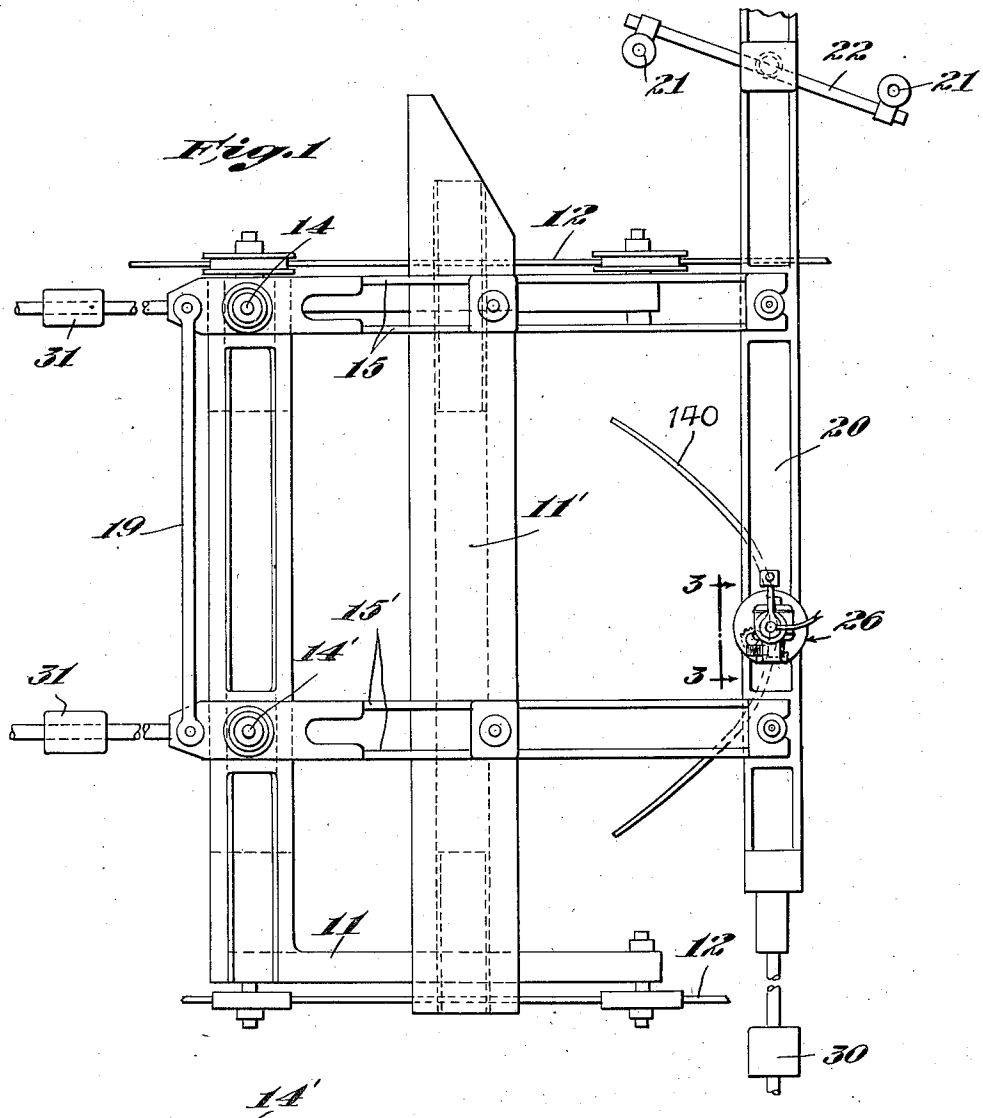
May 24, 1932. C. KREBS 1,860,037

REPRODUCING MACHINE

Filed July 12, 1930 2 Sheets-Sheet 1

Fig. 1



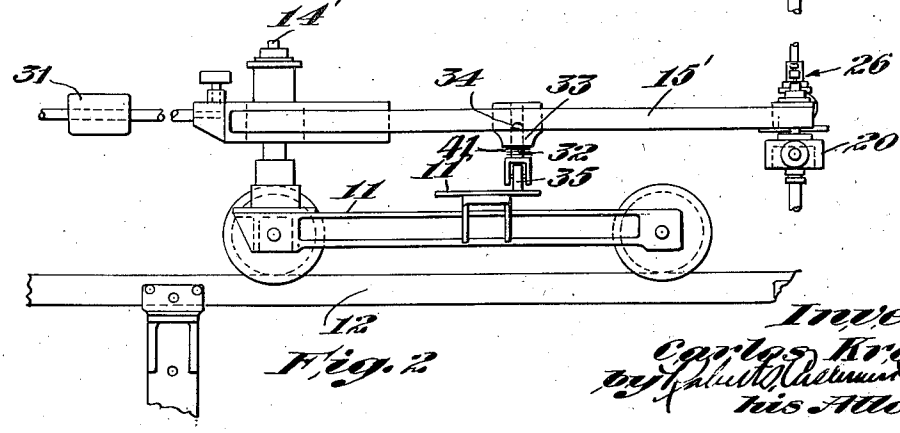


Fig. 2

Inventor
Carlos Krebs
by Albert G. Davis & Bodell
his Attorneys

May 24, 1932. C. KREBS 1,860,037

REPRODUCING MACHINE

Filed July 12, 1930 2 Sheets-Sheet 2

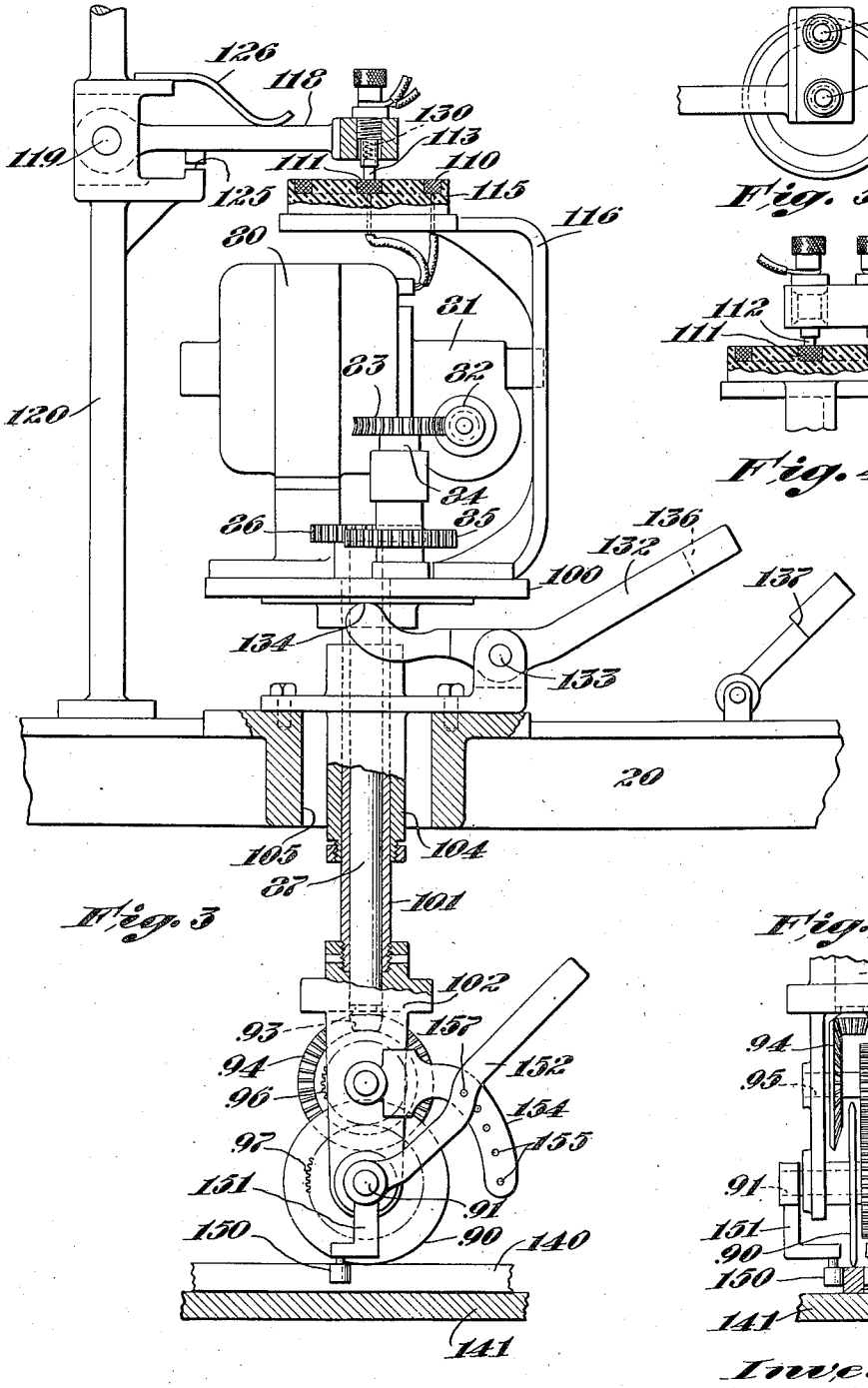


Fig. 3

Fig. 5

Fig. 4

Fig. 6

Inventor
Carlos Krebs
by Pollock, Vanderhoof & Cushman
his Attorneys

Patented May 24, 1932 1,860,037

UNITED STATES PATENT OFFICE

CARLOS KREBS, OF BOSTON, MASSACHUSETTS

REPRODUCING MACHINE

Application filed July 12, 1930, Serial No. 467,422, and in Great Britain May 10, 1930.

This invention relates to reproducing machines, particularly those adapted to control the movement of metal cutting or welding torches. My copending application, Serial No. 392,723, for patent on reproducing machine, filed September 14, 1929, discloses and claims a reproducing machine including a movable carriage, parallel motion linkage including a pair of rotatable links mounted on the carriage about spaced parallel axes, a lateral link connecting these rotatable mounting links and a tracer and a reproducing tool suitably mounted on the linkage. Such parallel motion linkage is preferably counterbalanced so as to swing about the movable carriage with little friction and without unequal distortion of the links during motion, as more fully set forth in the above copending application Serial No. 392,723. The present invention provides an improved pattern follower mechanism suitable for use in combination with the parallel motion linkage of the above copending application, and with parallel motion mechanisms in reproducing machines generally, and has for one of its objects to provide an arrangement of parallel motion mechanism and pattern follower mechanism wherein the pattern follower mechanism is supported independently of the parallel motion mechanism so that the movement of the parallel motion mechanism is unaffected by the rather heavy weight of the pattern follower mechanism, so that distortion of the parallel motion mechanism during operation is diminished and so that the parallel motion mechanism may be lighter and more freely moving than heretofore.

My invention furthermore provides a simplification of driving connections between the driving motor and pattern follower wheel.

My invention also aims to provide a simple and effective device for supplying electric current to the driving motor in various angular positions of the pattern follower mechanism and the parallel motion mechanism, and also to enable such means to supply the desired electric current during vertical oscillation of the pattern follower mechanism. Other objects of this invention reside in the details of construction hereinafter set forth as will be apparent to one skilled in the art from consideration of the following specification taken in connection with the drawings which form a part thereof and in which:

Fig. 1 is a plan view of an illustrative embodiment of a reproducing machine, showing particularly a preferred arrangement of parallel motion mechanism;

Fig. 2 is a side elevation, partly in section, of the reproducing machine of Fig. 1;

Fig. 3 is a side elevation taken on the line 3—3 of Fig. 1 and partly broken away, of the pattern follower mechanism of the machine;

Fig. 4 is a fragmentary side elevation partly broken away and taken at right angles to Fig. 3, showing particularly a slip ring and brush electrical connection for transmitting current to the driving motor of the pattern follower mechanism;

Fig. 5 is a fragmentary plan view of the parts illustrated in Fig. 4; and

Fig. 6 is a fragmentary side elevation, taken at right angles to Fig. 3, of the lower portion of the pattern follower mechanism, and showing the manner of engagement of this mechanism with a suitable pattern.

Referring to Figs. 1 and 2 the illustrated machine includes a main carriage 11 restricted to movement along a track 12, 12 or other fixed path, and carrying (Fig. 1) spaced vertical pivots 14 and 14′ serving as parallel axes for the rotation of two longitudinal links 15 and 15′ which are pivotally mounted thereon in any suitable manner, for instance by ball bearings. The links 15 and 15′ are constrained to parallel movement by the transversely extending third link 20 which is connected to ends of

links 15 and 15'. A transversely extending fourth link 19 is pivotally connected to the opposite ends of the links 15 and 15', the links 15, 15', 19 and 20 thus forming a closed parallelogram of which non-adjacent sides are pivoted to the main carriage by the pivots 14 and 14'. The transverse link 20 is extended to one side of this parallelogram to support one or more cutting torches 21, which are adjustably carried by link 20 and/or on an angularly adjustable bracket 22 extending from this link.

A pattern follower mechanism indicated generally by the reference character 26 and more fully described below is connected to transverse link 20 and is adapted to be moved in contact with a template, drawing, or other pattern lying between the rails 12. According to a preferred construction the pattern follower mechanism 26 is supported directly upon the pattern, independently of the parallel motion linkage. While as described, the weight of the pattern follower mechanism in such cases does not affect the balance of the parallel motion linkage, the parallel motion linkage system, including the torches, is balanced in itself by the provision of suitable balancing weights 30, 31 and 31' to enable the linkage system to swing about these pivots without variable distortion during movement.

In order to steady the linkage as its moves pivotally about two pivots 14 and 14' each of the links 15 and 15' is preferably provided between its carriage pivot 14 or 14' and the transverse link 20 with a depending member 32 in the form for example of a square shaft extending through a boss 33 on the link, adjustably supported by a set screw 34 and carrying at its lower end a roller or caster 35 which rolls over the upper surface of a raised portion 11' of the main carriage 11. If desired, the connection between the roller or caster 35 and the associated link may be made yielding, as for instance by interposition of a suitable spring 41.

The pattern follower mechanism indicated in Fig. 1 by the reference character 26 is shown in more detail in Figs. 3 to 6. A pattern follower wheel 90, freely rotatable about a horizontal shaft 91, is adapted to move over the pattern, drawing, or template. A driving motor 80 operates through speed reduction gearing 81, a worm gear 82, a worm wheel 83, a vertical shaft 84 and cooperating gear wheels 85 and 86, to drive a single vertical shaft 87 disposed directly above the point of contact of the pattern follower mechanism with the pattern or template.

Referring to Fig. 6, shaft 87 carries at its lower end a bevel gear wheel 93 meshing with another bevel gear wheel 94 fixed to the revoluble shaft 95. Shaft 95 in turn rotates a gear wheel 96 which intermeshes with another gear wheel 97 fixed to the pattern follower wheel 90. The pattern follower wheel 90 is advantageously quite narrow as shown in Figure 9 and is thus capable of following accurately the lines of a drawing.

To permit the pattern follower mechanism to follow pattern lines of any curvature, provision is made for permitting rotation of the entire pattern follower mechanism. Referring to Fig. 3 the casing of the motor 80 and the cooperating speed reduction gearing 81, and the gear wheels 82, 83, 85 and 86 are mounted upon a turntable or platform 100 capable of rotation with respect to the transverse link 20 of the reproducing machine. A sleeve 101 is fast at its upper end to this turntable and at its lower end is fastened to a forked bracket 102 (Figs. 3 and 6) in which the lower end of the driving shaft 87 and the two horizontal shafts 95 and 91 are mounted. In this way the entire pattern follower mechanism is free to rotate as a unit with respect to the system of linkage of the reproducing machine.

Referring to Fig. 3 the pattern follower mechanism is enabled to guide the transverse link 20 in horizontal directions through the provision of a bearing sleeve 104 which surrounds the sleeve 101 of the pattern follower mechanism and is fixed to the transverse link 20 at opposite sides of an opening 105. The rotatable sleeve 101 of the pattern follower mechanism is, however, capable of freely moving up and down through sleeve 104, the entire weight of the pattern follower mechanism thus being unsupported by the transverse link 20 of the parallel motion mechanism. In this way the pattern follower mechanism is capable of moving up and down in conformity with slight irregularities in the pattern without transmitting corresponding vertical movement to the parallel-motion linkage. In addition the weight of the pattern follower mechanism, since carried entirely by the tracing wheel 90, does not subject the linkage system to vertical flexure.

A slip ring 110 is electrically connected to one pole of the driving motor 80, a contact 111, insulated from slip ring 110, is connected to the other pole of the driving motor, and two insulated brushes 112 and 113 connected to a suitable source of electrical energy cooperate with the slip ring 110 and contact 111 to furnish current to the driving motor in all angular positions of the pattern follower mechanism. As illustrated in Fig. 3, the slip ring 110 and contact 111 are mounted in an insulated block 115 supported by a suitable bracket 116 from the turntable 100. The two brushes 112 and 113 are carried by an arm 118 pivotally mounted at 119 upon a vertical support 120 carried by the transverse link 20, and are pressed down toward the slip ring 110 and contact 111 by a suitable spring 126. Each of the brushes 112 and 113 is yieldingly projected by a small

spring 130 as diagrammatically illustrated in Fig. 3. In this way vertical movement of the pattern follower mechanism is permitted without subjecting the transverse link 20 to an appreciable vertical stress. A stop shoulder 125 is preferably provided for supporting the arm 118 in case the pattern follower mechanism is lowered beyond a predetermined distance.

In order to provide for raising and lowering the pattern follower mechanism to permit this mechanism easily to be moved to a desired portion of the pattern, a lifting lever 132 is provided, pivotally mounted at 133 and adapted to bear at its outer end 134 against the lower side of the turntable 100. By pressing down upon this lever 132 the turntable and the entire pattern follower mechanism may be lifted from the pattern, the spring 126 permitting the pivoted arm 118 to follow this vertical movement. The extreme end of the lever 132 is bifurcated as indicated at 136, and a pivotally mounted locking lever 137 is provided, adapted to extend into this bifurcation and to retain this end of the lever 132 in a lowered position in order to lock the pattern follower mechanism in its upper or abnormally elevated position.

In the illustrated embodiment of the invention the pattern comprises a template in the form of a metal strip 140 bent into any suitable form, fastened to a supporting plate 141, and adapted to receive and support the narrow periphery of the follower wheel 90. In order to hold the wheel upon the template, two rollers 150 are provided for contacting with the opposite sides of the template strip, these rollers preferably, as shown in Figs. 3 and 6, being positioned slightly in advance of the point of contact of the follower wheel 90 and template. With the rollers 150 in this position the follower wheel follows accurately and with great facility the path defined by the template strip 140. The rollers 150 are vertically supported by levers 151 fastened at their upper ends to the shaft 91. An extension 152 of one of the levers 151 serves as a handle for rotating the levers 151 to move the rollers 150 into and out of engagement with the template. A bracket 154 is provided with a plurality of holes 155 and the handle 152 is provided with a single hole, so that a pin 157 passing through one of the holes 155 in the bracket and through the hole in the handle serves to retain the rollers 150 in a predetermined position. By removing this pin 157 and depressing the handle 152, the rollers may be raised above the lowest part of the follower wheel 90, in which event the follower wheel may be used in connection with a drawing or other plane pattern. In such operation of the pattern follower mechanism the handle 152 is useful in manually guiding the follower wheel 90 over the lines of the drawing or the pattern employed.

In the operation of the machine of the present invention the follower wheel 90 is moved either automatically or manually in contact with the template or other pattern having the shape of the intended finished article while the parallel motion linkage transmits the motion of the pattern follower mechanism to the one or more cutting torches 21 and causes them to produce replicas of the pattern. The machine as a whole may be moved toward and from the work by movement of the carriage 11 along rails 12, 12, the desired universal movement of the pattern follower mechanism and torches 21 being obtained by the combined movement of the carriage 11 along the rails 12, 12 and the transverse swinging movement of the parallel-motion linkage about the pivots 14, 14′ on the carriage.

I claim:

1. A reproducing machine comprising parallel motion mechanism and a pattern follower device for controlling the parallel motion mechanism, the pattern follower device comprising a unit including a motor and a pattern follower wheel adapted to be driven thereby and adapted to rest upon a pattern, the pattern follower device being mounted for vertical oscillation as a unit with respect to the parallel motion mechanism, whereby the weight of the pattern follower unit is bourne by the pattern and the pattern follower wheel is adapted to follow the pattern without transmitting to the parallel motion mechanism substantial vertical oscillations.

2. In a reproducing machine the combination of parallel motion mechanism, a vertical sleeve connected to said mechanism for vertical sliding and for axial rotation with respect thereto, a driving motor having its casing connected fast to said sleeve, means at the lower end of said sleeve and movable therewith for rotatably retaining a pattern follower wheel, a pattern follower wheel retained by said means, means including a drive shaft extending through the sleeve for driving said wheel from the motor, the motor, the sleeve, the wheel and the drive shaft thus being normally adapted to rise and fall as a unit with respect to the parallel motion mechanism, and means for retaining the said unit in an abnormally elevated position with respect to the parallel motion mechanism.

3. In a reproducing machine, the combination of parallel motion mechanism, pattern follower mechanism normally free to rest on a pattern and to rise and fall with respect to the parallel motion mechanism and so connected with said mechanism as to impart pattern following horizontal movements thereto, and means for retaining the pattern follower mechanism at will in an abnormally elevated position with respect to the parallel motion mechanism.

4. In a reproducing machine the combina-

tion of parallel motion mechanism, a pattern follower wheel rotatable about a horizontal axis and adapted to roll over a pattern, a single vertical drive shaft for the pattern follower wheel, said shaft being disposed substantially directly above the point of contact of the pattern follower wheel with the pattern, and a motor for rotating said drive shaft.

5. In a reproducing machine adapted to control a torch in accordance with a raised pattern, the combination with parallel motion mechanism, of a pattern follower wheel rotatable about a horizontal axis and adapted to roll over the upper surface of the pattern, a vertical drive shaft for the wheel disposed substantially directly above the point of contact of the pattern follower wheel with the pattern and so connected with said mechanism as to impart pattern following horizontal movements thereto, said pattern follower wheel being adapted to swing bodily about an axis common with that of the drive shaft to follow curvature of the pattern, a motor for rotating said drive shaft, and means for engaging opposite sides of the pattern to constrain the wheel to movement along the pattern.

6. In a reproducing machine adapted to control a torch in accordance with a pattern, the combination with parallel motion mechanism, of pattern follower mechanism supported on a pattern for vertical movement independently of the parallel motion mechanism and comprising a vertical rotatable sleeve which is so connected with said mechanism as to impart pattern following horizontal movements thereto, a driving motor bodily movable with the sleeve, a bracket on the lower end of the sleeve, a pattern follower wheel mounted for rotation on a horizontal axis in the bracket, the pattern follower wheel thus bearing the weight of the bracket and sleeve, and driving connections between the motor and the pattern follower wheel.

7. In a reproducing machine adapted to control a torch in accordance with a pattern, the combination of parallel motion linkage, a pattern follower device mounted in the linkage for bodily rotation about a vertical axis with respect thereto and including a pattern follower wheel and a driving motor for the wheel, current conductors supported from the linkage, and a slip-ring and brush electrical connections between the motor and said conductors for supplying current to the motor in various angular positions of the linkage and pattern follower device.

8. In a reproducing machine adapted to control a torch in accordance with a pattern, the combination of parallel motion linkage, a pattern follower device including a pattern follower wheel adapted to rest upon a pattern, a driving motor and driving connections for the wheel supported by said wheel, a vertically movably member mounted on the linkage adjacent the pattern follower device to follow vertical movement thereof, current conductors mounted on said member, and a slip-ring and brush electrical connection between the motor and said conductors for supplying current to the motor in various angular and vertical positions of the linkage and pattern follower device.

Signed by me at Boston, Massachusetts, this tenth (10th) day of July, 1930.

CARLOS KREBS.