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L. B. RIAL ET AL
ELLIPSE-DRAWING COMPASS

2,707,831

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FIG. 1

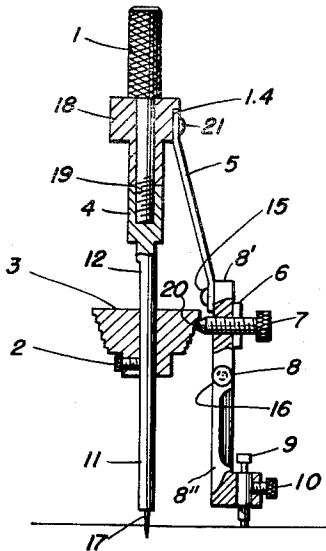


FIG. 2

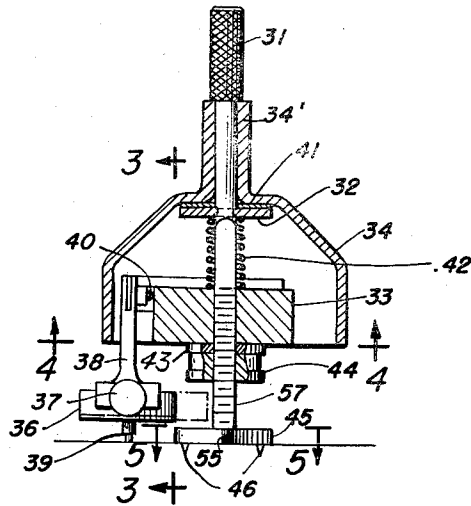


FIG. 3

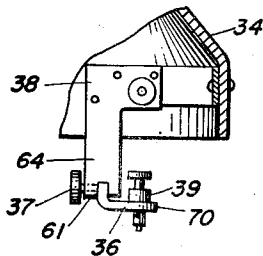


FIG. 4

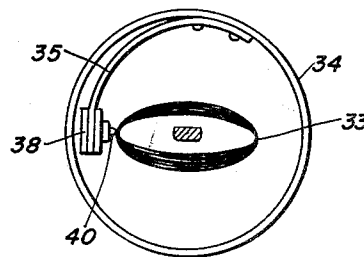
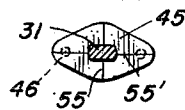


FIG. 5



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ELLIPSE-DRAWING COMPASS

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This invention relates to a curve drawing instrument and particularly relates to an instrument for drawing ellipses of varying size and angle.

A common method for drawing ellipses and other curves include the use of plastic or metal templates where a different templet is needed to draw a different curve. Thus a dozen or more templates must be kept on hand to be available to draw any required curve.

There are several ellipse drawing devices in the prior art which, in a single instrument, allow the drawing of ellipses of varying size without the need of a plurality of interchangeable parts. The following U. S. patents are examples of such instruments: U. S. Patents Nos. 2,498,798; 1,055,303; 1,128,289; and 1,562,749.

The ellipse drawing instruments which precede the instant invention suffer from a disadvantage that they are complicated, cumbersome, and expensive to construct.

One object of the instant invention is to provide an improved curve drawing instrument wherein the instrument can draw curves of varying sizes and shapes without the need of a plurality of interchangeable parts.

Another object of the instant invention is to provide a novel curve drawing instrument capable of drawing curves of varying sizes and shapes which is less cumbersome and less expensive to construct than the prior existing devices.

Still another object of the instant invention is to provide a novel adjustable ellipse drawing instrument which is of a more simple construction than the existing ellipsing drawing instruments.

A feature of the instant invention is in providing an ellipse drawing instrument in the form of a compass-like device including a central shaft member which is adapted to be fixed to the surface on which the ellipse is to be drawn and a tapered cam surface whose outer extremity forms the outline of an ellipse of gradually changing ellipse angle. An arm member rotatable about the central shaft has a spring-biased contact member which rides about the periphery of the cam and carries a line drawing instrument which makes the imprint of the ellipse on the drawing surface. The position of the cam on the shaft is varied to change the shape of the ellipse, and the distance of the drawing instrument from the shaft is variable to vary the size of the ellipse.

Other objects and features of the instant invention will become apparent upon making references to the specifications to follow the drawings wherein:

Figure 1 is a partial cross-sectional view of one embodiment of the instant invention;

Figure 2 is a partial cross-sectional, elevational view of the preferred embodiment of the instant invention;

Figure 3 is a view of portion of Figure 2 taken along section plane 3—3;

Figure 4 is a cross-sectional plan view of the embodiment of Figure 2 taken along section plane 4—4; and

Figure 5 is a cross-sectional plan view of the pin carrying plate member carried by the shaft of the drawing instrument taken along section plane 5—5 of Fig. 2.

Referring now more particularly to Figure 1, the embodiment there shown comprises a shaft member 11 having a pointed pin 17 in the lower end thereof for anchoring the shaft to the drawing surface. Shaft 11 is generally circular in cross section and includes a flat surface 12

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along the side thereof which receives a cam 3 which is held in place on the bottom portion of shaft 11 by means of a screw 2 which rests on the flat portion thereof. The upper portion of shaft 11 includes an enlarged portion having a threaded bore 19 therein into which a knurled screw 1 is threaded. A rotatable sleeve 18 rests on the enlarged portion 4 of shaft 11 and receives the upper portion of knurled screw 1. A flat shoulder 14 is made on the top portion of sleeve 18 to receive a flat spring member 5 which is fastened thereto by a screw 21. Connected to the end of spring member 5 by a screw 15 is an arm member 8 which comprises the upper section 8' and the lower section 8'' which swivels only clockwise from the position shown in Figure 1 about a rotatable joint 16 located at the end of upper part 8' to enable the inking pen 9 carried thereby to be parallel to shaft 11 irrespective of the inclination of upper arm member 8'. A screw 7 passes through an opening in the upper part 8' of arm 8, and carries a freely rotatable ball 20 on the tip thereof which rests on the periphery of cam 3. Attached to the lower arm portion 8'' is a conventional "Leroy"-type inking pen 9. Adjusting screw 10 clamps pen 9 in place and enables pen 9 to be adjusted in position to keep the pen point at proper level for best inking. In place of pen 9, a lead holder can be inserted for pencil work.

The radial displacement of pen 9 is adjusted by rotating screw 7 in one direction or another to move upper arm member 8' relative to cam 3. This varies the size of the ellipse. To vary the shape or angle of the ellipse, the position of cam 3, on which the end of screw 7 rides, is varied by loosening the screw 2 which holds cam 3 to shaft 11 and moving cam 3 up or down depending upon the particular ellipse desired.

As can be shown more clearly in Figure 4, cam 3 has a tapered cross section of elliptical shape where the shape or angle of the ellipse varies gradually in steps. A series of shoulders are then formed between which are vertical cam surfaces on which ball 20 of screw 7 rides.

Reference is now made to Figures 2 to 5 which disclose the preferred embodiment of the instant invention. This embodiment comprises a shaft 31 knurled at the top portion thereof to enable it to be more readily grasped by one's fingers. A rotatable housing 34 in the form of an inverted cup surrounds shaft 31 and contacts shaft 31 at the upper portion thereof with sleeve portion 34'. To prevent housing 34 from slipping down the shaft and to provide a bearing surface therefore, an apertured disk 32 is fixedly connected to shaft 31 as by soldering, etc. An oil-impregnated washer 41 having an oily surface is slipped on to shaft 31 and rests upon the top portion of disk 32. The sleeve portion 34' of housing 34 rests on oil-impregnated washer 41 and is thereby freely rotatable about shaft 31. Shaft 31 has a circular cross section on the upper portion thereof. The lower half of shaft 31 is flattened up to disk 32 to receive elliptical cam 33 which makes a slide fit thereupon. Cam 33 is similar to cam 3 described in connection with the embodiment of Figure 1. The cross section of the lower portion of shaft 31 has the shape shown in Figures 4 and 5. Shaft 31 is flattened in order to prevent any relative motion by the shaft 31 and cam 33 and also provides a flat index marking surface.

A spring 42 is interposed between cam 33 and disk 32 and applies a downward pressure against cam 33. Shaft 31 is threaded at the lower end along the rounded portion thereof to receive a knurled nut 44. A slide fit washer 43 is located between knurled nut 44 and cam 33. The position of knurled nut 44 determines the position of cam 33. Thus cam 33 can be adjusted up or down against the pressure of spring 42 at the end of shaft 31. Fixedly connected to the end of shaft 31 is pin carrying plate member 45 (see Figure 5 for specific details) having two pointed pins 46 at opposite ends thereof projecting downward a

small distance from the bottom surface thereof. Traversing the upper and side portions of plate 45 are two lines 55—55' at right angles to serve as positioning guide lines. Thus with two ellipse axis lines located on the surface on which the ellipse is to be drawn, the plate 45 is positioned on the drawing surface such that the two described lines fall respectively along the two ellipse axes. The ellipse is thus properly centered. The pointed pins 50—51 anchor the instrument to the drawing surface.

Located along the flattened portion of shaft 31 are calibration lines 57 which, in conjunction with the numbered markings thereon, indicate the angle of the ellipse which will be drawn as indicated by the relative position between knurled nut 44 and one of these index lines.

As is more clearly shown in Figure 4, a curve spring member 35 is riveted at one end to housing 34, and at its free end has riveted to it an arm member 38. Extending from the upper portion of arm member 38 is a freely rotating ball 40 which bears upon cam surface 33. Cam surface 33, as in the other embodiment just described, comprises a series of elliptically-shaped sectors of varying angle or shape.

Referring now more particularly to Figures 2 and 3, at the bottom portion of arm 38 is a vertical groove 61 in which a slide bar 36 is fitted; a screw 37 is in threaded engagement with an opening 64 and acts as a clamping mechanism for sliding bar 36. Slide bar 36 includes a vertical section fitting into groove 61 and a horizontal portion 70 which carries the drawing apparatus which, in the drawing, is a "Leroy"-type inking pen 39. By varying the position of slide bar 36 the size of the ellipse is varied.

Thus to operate the instrument shown in Figures 2 to 5, the knurled nut 44 is adjusted to the position indicating the ellipse of the desired angle. Housing 34 is then rotated, and spring 35 forcing ball 40 against cam 34 causes pen 39 to traverse the desired ellipse.

The advantage of the embodiment of Figures 2 to 5 over that of Figure 1 is that the former instrument is more compact and is easy to operate since the device is brought closer to the drawing surface which thereby tends to lessen error and fatigue to the operator. A further advantage is that the housing is rotated about the shaft and the spring arm is moved about the cam surface to apply the drawing instrument in a horizontal position with respect to the shaft. This is also a distinct advantage over the bow type of drawing instrument in which the movement of the drawing point toward and away from the pivot point requires the tilting of the shaft to maintain the drawing instrument in contact with a flat surface. By having a relatively long spring arm mounted in the housing, the rotative force is applied to move the drawing instrument substantially at a tangent to the cam surface, thus providing a smoother following of the variations in the contour of the cam surface.

It should be understood that although the instant invention has its most effective application in drawing ellipses, it may also be used to draw other curves if the cam is appropriately shaped.

Thus the instant invention has the advantage of providing in a relatively simple and compact manner an instrument which may be quickly and accurately adjusted to produce any desired size or angle of ellipse.

Many modifications may be made of the specific embodiments of the invention above described without departing from the broader aspects of the instant invention.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. An adjustable drawing instrument comprising a shaft to engage a drawing surface at its lower end, a cam adjustable on the shaft having a tapered cross section corresponding to the shapes of the various curves to be drawn;

a housing having a narrow upper sleeve portion rotatable on the shaft and a bottom portion flaring outwardly from the upper portion and beyond the cam and being open at the bottom, and a line-drawing instrument having a resilient arm secured at one end to the inside of the housing for rotation therewith and supporting said drawing instrument below the cam at the other end of the arm, a portion of said arm being pressed in sliding contact with the surface of the cam whereby rotation of the housing carries the drawing instrument around the cam.

2. An adjustable drawing instrument according to claim 1 in which the resilient arm extends adjacent the inside of the periphery of the housing in a horizontal curve when the instrument is in use with the end which is secured to the inside of the housing spaced from the other end which engages the cam a distance of substantially one fourth of the circumference of the housing so that the portion of the arm in sliding contact with the cam makes an engagement tangent to the cam surface to provide a smoother following of the cam surface.

3. An adjustable drawing instrument according to claim 1 in which the drawing instrument carried by the end of the arm member includes means for varying the distance of said line-drawing instrument from the shaft member for varying the size of the curve to be drawn.

4. An adjustable drawing instrument according to claim 1 in which the tapered cam is adjustable in a position along the shaft and relative to said arm whereby the extent of the drawn curve may be varied.

5. An adjustable drawing instrument in accordance with claim 4 in which the shaft is threaded near its lower end and has a nut adjustable thereon for engaging and limiting the position of the cam on the shaft, and a spring surrounding the shaft and interposed between the top of the cam and housing to press the cam downwardly against the nut in any adjusted position and the cam having a non-rotatable connection with the shaft so that the cam remains in a fixed position when the housing is rotated.

6. An adjustable drawing instrument comprising the combination of a shaft having means at one end to anchor it to a drawing surface, a cam having tapered cross section corresponding to the shapes of various curves to be drawn, slidable along the shaft, a housing having a narrow upper sleeve portion rotatably mounted on the shaft above the cam with a bottom flaring portion to extend outwardly beyond the cam and open at the bottom, a curved spring arm secured at one end to the inside of the housing and extending around the sleeve between the housing and the cam, a line-drawing support at the other end of the arm and extending below the bottom of the housing, means adjustable on the shaft below the cam for limiting the downward movement of the cam, a spring surrounding the shaft above the cam between the top of the cam and the housing to press the cam against said means adjustable on the shaft, said spring arm having a portion in sliding contact with the surface of the cam and pressed in such engagement by the resilience of the spring arm whereby rotation of the housing relative to the shaft carries the drawing instrument about the cam in a horizontal direction with respect to a drawing surface.

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