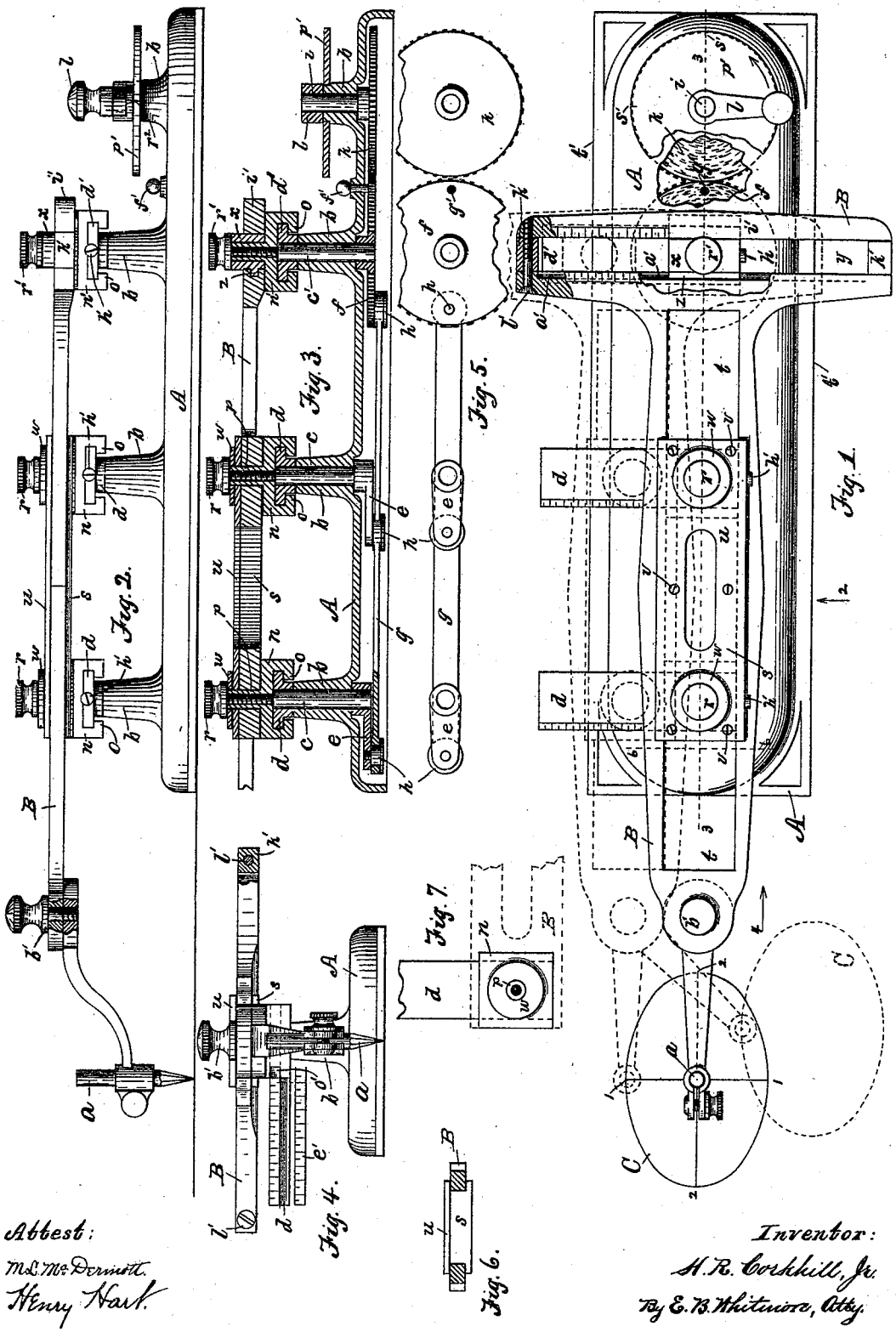
(Model.)

# H. R. CORKHILL, Jr.

## ELLIPSOGRAPH.

No. 492,142. Patented Feb. 21, 1893.

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# UNITED STATES PATENT OFFICE.

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## ELLIPSOGRAPH.

SPECIFICATION forming part of Letters Patent No. 492,142, dated February 21, 1893.

Application filed March 26, 1892. Serial No. 426,569. (Model.)

*To all whom it may concern:*

Be it known that I, HENRY R. CORKHILL, Jr., of Rochester, in the county of Monroe and State of New York, have invented a new and useful Improvement in Ellipsographs, which improvement is fully set forth in the following specification and shown in the accompanying drawings.

The object of my invention is to produce a device for conveniently and accurately tracing ellipses, which possesses certain advantages over similar devices heretofore used, the invention being hereinafter fully described and particularly pointed out in the claims.

Referring to the drawings Figure 1 is a plan of my improved ellipsograph, parts being broken away and other parts shown in various positions by full and dotted lines. Fig. 2 is a side elevation of the device seen as indicated by arrow 2 in Fig. 1. Fig. 3 is a central longitudinal section taken on the dotted line 3 3 in Fig. 1. Fig. 4 is an end elevation seen as indicated by arrow 4 in Fig. 1. Fig. 5 is a plan of some of the interior parts. Fig. 6 is a cross section of the tracing arm taken on the dotted line 6 6 in Fig. 1. Fig. 7 is a plan of a crank-arm pin with adjacent parts.

Referring to the parts shown A is the base or body of the instrument, which is hollow and preferably made of cast metal, and B the tracing arm carrying a tracing point *a*. The base piece is formed with four vertical standards *b* arranged in a central longitudinal line, the three at the left being equal in height, and having within them shafts *c c c'*, as shown in Figs. 2 and 3. At the upper ends of these shafts are rigidly secured similar horizontal crank-arms *d d d'* which turn with the shafts and bear upon the upper ends of the standards. Within the base are two cranks *e e* each secured rigidly to a shaft *c*, and a crank gear *f* secured to the shaft *c'*.

*g* is a rod connecting the three cranks, being held by crank pins *h h h*, one secured rigidly in each of the two cranks and in the gear.

Within the right-hand short standard *b* is fitted a vertical shaft *i* similar to the shaft *c*, to the lower end of which, and within the base-piece, is secured a spur gear *k* similar to, and engaging, the gear *f*. At the upper end of the shaft *i* is secured an operating crank *l* by means of which all the shafts *c c c'* and *i*, and the crank-arms *d d d'* are caused to revolve. The crank-arms *d d d'* are arranged so that all three will be exactly in line when turned longitudinally over the base piece, or parallel when turned at right-angles to the base piece, as shown in Fig. 1. The connecting rod *g* serves to keep the arms all thus relatively arranged. These arms carry and operate the tracing arm B.

The crank-arms are, as a matter of convenience, made T-shape in cross section, as shown, and are provided with adjustable crank-pins *n n n'* having lips *o* turned horizontally under the projecting edges of the arms. The crank-pins are provided with vertical clamping screws *r r r'* threaded in the reduced parts *p*, having their points bearing upon the respective crank-arms, by means of which the crank-pins are held to place on the crank-arms.

Upon the two crank-pins *n n* is mounted a holding-bar or body *s* for holding the tracing arm B. This tracing arm is formed with a central longitudinal slot *t*, Fig. 1, occupied by the bar *s*, the two sides of the arm occupying horizontal grooves or rests in the opposite edges of the holding-bar, as shown in Fig. 6. The holding-bar is provided with a cap-piece *u* above the tracing arm, held to place by fastening screws *v*. The parts are fitted so that the tracing arm may slide freely but without lost motion in a longitudinal direction in its bearings in the holding bar.

*w* are washers resting upon the cap-piece *u*, rigid with the crank-pins *n n*, so as to turn with the latter when the crank-arms *d* are revolved. The crank-pins pass through vertical circular openings in the holding-bar, as shown in Fig. 3, which constitute the vertical bearings between the pins and the bar. For horizontal bearings the holding bar rests upon the upper horizontal faces of the crank-pins. As constructed, when the crank-arms *d d* are revolved the crank-pins *n n*, the washers *w w* and the clamping screws *r r* all turn together, the crank-pins *n* turning in their bearings, in the holding-bar.

The crank-pin *n'* is provided with a prismatic block *x* Figs. 1 and 3, which occupies a transverse slot *y* in the tracing arm B. This block is formed with a tongue *z* fitted to a corresponding horizontal groove *a'* formed

in the tracing arm. When the crank-arms are revolved the crank-pin $n'$ turns in the block $x$ for a bearing similar to the manner in which the crank-pins $n\ n$ turn in the holding-bar $s$. The tongue $z$, fitting closely in the groove $a'$, tends to keep the tracing arm steady and prevents it from rocking upon its bearings in the holding-bar $s$. The slots $t$ and $y$ in the tracing arm are at right-angles with each other, and disconnected, the slot $y$, being beyond the rear end of the slot $t$.

The tracing arm B is divided, as shown in Fig. 2, the parts being fitted to turn upon each other as with a swivel movement, held together by a clamping pivot-screw $b'$.

The three crank-pins $n\ n\ n'$ are shown placed centrally over the respective shafts $c\ c\ c'$, the axes of the clamp-screws $r\ r\ r'$ coinciding with the axes of the shafts. In this position a revolution of the crank $l$ and crank-arms $d\ d\ d'$, would cause no motion of the tracing point $a$.

To cause the tracing point to describe a figure the crank-pins must be moved away from the shafts, each along its crank arm $d$. By moving the pins $n\ n$, with the holding bar, toward the outer ends of the crank-arms the vertical dimension 1 1 of the figure, C, will be determined; and a similar movement of the crank-pin $n'$ will determine the horizontal diameter 2 2 of the figure. If all three of the crank-pins are moved equally distant from their respective centers of motion, that is to say the shafts $c\ c\ c'$, the figure C will be a circle. If an ellipse is to be described having its major axis horizontal or parallel with the tracing arm, the crank-pin $n'$ will be moved farther from its center of motion than the crank-pins $n\ n$ are from theirs. If the major axis of the ellipse is to be vertical or at right angles with the tracing arm, the crank-pin $n'$ must be nearer its shaft $c'$ than the other two crank pins $n\ n$, are to their respective shafts $c\ c$. The crank-arms $d\ d$ carry the holding-bar around in a circle, and the crank-arm $d'$ carries the block $x$ in a circle when the operating crank $l$ is turned. If the pins $n\ n$ occupy central positions over their respective shafts $c\ c$, as shown in full lines in Fig. 1, and the pin $n'$ is moved away from its shaft the tracing point will, when the crank $l$ is turned, describe a straight line 2 2, having a length equal to twice the distance said pin $n'$ is moved from the shaft $c'$. If, now, the pins $n$ $n$ be moved successively away from their shafts through small distances and a figure be described by the tracing point each time, a series of ellipses will be formed having the line 2 2 for a common major axis, until the distance of said pins from their respective shafts becomes equal to the distance the pin $n'$ is from its shaft, when the figure will be a circle with the line 2 2 for a diameter. And, conversely, if the pins $n\ n$ are placed away from the shafts $c\ c$ and the pin $n'$ remains over its shaft a revolution of the crank $l$ will cause the tracing point to describe a straight line corresponding to 1 1, at right angles with the axis of the tracing arm. Then, by moving the pin $n'$ successively through small distances as in the first case, until its distance from the shaft $c'$ equals the distance of a pin $n$ from its shaft $c$, a series of ellipses may be drawn having line 1 1 for a common major axis, the last figure being a circle with said line 1 1 for its diameter.

The edges of the arms $d\ d$ are divided into equal scales of equal parts, as shown in Fig. 4, the division marks of which may, if necessary, be carried over upon the upper surfaces of the arms, as shown in Fig. 1. By this means the crank-pins $n\ n$ may be set at any given distance, within limits, from their centers of motion, this distance corresponding to the semi-major axis or semi-minor axis as the case may be, of the ellipse to be drawn. The division marks on these two arms $d\ d$ are alternated, as will be understood by comparing the marks on the arm $d$, Fig. 4, with the marks on the fictitious scale $e'$ which represents the other arm $d$. If the scales on the two arms show subdivisions of an inch, as eighths and sixteenths, for example, then by alternating the two scales, as shown, so that the marks indicating eighths on one arm shall bisect the spaces on the other the pins $n\ n$ may be set to thirty-seconds of an inch without such fine division being made on the scale of either arm. In a similar manner the two sides of the transverse slot $y$ in the tracing arm are divided into alternated scales, as shown, by means of which the block $x$ may be exactly set as use of the instrument may require.

In setting the crank-pins $n\ n$ to describe a figure the crank arms are first turned in line under the tracing arm and the clamp-screws $r\ r$ are loosened. The pins $n\ n$ (with the holding-bar) are then moved to their proper positions upon the arms, reference being had to the scales, after which the clamp-screws $r$ $r$ are set up firmly. Then turning the arms across the device and at right angles thereto, as shown in Fig. 1, the clamp-screw $r'$ is loosened and the pin $n'$ moved to bring the block $x$ to its proper place in the slot $y$ indicated by the scale on the tracing arm, the screw $r'$ being then firmly set.

As shown in Fig. 4, the forward crank-pin $n$ is beveled down to an edge, $o'$, adjacent to the scale on the arm $d$ to facilitate the setting of said pin to the proper place on the scale. The other crank-pin $n$ is similarly formed, and for the same purpose.

To determine when the crank-arms are exactly in line under the tracing arm for the purpose of setting the pins $n\ n$, as above described, I provide a centering pin or detent $f'$, Figs. 2 and 3, held by the base-piece A in position to have its point enter a hole $g'$ in the gear $f$, Figs. 1 and 5. A similar hole is formed in the gear ninety degrees from the hole $g'$ so that when the gear is turned to receive the pin in this second hole the arm $d'$ will stand parallel with the slot $y$, in which position of

the parts the pin $n'$ may be shifted and set as described.

Stop-screws $h'$, Figs. 1 and 2, are inserted in the respective arms $d$ $d$ $d'$, forming stops for the respective pins $n$ $n$ $n'$. These stop-screws are so placed that when said pins are moved against them the vertical axes of the pins will correspond with the axes of the respective shaft $c$ $c$ $c'$. When the pins are in these positions a revolution of the operating crank $l$ will cause no motion to the tracing point, as above stated.

To form the slot $y$ in the tracing arm I commonly use a rear bar $i'$ and two equal parallel spacing blocks $k'$ $k'$, held together by fastening screws $l'$ as shown in Figs. 1 and 4. This slot may, however, if desirable, be formed in the arm like the slot $t$, without surrounding pieces. Also in constructing this instrument the gears $k$ and $f$ may be dispensed with if found desirable and replaced by simple cranks like those referred to by $e$ $e$, the connecting rod $g$ being extended to connect all. In this case the hole $g'$ for the detent pin $f'$ would be formed in the rod $g$, and some simple provision made for holding the arm $d'$, under the slot $y$, not involving invention.

In constructing this ellipsograph the edges $t'$ $t'$ of the base-piece A are made straight and parallel so that the instrument may be used against the edge of the blade of a T-square, or other straight edge.

On account of the swivel joint in the tracing arm the tracing point may be turned aside or offset, as shown in Fig. 1, and ceased to draw a figure out of line with the axis of the instrument.

It is frequently necessary for a draftsman to describe a semi-ellipse, as in drawing an arch, or a fourth of an ellipse, as when representing the overhanging portion of a projecting beam. To facilitate the execution of such figures or portions of an ellipse I provide a disk or dial $p'$, Figs. 1 and 2, under the operating crank $l$ and securely seated on the standard $b$ of the base A. This dial is marked with four equally spaced peripheral marks $s'$, and the crank is provided with a pointer $r^2$ in position to traverse the periphery of the dial and pass these marks when said crank is turned. By means of this dial and the pointer an exact fourth of an ellipse as from 1 to 2, or a semi-ellipse as from 1 around to 1 or from 2 around to 2, may be drawn.

What I claim as my invention is—

1. An ellipsograph formed with a base piece, a pair of revolving crank-arms held by said base piece, a holding bar mounted upon said crank-arms, and a tracing arm held by said crank-arms and provided with a tracing point overhanging said base piece, in combination with a third crank-arm held by said base piece in position to bear against said tracing arm and adapted to move it longitudinally in the holding bar, substantially as shown and described.

2. An ellipsograph having a tracing arm carrying a tracing point, and a holding bar or holder formed with rests to receive the tracing arm, in combination with revolving crank-arms for carrying the holding-bar around, and a revolving crank-arm adapted to act alternately in opposite directions upon the tracing arm to reciprocate the latter longitudinally in its bearings in the holding-bar, the tracing arm being formed in two parts and united by a swivel joint and a fastener for the parts, substantially as and for the purpose specified.

3. An ellipsograph having a tracing arm formed with a longitudinal slot, and a transverse slot separate from, and at right angles with, each other, in combination with a revolving holder for the tracing arm, occupying the longitudinal slot, crank-arms for operating the holding-bar, and a crank-arm with crank-pin in the transverse slot, and an operating crank to turn the crank-arms, substantially as described.

4. An ellipsograph having, in combination, a tracing arm, a revolving holder for the tracing-arm, revolving crank-arms for carrying the holding-bar, adjustable crank-pins on the crank-arms, and clamping screws for the crank-pins, the crank-arms being provided with scales of equal parts for setting the crank-pins, substantially as shown and described.

5. The combination in an ellipsograph of a tracing arm, a revolving holding-bar for the tracing-arm, revolving crank-arms for carrying the holding-bar, adjustable crank-pins on the crank-arms, and clamping screws for the crank-pins, each of said crank-arms being provided with a scale of equal parts, alternated with each other, substantially as and for the purpose set forth.

6. An ellipsograph having a tracing arm, in combination with a holder for the tracing arm, a pair of revolving crank-arms for carrying the holding-bar, and a crank-arm to move the tracing-arm longitudinally, adjustable crank-pins on the several crank-arms and clamping screws for said crank-pins, and stops on said crank-arms to limit the motion of the crank-pins upon the crank-arms, substantially as and for the purpose specified.

7. The combination in an ellipsograph, of a tracing arm, a revolving holder for the tracing arm, a series of crank-arms to operate the tracing arm, an operating-crank to revolve the crank-arms, a disk or dial associated with the operating crank, and a pointer for the dial attached to the operating crank, substantially as shown and described.

8. In combination with the tracing arm of an ellipsograph, a revolving holder for the tracing arm, a series of crank-arms for operating the tracing arm, an actuator for the crank-arms, and a detent to hold the crank-arms in position, substantially as shown and for the purpose specified.

9. An ellipsograph having a hollow base

formed with a series of vertical standards projecting therefrom, in combination with vertical shafts in said standards, cranks secured to the shafts within the base, a connecting rod joining said cranks, crank-arms secured to the shafts above the standards, and a tracing arm held and operated by the crank-arms, and means to revolve the shafts, substantially as shown and described.

10. An ellipsograph having a tracing arm and a holder for the tracing arm, in combination with a pair of revolving crank-arms for carrying the holder for the tracing arm, a crank-arm to move the tracing arm longitudinally, a crank-pin on said last named crank-arm, and a sliding block on the crank-pin to press the tracing arm, the latter being formed with a groove or race and the sliding block having a tongue to enter said groove, as and for the purpose specified.

11. The combination in an ellipsograph of a tracing arm, a revolving holder for the tracing arm, a series of crank-arms for operating the tracing arm, an adjustable crank-pin for each crank-arm, and clamp-screws for the crank-pins, the latter being formed with lips turned under projecting parts of the respective crank-arms, substantially as shown.

In witness whereof I have hereunto set my hand, this 21st day of March, 1892, in the presence of two subscribing witnesses.

HENRY R. CORKHILL, JR.

Witnesses:
ENOS B. WHITMORE,
M. L. MCDERMOTT.