Railway heads, breakers, one horse power per each ten yards per minute.

Railway heads, finishers, 0·001 horse power per revolution per minute.

Drawing frames, 0·002 horse power per revolution per minute.

Spindles, 0·008 horse power per spindle per 1,000 revolutions.

The very great irregularity of the results given in the pamphlet indicates how vast are the losses experienced in every mill where machinery, badly made, out of repair, or badly lubricated, is allowed to run. We have little doubt that there are many mills in the United States where a knowledge of these facts may lead to a reduction of running expenses within their walls, which will go far toward compensating the proprietors for their losses incurred in these dull times outside their mills.

A SWITCH ACCIDENT.

A very unfortunate switch accident recently took place on the Shore Line Railway, near New Haven, Conn. The switchman shifted the switch just before the last truck of the last car of the train had passed. This threw the truck from the rail, and the truck bumped along over the sleepers for a short distance to a trestle work bridge, when the rear car fell off the trestle, drawing with it the next car ahead, then the next, and the next, and then the baggage car. The coupling then broke, leaving the tender and the locomotive on the track. The superintendent of the road, Mr. William Wilcox, was in the baggage car and jumped out, but only to be crushed and killed by that car. His was the only life lost, though many passengers were more or less injured. The train was moving quite slowly, or the loss of life might have been serious, as the trestle was some fifteen feet high. The coroner's jury found that the switch was in perfect order, both before and after the accident; and there appears to be no other way to account for the catastrophe than as stated, though the switchman avers that he did not move the switch too soon, as alleged. The switch was of the caboose style, the switchman being obliged to enter a round house and close the door, in order to shift the switch, the switch being connected with the door. The object of this arrangement is to compel the switchman to remain at his post so long as the main track is open. A window is so placed in the house that the range of view of the switchman is confined almost entirely to the switch points, thus compelling him, as it were, to pay attention to his duty, that is, observe the switch.

This device has been in use for several years on the Connecticut railways, and has hitherto been an effective and valuable auxiliary in the prevention of switch accidents. It is, perhaps, as good a contrivance of the kind as can be provided. But what the public require is an easy plan of shifting cars from one track to another, without subjecting passengers to the risk of injury if a switchman is sleepy or careless. One plan of this kind was mentioned last week in the SCIENTIFIC AMERICAN, whereby switches are done away with altogether.

It is pleasing to be able to state that the Shore Line Railway is a comparatively well appointed institution, in respect to the ordinary means of safety. The rails are of steel. To prevent a repetition of the telescoping horror which occurred on this road a few years ago, the cars have been provided with the Miller platform and its strong couplings. Had the cars at the time of this last accident been coupled with the old style of couplings, it is probable that the coupling of the first car that left the track would have snapped, and the other cars would not have been thrown down. The strong safety couplings appear to have been productive of evil in this case But experience shows that, in the ordinary run of accidents, in nine cases out of ten, this device may be relied upon to prevent injury.

Superintendent Wilcox was one of the most careful, experienced, and able railway officials in this country, highly esteemed in every walk of life. His loss is deeply deplored.

THE MANUFACTURE OF GEM STONES.

What boxwood is to the wood engraver—the means without which his finest art would be impossible—that chalcedony is to the engraver of gems. Hard without brittleness, susceptible of a fine and endurable polish, tinted by Nature with beautiful and at times strongly contrasted hues, or capable of taking on such colors at the hand of man, it has been from the earliest period of art not only the favorite medium but the only possible medium of the gem engraver's most striking effects.

In its simplest state, chalcedony is an unattractive white stone, nearly transparent, and chiefly useful for making spear heads and arrow tips, or their more modern representatives, gun flints. Sometimes it has a striped or banded appearance, due to alternations of more or less translucent layers, ranging in color from whey white to the white of skim milk, still not very serviceable for gems or jewelry. When stained by metallic oxides, however, chiefly those of iron, it rises to the dignity of gem stone, as sard, cornelian, chrysoprase, etc., when uniformly tinted brown, yellow, red, or green: as agate, onyx, sardonyx, etc., when the colors lie in bands or strata, or are separated by layers of white. The natural formation of these flowers of the mineral world is recorded in their substance. Though commonly found in lavas and other igneous rocks, or in the *débris* remaining from their disintegration, gem stones are substantially an aqueous product, and require the agency of fire simply to develope their fine colors, a step in their production more the work of Art than of Nature.

At high temperatures, especially under pressure, silica, the basis of all these stones, is dissolved to a limited extent by water, and thrown down in a more or less crystaline form when the temperature falls or the pressure is lowered. Illustrations of this process may be seen on a grand scale in the hot springs of the Yellowstone country and elsewhere in the Great West, where immense masses of siliceous sand and rock, sometimes chalcedonic, have been brought up from the heated depths by the flowing or spouting water, and deposited around the orifices of the springs. When water similarly impregnated with silica finds passage through rocks containing cavities, bubble holes, and the like, a portion of the mineral is deposited in the cavities, gradually filling them from circumference to center, the variable rate of deposit showing in concentric rings or bands of more or less opacity. Frequently the supply of silica-bearing water appears to have been prematurely cut off, leaving a crystal-lined druse or geode; and occasionally the cavity remains filled with water hermetically enclosed, forced in possibly under pressure and unable to escape when, by some geologic change, the pressure has been removed. In case the siliceous water is also charged with iron, nickel or other metal, the stone may be more or less impregnated with the foreign material according to the degree of its crystalization, the more amorphous layers naturally taking the most and consequently developing the deepest color when subjected by Nature or Art to the action of heat, sunlight, or other agent of chemical change. Or after the deposition of the stone, the enclosing rock may be washed by chalybeate or other mineral waters supplying the coloring matter necessary to convert the unattractive gray chalcedony into the highly prized sard, cornelian, onyx, or other gem stone. It is in these latter processes that Art steps in to complete or improve upon the work of Nature, either by developing the latent color of naturally impregnated stones or, going further back, by supplying the coloring material also. Probably the majority of gem stones, thus owe part if not all their beauty of color to Art, as well as their beauty of engraving and finish.

The simplest process is the development or hightening of dull or latent color by the action of heat. The celebrated cornelians of India, for example, are largely produced from dull brown stones, by a native process of roasting in a matrix of camel's or cow's dung, which prevents the stones from being too highly or too rapidly heated. A temperature sufficient to char wood is enough, the effect being like that observed in the burning of bricks: the brown oxide of iron is changed to red oxide, and the color of the stone is correspondingly improved. At Oberstein, the great manufacturing place of gem stones in Germany, carefully regulated ovens are employed for the same purpose. Similarly treated lumps of unimpregnated chalcedony are converted into white cornelian, the texture of the translucent stone being sufficiently disturbed by the heat to make it opaque. The snow-white bands of onyx, to which we owe the art of the cameo engraver, are almost always artificially produced in this way, the heat which improves the color of the darker layers, serving to develope the white ones at the same time.

But Art, as we have said, goes a step further back, and introduces as well as developes the colors of these stones, sometimes producing effects which Nature is unable to rival. In all cases the staining process involves, first, the introduction of a substance capable of producing color on precipitation, by heat or chemical action, second, the precipitation of the color. As the stone is too finely grained to absorb any colored solution, the coloring liquid must itself be colorless To convert gray chalcedony into cornelian, the stone is soaked in a solution of pernitrate of iron, roughly made by dissolving old nails in dilute nitric acid; then the colorless pernitrate is changed into red peroxide of iron by roasting, the resulting color being faint or dark according to the amount of the solution absorbed. The more translucent the stone, the longer the period of steeping required; and when layers of unequal translucency exist, unequally colored bands result, giving sardonyx or cornelian onyx instead of simple sard or carnelian. Black onyx, that is, black stones crossed by bands of pure white, are always artificial. The coloring matter is carbon introduced in a colorless solution and blackened by fire or sulphuric acid. By the oriental and most ancient method, the stones are first boiled in honey or oil, sometimes for weeks, then heated to a temperature which chars the vegetable matter in the pores of the stone, producing black or brown according to the amount absorbed. This method produces the finest and most permanent black; but as the heating is liable to check or crack the stones and so destroy them, the western practice is to darken the carbon by the action of sulphuric acid. Inasmuch as the oriental black resists the action of nitric acid, while that produced by sulpburic acid is readily "drawn" thereby—that is, reduced to the iron mold tint of natural sardonyx—it has heretofore been regarded as a natural color. Billing has discovered, however, that it is merely a question of time in soaking, a sufficiently protracted bath in nitric acid drawing the oriental as well as the western black color. He has found also that any stone made pale by nitric acid, if properly heated, will recover its color by the charring of the carbon remaining in its pores, and that the color so produced will resist nitric acid as well as the best oriental black, which in fact it is.

The yellowish brown, orange, and lemon tints of sards are artificially producible by methods the same in principle as those already described, the last being developed by the action of hydrochloric acid on nearly transparent stones slightly impregnated by Nature with oxide of iron, the other two by the protracted soaking of the stone in the neutral solution of pernitrate of iron, afterwards exposing them to the action of sunlight.

The pale green of chrysoprase is imparted to translucent chalcedony by a bath in the saturated solution of nitrate of nickel, the best effect being produced with the unpurified metal, which always contains a trace of cobalt. The stone must remain a long time in the bath—three or four weeks or more—as it is nearly crystaline and the process is comparatively slow.

A blue color is more easily produced, but it is not permanent. The dye is Prussian blue, precipitated in the pores of the stone by the action of ferrocyanide of potassium on the peroxide of iron, introduced as for the production of red. A better effect is secured by soaking the stone in the ferrocyanide solution first, then treating it to a bath in the peroxide solution.

SCIENTIFIC AND PRACTICAL INFORMATION.

BLEACHING IVORY AND BONES.

The curators of the Anatomical Museum of the *Jardin des Plantes* in Paris have found that spirits of turpentine is very efficacious in removing the disagreeable odor and fatty emanations of bones or ivory, while it leaves them beautifully bleached. The articles should be exposed in the fluid for three or four days in the sun, or a little longer if in the shade. They should rest upon strips of zinc, so as to be a fraction of an inch above the bottom of the glass vessel employed. The turpentine acts as an oxidizing agent, and the product of the combustion is an acid liquor which sinks to the bottom, and strongly attacks the bones if they be allowed to touch it. The action of the turpentine is not confined to bones and ivory, but extends to wood of various varieties, especially beech, maple, elm, and cork.

SOFTENING VIOLIN NOTES.

M. Laborde states, in *Les Mondes*, that the disagreeable rasping tone peculiar to some violins may be avoided by placing a small strip of wax on the upper portion of the bridge. The notes are immediately rendered sweet and soft, and can be suited to the ear by regulating the size of the piece of wax.

RABIES IN ANTS.

Corrosive sublimate, it is said, has the most remarkable effect upon ants, especially the variety of insect which we lately described as living upon fungi found on leaves of trees. The powder, strewed in dry weather across their path, seems to drive every ant which touches it crazy. The insect runs wildly about and fiercely attacks its fellows. The news soon travels to the rest, and the fighting members of the community, huge fellows some three quarters of an inch in length, make their appearance with a determined air, as if the obstacle would be speedily overcome by their efforts. As soon, however, as they have touched the sublimate, says the narrator in the *Naturalist in Nicaragua*, all the stateliness leaves them; they rush about; their legs are seized hold of by some of the smaller ants already affected by the poison, and they themselves begin to bite, and in a short time become the centers of balls of rabid ants. As these insects are one of the scourges of tropical America, destroying vegetation in immense quantities, it is probable that this extraordinary remedy may be of considerable service to agriculturists.

A REMARKABLE HAILSTORM.

A hailstorm of extraordinary nature recently took place in the northern portion of New Jersey. The hailstones, it is stated, in some instances, measured as much as five inches in circumference, and resembled common rock candy, being of oval form bristling with cubical crystals. The ice was very hard and difficult to break, but when broken presented the appearance of the section of an onion, in its concentric rings. The damage done to buildings and crops was excessive, windows being smashed by scores, roofs torn, and fruit trees completely denuded.

FOSSILS OF THE DEPARTED.

A German inventor, Dr. Von Steinfels, seems to have hit a happy medium for disposing of the dead, which is at least free from the objections urged against burial, while it does no violence to the feelings which naturally shrink from destroying by fire the corpse of a beloved friend. It is proposed to place the body in a sarcophagus made of stone, and to pack around the corpse artificial stone or cement in a plastic state. The latter being allowed to harden, the remains become like a fossil embedded in the solid rock, and, if need be, the deceased finds his grave and his monument in one and the same mass.

COCOA NUT TREPANNING.

There is a well known trick performed by the clowns in pantomimes, to the mystification of the juvenile portion of the audience, which consists in shooting a hole in a man's head, and then artistically plugging up the orifice with a carrot, thus completely curing the apparently assasseinated individual. While this is, of course, very ridiculous, it is not more so than a somewhat similar operation practiced by the inhabitants of Uvea, an island in the Loyalty group. These queer people have a notion that when a person gets a headache his skull is cracked, or that the bone is pressing down on the brain. Consequently they proceed to cure the trouble by cutting open the scalp, and scraping a hole in the cranium with a bit of glass, and then stopping the aperture with a piece of cocoanut shell rubbed smooth Sometimes the surgeon scrapes too far and injures the *pia mater*, when the patient is killed; but ordinarily the boring proceeds to the *dura mater*, leaving a hole in the skull. It seems that few adults are without perforated heads, and that the cocoanut patch is common.

Our Iron Rail Products.

In 1873 the United States produced 850,000 tuns of rails and imported 207,986 tuns, making an aggregate consumption of 1,057,986 tuns. Comparing these figures with those of 1872, there is shown a diminution of production of 91,992 tuns, and of importation of 372,864 tuns. From this it appears that the effect of the stoppage of railroad construction, due to the panic, must have resulted far more disastrously to foreign producers of rails than to those at home. The figures of importation for 1873 are less than those of any single year since 1867, while the aggregates of 1872 are larger than at any period during the past twenty years. Our production during the last mentioned space of time steadily increased, rising gradually from 108,016 tuns in 1854 to 941,992 tuns in 1872, while on the other hand importations have widely fluctuated, running as low as 10,185 tuns in 1862.

The coal product for years past shows an enormous development, every year, with one exception (1867), indicating an increase. For 1873 about the usual rate of augmentation was maintained, 45,413,000 tuns being produced, against 42,749,000 tuns in 1872 and 22,500,000 in 1864.

The Chemical Centennial.

We have already alluded to the proposition of Dr. H. Carrington Bolton, of Columbia College, of a reunion of chemists to celebrate the hundredth anniversary of the birth of modern chemistry, that event being fixed as in the year 1774, owing to the discoveries, at that time, of oxygen by Priestley, chlorine by Scheele, and other important investigations by Lavoisier having simultaneously taken place. The day set apart for the meeting, we understand from a circular lately received, is August 1st next, and the place, Northumberland, Pa., where Priestley's remains are buried.

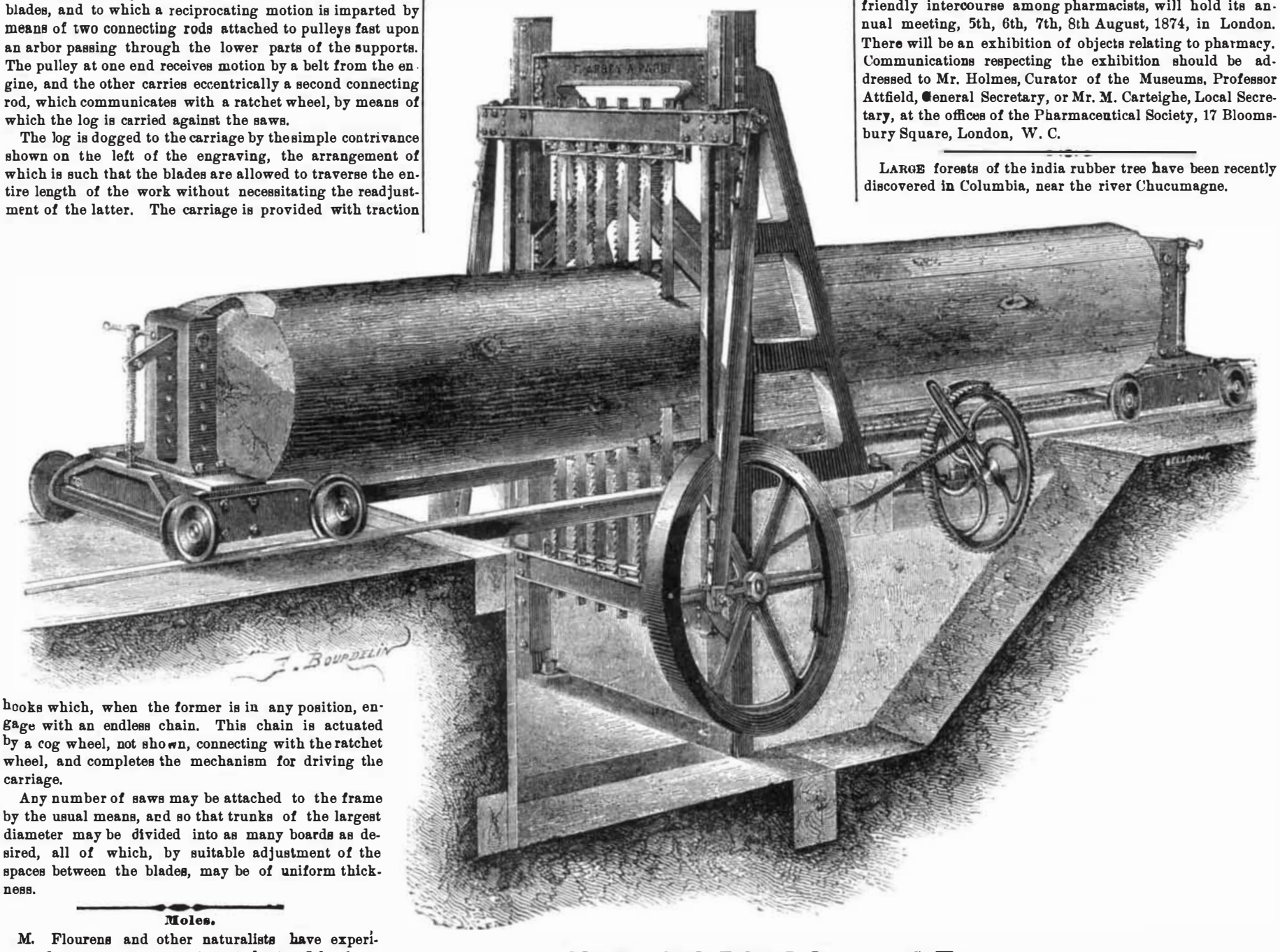
The programme of the celebration will include an address by Professor Joseph Henry; a sketch of the life and labors of Joseph Priestley, by Professor Henry H. Croft, of Canada; a review of the century's progress in theoretical chemistry, by Professor T. Sterry Hunt; a review of the century's progress in industrial chemistry, by Professor J. Lawrence Smith, and an essay on American contributions to chemistry, by Professor Benjamin Silliman. The books, manuscripts, etc., of Dr. Priestley will be exhibited, together with other objects of historical interest.

GANG SAW IMPROVEMENTS.

We extract from the *Moniteur Industriel Belge* the annexed engraving of a new gang saw, manufactured by M. Arbrey, of Paris. The machine, which appears to be of very simple, and doubtless effective, construction, is composed of two heavy standards of cast iron, joined above by a crosspiece and bolted below to a heavy bed of stone. Between the standards vertically travels a frame which carries the saw blades, and to which a reciprocating motion is imparted by means of two connecting rods attached to pulleys fast upon an arbor passing through the lower parts of the supports. The pulley at one end receives motion by a belt from the engine, and the other carries eccentrically a second connecting rod, which communicates with a ratchet wheel, by means of which the log is carried against the saws.

The log is dogged to the carriage by the simple contrivance shown on the left of the engraving, the arrangement of which is such that the blades are allowed to traverse the entire length of the work without necessitating the readjustment of the latter. The carriage is provided with traction hooks which, when the former is in any position, engage with an endless chain. This chain is actuated by a cog wheel, not shown, connecting with the ratchet wheel, and completes the mechanism for driving the carriage.

Any number of saws may be attached to the frame by the usual means, and so that trunks of the largest diameter may be divided into as many boards as desired, all of which, by suitable adjustment of the spaces between the blades, may be of uniform thickness.



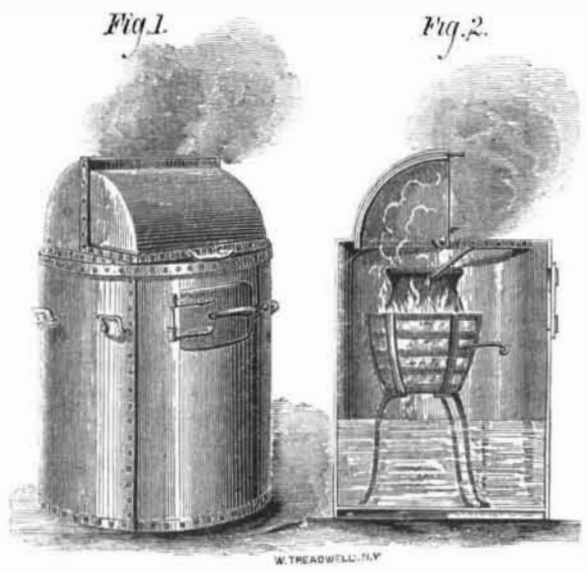
A FRENCH IMPROVEMENT IN GANG SAWS.

Moles.

M. Flourens and other naturalists have experimented with moles to ascertain their habits. It has been found that they will starve to death in presence of abundant vegetable food, refusing to touch it, but that they will greedily devour cutworms, earthworms, mice, and even small birds, when nearly starving in an enclosed jar. Of the birds they only devour the inside; but they devoured, indiscriminately, their own weight each day of snails, insects, larvæ, chrysalides, caterpillars, adders, slow worms, and lizards. M. Carl Vogt relates an instance of a land proprietor in France who destroyed every mole upon his property. The next season his fields were ravaged with cutworms, and his crops totally destroyed. He then purchased moles of his neighbors and preserved them as his best friends.

A SAFETY FURNACE.

We extract from the London *Building News* an illustration of a furnace for the use of plumbers in repairing roofs, an operation attended with considerable danger to the building itself, and (from the distribution of sparks by the wind) to



others in the neighborhood. It is the invention of Messrs Shand and Mason, engineers, of London; and its use would probably have saved the roof of Canterbury cathedral from the destruction recently caused by fire.

In Fig. 1 is seen the furnace when closed, the only outlet from which is the slot in the cover, through which the smoke passes. The basket containing the fire is placed some distance below and at one side of this opening, so that immunity from the escape of sparks is secured. The tripod, on which is the fire basket, stands in nine inches of water; and a side opening, at the hight of the fire, allows of the introduction and removal of ladles and soldering irons. The cowl of the furnace can easily be removed when required.

The New York Post Office.

The new Post Office in this city is rapidly approaching completion, and the department will move therein during the latter part of the present year. About 100 workmen are now employed, principally upon the basement, first and second floors. In this part of the building, every improvement which invention can suggest will be utilized. Arrangements are in progress for pneumatic tubes from all the daily newspaper offices to the paper mailing room, by the use of which hardly an instant will be wasted in the dispatching of daily journals. The basement portion of the building has been arranged with special reference to the admission of railway postal cars from the tracks of the Broadway Underground Railway; and when that road is built, the mail cars will run directly down from Forty-second street into the Post Office building. The Underground Railway is to pass directly along the Broadway front of the edifice. One of these days, when the Hudson river is tunneled or bridged, the postal cars of all the railways that center in this vicinity, such as the New Jersey Central, the Pennsylvania Railway, the Erie, the Delaware and Lackawanna, will all be brought down on the Broadway Underground Railway, directly into the basement of the Post Office. This will greatly facilitate the receipt and dispatch of the mails. The new Post Office is a magnificent building, imposing in appearance, and well calculated, by its location and construction, to be the great postal center of the country. The estimated cost of the building is over five millions of dollars.

Results of Improved Weapons.

Improvements in missile weapons have, partly by keeping the combatants wider apart, tended materially to reduce the cost of victories in their most costly element—human life and suffering. The French War Office has worked out the statistics of this question and the following are some of the results: At the battle of Friedland, the French lost fourteen per cent and the Russians thirty per cent of their troops; and at Wagram, the French lost thirteen per cent and the Austrians fourteen per cent. At Moscow, the French lost thirty per cent and the Russians forty-four per cent. Again, at Waterloo, the French lost thirty-six per cent and the Allies thirty per cent of their forces engaged. Forty years later, when the new weapons were employed, the loss of the French at Magenta was seven per cent, that of the Austrians the same. At Solferino, the French and Sardinians suffered a loss of ten per cent, and the Austrians of only eight per cent.

THE British Pharmaceutical Conference, for the encouragement of pharmaceutical research and the promotion of friendly intercourse among pharmacists, will hold its annual meeting, 5th, 6th, 7th, 8th August, 1874, in London. There will be an exhibition of objects relating to pharmacy. Communications respecting the exhibition should be addressed to Mr. Holmes, Curator of the Museums, Professor Attfield, General Secretary, or Mr. M. Carteighe, Local Secretary, at the offices of the Pharmaceutical Society, 17 Bloomsbury Square, London, W. C.

LARGE forests of the india rubber tree have been recently discovered in Columbia, near the river Chucumagne.