PRACTICAL MECHANISM.

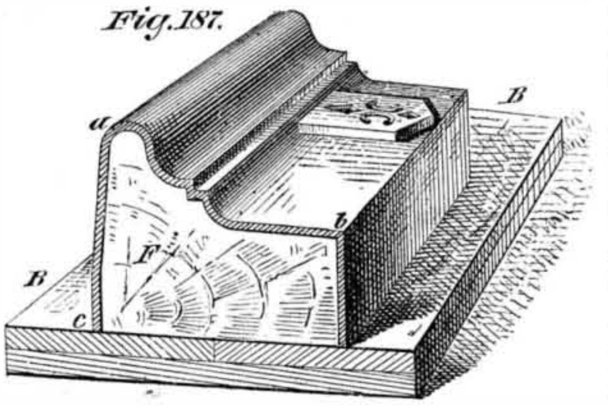
BY JOSHUA ROSE.

NEW SERIES—NO. XXV.

PATTERN MAKING.—THIN WORK.

In the examples we have hitherto presented to the reader, we have supposed the pattern to be of such substance or thickness as to be able to bear the pressure of the sand being rammed about it in moulding without breaking or altering its form; but this is not always the case. The parts of a stove, for instance, are cast often less than $\frac{1}{8}$ inch in thickness; the same may be said of most of the ornamental iron-work used in architecture, and even cornices and window sills range only about $\frac{3}{16}$ or a $\frac{1}{4}$ inch thick. It is true that for this kind of work metal patterns are almost invariably used; but for the pattern maker this is indifferent, as wood patterns have to be made from which the metal patterns are to be cast. Take, for example, the window sill shown in section in Fig. 187; to enable it to withstand the pressure of the sand while ramming, we must fill the interior with a

Fig. 187.



form or block, shown at F, which is to be used in conjunction with the board, B. This form and board are no less useful to the pattern maker than to the moulder; for let the form be once obtained of the proper size and shape, and the construction of the pattern is so far simplified as to be merely a covering of this form with wood slightly thinner than the required thickness of metal. Most thin work is made in this manner, especially if the patterns are of such size or shape as to need the joining together of many pieces; it is not the pattern itself that demands our first attention, but rather the form that supports it.

Thin work demands great care and patience on account of its fragile nature. Scarcely any hold can be obtained for nails; and though the best glue is used, it cannot always be relied upon. Dovetails for square corners, if they are end wood to end wood, will be found very superior to glued joints. Furthermore, as few joints should be made as possible, and the pattern should be well protected by several coats of varnish. In working out thin mouldings, as for instance, the portion of the sill from *a* to *b*, which should be of one piece, we plane up a piece of a suitable width and thickness, and trace the outline of the moulding upon each end of the piece; then, as it lies flat upon the bench, we work out on one side to the lines which will fit the form, as in Fig. 188, and then, by temporarily fastening the piece to the form, F, to give it proper support, we are enabled to work out the opposite side to the required shape. In working out thin mouldings, a circular saw with an adjustable table will be of great assistance, as by its means we may make a series of saw cuts so close together as practically to take out half the stuff, and form an excellent guide for cutting away the other half (see Fig. 188). The part from *a* to *c*, Fig. 187, should not be formed by glueing thin stuff together at the obtuse angle, but should be of one piece. Fig. 189 is a section of a cornice lying upon its bed or follower board, B; it may be made of one piece, as in the previous example.

Fig. 188.

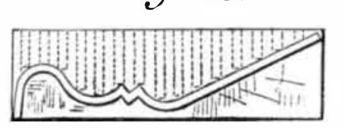
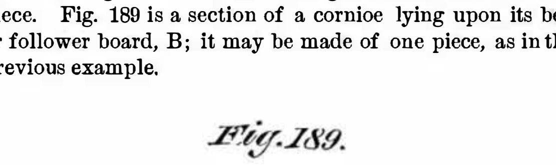
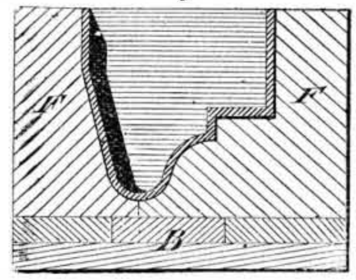


Fig. 189.



In moulding work of this kind, the procedure is as follows: The board, B, with the form and pattern, is placed upon a level bed of sand so that it may not wind or twist under the weight that is to be put upon it, which will consist of the nowel rammed full of sand. The board and nowel are fastened together by cramps, and, the ramming finished, the whole is turned over; the board and form are then removed. There is no longer any necessity for the support of the latter, as the sand, having been once rammed, does not press upon the pattern to its injury, but keeps its position and becomes a good and sufficient support to it during the ramming up of the cope, which is now placed in position, and the moulding continued in the usual manner. Instead of the form, F, which fills the interior of the pattern, we may provide a strong enveloping form, as shown in Fig. 190; the difference is that the reverse side of the casting will be uppermost as compared with the other case. The form must fit that side of the pattern which we wish to come next the cope. Forms of an irregular or difficult shape are often advantageously made by simply pouring plaster of Paris into the patterns for which they are intended. A great deal of thin work is formed by dry sand coring, often from necessity; but when practicable, the dry sand core is discarded and the pattern made to leave its own core. This insures greater accuracy, is cheaper, and causes the interior surface of the casting to be the same as the exterior. When dry sand cores are employed, there is no difference between thin work and thick, and therefore the methods described in former pages are a sufficient explanation of the process.

Fig. 190.



Duties of an Engineer in the Care and Management of a Steam Boiler.

The following instructions may be of little importance to skilled engineers, as such are supposed to be thoroughly versed in all the matters discussed; but to young and less experienced engineers, we believe that the directions, from the Indianapolis *Mechanical Journal*, will be found useful.

The first duty of an engineer when he takes charge of an engine and boiler is to examine his boiler and see that the water is at the proper level. The water should be kept up to the second gauge whilst working, and up to the third at night. The reason why the water should be raised at night is to prevent it from becoming too low from leakage or evaporation. In case the water should become dangerously low, the engineer should immediately draw the fire and allow the boiler to cool, and not admit any cold water to the boiler or attempt to raise the safety valve, as it would be positively dangerous. The reason why it would be dangerous is, that it would lessen the pressure in allowing the steam to escape from the boiler, thus allowing the water to rise up and come in contact with the overheated iron, and probably cause an explosion. In case the water supply should be cut off from the boiler for a short time, he should cover his fire with fresh fuel, stop his engine, and keep the regular quantity of water in the boiler until the accident is repaired and the water supply renewed. To get up steam, the engineer should first see that the water is at the proper level; he should then remove all ashes and cinders from the furnace, and cover the grate with a thin layer of coal; and after placing his wood and shavings on the coal he will be ready to start his fire. The advantage in placing a covering of coal on the grate before the wood or shavings is that it is a saving of fuel, as the heat that would be transmitted to the bars is absorbed by the coal, and the bars are also protected from the extreme heat of the fresh fire. An engineer should allow his fire to burn gradually when commencing to get up steam from cold water, as by allowing the fuel to burn very rapidly some parts of the boiler become expanded to their utmost limits, while other parts are nearly cold. Of course, a great deal depends upon the time in which he has to raise his steam. An engineer should regulate his fire at a uniform thickness, and not allow any bare places or accumulations of ashes or dead coals in the corners of the furnace, as these places admit great quantities of cold air into the furnace, and render the combustion very imperfect. An engineer should avoid excessive firing as much as possible, as it is attended with more or less danger, because the intense heat repels the water from the surface of the iron and allows the boiler to be burned. He should keep about three inches of anthracite coal and about five inches of soft coal on his fires, but he should regulate the thickness of the fire according to the capacity of the boiler. If the boiler is too small for the engine the fire should be kept thin, the coal supplied in small quantities and distributed evenly over the grate, and the grate kept as free as possible from ashes and cinders; but if the boiler is extra large for the engine, the thickness of the fire makes but little difference. If the fire becomes very low, he should neither poke nor disturb it, as that would have a tendency to put it entirely out; but he should place shavings, sawdust, wood or greasy waste on the bare places, with a thin covering of coal; then, by opening the draught to its full extent, the fire will soon come up. If it should become necessary to burn wood on a coal fire, it is always best to make an opening through the coal to the grate bars, so that the air from the bottom of the furnace can act directly on the wood and increase the combustion. He should give great attention to the regulation of the draught in the furnace, as it is one of the most important parts of an engineer's duties, for in fact it is next in importance to the regulation of the water in the boiler.

It is well known that immense quantities of fuel are recklessly wasted by ignorance and carelessness in the management of the draught. He should not have any more draught at any time than would produce a sufficient combustion of the fuel to keep the steam at the working pressure, as by opening the damper to its utmost limits great quantities of heat are carried into the chimney and lost. An engineer cannot carry out this plan in all cases—only in furnaces and boilers that are sufficiently large to furnish the necessary amount of steam without forcing.

Of course, where the boiler is too small for the engine, or has not sufficient heating surface, it is impossible to economize fuel. In some cases it is a good plan to throw a jet of steam under the furnace bars when the draught is insufficient to produce the necessary combustion of the fuel. It is considered an advantage, before clearing a fire, to throw some water under the grate bars, as the oxygen of the steam thus generated under the furnace will unite with the oxygen of the atmosphere, and insure a more rapid combustion of the fuel after the fire is cleaned.

Steam or water should not be thrown under the grate bars of locomotive boilers when such boilers are used for stationary engines, as steam or water in the ash-pit forms a lye with the ashes, and corrodes the iron and destroys the water legs of the boiler. An engineer should always keep his pit clean, as by allowing the ash pit to become filled with ashes and cinders the air becomes heated to a high temperature before entering the fire, which naturally interferes with the combustion of the fuel. The grate bars also become overheated, and in many cases badly warped or melted down. He should at all times watch his safety valve carefully, and keep it in good working order. He should do this at least once a day; the morning is the proper time, and then he will feel safe during the day. We have often seen safety valves with all kinds of weights on them, and it at once gave us a poor opinion of the engineer. No first-class engineer will do this. It should be one of the main reasons for discharging him. In blowing out a boiler, remove all fire from the furnace, and see that the steam is at the proper pressure—say from 45 to 50 lbs. Always close the damper.

At least one hour should pass between drawing the fire and blowing out the boiler. This will allow the furnace to cool and prevent the boiler from being injured with the heat after the water is all blown out. The higher the steam pressure, the higher the temperature of the iron, so that by blowing out the boiler under a high steam pressure the change is so sudden that it has a tendency to contract and cause the boiler to leak. The boiler should not be filled with cold water immediately after blowing out, as the introduction of cold water into the boiler before the temperature of the iron becomes lower would, in all probability, cause the boiler to leak. The boiler should be blown out whenever any appearance of mud is found in the water. When fresh water is boiled, it is supposed to deposit its mineral, and after that it is not advisable to blow out the pure water and fill the boiler with water holding matter in solution and suspension; and for this reason once in two or three weeks is often enough to blow out the boiler. When filling the boiler, some cock or valve in the steam room should be opened and allow the air to escape. If not, the air would retard the ingress of the water, and also collect in the steam-room of the boiler, and prevent the regular expansion of iron when the fire is started.

The steam-room in a boiler is that portion of the boiler occupied by steam above the water. The water room is that portion of the boiler occupied by water. The fire line of the boiler is a longitudinal line above which the fire cannot rise, on account of the masonry by which the boiler is surrounded. The tubes of a boiler should be cleaned at least once a week; all ashes and soot should also be removed from the outside of the boiler. This all makes a great saving in fuel, as it allows the fire to act directly on the iron. Boilers should be cleaned at least once in three months. All stays, braces, seams, and angles of the boiler should be examined carefully. He should also sound the shell of the boiler with a very light steel hammer. It is a good way to determine the condition of the iron.

The steam guage should be tested at least once a year. It should be done by a test-gauge, made expressly for the purpose. The water gauge should be kept clean, inside and out, and all points belonging to same. By opening the drip cock and closing the water valve and allowing the steam to rush down the glass, the steam will carry out the mud and sediment. They should also be swabbed out with a piece of cloth or waste on a small stick when the boiler is cold; but care should be taken not to touch the inside of the glass with wire or iron, as an abrasion will immediately take place.

Decay of Timber.

Wet and dry rots are the two forms of decay which attack timber that is exposed to the action of the weather, and the cause of both may be said to be heat with moisture. Confined air and evaporation cause dry rot, and imperfect evaporation wet rot to a greater or less degree.

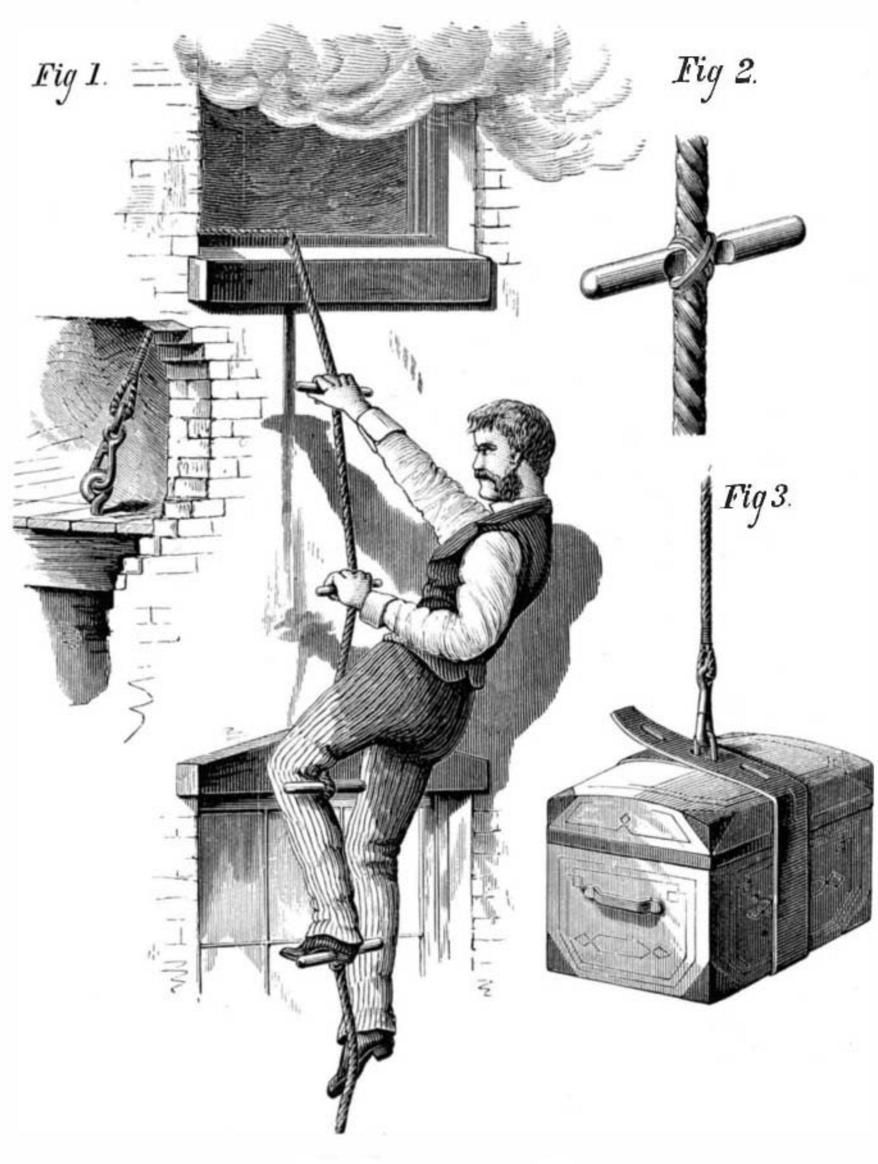
Investigation shows that as a preventive against these rots the timber should be well seasoned, and if used where liable to be under the influence of sun and rain should be well well painted, or, if not painted, should be impregnated with linseed or oil of tar. The best preventive, however, is found to be that of allowing a free circulation of air around the timbers, and the walls to be allowed to dry thoroughly before the introduction of the timbers; should the timbers have taken either of these rots very little can be done to preserve them. In case the rot is perceived to be at the end of beams only—where in fact it generally commences—the best method of preserving the rest of the timbers is to effectually cut away the decayed portion and scarf with sound; if, however, this should not be practicable, the wood may be scraped and cleaned of all fungus or extraneous matter and then impregnated with any of the usual oils.—*Cincinnati Trade List.*

IMPROVED FIRE ESCAPE.

We noted last week the necessity existing for some simple and efficient fire escape, which could be rolled in small compassso as to be conveniently stowed in the traveler's satchel or trunk. The invention illustrated in the annexed engravings aims to supply this need. It consists of about a hundred feet or less of wire rope, one end of which is turned up to form a loop which is secured by wire seizings. In this loop, which is lined with leather to prevent chafing, a spring hook is secured. Along the rope, crossbars or rests are lashed with wire, at intervals of about 15 inches. These bars are of iron, having a portion of their surface flattened near the centers on one or both sides, and are inserted through the strands of the rope (Fig. 2).

The apparatus can be very quickly got ready for use, as it is only requisite to screw an eye into the woodwork or flooring of the room, attach the snap hook, and lower the escape out of the window, whence it forms a ladder, Fig. 1. The inventor also provides a strap, Fig. 3, which carries a staple to which, after the strap is passed around a trunk, the end of the fire escape rope is attached. The trunk is thus easily lowered; and after reaching the ground, it serves as a means of steadying the ladder. By the same means, women, children, or invalids may be lowered from windows.

Patented through the Scientific American Patent Agency, October 24, 1876. For further particulars, address the inventor, Mr. H. R. Houghton, West 42d street, New York city.



HOUGHTON'S FIRE ESCAPE.

Age of Labor-Saving Appliances.

The *Manufacturing and Trade Review* thinks that the greatest reason why there is such an over-proportionate abundance of all kinds of products as compared with former times, and comparatively so few workmen are employed, is that these products are the results of mechanical appliances, one of which does the labor of numbers of workmen. Instead of hoes and spades, and sickles, and scythes, and flails, the cultivators, planters, reapers, and mowers, and thrashers are used. So with the production of the nail, horseshoe, cutlery, tools, clothing; in fact, what is not made by machines for the purpose is very far behind the age. The business of the world now is inventing, improving, and running machinery and appliances to make machinery and tools, and in producing the articles they make; and the aim of the present workman must be to thoroughly know the use and care of machinery, the strength and adaptability of materials for the manufacture of appliances. If the world seems to be already supplied with all these, then his business is to possess the machine or appliance and use it in producing the thing which his taste and judgment may suggest. It is useless to resist this march of machinery. Only the man who accepts, adopts, and enters most heartily into its use and product, will keep abreast of the present progress.

IMPROVED CALCULATING MACHINE.

The drudgery of mental computation, of all labor, is perhaps the most enervating and uninteresting; and an effectual device to remove or even lessen the mental effort will be readily appreciated by mathematicians, engineers, bankers, actuaries, and accountants.

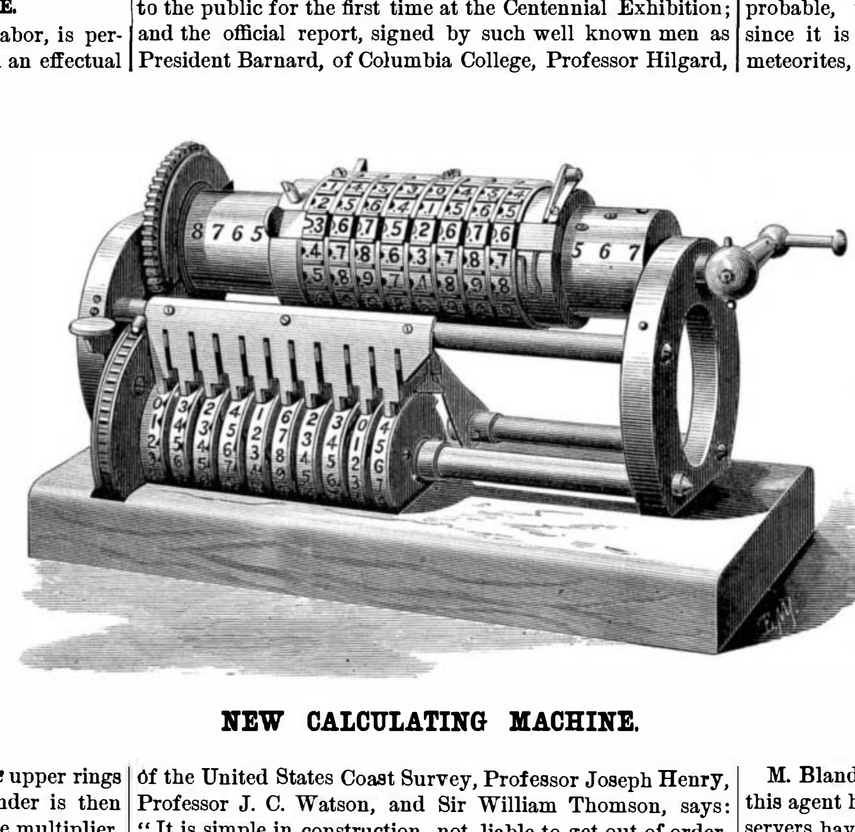
The calculating machine, properly so called, must not be confounded with the simple slide rules, adding machines of various kinds, interest tables, and other devices called by the same name. This instrument is a piece of mechanism that performs its task in a direct and complete manner, taking in a great range of work, and using and giving numbers at full length and in plain figures.

The construction and operation of the apparatus as illustrated herewith are both simple. There is an upper cylinder, which is turned by the crank, and which itself drives a smaller shaft underneath. A slide, that can be set in eight different positions on the cylinder, carries eight figured rings that can be set to represent any number of eight or less decimal places. Each turn of the crank adds the number set up on the rings to the number represented on the ten recording wheels carried by the lower shaft. The multiplication process will best be understood by an example. To multiply 347 by 492, the three upper rings are set at 3, 4, and 7, respectively. The cylinder is then turned twice to multiply by the units figure of the multiplier. If now the slide is carried along one notch, where each ring will act on the next higher recording wheel, and turned 9 times, 347 will be multiplied by 90, and the product at the same time will be added to the product already scored. Another shift of the slide and four turns will complete the operation, and show the result, 170724=(347×2)+(347×90)+(347×400) upon the recording wheels. A half turn of the crank backwards erases this result, bringing all the wheels to 0, ready for the next operation.

Division is the reverse of multiplication. The dividend is set up on the wheels, the divisor on the rings, and the quotient records itself on the upper recording wheels. The machine of the size illustrated will use numbers of eight or less figures, and show the result in full, if not over ten figures, and its upper figures if more than ten places are necessary.

The dimensions of the instrument are 13×5×7 inches, and it contains but eighty working pieces of mechanism, none of them small or delicate. Made mostly of brass and iron, its smaller parts are of steel, portions of which are tempered. Its results are shown in plain figures, stamped on unpolished silver-plated surfaces and filled in black. All prominent parts are nickel-plated and polished.

The machine was invented in 1870, but was not manufactured for general use until this year. It was introduced to the public for the first time at the Centennial Exhibition; and the official report, signed by such well known men as President Barnard, of Columbia College, Professor Hilgard,



NEW CALCULATING MACHINE.

of the United States Coast Survey, Professor Joseph Henry, Professor J. C. Watson, and Sir William Thomson, says: "It is simple in construction, not liable to get out of order, its use greatly saves the mental labor of computation, and lessens the liability to error. It is deemed superior to all other instruments of its class yet produced." Other well known experts state that a saving in time of more than sixty per cent is effected over ordinary methods.

Upon work of four or five decimal places, the machine is claimed to have an advantage of three to one over common logarithms; and it is quicker and easier to use natural numbers and natural sizes, tangents, etc., on the machine than to use the common logarithmic method.

The patentee and manufacturer is George B. Grant, 94 Beverly street, Boston, Mass. He will supply any further information.

New Theory of the Origin of Petroleum.

The origin of the immense quantities of hydrocarbon oils which are found saturating strata of sandstones, or pent up in cavities of the older rocks, or escaping to the surface and collecting upon pools of water, has been the subject of frequent discussion. The theory generally accepted, and endorsed by such names as Hunt, Newberry, and Silliman, is that it is of organic origin, either vegetable or mineral. It has even been suggested that the bad smelling petroleum of Canada owes its origin to decayed fish. According to T. Sterry Hunt (*American Journal of Science*, March, 1863), "the pyroschists of Bosanquet belong to the Devonian series, and contain the remains of land plants, so that a partially decayed vegetation may be supposed to have been the source of the organic matter which is intimately mingled with the earthy base of the rocks; * * * but in the pyroschists of the Utica formation, the chief organic remains to be detected are graptolites, with a few brachiopods and crustaceans."

In view of these facts we are not a little surprised at the new and yet plausible theory advanced by the distinguished Russian chemist, Mendelejeff, before a meeting of the Chemical Society of St. Petersburg. The appearance of oil on the surface of the earth proves that it has a tendency to rise through the various strata of the earth, and this is no doubt due to its being lighter than water, which, being everywhere present, forces it upward. For this reason we are compelled to suppose that it was formed lower down in the earth than the places where it is now found. Another reason for this belief is that the sandstones, in which much of this mineral oil is found, contain no charred organized remains, which must be present where the oil was produced, if it be of organic origin. Since petroleum is found in the Caucasus in tertiary, and in Pennsylvania in the Devonian and Silurian, its origin must have been in the older rocks at a still greater depth. But in those ancient periods, like the Silurian, not many organized beings could have existed. Hence Mendelejeff thinks that it is very improbable that petroleum is the product of any decomposed organic matter.

Mendelejeff starts with Laplace's theory of the formation of the earth, applies Dalton's law to the original gaseous condition of the constituents of the earth, and calculates the probable arrangement of the metals in the earth from the density of the globe and the vapor density of the elements. Starting with the assumption, which is not improbable, that iron is the most abundant of metals, since it is present in large quantities in the sun and in meteorites, and admitting the existence of carbon compounds of this metal. not only will it be easy to explain the formation of petroleum, but one can understand all the peculiarities of its occurrence in those places where the earth's strata has been broken by the elevation of mountain chains. Breaks made in this way permitted the water to permeate to the carbonaceous metals; and at the high temperature, and under heavy pressure, it acted upon them, forming oxides of the metals and saturated hydrocarbons. The latter rose as vapors to the higher strata, where they were condensed, saturating the porous sandstones, which are capable of absorbing many oily products.

Many other phenomena of nature are explained by this theory of the formation of petroleum, such as predominance on the earth's surface of elements with small atomic weights, the occurrence of oil in straight lines or arcs of huge circles, its dependence upon volcanic action, which has been noticed by Abich and others, the magnetism of the earth, and many other natural phenomena.

Salicylic Acid.

M. Blandeau, of Paris, states that, according to dentists, this agent has injurious effects on the teeth. English observers have noticed its effect on the bones, and necrosis of the tibia has been assigned to its use. It evidently possesses considerable affinity for the calcareous salts of bone, and we see the urine loaded with lime salts in an ultra-physiological proportion, from the internal use of the acid. The salicylate of soda presents the same dangers; and too much caution cannot be taken in the use of any salicylic preparation.