

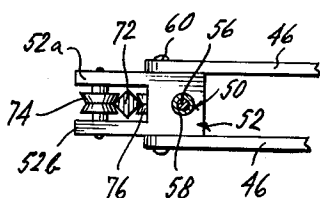
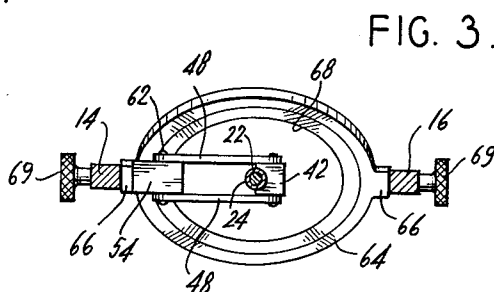
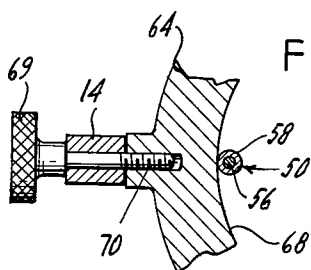
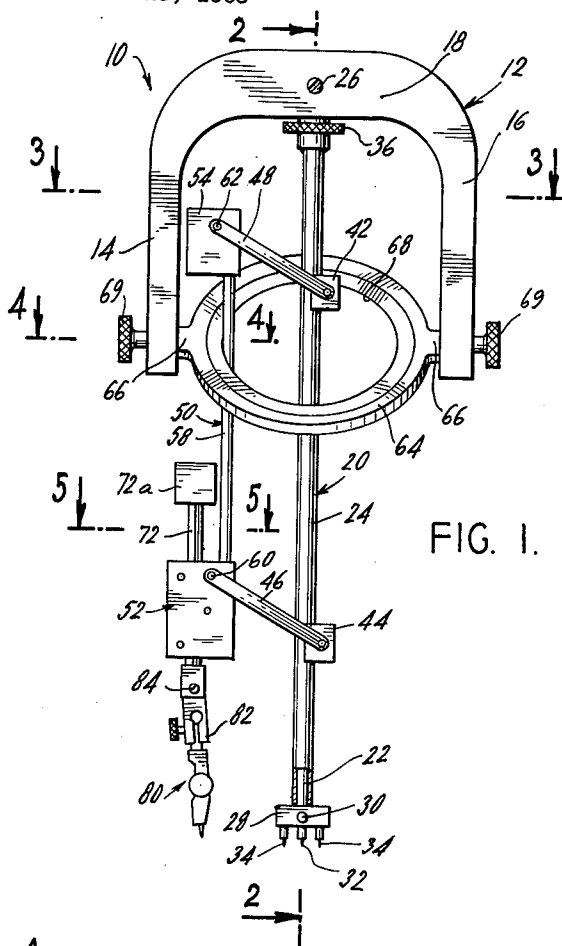
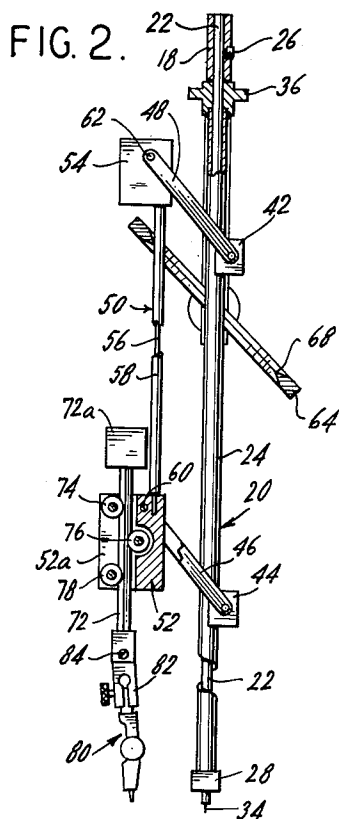
June 23, 1964

F. D. DA SILVA

3,137,945

ELLIPSOGRAPH

Filed Feb. 18, 1963



INVENTOR.
FERNANDO DIAS DA SILVA

BY

Amster & Levy

ATTORNEYS

1

3,137,945

ELLIPSOGRAPH

Fernando Dias Da Silva, 1621 Dundee Road,
North Brook, Ill.

Filed Feb. 18, 1963, Ser. No. 259,330

3 Claims. (Cl. 33—30)

The present invention relates generally to equipment for drawing and otherwise forming two dimensional geometric shapes and particularly to an improved machine for drawing ellipses on flat drawing surfaces.

Although a great number of simple mechanical aids exist for helping a draftsman accurately form geometric lines, notably the ruler for straight lines and the compass for arcuate lines, considerable difficulty is encountered in the formation of ellipses or portions of ellipses. A number of ellipsographic devices have been constructed and proposed for this purpose, however none of these have met with substantial success due to any one of a number of failings in the particular devices.

Accordingly, it is generally an object of the present invention to provide an ellipsograph which will enable a draftsman to accurately construct ellipses of differing sizes and shapes. Further, it is an object of the invention to provide such a device in a structure having sufficient reliability and ease of use that draftsmen and engineers may depend upon the accuracy of curves produced by the device. Still further, it is within the contemplation of the present invention to provide such a drawing machine at a cost to the user which is reasonable from a commercial point of view.

In accordance with the present invention there is provided a mechanical device for forming ellipses on a flat drawing surface. The device comprises a frame and a main shaft secured to the frame for orientation perpendicular to the drawing surface on which an ellipse is to be formed. A mounting foot is provided at the base of the main shaft and has a first pin for location at the center of the ellipses to be formed and at least one further pin which, in combination with the center pin, defines the major axis of the ellipse to be formed. A pair of pivot mounts is provided at spaced locations along the length of the main shaft and means are provided to secure the pivot mounts for rotation about the axis of the main shaft. First and second guide arms are pivoted at one of their respective ends to the pivot mounts and a parallel beam, of a length equal to the spacing between the pivot mounts, pivotally interconnects the free ends of the first and second guide arms creating a four-bar linkage with the parallel beam and guide arms forming the three moving links and the portion of the main shaft between the pivot mounts forming the stationary link. The parallel beam moves toward and away from the main shaft in parallel orientation thereto as the guide arms pivot about the pivot mounts and the parallel beam rotates about the main shaft as the pivot mounts rotate about that shaft. There is a circular template having a sharp-edge internal circumferential edge mounted on the frame and positioned intermediate the pivot mounts such that the internal circumferential edge encompasses the main shaft and the parallel beam. The template is mounted on the frame for rotation about the diameter of the circumferential edge which is parallel to the major axis of the ellipse to be formed. The parallel beam is engaged against the internal circumferential edge of the template such that the axial projection of the circumferential edge, and therefore the projection of the rotating parallel beam describes a closed ellipsoidal curve on the drawing surface of a shape dependent upon the degree of tilt of the template within the frame. A parallel beam rotating sleeve may be provided about the parallel beam shaft to provide rolling contact between the parallel beam and the internal circumferential edge. An

2

image producing stylus, such as a pencil or a pen, is mounted on the parallel beam by means of a structure which allows the free vertical movement of the stylus with respect to the beam such that the image forming tip of the stylus may remain in the plane of the drawing surface as the parallel beam is rotated about the axis of the main shaft in contact with the template.

The above brief description, as well as further objects, features and advantages of the present invention, will be best understood by reference to the following detailed description of one presently preferred embodiment of the invention when taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a side elevational view of an ellipsograph according to the present invention illustrating the image producing stylus in location at approximately the major axis of the ellipse to be formed;

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1 looking in the direction of the arrows with the image producing stylus and its associated linkage positioned 90° from the position shown in FIG. 1;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 1 looking in the direction of the arrows;

FIG. 4 is an enlarged sectional view along the line 4—4 of FIG. 1 looking in the direction of the arrows illustrating the mounting of the template on the frame and the contact between the parallel beam and the template; and

FIG. 5 is an enlarged sectional view along the line 5—5 of FIG. 1 looking in the direction of the arrows illustrating the mounting mechanisms for the image producing stylus.

Referring now specifically to the drawings, there is shown an ellipsograph, generally designated by the numeral 10, which comprises an inverted U-shaped frame 12 having a pair of parallel legs 14, 16 and an interconnecting bight portion 18. A main shaft 20 extends from the center of the bight 18 of the frame 12 in a direction parallel to the arms 14, 16 and includes a main shaft rod 22 and a loosely journaled sleeve 24 about the main shaft rod 22. The rod 22 is rigidly secured to the frame 12 by means of the set screw 26 at the bight portion 18 of the frame 12. At the lower end of the main shaft rod 22 is a mounting foot 28 secured thereto by the screw or rivet 30. The mounting foot has a center pin 32 for placement on the drawing paper at the center of ellipse to be formed and a pair of major axis locating pins 34 in line with the center pin 32. The major axis locating pins 34, with the center pin 32, define the major axis of all ellipses which can be formed by the device 10. As may be best seen in FIG. 2, the upper portion of the sleeve 24 of the main shaft 20 is formed with a knob 36 rigid with the sleeves 24 and rotatable about the rod 22 such that when the frame 12 is held stationary, turning motion applied to the knob 36 will be effective to turn the main shaft sleeve 24 about the axis of the main shaft 20.

A four-bar linkage, generally designated by the numeral 40 is provided on the main shaft 20. The stationary link of the four-bar linkage 40 is formed of a portion of the main shaft 20 between a pair of pivot mounts 42, 44 which are secured at spaced locations on the main shaft sleeve 24. It will be understood that the pivot mounts 42, 44 are rotatable about the axis of the main shaft 20 as the sleeve 24 rotates thereabout. First and second guide arms 46, 48 are mounted respectively on the pivot mounts 42, 44 and extend outwardly from the main shaft 20. A parallel beam, generally designated by the numeral 50 is pivotally secured to the free ends of the first and second guide arms 46, 48 by means of blocks 52, 54 respectively. Specifically, and referring to FIG. 2, the parallel beam 50 comprises a parallel beam rod 56 and a parallel beam sleeve 58 mounted thereabout. The parallel beam rod 56 is rigidly secured at its lower end in

the block 52 and its upper end in the block 54. In turn, the block 52 is connected at pivot 60 to the first arm 46 and the block 54 is connected at the pivot 62 to the second arm 48. Thus, the parallel beam 50 is mounted in parallel relationship to the main shaft 20 and the guide arms 46, 48 and the parallel beam 50 form three moving links of a four-bar linkage with the portion of the main shaft 20 between the pivot mounts 42, 44 serving as the stationary link. As shown in the sectional view of FIG. 3, it is desirable for the sake of rigidity of construction to provide two elements for the guide arms 46, 48, one on each side of the blocks 52, 54 and pivot mounts 42, 44.

A template 64, having mounting extensions 66, is adjustably secured between the lower ends of the arms 14, 16 of the frame 12. The template 64 has formed therein a sharp-edged internal circular edge 68 for engagement with the parallel beam 50. Utilizing the principle that the projection of a tilted circle produces an ellipse, the template 64 is utilized on the ellipsograph 10 to guide the moving parallel beam 50 of the four-bar linkage 40 such that the axis of the parallel beam 50 describes an ellipse on the drawing surface. As may be seen in FIG. 4, the template 64 is mounted to the frame 12 and specifically to the arms 14, 16 by means of thumb screws 69 which pass through horizontal openings in the arms of 14, 16 and into threaded openings 70 in the mounting extension 66 of the template 64. Upon tightening of the respective thumb screws 69, the angular orientation of the template 64 is fixed within the frame 12. It may be seen that the template 64 may be mounted perpendicular to the main shaft 20 or at various lesser angles with respect thereto.

It will be appreciated that if the template 64 is mounted perpendicular to the main shaft 20 and parallel to the surface upon which the ellipsograph 10 is resting, movement of the four-bar linkage 40 about the axis of the main shaft 20 will maintain the relationship between the various links of the four-bar linkage. Specifically, parallel beam 50 will rest against the internal circular edge of the template 64 and the radial distance between the axis of the main shaft 20 and the circular edge 68 will remain the same. Thus, as the sleeve 24 of the main shaft 20 is rotated, and as the first and second guide arms 46, 48 and the parallel beam 50 are rotated, the angular relationship of the various links will remain constant. However, if the template 64 is tilted from the perpendicular to the main shaft 20, the radial distance to the axis of the main shaft 20 will vary at various orientations of the four-bar linkage 40. Thus, when the sleeve 24 of the main shaft 20 is rotated, the parallel beam 50, guided by the first and second guide arms 46, 48 will move toward and away from the main shaft 20 dependent upon the angular position about the main shaft 20. Since the parallel beam 50 describes a projection of the circular edge 68 of the template 64, and since that projection is an ellipse, the parallel beam 50 will describe an elliptical path.

The means provided for forming the elliptical image on the drawing surface include the block 52 which effectively mounts a stylus slide shaft 72 for free vertical movement but prohibits movement transverse to the vertical. Specifically, the stylus slide shaft 72 is square in its cross-section (see FIG. 5) and is mounted on three negative V-shaped rollers 74, 76, 78 rotatably secured between the bifurcated faces 52-a and 52-b of the block 52. As may be seen from FIG. 5, the angle of the V-shaped rollers 74, 76, 78 is greater than 90° such that the stylus slide shaft 72 has essentially point contact with the rollers. The rollers are alternated two on one side of the slide shaft and one on the other and are freely rolling such that the shaft 72 may move vertically within the block but is held against any movement in any direction other than the vertical. At the lower end of the slide shaft 76 there is secured an image forming stylus generally designated by the numeral 80. The stylus 80 in this instance

is a conventional lead holder for drawing instruments but may also be an ink pen, a ballpoint pen, a sharp point or any other such device. The stylus 80 is secured to the slide shaft 72 by means of a releasable clamp 82 which has a built-in pivot 84 such that the point of the stylus 80 may be moved radially with respect to the main shaft 20.

The structure and operation of the ellipsograph 10 may be best understood by considering the following description of the device in use. The operator of the ellipsograph 10 places the device on a flat drawing surface with the center point 32 placed upon the center of the ellipse to be formed and the major axis locating pins 34 positioned along the line intended to be the major axis of the ellipse. Since the blocks 52, 54 are of relatively large weight, and since the pivots at the pivotal mounts 42, 44 and the pivots 60, 62 are free acting, the parallel beam 50 is engaged against the internal circular edge 68 of the template 64. His contact may also be insured by the use of conventional biasing springs engaged with the four-bar linkage rather than by the simple gravity bias illustrated. Upon rotation of the main shaft sleeve 24, the four-bar linkage 40 is rotated about the axis of the main shaft 20 and, as it rotates, the parallel beam rotating sleeve 58 rides along the internal circular edge 68. Depending upon the tilt of the template 64, the parallel beam 50 is moved toward and away from the main shaft 20. As the beam is moved toward and away from the shaft it is moved in a vertical direction by the pivotal action of the guide arms 46, 48. Although the block 52 is moved vertically with the parallel beam 50, the stylus 80 is maintained in contact with the flat drawing surface by means of the slide shaft 72 which is free to move vertically on the rollers 74, 76, 78. A weight 72(a) may be applied at the upper end of the slide shaft 72 to provide sufficient vertical force for the stylus 80 to make an image on the drawing paper. Similarly, the slide shaft 72 may be biased for downward movement by a spring or other biasing means. Since the stylus 80 is moved radially inwardly and outwardly of the main shaft 20 and is rotated thereabout as the main shaft sleeve is located about its own axis, the point of the stylus 80 will transcribe a curve defined by the projection of the template 64. When the point of the stylus 80 is positioned exactly under the axis of the parallel beam 50, it describes a perfect ellipse upon the flat drawing surface beneath the ellipsograph 10. When it is desired to produce a curve of a shape larger or smaller than the exact projection of the circle 68 of the template 64, the stylus 80 is moved radially inwardly or outwardly with respect to the main shaft 20 by rotating the holder 82 about its pivot 84.

It will be appreciated that there is provided in accordance with the present invention a simple and effective device for forming ellipses with either a pen or pencil. Other means may be similarly used on the device for transcribing the curves which are produced by the machine. It will be further appreciated that the presently disclosed device is reliable due to its simplicity, is easy to use and may be manufactured and marketed at an attractive price.

Although the foregoing describes only one embodiment of the present invention, it is apparent that many design changes may be made in the disclosed device without departing from the teachings of the present invention. Therefore, the following claims should be interpreted broadly, in the manner consistent with the spirit and scope of the invention.

What I claim is:

1. A machine for forming ellipses on a flat drawing surface comprising an inverted bifurcated frame having a bight portion and a pair of downwardly extending arms, a main shaft secured to the center of said bight portion of said frame for orientation perpendicular to said drawing surface and over the center of the ellipse to be formed, a mounting foot at the base of said main shaft

5

for engagement with said surface defining the major axis of the ellipse to be formed, said mounting foot having at least two drawing surface-engaging pins, one of said pins being along the axis of said main shaft, said pins defining the center and the major axis of the ellipse to be formed, a pair of pivot mounts at fixed spaced locations along the length of said main shaft, means mounting said pivot mounts for rotation about the axis of said main shaft, a first guide arm pivoted at one end to one of said pivot mounts, a second guide arm of equal length pivoted at one end to the other of said pivot mounts, a parallel beam of a length equal to the spacing between said pivot mounts pivotally connected at one of its ends to the free end of said first guide arm and at its other end to the free end of said second guide arm, said parallel beam and said guide arms forming three moving links of a four-bar linkage with the portion of said main shaft between said pivot mounts forming the stationary link thereof, said parallel beam moving toward and away from said main shaft and remaining parallel thereto as said guide arms pivot on said pivot mounts, said parallel beam being rotatable about said main shaft as said pivot mounts rotate about said main shaft, a circular template having an internal circumferential surface mounted on said frame between said downwardly extending arms with its center positioned along the axis of said main shaft, pivot means mounting said template on said frame for rotation about the diameter of said template which is parallel to the major axis of the ellipse to be formed, lock means to secure said template in an adjusted position within said frame, said parallel beam being engaged with the inside internal circumferential surface of said template such that the axial projection of said parallel beam describes a closed elliptical curve on said drawing surface of a shape dependent on the degree of tilt of said template from parallel to said drawing surface, an image producing stylus, means mounting said stylus on said parallel

6

beam for free movement parallel to said parallel beam and preventing movement transverse thereto to produce an ellipse on said drawing surface as said parallel beam is rotated about said main shaft in contact with said template, first biasing means engaged with said stylus urging same downwardly into firm image-producing contact with said drawing surface, and second biasing means urging said parallel beam radially outwardly from said main shaft into contact with said template.

2. A device according to claim 1 wherein the parallel beam comprises an internal parallel beam rod pivotally secured at its ends respectively to said first and second guide arms, and a parallel beam sleeve journaled on said rod for rotation thereabout, said sleeve contacting said template as said parallel beam rotates about said main shaft.

3. A device according to claim 1 wherein the main shaft comprises a main shaft rod rigidly secured to said frame and said mounting foot, and a main shaft sleeve journaled about said rod for rotation thereabout, said pivot mounts being secured to said main shaft sleeve for rotation about the axis of the main shaft.

References Cited in the file of this patent

UNITED STATES PATENTS

324,395	Marichal	Aug. 18, 1885
1,637,507	Zavagno	Aug. 2, 1927
1,707,914	Lampe	Apr. 2, 1929
2,496,614	Arnason	Feb. 7, 1950
2,498,798	Edwards	Feb. 28, 1950
2,677,181	Sury	May 4, 1954
2,690,013	MacGuire	Sept. 28, 1954

FOREIGN PATENTS

54,866	Switzerland	Jan. 27, 1912
332,350	Germany	Jan. 29, 1921
539,426	Germany	Nov. 25, 1931