A Microscopical Exhibition.

Mr. D. S. Holman, the Actuary of the Franklin Institute, recently gave a very interesting microscopical exhibition in Philadelphia. The method he adopted of giving ever person in the audience a good view of the image was a novel one. An assistant carried a white screen some 18 inches square to different parts of the room, and all in its immediate vicinity had thus an opportunity to examine the details of the object. Mr. Holman has invented a number of very ingenious appliances for exhibitions of this kind. Perhaps the most noteworthy is a slide by which a small animal, like a salamander, may be kept alive in water, and quiet enough to show the circulation of its blood. The fish is laid in the groove of the glass slide, through which a current of water is kept flowing. A thin portion of the body is selected for examination, which, by the powerful light, is made transparent, and this portion is firmly held by the pressure of the very thin sheet of glass above the fish. A lens magnifying about 800 diameters is used, and a small artery invisible to the naked eye is made to appear on the screen as large as the finger; and the blood, which has been resolved into its component globules, or, as they are called, corpuscles, is seen coursing along, each heart beat accelerating its motion. It may be remarked that the frequency of these beats corresponds almost exactly with those of the human subject. These corpuscles vary in shape with the species of animal, and it is upon this fact that the expert testimony introduced latterly in murder trials is based.

In the salamader it is shaped much like a boy's torpedo or a pegtop. There are two varieties in all blood, the red and white, of which the former are much the more numerous; the red appears to be inert, but the white has apparently an individual motion, and may be said to be endowed with a certain kind of intelligence. These corpuscles are suspended in a transparent fluid which, of course, the microscope does not analyze.

At a private exhibition at the Institute, Mr. Holman, by a lens of his table microscope magnifying 1,200 diameters, showed the circulation of the sap in the leaves of plants. What does 1,200 diameters mean? Simply that the surface appears 1,440,000 times as large as it really is. To furnish a basis for comparison, he pricked a hole in a piece of paper with a fine cambric needle point, and found, when put in the field of the microscope, that the hole was nearly four times as large as the field. A small portion of a leaf of the *anarcharsis alsinastrum*, a water plant, was then shown under the lens, and the cellular structure of the leaf was seen. The cells appear like bricks laid in a wall, about forty appearing in the field, each overlapping its neighbor, and of about the same proportions as a brick.

Within each cell were little globules, which kept up a ceaseless movement round about the edges of their prison, like little mice chasing each other around a room. In all the cells the movement was in the same direction and at the same speed. That infinitesimal point could be studied with interest and profit for hours.

That motion is an attribute of all matter is very nicely shown by Mr. Holman in a slide which illustrates what microscopists term the dance of the atoms. Gamboge is pulverized and thrown into water, which is slightly colored by it. With a lens magnifying 2,000 diameters, the particles are seen in a rapid, cycloidic motion, which never ceases and is perfectly uniform, resembling very much a swarm of midges in the warm days of October.

Progress of Torpedo Improvements.

An experimental trial of a new torpedo boat, embodying the most recent improvements of the Lay system, was recently tried near the Navy Yard, Washington, D. C. The boat, of cigar shape, 16 feet long, 19 inches in diameter, is made of iron. It is propelled by liquid carbonic acid, carried in a reservoir within the shell, the liquid being allowed to expand into gas, which operates an engine and propeller. The boat is steered and the speed and direction of the engine governed by electricity, the circuit being opened and closed by means of a cable, which is wound or unwound, as desired, from a reel carried in the boat: the boat's direction and motions being governed by electric keys, located at the station or on the vessel whence the torpedo boat is sent out. The boat carries an explosive magazine which is discharged by electricity.

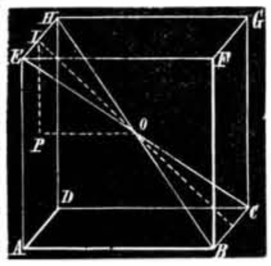
Mr. Lay's invention is calculated to revolutionize the entire system of naval warfare, particularly that branch pertaining to harbor defences and protection of fortifications, as well as open combat between floating navies. So fast as shipbuilders have been able to construct the thickest metallic defences for naval vessels, so fast have manufacturers of guns been able to invent projectiles that will pierce them. The submerged torpedo is impregnable to attack. With its explosion it carries far wider destruction than the most terrific storm of shot and shell, and the loss of life inevitable upon a close naval conflict is entirely avoided. The advantages of the movable torpedo over fixed mines and the spar torpedo are so apparent that it is not necessary to enumerate them. The torpedo boat is calculated to be used in a most efficient manner for offensive warfare. It can be used as a towing boat to effect an entrance to the harbor of an enemy or approach his fortifications, even if they are protected with fixed mines or torpedoes in the channel. To the Lay torpedo boat may be attached a line of floating explosive mines, connected with the operator's station, as is the torpedo itself, by electric cable. The torpedo boat may be despatched with these floating mines in tow to open the channel. The mines can be detached from the boat at any given point and sunk in position by an arrangement peculiar to their construction, still retaining their electric cable connection with the operator's station. They may be fixed at will. Mr. Lay has invented a submarine torpedo battery for harbor and coast defence. It is similar to the ship floating torpedo.

Correspondence.

The Largest Cube in a Ball.

To the Editor of the Scientific American:

There is an error in the reply of L. S. W. to J. C. W., No. 58, page 267, in regard to the largest cube which can be cut out from a ball; this error has been pointed out by others of your correspondents. L. S. W.'s assertion is strangely wide of the mark, as the great circle of a sphere passes always through its center, and the square inscribed in the same must therefore also pass through the center; but the sides of the cube are of course beyond the center, and are squares inscribed in circles situated at a distance from the center, and consequently much smaller. The annexed figure makes this clear: the globe which may be circumscribed on the cube is here represented, and its surface passes through the eight angles; and it has none of the surfaces for its large circle, but the larger circle will have for its diameter the diagonal, E C, passing from one angle to the diagonally opposite one, through the center, O, of the sphere and cube. This diagonal is considerably longer than the diagonal of one of the sides of the cube.



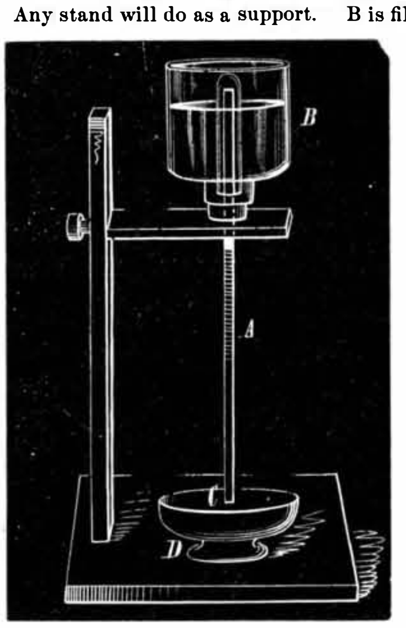
To find the relation between the globe and inscribed cube, we draw the perpendiculars, P O and I P, and the line, O T. Then we have $PO = PI$, and $EI = \frac{1}{2} EH$ = half the side of the cube, which we will call s. Further: $IO^2 = OP^2 + PI^2 = s^2 + s^2 = 2s^2$. Further: $HO^2 = IO^2 + sH^2 = 2s^2 + s^2 = 3s^2$; but H O is the radius of the ball, and so, if we call this r, we have $r^2 = 3s^2$, and $s^2 = \frac{1}{3} r^2$, or $s = r\sqrt{\frac{1}{3}}$. If we call the whole side of the square x, and the diameter d, we have, for the same reason, $x = d\sqrt{\frac{1}{3}}$; so that, if the diameter is 12 inches, we have $x = 12\sqrt{\frac{1}{3}} = 6{\cdot}94$ inches, and the volume of the cube $576\sqrt{\frac{1}{3}} = 332{\cdot}95$, considerably less than that found by L. S. W. in applying his erroneous proposition.

New York city. P. H. VANDER WEYDE.

Liquids under Atmospheric Pressure.

To the Editor of the Scientific American:

The accompanying engraving shows a very simple and cheaply constructed apparatus for illustrating the flow of liquids under atmospheric pressure, which might be called an interrupted siphon. It consists of a long glass tube, A, passing through a cork fitted in the neck of an open-mouthed bell glass, or a bottle with the bottom cut off, B, and a large test tube. Any stand will do as a support. B is filled with



water to the upper opening of A. The opening, C, is closed with the index finger of the left hand, and the test tube, previously let down over the tube, A, is gently raised. The elasticity of the air confined in A is diminished, and the normal pressure upon the surface of the water, in B, forces the water up in the test tube and into A. So soon as the column of water in A is greater than the depth of water in B, the finger may be removed from C, and the vessel, B, is emptied. Of course, if C is already under the surface of the water previously placed in D, it is not necessary to apply the finger to C. By holding the test tube quite high, a small quantity of air may be kept in the top of the test tube, and thus the difference of atmospheric pressure is very prettily shown.

Baltimore City College, Md. C.

Corn Sugar.

The Davenport (Iowa) *Gazette* claims for that city the first manufactory of pure glucose in this country. The demand for the article by confectioners alone, in the United States, is immense. The sources of supply heretofore have been France and Germany, where glucose is made from potatoes. Here it is the product of corn wholly. It is as pleasing to the taste as honey. The production of grape sugar and glucose opens a new department for Iowa corn. The capacity of the works at Davenport is 500 bushels per day. This branch of manufacture bids fair to become of immense importance to the State and country

Preserving Wet Plates.

At a recent meeting of the Belgian Photographic Society, a paper was read by M. Watrigant, who was of opinion that none of the dry plate processes in vogue at the present day were capable of giving pictures equal to those from wet plates. M. Watrigant proposed a method for maintaining the moist film in a wet condition for many hours, so that it would be possible, for tourists and others occupied in photography, to employ wet plates without having the trouble of carrying about with them a lot of solutions necessary under ordinary circumstances.

M. Watrigant's plan is to take the plate as it comes from the dipping bath, and to put round its margin an india rubber ring, in such a way that the rubber laps over on each side. Upon this sensitized plate he now places a second one, similarly prepared, the two collodion films towards each other. The two are tightly fastened together in any way that might suggest itself, by string or some other means, and then one is in possession of a couple of prepared films sealed hermetically. No injury can arise from the two plates pressing against one another, as the rubber ring forms a suitable buffer. M. Watrigant says that plates may be kept in a moist condition in this state for a period of forty-eight hours.

If it is considered undesirable to have a dark tent in which to separate the films before exposure, then M. Watrigant suggests that only the sensitive film should be sealed in like manner against an ordinary glass plate, and then an exposure may be made in the camera without inconvenience, due regard being paid to the thickness of the plates in the dark slide. The result in this case is not, however, so good as that secured when two prepared films are fastened together.

The landscape photographer, by adopting the Watrigant method, may spare himself the trouble of carrying collodion, silver bath, developer, and other solutions, and this is the object which the author desired to obtain.

Zuccato's Papyrograph.

This is a useful invention for the speedy reproduction of circulars, price lists, diagrams, maps, examination papers, music, etc., upon any description of dry and unprepared paper. The writing or drawing to be multiplied must be executed with a steel pen, by means of special ink, upon a sheet of prepared waterproof paper. The ink passes through the fibers of the paper without injuring them, and attacks or corrodes the waterproofing beneath. The corroded parts are then removed by placing the waterproof paper upon a piece of thoroughly wet calico. The moisture from this dissolves the corroded lines, ascends through them to the surface of the paper, and, loosening the ink, enables it to be entirely removed by blotting paper. The result is a porous paper stencil, held together by its fibers, which presents in facsimile the delineations that have been made upon it with the ink. The stencil is then lightly painted upon the written side with papyrographic color. It is next placed upon a pad of velvet, painted side downwards, and, upon being pressed, color is forced through the lines of the matrix and brought in contact with the paper employed for printing, upon which is formed a perfect facsimile of the writing. A like result is attained, without repeating any of the before mentioned operations, as often as a new sheet of paper is laid upon the stencil and submitted to light pressure by means of a copying press. A proof impression can be taken in a few minutes, and afterwards quickly multiplied. It is said that 500 copies can be produced from one sheet of the specially prepared paper at an infinitesimal cost.

Photo Plates under the Microscope.

M. Jules Girard, who has published several valuable works upon the application of photography to the microscope, has just communicated to the Academy of Sciences the results of his interesting researches upon the transformation of collodion in photographic operations. A microscopic examination of collodion permits one to discover the texture of the film, and to follow the reactions which take place in the production of the luminous impression. When of good quality, the collodion plate is translucid and colorless in the event in the collodion being perfectly dissolved; but its composition, age, and the actions which constitute sensitizing change its texture. The photo-micrographs which M. Girard presents to the Academy, representing enlargements to 50 diameters, demonstrated several phenomena. Old collodion which gives very fine images, but the rapidity of which leaves much to be desired, is shown to contain liquid bubbles holding unchanged ether. If the collodion contains alcohol, it has the appearance of a cellular tissue; and if there is much water in the collodion, the fibers of cotton become apparent in the form of flocculent matter. Collodion which is too thick gives intensity, but is not rapid; it has the appearance of an undulated cellulo-vascular tissue. The irregularity of the film militates against the clearness of the image. Two indications or proofs are at hand of the time during which the action of sensitizing in the nitrate of silver bath is still incomplete, and of the moment when the operation has terminated. In the first case, the greasy marks, which are an indication of the sensitizing being still incomplete, are full of streaks and groups of crystals, some in the form of needles and some amorphous. It seems as if the crystals of iodide of silver, which were in course of formation, have been arrested in the midst of their development.

In the second case, when the operation of sensitizing is complete, the texture of the film is homogeneous and compact. It is covered with a uniform network, rendered the more evident by those portions which are free from crystals

The greater part of the photographic action necessary to obtain an image is due to the successive transformation of the crystallographic system, the reaction of the iodide of silver being the most perceptible of all. The result is that an examination of the plate at different stages of the operation under a microscope of moderate power permits the operator to judge of the success or otherwise of the process he is employing.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES—Number III.

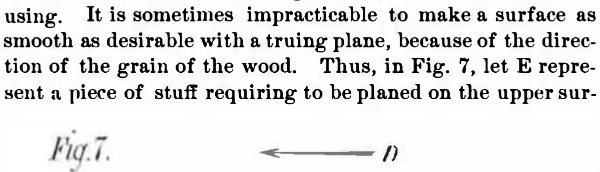
PATTERN MAKING.

In using a jack plane, we commence each stroke by exerting a pressure mostly on the fore part of the plane, commencing at the end and towards the edge of the board, and taking off a shaving as long as the arms can conveniently reach. If the board is longer than can be reached without moving, we pass across the board, planing it all across at one standing; then we step sufficiently forward, and carry the planing forward, repeating this until the jack planing is completed. To try the level of the board, the edge or corner of the plane may be employed; and if the plane is moved back and forth on the corner or edge, it will indent and so point out the high places.

The fore plane (or truing plane, as it is sometimes called) is made large, so as to cover more surface, and therefore to cut more truly. It is ground and set in the same manner as the jack plane, with the exception that the corners of the iron or blade, for about one eighth inch only, should be ground to a very little below the level of the rest of the cutting edge, the latter being made perfectly straight (or as near so as practically attainable) and square with the edge of the iron. If the end edge of the cover is made square with the side edge, and the iron is ground with the cover on, the latter will form a guide whereby to grind the iron edge true and square; but in such case the cover should be set back so that there will be no danger of the grindstone touching it. The oilstoning should be performed in the manner described for the jack plane, bearing in mind that the object to be aimed at is to be able to take as broad and fine a shaving as possible without the corners of the plane iron digging into the work. The plane iron should be so set that its cutting edge can only just be seen projecting evenly through the stock. In using the fore or truing plane, it is usual, on the back stroke, to twist the body of the plane so that it will slide along the board on its edge, there being no contact between the cutting edge of the plane iron and the face of the board, which is done to preserve the cutting edge of the plane iron from abrasion by the wood: as it is obvious that such abrasion would be much more destructive to the edge than the cutting duty performed during the front stroke would be, because the strain during the latter tends mainly to compress the metal, but, during the former, the whole action tends to abrade the cutting edge. The face of the fore plane must be kept perfectly flat on the underside, which should be square with the sides of the plane. If the under side be hollow, the plane iron edge will have to protrude further through the plane face to compensate for the hollowness of the latter; and in that case it will be impossible to take fine shavings off thin stuff, because the blade or iron will protrude too much, and as a consequence there will be an unnecessary amount of labor incurred in setting and resetting the plane iron. The reason that the under surface should be square, that is to say, at a right angle to the sides of the body of the plane, is because the plane is sometimes used on its side on a shooting board.

When the under surface of the plane is worn out of true, let the iron be wedged in the plane mouth, but let the cutting edge of the iron be well below the surface of the plane stock. Then, with another fore plane, freshly sharpened and set very fine, true up the surface, and be sure the surface does not wind, which may be ascertained by the application of a pair of winding strips, the manner of applying which will be explained hereafter. If the mouth of a fore plane wears too wide, as it is apt in time to do, short little shavings, tightly curled up, will fall half in and half out of the mouth, and prevent the iron from cutting, and will cause it to leave scores in the work, entailing a great loss of time, in removing them at every few strokes. The smoothing plane is used for smoothing rather than truing work, and is made shorter than the truing plane so as to be handier in using. It is sometimes impracticable to make a surface as smooth as desirable with a truing plane, because of the direction of the grain of the wood. Thus, in Fig. 7, let E represent a piece of stuff requiring to be planed on the upper surface,

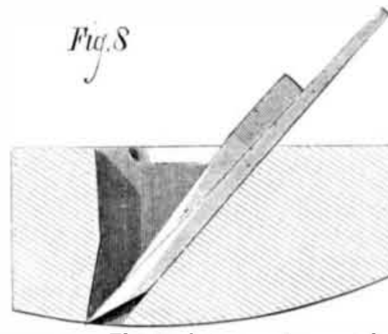
Fig. 7.



face, and let us plane it, cutting in the direction of the arrow, D; it is evident that the edge of the plane iron, when cutting the surface from B to A, will strike against the edge or end of the grain of the wood, tending to rough it up: whereas, while passing from A to C, the tendency of the pressure of the iron edge would be to smooth the grain of the wood downwards, the difference between the two tendencies being sufficient to make it necessary in many cases to use a smoothing plane cutting in both directions, as shown in Fig. 7, first from A to B, cutting in the direction of the arrow, F, and then from A to C, cutting in the direction of the arrow, G. Thus the cutting will be at all times performed in the direction tending to smooth down and not rough up the grain of the wood. That this method of planing is necessary is demonstrated in planing across the end grain of wood, for which purpose the smoothing plane is almost indispensable, and in which operation it is necessary to use it, on small surfaces, with a side as well as with a forward sweep, thus producing a curved motion, the most desirable direction of which is determined by the direction of the grain of the wood.

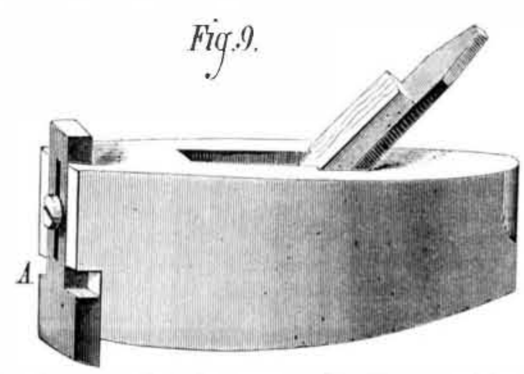
Fig. 8 represents an ordinary compass plane, which is a necessary and very useful tool for planing the surfaces of

Fig. 8



hollow sweeps. This tool is sometimes made adjustable by means of a piece dovetailed in the front end of the plane, as shown in Fig. 9, at A; which, by being lowered, alters the sweep and finally converts it from a convex to a concave. There is now, however, in the market a compass plane, the body of which is made of malleable iron with a sole made of

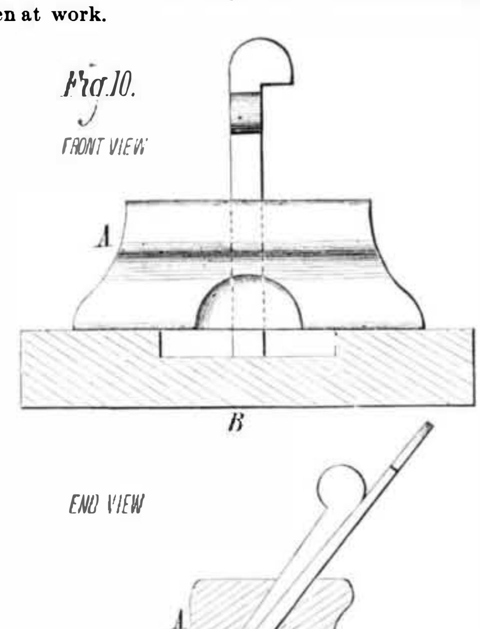
Fig. 9.



a blade of spring steel, which, by the operation of two screws, can be set to any curvature, either concave or convex, within the capacity of the instrument.

Another very useful species of plane is the router, shown in Fig. 10, which represents one of these planes in operation, A being the router, and B the work. The use of this tool is to plane out recesses (exactly to any given depth) such as are required to receive rapping plates. The wood in the plane stock is cut away just over the edge of the iron, to give clearance for the shavings, and so that the cutter may be seen at work.

Fig. 10.



Rabbet planes are narrow planes having the sole or side of a conformation to suit the work. Fig. 11 represents a rabbet plane to suit a round edge, Fig. 12 a similar plane for a groove, and Fig. 13 a side rabbet plane. The latter is, however, very seldom used, but is especially useful in planing hard wood cogs fitted to iron wheels, or the teeth of wheel patterns or other similar work. For ordinary use, it is sufficient to have two, a ¾ and a 1¼ inch, as represented in Figs. 11 and 12, and two or three having a flat sole for flat bottom grooves. Small thumb rabbet planes, having an iron stock, with the blade near the front end, are now supplied, and are very useful for cutting out half checks that are not cut right across the stuff.

Fig. 11.

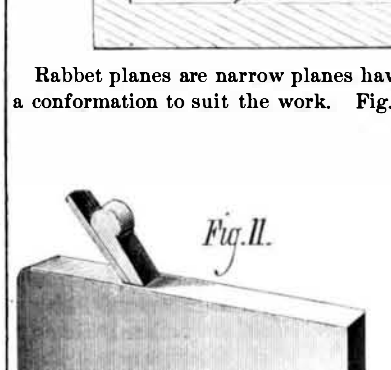


Fig. 12.

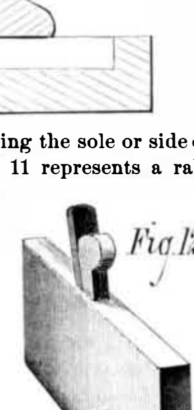


Fig. 13.

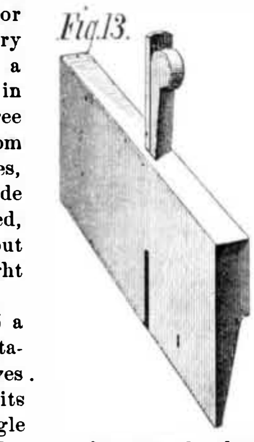


Fig. 14 is an end, and Fig. 15 a side, view of a core box plane, suitable for planing semicircular grooves out of the solid. The principle of its construction and use is that the angle in a semicircle is a right angle. Suppose, for example, that Fig. 16 represents a piece of wood having a semicircular groove in it, and we mark off on the groove the points, *a*, *b*, *c*, *d*, *e*, and strike from each of these a line direct to each corner of the groove. We shall thus find that the two lines struck will be at a right angle to each other, the two lines, A A, meeting at the point, *a*, being at a right angle. The two side faces, C C, of the plane in Fig. 14 are made to stand at a right angle to each other; and while the plane is in position (as shown in Fig. 14) to bear against the corners of the core box, a semicircle (the apex of the plane, D, in Fig. 14)

Fig. 14.

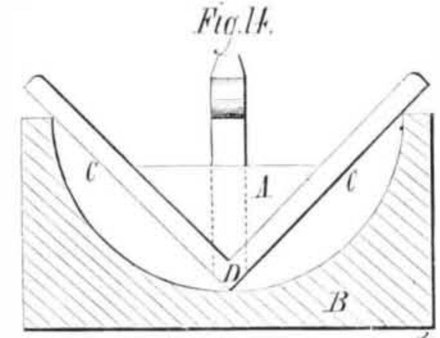


Fig. 15.

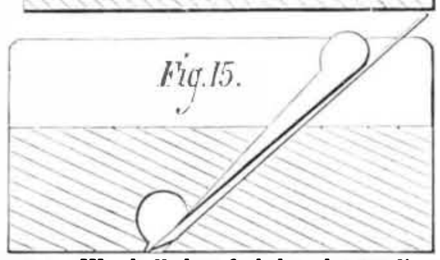
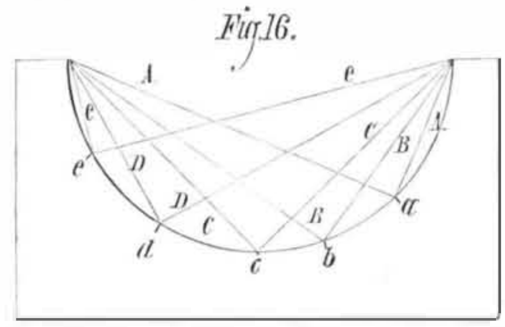
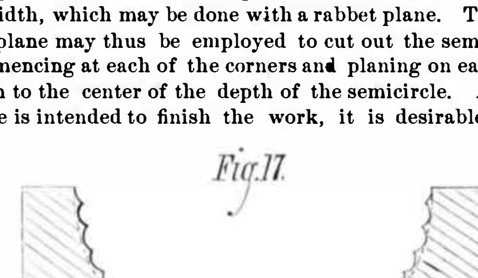


Fig. 16.



must be in the semicircle, and will only cut away the wood in the form of the circle, no matter in what position the plane stands, so long as its sides touch the corners of the semicircle. This being the case, the first operation in using this plane is to cut out the required semicircle to the necessary width, which may be done with a rabbet plane. The core box plane may thus be employed to cut out the semicircle, commencing at each of the corners and planing on each side down to the center of the depth of the semicircle. As this plane is intended to finish the work, it is desirable to cut away as much of the stuff as possible before employing it, the work appearing as shown in Fig. 17. These planes have one disadvantage. They are apt to abrade the corners of the work; hence great care should be exercised in their use, and care must also be taken that the extreme point of the plane iron stands just at the apex of the angle of the body of the plane; for if it be in advance or not up to it, the work will not be semicircular.

Fig. 17.



Trademark Decision.

In a recent application for trademark registration for the use of the words "Star Oil," the Commissioner of Patents refused registration, because a prior registration had been obtained, by other parties, for the use of the figure of a star in connection with the word oil, thus: "* Oil." The Commissioner held that, in cases where parties used a brand containing the figure of an object, the mere substitution, by a new applicant, of the name word of that figure, would not entitle such applicant to registration.