Otis M. Holbrook Franklin, Mass.—This invention consists of a movable die for cutting the shank off the metal strip and shaping the edges, contrived also in suitable form on the bottom end to form one of the dies for producing the middle bend, and also the reverse bend, and combined with a stationary counterpart die. The cutting, shaping, and bending may thus all be accomplished at one operation, considerably simplifying and cheapening the machine and facilitating the work. There is also a peculiar arrangement of dischargers in connection with the cutting dies for throwing off the waste pieces. The invention also consists of a novel arrangement of dischargers in combination with the stationary bending die, for throwing the completed shanks off from it.

Improved Dish Washer.

John M. McKesson, Lincoln, Neb.—A lever is connected to a rod by a block having a hole through which the rod passes, and a slotted key wrench and locking spring, the slot of the key wrench being somewhat narrower than the rod, the rod being notched in the sides to allow the key wrench to slide on it, and the spring having a notch which engages the rod when the wrench is slipped on and holds the wrench from slipping off. The key wrench holds the rod so that the lever will lift a basket and let it fall; and it also serves for turning the basket forward and backward, at the same time the lever is worked, to increase the action of the water. When the dishes have been sufficiently washed, the cover and lever are taken off and the key wrench is again applied, and is used for a handle for lifting the basket out of the washing vessel.

Improved Buggy Top.

Joinville F. Fowler, Carrollton, Ohio.—This top folds neatly and easily together, and carries the back into such shape between the stays that it is not exposed to the dust and wear by hanging over the body of the carriage. The invention consists of two bow sections or frames, which are pivoted to the main supporting stays, and folded toward the same. Horizontal jointed stays stiffen them in upright position, while inclined side stays, pivoted to the main stays, and gearing, by mutilated end pinions, with the rear top stays, similarly pivoted thereto, carry the top up or down on raising or lowering the main stays for instant adjustment, and support the same strongly and firmly thereon.

Business and Personal.

The Charge for Insertion under this head is **$1** *a Line.*

W. A. A. will find directions for molding rubber on p. 283, vol. 29.—R. T. T. will find full directions for lacquering on p. 362, vol. 30.—D. T. is informed that we have repeatedly cautioned our readers against being deceived by mineral rod men.—B. F. T. will find directions for enameling cooking utensils on p. 157, vol. 27.—D. S. Jr. will find a full description of an induction coil on p. 264, vol. 25.—W. U. L. will find an explanation of an ice boat sailing faster than the wind on p. 43, vol. 28.—J. J. M. will find rules for proportioning safety valves on p. 363, vol. 29.—G. W. B. will find directions for repairing meerschaum on p. 202, vol. 27.—J. McD., who asks as to fulminating powder, must send his address.—C. H. C. will find an answer as to transparent colors on p. 390 of this issue.—W. C. will find directions for cleaning brass on p. 102, vol. 25. For dyeing cotton goods, see p. 405, vol. 29.—J. O'C. on the circle squaring question is right, and the "Professor" wrong.—J. B. H. will find a recipe for grafting wax on p. 345, vol. 24.

J. A. L. says: I have an engine of 24 inches stroke, with a direct acting slide valve, which cuts off at 16 inches. I wish to change it so as to make it cut off at 20 inches or at full stroke. How can I do it? A. More data would be required to enable us to answer this question. Your best plan will be to refer the matter to an engineer.

H. G. D. asks: 1. Have tubular grates, carrying a current of water from the pump to boiler through them, ever been in use or been patented? A. Yes. 2. If a tube carries a current of water from the pump of an engine through the firebox to the boiler, and the current should cease by stopping the pump, would the water divide or be driven out of the tube by the great heat, the pressure of the boiler being on the tube to the check valve below the fire? A. The tubes would soon be filled with steam.

D. asks: Why does chloral hydrate decompose the cork of the bottle? A. We have kept a large quantity of chloral for several years in a glass-stoppered bottle, which is the proper plan. With cork, it forms by decomposition certain substitution products which gradually destroy the cork.

J. B. R. asks: 1. Is there any practical method of getting an electric light of even moderate intensity without using carbon points? If there be, will you tell me where I can find a description of it? A. See description of Mr. A. Ladiguin's electric lamp, p. 337, vol. 29. 2. Can frictional electricity be induced in sufficient quantity to create light? A. Yes, but only with considerable expense and complicated apparatus, and even then the experiment is not free from danger.

A. A. asks: 1. When a person is poisoned by arsenic, what parts of the body are first and most affected, and how does this poison operate? A. It first affects the stomach, producing nausea, pain, burnings, vomitings, etc. Besides these local effects, there are others of a general character, such as general suffering, heat, and effect upon the pulse and respiration. 2. Does arsenic operate on the body in the same way that quicksilver does? A. Quicksilver is not a poison at all. It was formerly frequently administered as a purge.

J. O. R. asks: Is there any mode of intensifying one pole of a battery in relation to the other? For example, I would like to increase the attraction of the negative pole, without changing the positive. A. This cannot be done.

Y. L. asks: How can I distil water for making sensitized paper with? A. The water derived from melted ice will be sufficiently pure if you filter it.

C. S. P. says: 1. I tried making ink as per formula on p. 160, vol. 27. A druggist tells me there is no such thing as sulphate of indigo: so I dissolved indigo with sulphuric acid. Although I have used much more indigo than recommended and as little acid as possible, my ink is very pale when first used. What can I do to bring up the color? A. Your mistake was in the character and amount of the acid which you employed. Rub up in a porcelain mortar 1 oz. of indigo with 6 ozs. of fuming oil of vitriol. Ordinary oil of vitriol may also be employed to dissolve indigo, but more than double the quantity of such acid is required, and it must be heated to 130° or 140°. If a sufficient amount of acid be employed, almost the whole of the indigo may be dissolved; and if the liquid be allowed to stand for a few hours, it will remain clear on being diluted. It is then filtered, and the filtrate will be an intense blue. 2 What is white copperas, as per p. 202, vol. 29? A. Copperas, when heated moderately, parts with six sevenths of its water of crystalization and becomes grayish white This is probably what you mean, and is the *ferri sulphas exsiccata* of the pharmacopœia.

R. L. asks: 1. What amount of water must I put in aquafortis for washing down brick walls? A. Four gallons of water to one of aquafortis. 2. How can I color cement to make it black? A. Try lampblack. As to power of engine, see our recent issues.

J. E. B. says: I have a small stationary engine, 2x4 inches. The cylinder heads are ¼ inch thick, and the crank shaft is ⅝ and 1-16 inch in diameter. The steam chest and cover are held on by four ¼ inch bolts. The steam chest is about 2x3 inches, the cover being 5-16 inch thick. Would the above engine bear 120 lbs. steam and give power enough to drive a small road steamer by gearing from crank shaft to driving shaft? A. The engine is rather light for such work; but if it is well built, it might answer.

J. J. asks: Can two boilers of different size and style be set beside each other, connected by the water pipe and steam pipe, and have the water always at at the same level in each? For instance, take one boiler of 50 inches diameter with 30 three inch tubes, and one boiler 44 inches diameter with 2 ten inch flues. Will the boiler which generates steam most rapidly force the water from itself to the other? A. The arrangement might possibly be made by very careful management, but it would be very dangerous, and should on no account be permitted.

B. R. asks: How can I propel a boat for hunting wild geese (boat is 12 feet long) without causing disturbance enough to scare the geese before getting within gunshot? A. Use a propeller about 10 inches in diameter at least. It would be necessary to hang it under the boat, so as to get sufficient immersion. If you build such a boat, we are sure that our readers will be interested in hearing of the result.

S. H. P. says: 1. Two locomotives that will pull 20,000 lbs. each are hitched together and started in opposite directions. What is the strain on the shackle between them? A. 20,000 lbs. 2. Which engine will pull the greatest load, one with 4 drivers with 18 tuns on drivers, or one with the 18 tuns on 2 drivers? A. If the weight is properly distributed in each case, there will be no difference in the tractive force. 3. Will an engine weigh any more pulling than not pulling, providing she pulls on an exact level with her cylinders? A. No.

R. & W. T. asks: Is there any way to render paper permanently translucent or transparent without the use of grease or acid? A. We know of no way of doing this.

T. asks for a recipe for covering the inside of iron water pan in a house furnace. By the evaporation of water by heated air, oxidation is carried on very rapidly, and the pan becomes caked and filled with rust, which, if the water happens to be impure, emits a foul odor. A preparation that could be laid on the inside of the iron pan, and not be itself affected by the action of heat or water, would be of widespread benefit. A. The lining which is generally used and answers these requirements is a lining of porcelain. See p. 157, vol. 27.

M. says: In your answer to R. J. H., No. 21, you say: "Electricity is a motion transmitted from particle to particle of the wire." This might seem probable where only an ordinary Morse circuit is worked, but when a wire is duplexed, that is, worked with Stearn's duplex instruments, in opposite directions at same time, how is it possible? A. Various theories have been advanced; but the fact of the matter is that until the exact nature of electricity is known, all such questions as yours will have to remain unanswered.

C. E. T. says: A mirror displayed one morning an unusual phenomenon. Its surface was embellished with a crystalization of some volatile substance, which was deposited on over half its area, and which resembled the frost on the window panes. There are no sinks or drains from which gases might arise in the room. Several rooms in the building contain similar mirrors, but only mine shows signs of the deposit. A. The surfaces of some specimens of glass are more hygroscopic than others, and it might have been due to the condensation upon such a surface, the form of the apparent crystalization having been determined by some structural peculiarity of the glass.

E. J. W. asks: 1. In your opinion how long would a plate of pure cast zinc, one fourth inch thick, last if exposed to the elements? A. Very many years. 2. Is the coating of oxide formed by the atmosphere a perfect protection from the elements? A. It is generally regarded as excellent, but we have no authority for stating that it is perfect. 3. Is the oxide soluble or insoluble in water? If insoluble, will it oxidize deeper after the coating has once formed? A. Some samples of oxide of zinc are sensibly soluble in water, others are not, according to the method of their production. However, water never dissolves more than a millionth part of its weight. 4. Has pure zinc ever been known to rust? A. It oxidizes when exposed to a moist atmosphere. 5. When exposed to the elements, which is the most enduring, silver or zinc? A. Silver is not oxidized at any temperature either in a dry or moist atmosphere; zinc is. 6. Will pure zinc ever change in color after it has become exposed to the atmosphere and become fully oxidized? A. It should not do so.

H. L. asks: What is indigo, chemically? A. Indigo consists of a number of substances: 1st, mineral matters of various percentages; 2d, indigo glue; 3d, indigo brown; 4th, indigo red; 5th, indigo blue, or indigotine, $C_{16}H_{10}N_2O_2$, the peculiar dye material for which the indigo is valued.

E. asks: What is the best battery for using on the animal organism, as in cases of poisoning? A. Batteries alone are not used for medical purposes. You had better use a small coil.

J. A. R. asks: Will the lye from wood ashes lose any of its soap-making properties if left several days before using? A. No, especially if not exposed to the air.

T. O. T. asks: Can you tell me of some simple method of exhausting the air in a small chamber 6 inches by 6, fitted with two airtight faucets, one on each side? How can I compress into the same chamber two or more atmospheres? A. There is no simpler method than that of using an exhausting and condensing air syringe.

W. P. B. asks: 1. Where can I send and get samples of the different woods? A. Not offered for sale; collected and prepared by private collectors. 2. Can you tell me a good work on fossils? A. Dana's "Manual of Geology" contains the best general account of fossils, and the volumes devoted to palæontology, of the various geological surveys of the States and Territories, the best particular descriptions. 3. Can you name any work on derivative woods? A. None having this title. 4. Can you give me the address of Dr. I. Hayes, the arctic explorer? A. We believe it is Philadelphia, Pa. 5. For what and how is gun cotton used? A. Gun cotton is advantageously used in blasting, being exploded by the electric spark. Also as a substitute in some cases for fulminating mercury in gun caps, when mixed with chlorate of potassa. 6. Was the steamship President, which was wrecked in 1841, an American or an English vessel? A. American. 7. Are the lumps and bogs in wet places the result of deposit? If not, what causes produce such formations? A. Deposition of silt, and the accumulation of vegetable growth in suitable places. 8. Can you name a work on the stuffing of birds and animals? A. See the instructions published by Smithsonian Institution. 9. In putting up alcoholic specimens, is pure alcohol used? A. Yes.

N. A. S. asks: How can I bleach wood tar? A. Wash repeatedly with caustic soda, water, and oil of vitriol.

M. F. J. asks: Can you give me a recipe for dissolving copper wire in some kind of acid? A. Dissolve 1 lb. of copper in 2¼ lbs. of strong nitric acid, which has been previously mixed with 3½ lbs. of water. On crystalizing out the resulting body, you should obtain nearly 3 lbs of nitrate of copper.

C. M. asks: Is there any substance which can be poured into a type metal mold, get hard, and have the same color as ivory? A. To liquid chloride of zinc of 50° to 60° Baumé, add 3 per cent of sal ammoniac then add zinc white until the mass is of proper consistence. This cement may be run into molds, and when hard becomes as firm as marble.

J. F. B. says: 1. I have contended with many friends in Nevada that the liability to frost at any time during summer, near the streams, is mainly due to the lands being saturated with snow water, and not unfrequently overflown. I find by experiment that the water flowing down these valleys always maintains its level from one side of the valley to the other, no matter how wide; and I also find that there are veins below the surface of the lowlands which convey the water from the streams or main channels to all points in the valleys, according to its level in the streams. If we dig for water, a half mile or more from the stream, we are always sure to find it when reaching the level with the main stream, and this water will rise and fall as the stream rises and falls; and these streams are exceedingly crooked, consequently the water passes off slowly, very frequently overflowing its banks. Now I argue that, if these streams are straightened, the water would pass off more rapidly and not fill their channels by four or five feet, thus leaving the lands high and dry, allowing them to become naturally warmed by the heat of the summer's sun; while the frosts, with the damp and chilly nights, would disappear, and the lands become more adapted to the cultivation of tender plants; but at present, these lands, rich with alluvium, are always during the summer months saturated to their surfaces with snow water; and farming is not a success in consequence of frosts. I am speaking more particularly of the valley of the Humboldt; and I also maintain that these lands, drained as aforesaid and warmed by the genial rays of the sun, would not be frozen by the influence of the surface irrigation. Are those ideas in accordance with scientific principles? A. Your ideas seem entirely reasonable. 2. In drinking anything hot, we naturally suck wind into the mouth and swallow; does this wind assist in filling the stomach? If so, then we cheat ourselves of half our meals. A. The wind goes into the trachea, not into the œsophagus. 3. If the dead were each incased in an airtight sarcophagus, and buried, would not the process meet the demands of those who are becoming alarmed at the present system of burial? A. No. 4. Is there any book or series of books published which contains the constitution and codes of all the different States in the Union? A. We know of no book of this kind.

B. L. asks: What ingredients shall I use with lime to color a new brick wall before tuckpointing it? I want the color of the best red brick, to retain its color and not wash off in a wet climate. Can such a composition be made without lime? A. Take a light colored cement and stain it with Spanish brown or Venetian red, or with a little of each, to produce a color to suit; if too dark, mix with lime to make it lighter, and apply as a wash. But this will give a rough application suitable for rear or side walls only, and hardly fine enough for front.

J. P. S. says: 1. I am running light machinery with rented power; the main shaft is driven by a 40 horse engine and makes two hundred revolutions per minute. I use a three inch belt from a 20 inch pulley on main shaft to a 15 inch on my countershaft, and I have plenty of power. What size of engine would I require to drive my countershaft? A. If you are using all the power transmitted by the belt, it would be well to put in at least a three horse engine; an answer of this kind must, however, be very indefinite, as an actual test is the only sure guide. 2. What is the new steam hammer at Woolwich, England, used for? A. For forging guns and armor plates. 3. Is there any kind of acid that I could soak garden peas in to kill the bugs and not destroy the growth of the peas? A. We do not know of any. 4. How can I soften bone so as to cut it easily, and so that it will get hard again? A. We do not think that it can be done with ordinary bones.

R. D. B. asks: 1. Is there a saving of steam by just opening the throttle valve enough to let the engine run at full speed, or is it better to open it wide? The engine has a governor. A. If the governor controls the speed of the engine just as well with the throttle wide open, there will be little, if any, difference. 2 How can I make a red or brown paint for steam pipes, that will not burn off? A. There is a very good material for such purposes called black varnish, made from petroleum, which can be purchased ready for use.

B. asks: What is the cost of building a first class Pullman palace car? Has a car already been built at a cost exceeding $50,000? A. We believe the average price ranges from $30,000 to $35,000. The most expensive car of which we have heard costs about $50,000.

W. J. R. says: 1. I have always had a taste for machinery and mechanical engineering; I have studied several books pertaining directly to these subjects, as well as understanding geometry quite thoroughly, and algebra as far as cubic equations. I am now trying to get into a machine shop as an apprentice, believing that the theoretical knowledge I can gain from books, backed by the practical, obtained in the shop, will fit me much better for a mechanical engineer than the former alone. Would you advise me to do as I propose? If not, what course do you think I should pursue? A. We think that your plan is a very good one. 2. What are the best works to perfect me as a mechanical engineer? A. We can recommend all Bourne's works on the steam engine. You should also have a good work on physics, such as Ganot's or Deschanel's, and a reliable treatise on workshop practice, such as Knight's "Mechanician and Constructor," or the "Machinist's and Millwright's Assistant." You will also need a work on drawing.

T. H. C. asks: Can you give me the actual number of pounds of power which constitute a horse power? A. The horse power of an engine or a machine is a unit, originally adopted by James Watt, and now generally accepted by engineers. It is the amount of work required to raise 33,000 pounds one foot high in one minute, or, as it is commonly stated, a horse power is 33,000 foot pounds. 2. Is there any given number of pounds, tested by dynamometer, that will equal the actual power of the horse? A. A. See p. 320, vol. 28.

G. D. R. asks: 1. Would there be a gain in power in making a three cylinder steam engine, by putting the three cylinders equidistant in a circle and attaching the piston rods to the same crank? A. Such an engine is manufactured in England, and has been described in our columns. See p. 291, vol. 29. 2. Is there any simple test for detecting adulteration of linseed oil? A. It should have a specific gravity of 0·9395, at 55° Fah.

V. says: Let there be given two boilers, A and B. A has two cylinders attached to it, the diameter of each of which is 6 inches. B has one, of which the diameter is 8·486 inches. All other things being the same, would a combination of the power of the steam that issues from the cylinders of boiler A be less, equal to, or greater than the power of the steam that issues from the cylinder of boiler B? The areas of the two cylinders of the boiler, A, taken together, are just equal to the area of the cylinder of boiler B. A. If you mean to ask which will use the most steam for a given power, the single or the double engine, we would say the latter.

B. F. W. says: A friend of mine built a mill with an overshot wheel 18½ feet in diameter; and instead of running the water over it in the ordinary way, it comes to the top of the wheel and makes a half turn, thus running backward or toward the flume instead of running from it. Is there not a loss of power in running it in this way, by suddenly changing the course of the water? If so, how much? A. There is a loss of power corresponding to the loss of velocity occasioned by the turn.

G. D. F. asks: How can I raise a quarter ounce weight half an inch high, by mercury or alcohol put in a bottle or a tube? A. We do not get a very clear idea of what you mean. If you intend to have the weight suspended by a cord over a pulley, some mercury or alcohol can be attached to the other end of the cord, to raise it. By means of a bent tube, the weight placed in one leg can be raised by the preponderance of mercury or alcohol in the other leg.

N. O. B. asks: 1. Has the magnet ever pointed due north? How much does it vary now? A. The variation differs, and is constantly changing at different points of the earth's surface. There are points in which there is no variation. 2. Is there any person who makes a business of making poetry, and where can I find him? A. We think that the editor of nearly any paper devoted to general literature can give you the address of a number of such persons. 3. Is there any pump that will pump water enough to drive itself? A. No.

W. D. S. sends an insect which has excited considerable curiosity, as to its origin and what it eventually turns into. It was first seen in a small stream of clear water, which runs only in wet seasons. The insect looked like bright red blood; but on close inspection it proved to be a small worm. The worms accumulated until there was a mass which sparkled and glistened in the sun. I cleaned out the stream, but the next day another mass had accumulated. They are constantly in motion in the water; and when out of it and left dry, they soon die. I send a sample in a bottle. A. The insect is a specimen of *canthocamptus*, a genus of *entomostraca*, of the order *copepoda*, and family *cyclopidæ*. Characteristics: Foot jaws small, simple; inferior antennæ, simple; ovary single. Four species, one aquatic, three marine. *Canthocamptus minutus:* Thorax and abdomen not distinctly separate, consisting of ten segments successively diminishing in size, the last terminating in two short lobes, from which issue two long filaments, slightly serrate on their edges; antennæ short, seven-jointed in the male, nine in the female; inferior antennæ simple, two-jointed, the first joint with a small lateral joint, terminated by four setæ; feet, five pairs. Common in ditches, color reddish, length about 0·66 inch. "Micographic Dictionary," Griffith & Henfrey. Dr. Parnell states that the Lock Leven trout owes its superior sweetness and richness of flavor to its food, which consists of small shellfish and *entomostraca*. These animals abound in both fresh and salt water. The ova are furnished with thick capsules, and imbedded in a dark opaque substance, presenting a minutely cellular appearance, and occupying the interspace between the body of the animal and the back of the shell. This is called the ephippium. The shell is often beautifully transparent, sometimes spotted with pigment; it consists of a substance known as chitine, impregnated with a variable amount of carbonate of lime, which produces a copious effervescence on addition of a small quantity of acid; and when boiled it turns red, like the lobster. Sometimes it consists of two valves united at the back, and resembling the bivalve shell of a mussel others are simply folded at the back, so as to appear like a bivalve, but are really not so; or they consist of a number of rings or segments (*c. minutus*, for instance), All the *entomostraca* are best preserved in a solution of chloride of lime.—(Hogg's "Microscope," pp. 557, 558, 559.) Not useful for a coloring matter.

W. F. M. asks: Why is it that in some steam engines the eccentrics are set in such a manner that, when the full throw of one is up, that of the other is down; and in others again, when the throw of one is up, that of the other is half way? A. When the eccentrics are set with centers opposite, generally one is for moving the valve when the engine is going ahead, and the other is for the backing motion. When the center of the eccentric is 90° away from the other, the second eccentric ordinarily moves the cut-off valve.

J. H. asks: What are the objections to the caloric engine? A. It is too large and heavy, on account of the low pressure generally employed.

W. B. asks: What is used to fill and make cast iron smooth before painting? A. It is generally sufficient to give one or two coats of red lead.

R. F. B. says: I wish to build a sail boat for use on a small pond, where there are some spots of low water. Which will be the best, a centerboard or a keel boat, and of what dimensions shall I make it? I want it about 16 feet long and to be a swift runner. How shall it be rigged and of what shall it be built? A. We would recommend a center board boat, cat-rigged, from 6 to 7 feet beam.

J. L. K. asks: Which runs the easier, a wagon with 4 foot wheels or one with 3 foot wheels? A. The former.

C. W. K. asks: How can I calculate rolling friction, for instance, the resistance to the movement of a car wheel on the track? Is there any work which treats on this subject? A. It must be determined by experiment. See Morin's "Mechanics," Clarke's "Railway Practice," Pamborn's "Treatise on the Locomotive," Colburn's "Locomotive Engineering," and the scientific periodicals.

R. J. J.—You do not send sufficient data. The best waterwheels utilize about 75 per cent of the power applied by the water.

E. W. A. asks: Why is the name live oak applied to the tree of that name? A. The name of live oak was no doubt applied to this tree on account of its great durability, as the following quotation from Downing's "Landscape Gardening" (6th edition, p. 126) shows: "The live oak (*quercus virens*). This fine species will not thrive north of Virginia. Its imperishable timber is the most valuable in our forests; and, at the South, it is a fine park tree, when cultivated growing about 40 feet high, with, however, a rather wide and low head. The thick oval leaves are evergreen, and it is much to be regretted that this noble tree will not bear our northern winters."

C. R. P. asks: What is the power of a steam engine with cylinder 16 inches in diameter and 24 inches stroke, with steam at 30 lbs. per square inch, slides cutting off at 9 inches, and running at 75 revolutions per minute? A. As we have frequently pointed out in former replies, questions of this nature cannot be answered with any degree of certainty, unless further data are given, that can only be determined by experiment. For instance, in the present case, although the pressure of steam in the boiler is 30 lbs., we can only guess at the initial pressure in the cylinder; and although the point of cutting-off is given, we cannot decide, except by experiment, whether wire-drawing also takes place. Lastly, we can only estimate the back pressure. If the case is of much importance, you had better call in an engineer.

T. J. says: I have a small bath boiler, 10 × 36 inches, to run an engine 1¼×3 inches; the fire is below one end and the heat goes up around the boiler about half way. A coal fire will run the engine slowly, but a wood fire increases the speed to about double that of the coal. I would like to know how to fix it so as to run the engine with a coal fire. It can be done by bricking the boiler in and exposing almost all of the surface to the fire; but that is not practicable in this case, as the boiler is in the third story. The engine exhausts into the chimney and is about 5 feet from the boiler. A. We do not understand whether or not you are troubled about the draft. If not, it might be well to raise your grate. If the draft is bad, probably there is something wrong with the chimney, or the manner of connection.

P. S. asks: 1. What can I saturate or paint a cubic foot of 1¼ inch boards with, to make it much harder and durable for iron to rub against? A. Timber impregnated with corrosive sublimate, resinous matters, or creosote is said to be harder than before. 2. Will it do to have a cistern sunk in the cellar of a house for holding the water from the roof, without damaging the water? Of course, I will have a drain for the overplus. A. Such cisterns are very common. 3. Is the water from felt roofs fit for drinking and cooking purposes? A. Yes. 4. Which is the cheapest and best for a siphon to be used for water for drinking and cooking purposes? A. Galvanized iron will answer very well.

C. McC. says: I am running an engine in a mine; the boilers are 2,500 feet from the engine. We have lately covered our steam pipe from boilers to engine; it takes the same pressure at boilers to do the work as before we covered pipe. J. C. thinks I had ought to run with less steam on account of the pipe being covered. I claim that it makes no difference as to pressure, but that steam can be made and kept up with less fuel on account of less condensation. Which is right? A. You do not send enough details. As a general rule, the loss of pressure is less with covered pipes than in the case where they are exposed.

A. D. P. asks: Is there any compound for removing scale in boilers, which it will be prudent to use under any and all circumstances? We are obliged to use water from various localities, and the impurities with which we have to contend are, of course, constantly changing. A. We do not know of anything of so general a preventive character.

W. C. says: 1. I have a small boiler that leaks badly under the firebox. What would be the best remedy to stop it? The boiler is 6x6½ inches, and is connected with a small cylinder, 1x3¼ inches stroke. A. A rivet or patch, if the sheet is cracked; caulking, if the joint leaks. 2. I have constructed a telescope like that described on p. 7, vol. 30, and I use a double convex lens for the eyepiece. Would a plano-convex lens magnify more? A. No.

W. S. W. asks: 1. What is the correct definition of sound? A. Sound is a peculiar sensation excited in the organ of hearing by the vibratory motion of bodies, when this motion is transmitted to the ear through an elastic medium. 2. If there were no ear, would there be any sound? A. Not as we understand it. 3. Is not sound produced only in the ear and nowhere else? A. Yes. 4. About what size are the pieces of skin which are grafted? A. See p. 312, vol. 30. 5. Is the function of the spleen known positively? A. We believe not.

W. T. W. asks: Which is the proper way to put a burr on a bolt, with the flat side towards the head, or the beveled edges toward the head? A. So that the convexity is toward the head.

W. P. S. asks: Can you tell me what course of study in mechanical engineering is necessary after leaving college, and on what terms are learners taken into machine shops and engineering works? What time is necessary to learn the trade? A. If you go into a machine shop, the pay will be merely nominal, say fifty cents a day. Many young men pursue this course with very good results.

S. P. B. asks: Upon what conditions are road steamers permitted to run on common roads, in the States where they are now being used? A. We believe that in general matters of this kind are settled by the township or county authorities.

J. H. O'K. says: A friend of mine has a 15 horse engine of about 3 feet 6 inches stroke and 6 inches bow; the engine itself runs well enough, but it "whoops" in the exhaust so much that it can be heard for nearly a mile. I contend that, if you reduce the exhaust pipe to one half its diameter and dispense with a bell which is on the top of pipe, it will avoid all "whooping." Am I right? If not, what will prevent it, as it annoys me and my neighbors very much? A. It seems probable that your plan would stop the noise, which, however, seems to give indications of a very perfect exhaust. It might increase the back pressure slightly, to make such a change as you propose.

F. D. says: 1. In the cab of a locomotive that had the vacuum brake, I saw something shaped like two long-neck squashes, joined together at the top. The fireman says that there is an arrangement inside such that, when steam is let on, it draws the air out and forms a vacuum. What is that arrangement, and is it patented? Is it as economical as a vacuum pump would be in the use of steam? A. It works on the principle of the ejector condenser, or the steam siphon. Probably it is not as economical as an ordinary pump, but it is more convenient. 2. Would not an engine fitted for steam run if the exhaust pipe were kept in a vacuum and the supply pipe opened into the air, without using steam? A. Yes.

P. W. D. asks: What kind of wire gauze is used for miners' lamps? A. Usually brass gauze, made of No. 20 wire, with 36 meshes to the inch.

F. H. D. asks: If it takes a certain amount of steam to drive a piston six inches, will it take as much again to drive it twelve inches, with the same pressure upon it? What is the proportion of steam between a long stroke and short stroke of piston with the same pressure upon each? A. If, as we understand your question, the full pressure of steam is admitted in each case, it will take as much more steam in the second case as the length of the second cylinder exceeds that of the first.

P. D. R. asks: 1. Why will a spoon in a glass jar or tumbler prevent its being cracked when hot water is poured in? A. Before we attempt to give an explanation, we desire to satisfy ourselves of the fact, whether or no a tumbler, that will break if hot water is poured into it when there is no spoon present, will not break when the spoon is in it. But in attempting to make the experiment we encountered the following dilemma: If the tumbler does not break without a spoon, when hot water is poured in, what use is there of trying the experiment with a spoon. If it does break, without the spoon, our tumbler is gone, and we cannot try what might have happened with the spoon. It is evident that one and the same tumbler must be used; it will not do to compare different tumblers. If our correspondent will get over this difficulty and prove the fact, we shall repeat the experiments and work out the explanation. 2. What metals transmit heat and cold the quickest? A. Silver, gold, and copper.

A. P., of Vienna, Austria, says, in reply to A. M., who asks how to find the weight of a person's head without cutting it off: I put the person (of course naked) on a balance and get the weight of the whole body. Call this P. Have a cask large enough for a person to sit in, still leaving space over the person's head within the basin. Have a perpendicular line drawn on one side of the basin, and mark it with a scale so that you can tell, by experiment, how many cubic feet of water you have in the cask. Put water into the cask up to half its hight, and mark the place on the scale. Let the person sit in the water so deep that his head will be just out of water; mark again the place on the scale, and the difference of the two places will show exactly the cubic volume of the body without head; let us call this v. Let the person plunge entirely into the water, so that the head also is under water, and mark again the place on the scale. The difference of the number marked the first time and this number will show the cubic volume of the entire person including the head; let us call this V. Now, of course, different volumes of the body being taken, their weights must be in proportion to their cubic volume, and therefore V : (V—v) : : P : x, where V is the cubic volume of entire person and v the cubic volume of person exclusive of the head; therefore, V—v = the cubic volume of the head, and P = the weight of the entire person: and therefore x, that is the weight of the head, is very easily found.

W. D. M. says that A. L. can make artificial honey as follows: To 10 lbs. sugar, add 3 lbs. water, 40 grains cream of tartar, 10 drops essence peppermint, and 3 lbs. strained honey. First dissolve the sugar in water, and take off the scum; then dissolve the cream of tartar in a little warm water, which you will add with some little stirring; then add the honey; heat to a boiling point, and stir for a few minutes.

C. C. G. says, in reply to J. W. T. S., whose chickens suffer from cholera: Put assafœtida into their drinking water, and I think you will have no further trouble with chicken cholera.

H. A. says: In explanation of the difficulty of blowing a disk of paper from a similar disk placed on the end of a tube as illustrated in a recent number of your journal, I send the following solution, suggested by an article in the *Popular Science Monthly*, entitled "The Atmosphere as an Anvil." In blowing through the tube, the force exerted on the paper disk is confined to the area of the internal diameter of the tube, the actual increase of power given by the breath being comparatively small. This column of air, in order to displace the paper, must move a column in front, and equal to the area of the paper. The disk of card is of use only to steady the paper, so as to keep it in a perpendicular position and to keep the forces exerted in parallel lines. The stronger and more sudden the blast through the tube, the closer will be the adherence of the paper to the card.

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

O. D. R.—It consists of carbonate of lime, carbonate of magnesia, carbonate of iron, and silica.—D. B.—It is sulphuret of iron.—M. S. No. 1 is black oxide of manganese. If this was found at the place where your letter was written, it is interesting as being the first found in Virginia, and showing another of the few localities in the United States where manganese is found. If there is a quantity of the ore you should have it fully analyzed and reported upon. No. 2 is galena or sulphuret of lead.—W. J. C.—Shall be glad to report on the character of the specimens you send, and, if truly valuable, to say so.—R. D.—They are garnets of different colors and varieties.—H. B. R.—Send on your specimens.—J. H. C.—It is galena or sulphuret of lead.—F. B.—No. 1 is hepatic pyrites. No. 2 is iron pyrites.—D. P. S.—The specimen contains some magnetic oxide of iron disseminated through a quartzose matrix, but no silver was found on assay.—J. M. H. writes from New Iberia, La., and sends some specimens found on Petit Anse Island, where the Louisiana salt mines are situated. The topography and formation of the island is rather curious, being a succession of hills and valleys, rising suddenly from an endless salt marsh which surrounds it. The specimens were taken from a deep run through one of the hills. The lead-looking particles in the sandstone exist in considerable quantity. They have excited much curiosity. A. The bright crystals of black color and metallic luster are rhombohedral crystals of specular iron ore. Much of it is attractable by the magnet, and can be picked out from the sand by running a strong magnet through it. Some of it contains a certain percentage of titanium. The minute crystals are delicately tinted pink crystals of quartz.

C. H. F. asks: What is slater's cement composed of?—T. M. P. asks: How can I construct a simple and cheap dry house for drying fruit on a small scale?—O. J. T. asks: 1. How can I case-harden breech actions of breech loading guns, to give them the clouded appearance? 2. How can I color twist and laminated steel shot gun barrels to make them show the twist, as we see in imported ones?—S. H. R. asks: From whom did the negroes spring, and what causes their black color?—R. P. asks: How can I make paper impenetrable to linseed oil?—B. F. B. says: There is a problem which some one has found in a work published many years since which is as follows: "A man at the center of a circle 560 yards in diameter, starts in pursuit of a horse running around its circumference at the rate of one mile in two minutes; the man goes at the rate of one mile in six minutes, and runs directly towards the horse in whatever direction he may be. Required the distance each will run before the man catches the horse and what figure the man will describe." I hardly think it admits of a solution under the above conditions; but were they reversed, that is, if the man were running at the rate of one mile in two minutes, and the horse one mile in six minutes, what would the answer be?

COMMUNICATIONS RECEIVED.

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

On the Vienna Exposition. By A. D.

On the Sun's Attraction. By H. B. and by A. L. L.

On Light Freight Cars. By H. S. B.

On the Madstone. By R. D. S.

Also enquiries and answers from the following:

W. E. L.—J. T. W.—M. E.—G. W. H.—P. J. K.—E. G. B.

Correspondents in different parts of the country ask: Who furnishes plans and machinery for steam laundries? Who supplies cotton seed hullers, decorticators, and oil presses? Where can a subscriber obtain a cider press? Who sells chestnut hoops for casks? Who makes wire sifters and baskets? Who makes the best metallic self-packing for pistons, with brass rings, etc.? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

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.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

May 19, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Windmill, T. Jefferson 151,132
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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

29,618.—PRINTING PRESS.—J. E. Priest. August 12.
29,699.—INSECT DESTROYING APPARATUS.—A. Isaacson. August 5.
29,727.—SHAPING AND MOLDING MACHINE.—H. D. Stover. August 5.
29,728.—PLANING MACHINE.—H. D. Stover. August 5.

EXTENSIONS GRANTED.

28,378.—FIRE ESCAPE.—L. King.
28,389.—RUBBER HOSE.—T. J. Mayall.
28,402.—ICE CREAM FREEZER.—C. W. Packer.

DESIGNS PATENTED.

7,435.—CARPET.—R. Allan, Yonkers, N. Y.
7,436.—TOY WAGON.—L. Althof, Hoboken, N. J., *et al*.
7,437.—GAME TABLE.—J. M. Brunswick, Cincinnati, Ohio.
7,438 to 7,443.—CARPETS.—A. Heald, Philadelphia, Pa.
7,444.—BOILER STAND.—F. Lancaster, New York city.
7,445.—OMNIBUSES.—C. M. Murch, Cincinnati, Ohio.
7,446.—FORK HANDLES, ETC.—C. Osborne, North Attleborough, Mass.
7,447.—HANDLES.—G. W. Plummer, Newark, N. J.
7,448.—FENCE.—S. Turnbach, Bloomsburg, Pa.
7,449.—PIPE MOUTH PIECE.—W. Demuth, New York city.
7,450.—COOK STOVE.—J. R. Rose *et al*., Philadelphia, Pa.
7,451.—HEATING STOVE.—J. R. Rose *et al*., Phila., Pa.

TRADE MARKS REGISTERED.

1,795.—COSMETICS.—J. A. Pezzoni, St. Louis, Mo.
1,796.—GREEN COLORS.—W. H. Swift & Co., Boston, Ms.
1,797.—CHEWING TOBACCO.—Allen *et al*., Cincinnati, Ohio.
1,798 & 1,799.—PLASTERS.—L. W. Warner & Co., N.Y. city.

SCHEDULE OF PATENT FEES.

On each Caveat $10
On each Trade Mark $25
On filing each application for a Patent (17 years). $15
On issuing each original Patent $20
On appeal to Examiners-in-Chief $10
On appeal to Commissioner of Patents $20
On application for Reissue $30
On application for Extension of Patent $50
On granting the Extension $50
On filing a Disclaimer $10
On an application for Design (3½ years) $10
On application for Design (7 years) $15
On application for Design (14 years) $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, MAY 19 to MAY 28, 1874.

3,447.—P. Mutter, G. Black, and W. W. Sims, Hamilton, Wentworth county, Ont. Improvement in clothes pin, called "Mutter's Adjustable Wire Clothes Pin." May 19, 1874.

3,448.—S. W. France, Hamilton, Wentworth county, Ont. Improvement in boiler attachment for cooking stoves, called "France's Stove Boiler Attachment." May 19, 1874.

3,449.—T. Miller, New York city, U. S. Improvements on a fire extinguishing system of water pipes for high buildings, called "Miller's Fire Extinguishing Water Pipe and Fire Escape Attachment for Buildings." May 19, 1874.

3,450.—A. R. Williams and J. S. Edwards, Marshalltown, Marshall county, Iowa. Improvements in kiln for burning bricks, tiles, earthenware, and other commodities, or drying the same, and the mode of setting the material to be burnt or dried, called "Williams' Furnace Kiln." May 19, 1874.

3,451.—J. F. Baldwin, Boston, Suffolk county, Mass., U. S., and C. H. Hardy, Hingham, Plymouth county, Mass. Improvements on planes, called "The Baldwin and Hardy Improved Metallic Plane." May 19, 1874.

3,452.—J. F. Baldwin, Boston, Suffolk county, Mass., U. S., and C. H. Hardy, Hingham, Plymouth county, Mass. Improvement on planes, called "The Baldwin and Hardy Improved Metallic Planes." May 19, 1874.

3,453.—C. L. Morehouse and R. Fitzgerald, Cleveland, Cuyahoga county, O. Improvements on lubricating grease compounds, called "Morehouse & Fitzgerald's Grease Compound." May 19, 1874.

3,454.—D. Bickford, New York city, U. S. Improvements on family knitting machines, called "Dana Bickford's New and Improved Family Knitting Machine." May 19, 1874.

3,455.—C. F. Wilson and S. H. Miller, New York city, U. S. Improvements on dies for cutting and cupping or drawing metal or other materials, called "Wilson & Miller's Improvement on Dies for Cutting and Cupping Sheet Metal." May 19, 1874.

3,456.—J. Briggs, Toronto, York county, Ont., and W. S. Finch, same place. Improvements on spring bottoms for seats and beds, called "Briggs & Finch's Elliptical Spring Seat and Bed Bottom." May 19, 1874.

3,457.—J. Briggs and W. S. Finch, Toronto, York county, Ont. Improvements in ventilating cars and buildings, called "Briggs & Finch's System of Ventilation." May 19, 1874.

3,458.—G. G. May, Troy, Orleans county, Vt., U. S. Improvements on milk pans, called "May's Milk Pan." May 19, 1874.

3,459.—S. H. Newcomb, Port Williams, Kings county, N. S. Improvements on folding standards for fixed or revolving stools and tables, called "Newcomb's Folding Stool and Table Standard." May 19, 1874.

3,460.—J. B. Smith, Sunapee, Sullivan county, N. H., and J. D. Sleeper, Coaticook, Stanstead county, P. Q. Improvements on machines for making clothes pins, called "Smith's Clothes Pin Machine." May 19, 1874.

3,461.—F. E. Smith, Montpelier, Washington county, Vt., U. S. Improvements on washing machines, called "Smith's Improved Washer." May 19, 1874.

3,462.—S. C. Gardner, Mansfield, Tolland county, Conn., U. S. Improvements on vehicle wheels, called "Gardner's Vehicle Wheel." May 19, 1874.

3,463.—R. L. Walker, Boston, Suffolk county, Mass., U. S. Improvements in railway car windows, called "Walker's Improved Car Window." May 19, 1874.

3,464.—T. H. Carruthers, Cincinnati, Hamilton county, O., U. S. Improvements on horse shoe bars, called "Carruther's Horse Shoe Bar." May 19, 1874.

3,465.—A. O. Abbott, Adrian, Lenawee county, Mich., U. S. Improvements on hub borers, called "Abbott's Little Giant Hub Borer." May 19, 1874.

3,466.—G. C. Bovey, Chillicothe, Ross county, O., U. S. Improvements on brick machines, called "Bovey's Queen City Brick Machine." May 19, 1874.

3,467.—I. A. Singer, New York city, U. S. Improvements on chest protectors, called "Singer's Graduated Chest Protector." May 19, 1874.

3,468.—J. W. McGlashan, Montreal, P. Q. Improvements on machinery for manufacturing drain pipes from cement, clay, etc., called "McGlashan's Drain Pipe Apparatus." May 19, 1874.

3,469.—D. Ashworth, Wappinger's Falls, Dutchess county, New York city, U. S. Improvements on hose and pipe couplings, called "Ashworth's Hose Coupling." May 19, 1874.

3,470.—J. McGuirl and H. McGuirl, Merrickville, Grenville county, Ont. Improvements in metallic molds for casting plow points, called "McGuirl's Shell Mold for Casting Plow Points." May 19, 1874.

3,471.—M. Moore, Sarnia, Lambton county, Ont. Improvements in machines or apparatus for preserving fruits, vegetables, fish, or meats in sealed cans or jars, called "Moore's Improved Preserving Apparatus." May 19, 1874.

3,491.—W. W. Allmand, East Boston, Suffolk county Mass., U. S. Improvements on machines for refitting valve seats, called "Allmand's Valve Seat Refitting Machine." May 28, 1874.

3,492.—M. Reeves, Harriston, Ont. Improvements on car couplings, called "Reeves' Self Acting Coupler." May 28, 1874.

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