April 5, 1927. 1,623,348

K. KIEFER

ELLIPSOGRAPH

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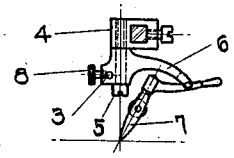


FIG. 3

FIG. 1

FIG. 2

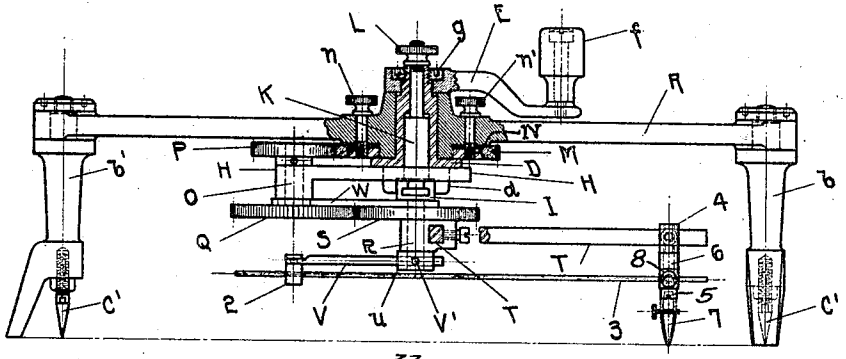
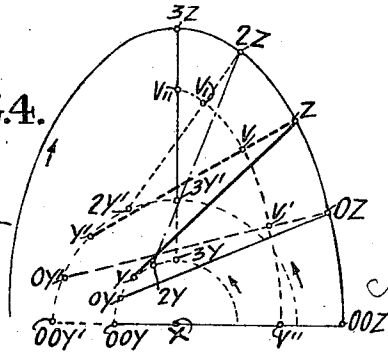


FIG. 4.



WITNESSES.

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UNITED STATES PATENT OFFICE.

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ELLIPSOGRAPH.

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My invention relates to drafting instruments, and its purpose is to enable a draftsman to draw a complete ellipse, or with slight modifications, curves related to the ellipse, within a minimum of space required for mounting the ellipsograph in proportion to the size of the figure drawn. A further object is to permit such curves or ellipses to be drawn continuously and cleanly with a drawing pen, as well as with a pencil or other marking element. Other objects will appear in the course of the ensuing description.

I attain these objects by the mechanism illustrated in the accompanying drawing, in which—

Figure 1 is a top plan view of the device with the parts in their true relation;

Fig. 2 is a sectional side elevation, some of the parts being out of their true relation, for clearness of detail;

Fig. 3 is a detail of the drawing pen and its mounting; and

Fig. 4 is a diagram illustrating the operation.

The frame A has a central bearing and has the two legged support b at one end and the single leg support b' at its other end (Fig. 1,) affording a three-point support. Centrally with these supports b and b' are located pins C^1, which are screwed into the supports and can be adjusted so as to enter the drawing paper, slightly helping in the alignment of the apparatus when the curve is being drawn.

In the central bearing of the frame A the main shaft D rotates on an upright axis, and, well fitted in its bearing, has its upper part square, receiving a crank E with a handle f; the crank being secured on the square part by a lock nut g (Fig. 2). This lock nut g also serves to adjust the shaft to prevent its up and down movement.

This shaft D carries the entire movable mechanism. Its lower enlarged cylindrical part d has the bracket H embracing it to turn thereon, and below this, in a slot diametrically cut in the part d, a bar I is fitted to slide lengthwise, preferably parallel with the crank E as shown in Fig. 1; it being shown at right angles to the crank in Fig. 2 for clearness.

The bar I has a longitudinal T-slot in which the lower flanged end of a smaller shaft K is fitted to extend up through the center of the main shaft D, with a threaded upper end, receiving a knurled nut L to pull the shaft K upward and clamp the bar I against the bracket H, holding the bracket H in any longitudinally adjusted position and at the same time clamping the bracket H in any position to which it may be rotated on the part d.

Concentric with the shaft D is a spur gear M fixed to the lower side of the frame A in any position to which it may be rotated, by a ring N wedged up inside the gear M and centering on a cylindrical downward projection of the frame A; this ring N being drawn up by two thumb-screws n and n' passed down through the frame A.

The bracket H carries at its outer end a bearing for the shaft O on which, above its bearing, is fixed the upper spur gear P in mesh with the gear M. Below this bearing the spur gear Q is fixed on this shaft O.

The shaft R, projecting down from the bar I, has the spur gear S rotating on it and this gear S meshes with the lower spur gear Q. This gear S has a downwardly extending hub with a radial projection having a square opening tangentially through it, in which slides a square bar T clamped at any longitudinal adjustment by a set screw t in the hub. This bar T, as shown in true relation in Fig. 1, is at right angles to the bar I; being shown parallel therewith in Fig. 2, in section, merely for clearness of detail.

The shaft R has the collar u fixed on its lower end below the hub of the gear S, through which collar slides the bar V, clamped in any longitudinal adjustment by a set screw V′ in the collar u. This bar V is alined with the bar I, as shown in true relation in Fig. 1; being shown at right angles thereto in Fig. 2 merely for clearness. At the outer end of the bar V a small bearing 2 revolves on an upright axis and has sliding through it the long bar 3. The bar T carries a bracket 4 in which at one side of the bar T is fixed the downwardly extending stud 5 on which the laterally extended pen carrier 6 oscillates. In this pen carrier 6 is trunnioned the drawing pen 7 to swing up and down. The long bar 3 is slidable through one side of the pen carrier 6, and is clamped therein by the set screw 8 in the pen carrier. The bracket 4 is clamped at any desired position along the bar T by a set screw 9 in the bracket.

The gears Q and S are of the same diameter and are held in meshing distance by

the link W, free to swing on the shafts R and O, while the bracket H maintains the same relation between the gears P and M, during adjustment of the shaft R radially to the gear M by sliding the bar I on loosening the nut L; the shaft R being fixed on the bar I, and thus is held any desired distance from the gear M when the nut L is tightened. The gear M, which is fixed when the device is operated, becomes the driving gear by virtue of the bracket H carrying its meshing gear P around, in a planetary relation, upon turning the crank E and driving shaft D, to which the bracket H is fixed. The gear S also is carried around, on the bar I; and the gear P being one-half the diameter of the fixed driving gear M, the gear S, and with it the bar T, or marking member, is rotated twice as fast as is the crank E. Thus the marking element or pen 7 swings twice around its planetary axis in the shaft R while once passing around its orbit, or the path taken by the shaft R, around the axis of the driving means in the shaft D.

In my improvement, the bar T is long enough to swing across the axis of its orbit, above defined, carrying the marking element 7 beyond this axis from the planetary axis, above defined. The width of the figure drawn, taken parallel with the frame A, thus may be nearly the distance between the supports *b* and *b'*; so that a much larger figure may be drawn, in proportion to the size of the apparatus, than with devices limiting the length of the marking member to less than the radius of the orbit, above defined.

For purpose of explaining the operation, the center of the whole instrument, or orbital axis, is marked X in Figs. 1 and 4; the center of the gear S, or planetary axis, is marked Y; the center of the bearing 2 of the penguiding means is marked Y', and the center of the pen or marking element is marked Z. Then:

X—Y is equal to one half the difference between the minor semi-axis X—00Z (Fig. 4) and the major semi-axis X—3Z of the desired ellipse;

Y—Y' is equal to X—Y;

Y—Z is equal to X—Y or Y—Y' plus the minor semi-axis X—00Z.

Fig. 4 is half the scale of Fig. 1, and the adjustments are those of Fig. 1. Points C' (Fig. 2) would be alined with X—00Z, and the gear M clamped by N so that bar I and marking member T will both be coincident with X—00Z. If these are with the gears at the right, pen 7 will start at left and rotation of handle *f* to left would cause pen 7 to travel around to the right, describing the ellipse, one half of which is shown. I have supposed the left quarter to have been drawn, during which handle *f* has been turned from the left of the operator; the pen having reached 3Z, with T extending out in alinement with I, and the rod 3 parallel with T and I.

Next 22½ degrees turning away to right brings shaft R from 3Y to 2Y and guiding member 3 from 3Y' to 2Y'. Bar I is now along X—2Y with V extending to 2Y'. Member T lies from 2Y to 2Z, pen position, with rod 3 from 2Y' to 2Z, holding the pen with its blades disposed along the ellipse at 2Z.

Likewise, in next indicated position Z of pen, Y'—Z (rod 3) is maintaining the relation of the pen, as is 0Y'—0Z at 0Z, and 00Y'—00Z at 00Z, when the parts again are alined with the small axis and next quarter of the ellipse has been drawn.

These relations are duplicated in drawing each quarter; the complete ellipse of course being drawn by a single continuous revolution of the handle *f*.

An additional pen on bar 3 would describe line V'', V', V, V', V'' (Fig. 4) equidistant from 3Z, 2Z, Z, 0Z, 00Z; any number of such curves being possible by that number of pens, equidistant according to adjustment of pen on rod 3. Each pen should have a swivel mounting as the mounting 6, to swing up and down, but held rigid on the rod by a screw, as the screw 8. In any case, bar 3, guided by bearing 2, always is perpendicular or normal to the ellipse, or additional curve parallel to the ellipse, being described by the pen. My construction thus maintains the relation of the pen to the line being drawn that is necessary to draw a clean cut line with a pen; that is, the flat sides of the pen blades are disposed along the line being drawn.

It will be seen that the apparatus is so adjustable that any size of ellipse can be drawn where the small axis falls within the limits of the supports *b* and *b'*, and where the large axis is not more than twice as great as the small axis of the ellipse. If the shaft R is adjusted inward until concentric with the driving shaft D, so that X—Y is zero, the apparatus will describe circles. If adjusted so that X—Y and Y—Y' are equal to Y—Z, the apparatus will describe theoretically straight lines. Thus, in Fig. 4, if Y—Z were shortened to equal X—Y and Y—Y', the straight line X—3Y', through 3Y, would be drawn. The adjustment of gear M on ring N permits the minor axis of the ellipse to be alined with points C' for conveniently locating the ellipse on the drawing.

The apparatus is capable of many other applications for drawing curves by varying the details, the proportions of the gears, and the adjustments; and I therefore do not limit myself to the particular apparatus shown or methods of use disclosed, but

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an ellipsograph, a support, a driving gear fixed to said support, a driven gear, a marking member fixed to said driven gear, means supporting said driven gear and said member for movement toward and away from and for revolution about said driving gear, a marking element mounted for oscillation on said member, intermediate gear means between said driving and driven gears for rotating said driven gear as it is revolved about the driving gear, a guiding member rotating with said driven gear, and means whereby said guiding member oscillates said marking element to maintain said element in predetermined relation to the adjacent portion of the curve being drawn.

2. In an ellipsograph, a support, a driving gear fixed to said support, a driven gear, a marking member fixed to said driven gear, means supporting said driven gear and said member for revolution about said driving gear, a marking element mounted for oscillation on said member, intermediate gear means between said driving and driven gears for rotating said driven gear as it is revolved about the driving gear, a guiding member rotating with said driven gear, and means whereby said guiding member oscillates said marking element to maintain said element in predetermined relation to the adjacent portion of the curve being drawn.

3. In an ellipsograph, a support, a driving gear fixed to said support, a driven gear, a marking member fixed to said driven gear, articulated means supporting driven gear and said member for movement toward and away from and for revolution about said driving gear, a marking element mounted for oscillation on said member, coaxial intermediate gears mounted on said articulated means, one meshing with said driving gear and the other meshing with said driven gear, for rotating said driven gear as it is revolved about the driving gear, a guiding member rotating with said driven gear, and means whereby said guiding member oscillates said marking element to maintain said element in predetermined relation to the adjacent portion of the curve being drawn.

KARL KIEFER.