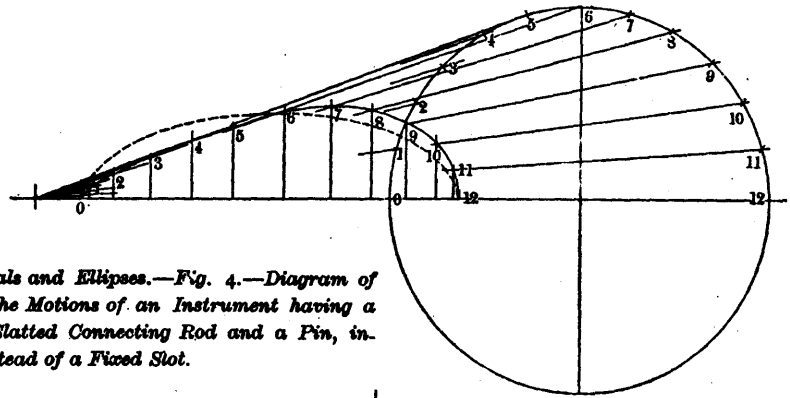


Ovals and Ellipses.—Fig. 4.—Diagram of the Motions of an Instrument having a Slatted Connecting Rod and a Pin, instead of a Fixed Slot.

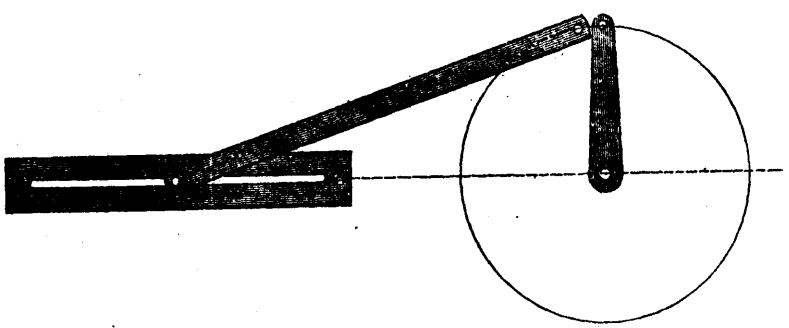
Fig. 2 represents a 45-degree ellipse—that is, one obtained by cutting a cylinder at an angle of 45 degrees, or drawing a circle in isometric perspective, as though seen at that angle. It will be found that if we divide the diameters into equal parts, beginning from the center, and then erect lines perpendicular to the diameters, we shall have these lines of equal length at equal distances from the center. Thus a will be found to be equal to f, both being located one space from the center, in like manner $b = e$ and $c = d$.

To demonstrate the form of the figure developed by a point on a connecting rod, we have drawn the diagrams shown in Figs. 3 and 4. Fig. 3 gives motions, etc., of an instrument having a short connecting rod, one end of which is supposed to work in a slot. A glance at the lines perpendicular to the long diameter shows that while they are of equal length, as they must be from the very nature of the case, they are by no means equally spaced. Those marked 1, 2 and 3 are much further apart than 9, 10 and 11. In this case the connecting rod is less than three times the crank, or $1\frac{1}{2}$ times the diameter in the length.

In Fig. 4 we give a similar diagram, showing the figure produced by an instrument having a slotted connecting rod and a pin, instead of a fixed slot, by which the end of the rod is compelled to move in a straight line. Here, it will be seen, that the departure from a true circle is much greater than in the other instrument. This is the result of making the slot in the connecting rod, rather than in the table upon which the instrument rests.

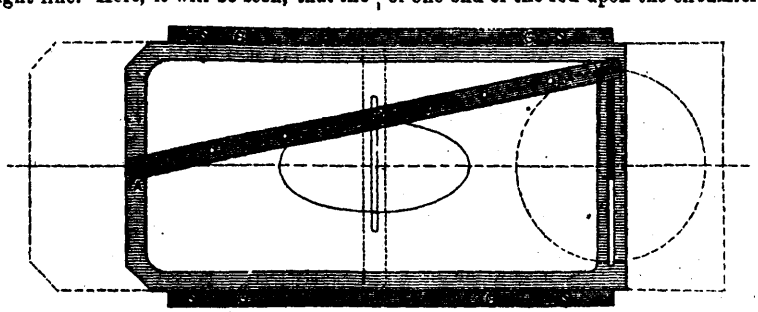
Most of the correspondents who have mentioned this way of drawing ovals tell us that, so far as they know, the plan is original with them, and they also add that the machine is so bulky that for practical work they prefer to use the trammels or the pins and string. This probably arises from the fact that they are obliged to use such long connecting rods and small circles in order to obtain an approach to accuracy.

At first our readers may not see why the connecting rod draws a distorted figure. This can be easily shown when we consider that the widest point of the oval is in the middle of its length.



Ovals and Ellipses.—Fig. 5.—Diagram Illustrating the Relations of the Parts with a Rod One and a Half Times the Length of the Crank.

Now, when the back end of the connecting rod has just reached its half travel, the front end will be some distance from the center of the crank circle. In other words, the crank will not be at right angles to the center line of the instrument. When the connecting rod is very long this difference is slight. If the rod could be infinitely long the difference would disappear entirely by becoming infinitly small. Fig. 5 shows the relation of the parts with a rod of $1\frac{1}{2}$ times the length of crank. The lagging of one end of the rod upon the circumference of the circle is due



Ovals and Ellipses.—Fig. 6.—Suggestion of an Instrument, Working on the Principle of a Connecting Rod, which may be made to Produce Perfect Ellipses.