HOW TO PAINT MAGIC LANTERNS.

The colors used for painting magic lantern pictures on glass must be either trausparent or semi-transparent. The former include Prussian blue, gamboge, carmine, verdigris, madder brown, indigo, crimson lake, and ivory black; the latter, raw sienna, burnt sienna, cappah brown and Vandyke brown, are semi-transparent. By combinations of these almost any desired tint can be produced. No particular mixing of the colors is requisite, but if oil colors are used megilp is the best thinning material. Water colors for first washes should be laid on with a hot solution of trans parent gelatin. Camels' hair pencils are preferable to sable for painting on glass, as their elasticity is less and the trouble of working out the brush marks, which must always be attended to, not so great. Dry colors may be mixed with varnish, in which case the glass must be covered with a coat of turpentine which must be allowed to dry. The simplest way of producing the picture on the glass is by using a series of stencils, as represented in our engravings. Fig. 1, for example, is the picture to be reproduced. The artist places over this a piece of oiled paper, and on this he traces the outlines of all that portion of the picture which is to be tinted with yellow or in which yellow enters in the compound tints. This portion of the design is represented in Fig. 2. Next, on another piece of paper, the red portions are traced as in Fig. 3. On a third piece are traced the green parts; and lastly, on a fifth piece of paper, are drawn the blue parts. The colors on these bases to be used would be gamboge, carmine, verdigris, and Prussian blue. Next, with a sharp penknife, the portions of the several papers included in the various outlines are carefully cut out, so that each piece of paper becomes a stencil. It only remaius to apply the stencils, in the order already named, to the glass, and rub the color over them, in turn to produce the picture, the different colors being superposed, and consequently combining. When the paint is dry it is coated with colorless varnish and the edges of the glass are surrounded with strips of strong paper.

Fig. 1.

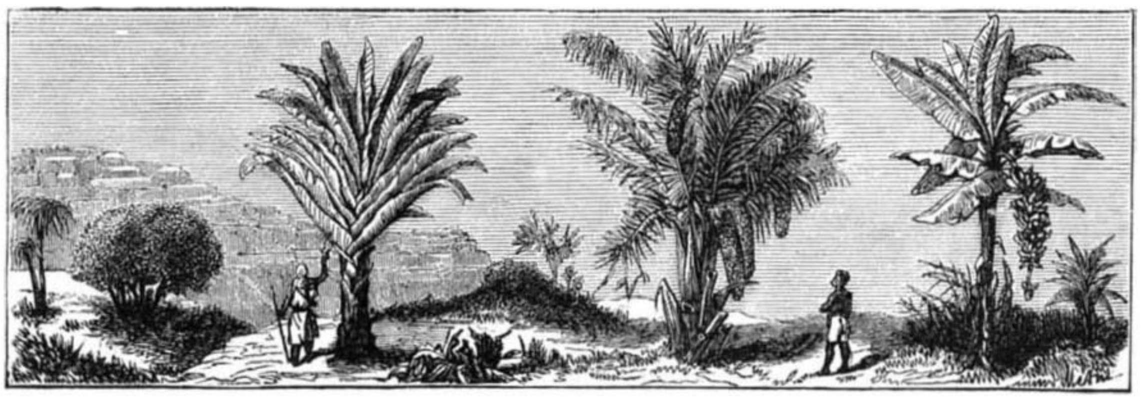


Fig. 2.

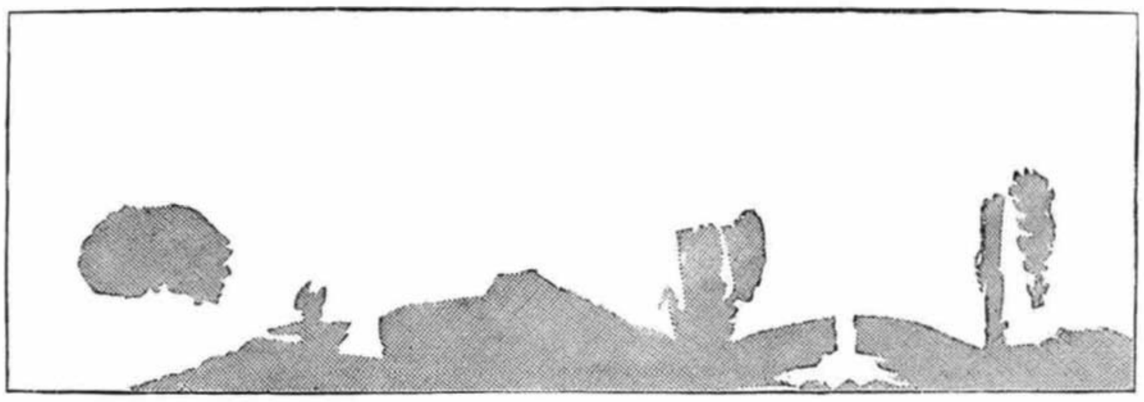


Fig. 3.

Fig. 4

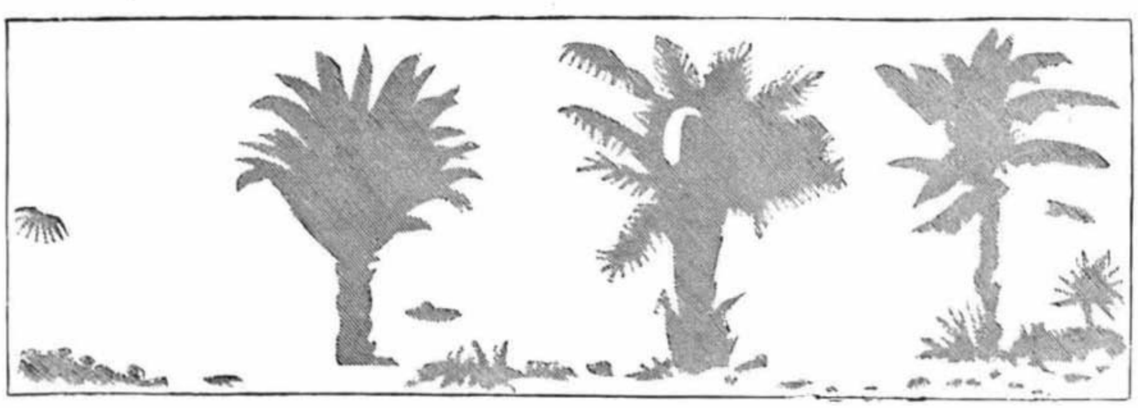
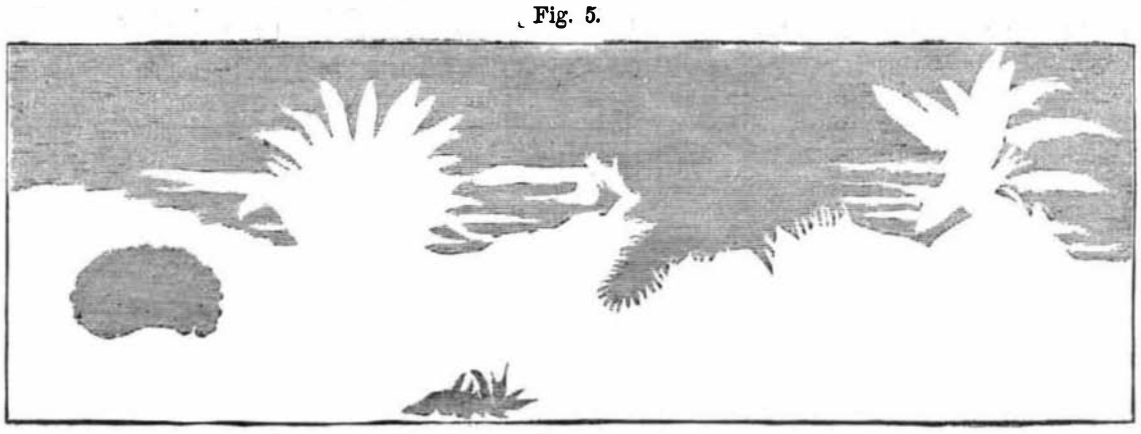


Fig. 5.



METHOD OF PAINTING MAGIC LANTERN SLIDES.

Real Antiquities.

If one wishes to see the oldest parts of the world let him go to Trenton Falls, and, after visiting the excavations made by the natural action of a mountain torrent into the ancient rocks, go to the hotel and see the collection made by the landlord, at an expense of ten thousand dollars, of specimens which prove the record of a geologic age so remote that no imagination can grasp it. Professor Agassiz declared that the land reaching from Trenton Falls to Saratoga was the first that appeared above the sea on the creation. Here are the trilobites in great variety, all modeled in black marble, so perfectly preserved in form that the multitudinous lenses of their eyes are as apparent under the microscope as are those of a living fly. Millions of years before man walked the earth these creatures lived their life, the limestone took on their forms, and here they are! What are *scarabœi* and ancient *intagtii*, or any other engraved or modeled semblance of the old life, compared to the trilobites? These creatures not only lived, but had become everlasting stone millions of years before there was a living man to see them.

The old hotel keeper is enthusiastic over his treasures and proud of the distinguished visitors who have been attracted by what he has to show them. Dr. J. G. Holland reports in *Scribner's Monthly* that he said to him, with a touch of pardonable pride, "I shall have Tyndall, Huxley, and Darwin here altogether in September, for they have written me that they are coming.'

It is a really exceptional case to find a landlord of a hotel who is a connoisseur in art and a lover of science, and who understands his business at the same time and is able to conduct a hotel. Paintings, old and new, adorn the walls; here is a Durand, there a Bouteille, besides many paintings by Hicks. They are on all the walls of the first story of the large house; while the collection referred to stands in the office, and is the admiration of all scientists and lovers of nature.—*Manufacturer and Builder.*

The Origin of Petroleum.

It is needless to say that the origin of petroleum has been the subject of much speculation, but from the scantiness of the facts hitherto collected nothing definite has been arrived at. The most generally received hypothesis is that it is formed, under conditions unknown to us, from vegetable matter; that it has, in fact, the same primary origin as coal. This theory is supported by the fact that we can, by chemical means, extract from coal and other vegetable matter bodies very similar in composition and properties to real petroleum.

But, at the best, this is merely a hypothesis with very few facts to support it; and Mendeleef, the well known Russian chemist, has recently proposed a new theory of the rmation of petroleum. From he fact that in Pennsylvania the petroleum occurs in the Silurian and Devonian formations, he considers it very probable that the hydrocarburets are the result of the decomposition of organic *débris*, because organic life at the period was very scanty. His theory, in conformity with the hypothesis of Laplace on the formation of the globe, supposes the existence of large masses of iron occurring with inorganic carbon in the heart of the earth. Water penetrating from the surface comes in contact with the iron in a state of fusion, and is decomposed, the oxygen combining with the iron, while the hydrogen, under the influence of the heat and pressure, combines with the carbon and produces the hydrocarbons of petroleum.

Every opinion of Mendeleef is worthy of the most respectful consideration; but, at the same time, we have a right to treat it as we would that of any other man. As this is not a question of fact, but one of theory, we will proceed to examine it. Regarded simply from a chemical point of view, this theory is a possible one. But the author of it starts with the assertion that organic life was not plentiful in the Silurian and Devonian periods of geology, and therefore that there was not sufficient organized material to provide for the formation of the vast quantities of petroleum which have been yielded and are still contained in the American deposits. It is true that we find but few fossil organized remains in the deposits referred to: but any one conversant with modern scientific thought on this subject will know that this fact is not regarded as any proof of the actual amount of organic life then existing. It has been put almost beyond a doubt that only a very small portion of the living beings existing at any one period are preserved in a fossil state: and that by far the larger bulk undergo the ordinary process of decay, and entirely disappear. Professor Mendeleef, therefore, unjustifiably assumes the position from which he endeavors to overthrow the older theory.

In the explanation of his own theory he makes another assumption, which we hardly think will be borne out. That is to say, "His theory supposes the existence of large masses of iron occurring with inorganic carbon in the heart of the earth, and this supposition is said to be "in conformity with the hypothesis of Laplace on the formation of the earth." Laplace's nebular theory, here referred to, amounts to this. At some period in the infinitely remote past the globe had no existence as such. The matter composing it existed in space, but at such a high temperature that it was not merely liquid but a gas. Everything of which the earth is now composed—iron, gold, granite, as well as water and air—existed only in the form of incandescent vapor.

In the course of ages this mass of gaseous matter gradually cooled, and the globe assumed first the form of a ball of melted matter surrounded by dense clouds; then it became covered with a solid crust, the clouds gradually disappeared, and the earth assumed its present form. This theory, startling at first, becomes more plausible as our knowledge increases, and if not itself the final explanation of globe formation, is at least a long stride toward accurate knowledge. From the experience men have gained in the operations of smelting and other processes requiring intense heat, we are enabled to predict with great certainty what would be the state of things during the gradual condensation of the globe from a gas to a solid. And the knowledge thus gained leads us to the conclusion that it is extremely improbable that carbon could exist in the earth in a solid state. Every one knows what would be the effect of exposing white-hot carbon to the atmosphere. It would burn rapidly and disappear. Metallurgists will understand further that if a limited amount of air were supplied to a number of combustible bodies, the carbon would burn first. Sulphur, phosphorus, white-hot iron, zinc, and many other substances, all burn, that is, they all use up the oxygen of the atmosphere. But it is well known that charcoal is used to smelt iron, that is to say, when heated iron and heated charcoal are placed in contact with a limited amount of oxygen, such as is contained in hæmatite and other good ores, the iron gives up its oxygen to the carbon, and we get as results metallic iron and carbonic acid gas. Carbonic acid gas is always formed when carbon is burnt in the air. It is the same with most other materials. The carbon would extract from them all the oxygen they contained, and would be transformed into gas. It may be said that carbon in the center of the earth would be protected from the atmosphere and would have no chance of burning. Our contention is, that it would never get into the center of the earth. Remember that the whole material of the earth is in a state of vapor. As this gradually cooled, carbon and iron among other things would separate as solid or liquid masses at more than a white heat. And it is impossible to suppose that the carbon would not immediately seize upon all the oxygen surrounding it and be instantly converted into the permanent gas, carbonic acid.

Further, Mendeleef assumes that water could penetrate soil which was sufficiently hot to keep iron in a melted state. If the water could creep down a crevice to the melted iron, it is certain that steam could escape by the same passage, and the heat generated by the neighborhood of the masses of melted iron would certainly cause every particle of water to disappear long before it would come in contact with the iron itself.

If there was not sufficient organic life in the Silurian and Devonian periods to supply the materials for the formation of petroleum; if carbon and iron could exist in a melted state in the center of the earth and could reach that position before the carbon was completely oxidised and converted into gas; if water could penetrate the intensely heated soil without being transformed into vapor and restored to the atmosphere; if water could come in contact with heated iron or carbon, it is possible that petroleum might be formed through the combination of these materials. But it is evident that this involves too many suppositions to be worthy of great confidence, and until we have obtained more facts we must content ourselves either with the older theory or with the statement that we know nothing about the origin of this important commodity.—*The Ironmonger.*

Arrow Poison.

Lovers of the weird and ghastly will be gratified by the perusal of the account of the poisoned arrow manufacture as carried on by the Samoan islanders, and related to the Fellows of the Linnæan Society by the Rev. Thomas Powell. An old chief of Efat—one of the Sandwich Islands—thus reveals the mystery of the poison craft to his son Pomare. The initiated, distinguished by wearing the *os femoris* of a pig inserted between the arm and armlet, watch for the death of a sufferer laid low by any acute disease which may be accompanied by delirium. They note the place of his burial, and six months afterwards open his grave by stealth. From thence they carry the large bones of both extremities, and the parietal bones of the skull. Of these, by sundry sawing, polishing, and scraping, they make the points of spears and arrows. For a saw they use the spines of a large echinus, of which they need a goodly quantity, as the edge is soon worn out. Three plants are pressed into service for the poison—the toto, the putu, and the fanuamamala. The most virulent is the toto, a large tree. When cut, a white milk exudes, which causes blindness; its sap introduced into the circulation causes death. A band of freebooters once landed on the western end of Efat. Proceeding eastward, they came to a place called Mole, where the inhabitants prepared for them an inhospitable reception. There was an enclosure of water on the beach, which, at low tide, served both for drinking and for bathing. The people dried some toto leaves and strewed them in the water. No sooner landed, the invaders rushed into the cooling lake. Immediately they were thrown into convulsive agonies. Those who only bathed in the impregnated water became blind, whilst those who drank, died. These three plants, the toto being chief, carefully picked and desiccated, were pounded in a mortar with a wooden pestle made of the ara. Next a species of holothuria was taken from the lagoon, put into a leaf of *colocasia Indica*, and placed in the shade till it became a putrid liquid, to which the powder was added in sufficient quantity to form a thin paste. One last ingredient was *na lat*, or wasp food, and the villanous concoction was worked up with the expressed juice of an old cocoa-nut, stirred for a month at intervals till the mass became a dark cloudy oil, which, when bottled and preserved for twelve months, was fit for use. Great precautions were employed in applying the poison to the tips of spears and arrows. Every trace of moisture was got rid of by careful drying in the smoke. The poison, taken internally, was always fatal. When received into the system on the spear point, recovery might be effected by making instantaneous free incisions in different parts of the body, to allow the escape of the poisoned blood. Whenever fatal the same symptoms followed—convulsions, lock-jaw, death. Tetanus was one of the invariable results. Imagine the old Samoan noting the grave for which delirium had found an occupant, exhuming the fever corpse to barb his weapons with the poisoned bones; then, with a skill and patience which no modern pharmacist could surpass, mixing, evaporating, and perfecting his vile compound.—*Chemist and Druggist.*

How the French Workman Lives.

The French laborer probably gets more for his wages than any other. His food is cheaper and more nourishing. His bouillon is the liquid essence of beef at a penny per bowl. His bread at the restaurant is thrown in without any charge, and is the best bread in the world. His hot coffee and milk is peddled about the streets in the morning at a sou per cup. It is coffee, not slops. His half bottle of claret is thrown in at a meal costing twelve cents. For a few cents he may enjoy an evening's amusement at one of the many minor theaters, with his coffee free. Sixpence pays for a nicely cushioned seat at the theater. No gallery gods, no peanuts, pipe, smoke, drunkenness, yelling or howling. The Jardin des Plantes, the vast galleries and museums of the Louvre, Hotel Cluny, palace of the Luxembourg and Versailles, are free for him to enter. Art and science hold out to him their choicest treasures at small cost, or no cost at all. French economy and frugality do not mean that constant retrenchment and self-denial which would deprive life of everything which makes it worth living for. Economy in France, more than in any other country, means a utilization of what America throws away, but it does not mean a pinching process of reducing life to a barren existence of work and bread and water.

PRACTICAL MECHANISM.

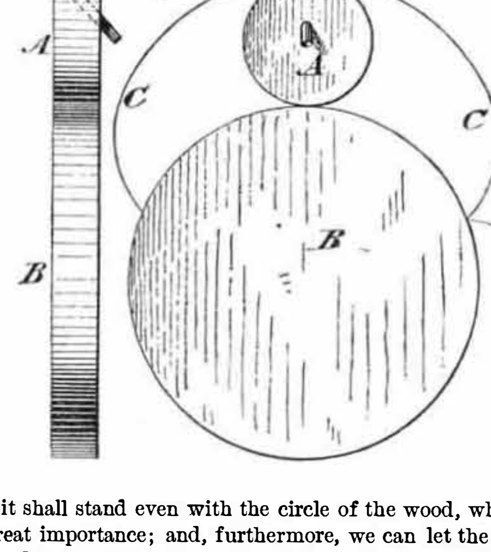
BY JOSHUA ROSE, M.E.

NEW SERIES—No. XXXV.

CURVES FOR GEAR WHEEL TEETH.

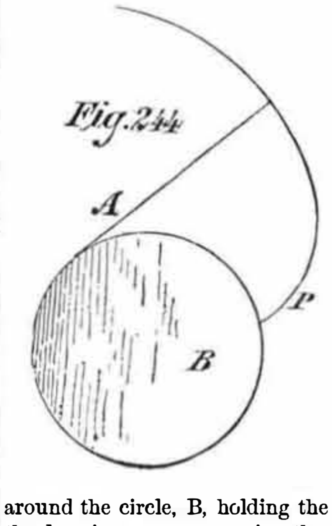
An epicycloid may be described or generated by a point in the circumference of a circle that rolls, without slip, upon the circumference of another circle. Hence to produce this curve, take two pieces of wood, having circular edges, A and B in Fig. 243, and bore a parallel hole obliquely in A to receive the tightly fitting and hard piece of pencil shown at P in the Fig. 243, which is to serve as a tracing point. It should be made to protrude well through the wood, be filed even with the circular edge of the same, and brought to a point by filing from the back and on the two sides. By adopting this plan of sharpening the pencil point we ensure

Fig. 243.



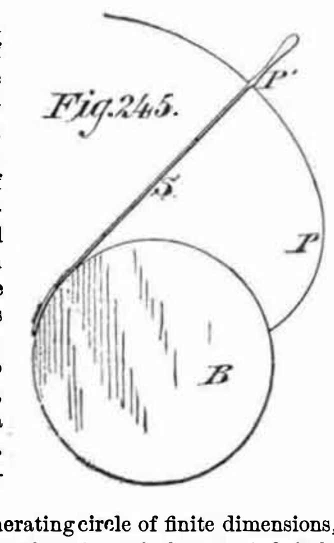
that it shall stand even with the circle of the wood, which is of great importance; and, furthermore, we can let the point protrude well, enabling us to see distinctly the operation of the point and place to any mark upon the base circle, B. Lay the radial face of the base circle, B, upon a sheet of drawing paper and, while holding it in a fixed position, take the piece, A, and placing its perimeter in contact with that of B, and pressing the two together to avoid slip, revolve A around B. The point, P, will then mark upon the paper the epicycloidal curve, C C. In this operation A (the moved circle) is called the generating circle and B (the stationary circle) the base circle. It will readily be perceived that the shape of the curve thus traced will vary with the size of the generating circle, but the properties of the curve will remain the same. If the diameter of the generating circle, A, be supposed to be infinite, than a portion of its circumference may be represented by a straight line, such as A in Fig. 244, and if this straight line be made to roll upon the circumference of a circle, as shown in Fig. 244, then the curve traced will be involute, P. In practice a piece of flat spring steel, such as a piece of clock spring, is used for tracing involutes. It may be of any length, but at one end it should be filed so as to leave a scribing point that will come close to the base circle or line, and have a short handle, as shown in Fig. 245, in which S represents the piece of spring, having the point, P′, and the handle, H. The operation is to bend the spring around the circle, B, holding the point, P′, in contact with the drawing paper, securing the other end of the piece of steel, so that it cannot slip upon B, and allowing the steel to unwind from the cylinder or circle, B. The point, P′, will mark the involute curve, P.

Fig. 244.



Another way to mark an involute is to use a piece of twine in place of the spring and a pencil instead of the tracing point; but this is not so accurate, unless, indeed, a piece of wood be laid on the drawing board and the pencil held firmly against it. In tracing any of these curves a hard pencil is necessary to obtain a fine line, and it is best to go over the operation twice, and if then the curve is a fine and not a double line, it is a proof of correctness.

Fig. 245.



Returning now to a generating circle of finite dimensions, we will suppose the radius of the base circle to be infinitely extended. A portion of its circumference may then be represented by a straight line, and the curve traced by a point in the circumference of the generating circle as it rolls upon the base line is termed a cycloid. Thus in Fig. 246, B is a portion of a base circle of infinite diameter, A is the generating circle, and C C is the cycloidal curve traced by the point, D, when A is rolled along B. If now we suppose the line, B, to represent a rack, it will be obvious that the part of the cycloid which meets B at one end is suitable for the face on one side of the tooth, and the part at the end is suitable for the other side of the tooth.

Fig. 246.

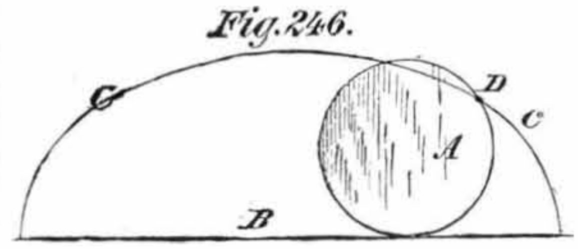
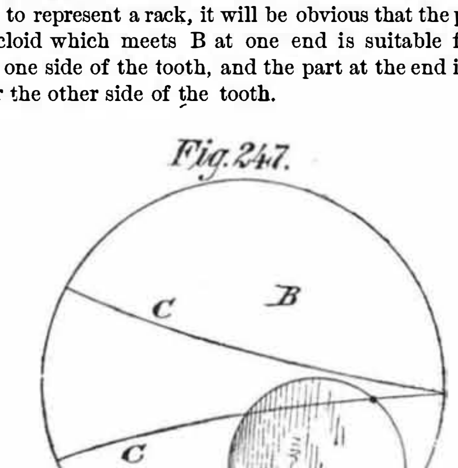


Fig. 247.



Let us now suppose that our base and generating circles have finite dimensions; the generating circle is rolled within instead of upon the circumference of the base circle, and