Jan. 11, 1955 S. HEALEY 2,699,119

VARIABLE STROKE PUMP

Filed June 27, 1950 3 Sheets-Sheet 1

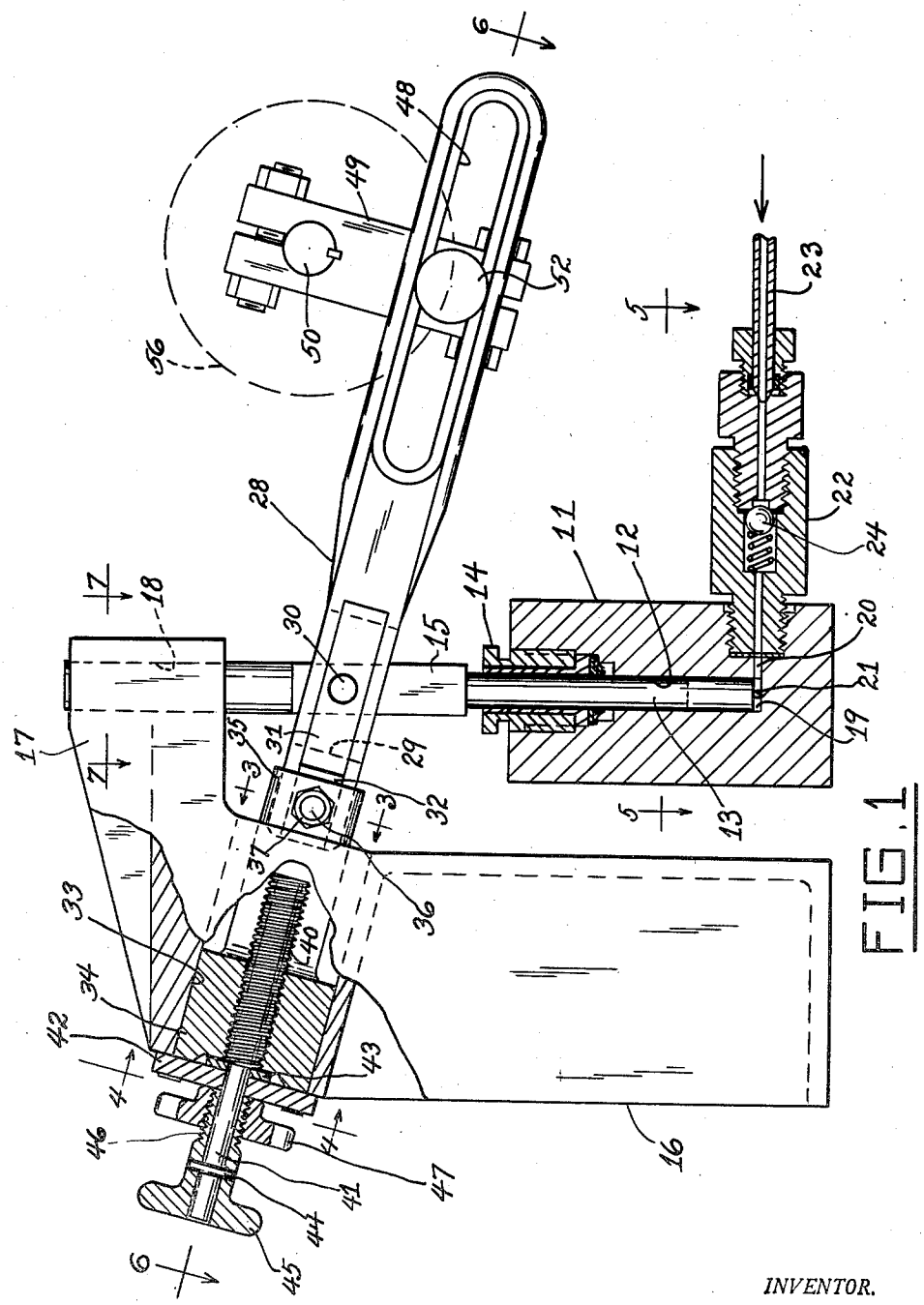


FIG. 1

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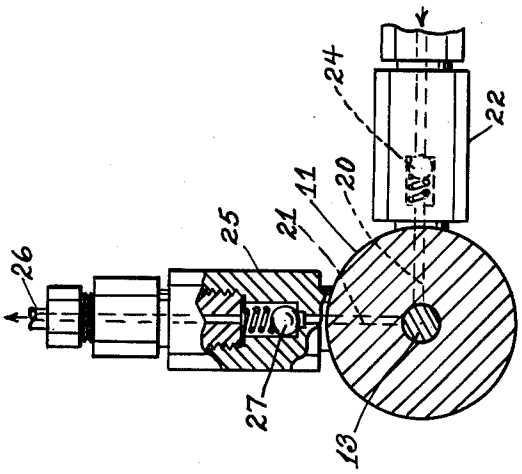


FIG. 5

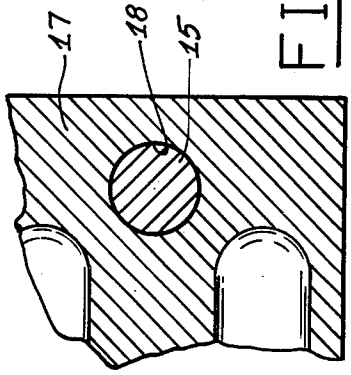


FIG. 7

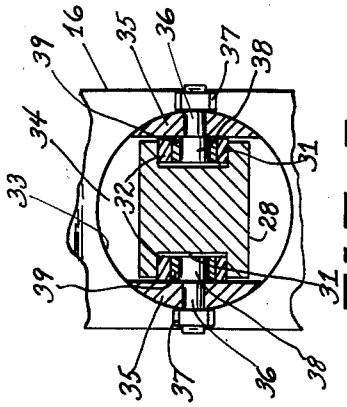


FIG. 3

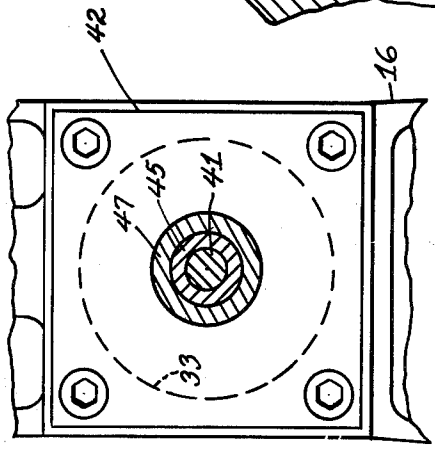


FIG. 4

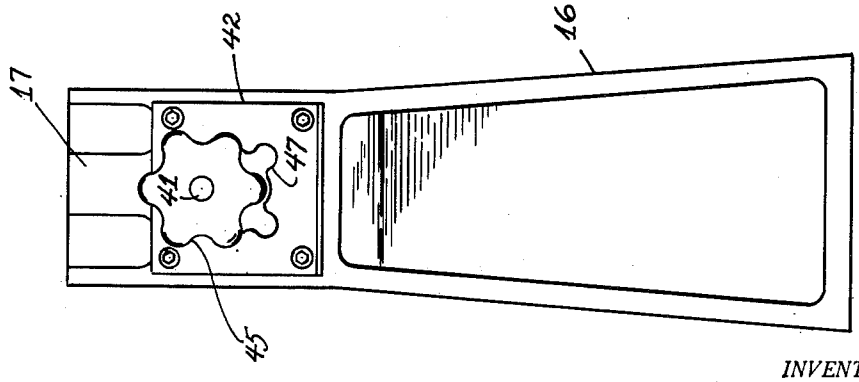


FIG. 2

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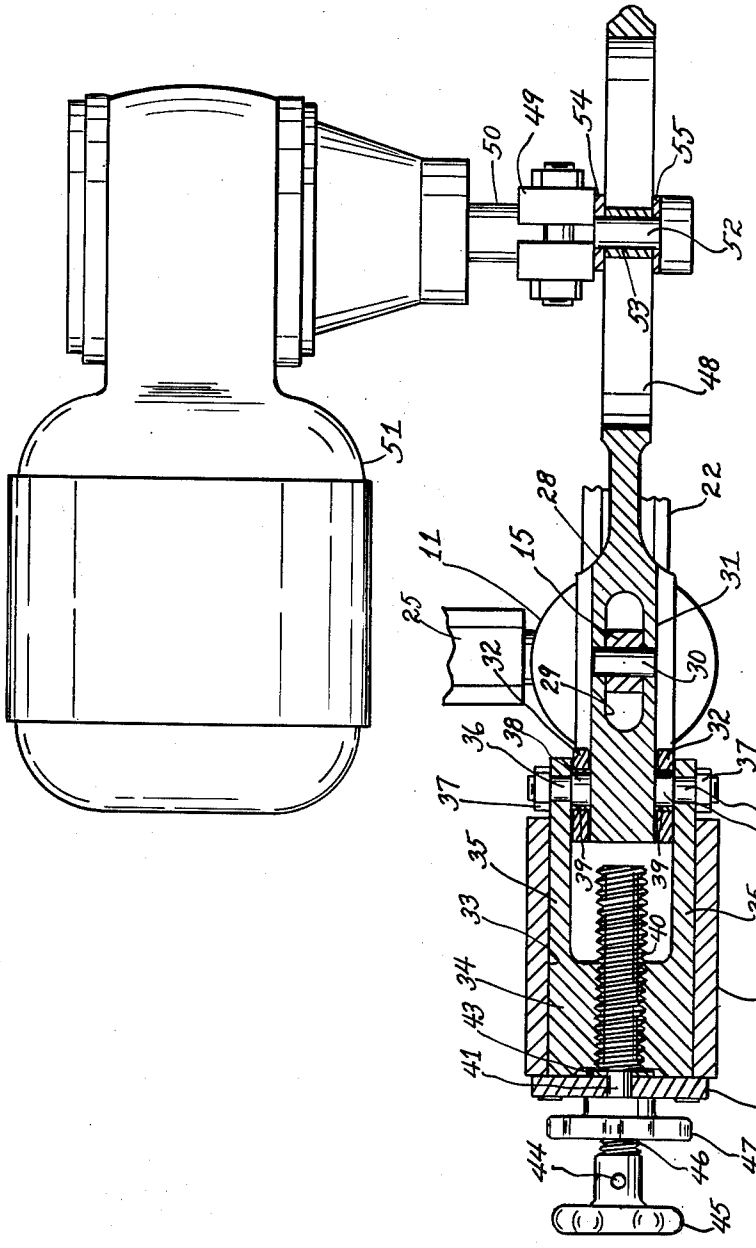


FIG. 6

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VARIABLE STROKE PUMP

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Application June 27, 1950, Serial No. 170,537

9 Claims. (Cl. 103—38)

This invention relates to fluid pumps, and more particularly to fluid pumps of the reciprocating-piston type.

A main object of the invention is to provide a novel and improved reciprocating-piston fluid pump which is provided with means for varying the length of stroke of the piston while the pump is running.

A further object of the invention is to provide an improved pump of the reciprocating-piston type provided with stroke-adjusting means arranged so that the lowest point of piston travel remains constant regardless of the adjusted length of the stroke, said means being operable while the pump is running.

A still further object of the invention is to provide an improved fluid pump of the reciprocating-piston type, provided with improved means for adjusting the length of stroke of the pump, the pump being very simple in construction, being easy to adjust, and involving only a few parts.

A still further object of the invention is to provide an improved fluid pump of the reciprocating-piston type having means for adjusting the length of stroke of the pump while the pump is running, said means being arranged to maintain constant clearance of the piston of the pump with respect to its bore end wall, regardless of the adjusted length of stroke, said means being further arranged for easy manipulation when it is desired to change the length of stroke, and consequently, the volumetric rate of delivery of the pump, whereby the pump may operate continuously, and whereby changes in its rate of delivery may be made very smoothly.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is a side elevational view, partly in longitudinal cross section, of an improved fluid pump constructed in accordance with the present invention.

Figure 2 is an end elevational view of the pump shown in Figure 1.

Figure 3 is an enlarged cross-sectional detail view taken on line 3—3 of Figure 1.

Figure 4 is an enlarged cross-sectional detail view taken on line 4—4 of Figure 1.

Figure 5 is a cross-sectional detail view taken on line 5—5 of Figure 1.

Figure 6 is a cross-sectional view taken on line 6—6 of Figure 1.

Figure 7 is an enlarged fragmentary cross-sectional detail view taken on line 7—7 of Figure 1.

Referring to the drawings, 11 designates the pump cylinder, which is shown, merely by way of example, as positioned vertically. The cylinder 11 is formed with a vertical axial bore 12 in which is slidably and sealingly positioned the piston rod 13. A suitable gland 14 is provided at the top end of the cylinder 11, the piston rod 13 extending sealingly and slidably through said gland. Rigidly secured to the top end of piston rod 13 is a vertical bar 15 which is rectangular in cross-section at its lower portion and circular in cross-section at its upper portion. Designated at 16 is a support member located adjacent the cylinder 11 and formed with a top arm 17 which extends over the cylinder and which slidably receives the cylindrical portion of bar 15 in a correspondingly shaped cylindrical vertical bore 18 formed therein.

The clearance space in the lower end of bore 12 is shown at 19. The cylinder 11 is formed with respective radial passages 20 and 21 communicating with said

clearance space. Connected to the cylinder and communicating with passage 20 is a fluid inlet check valve 22 to which is connected the fluid inlet conduit 23. As shown in Figure 1, valve 22 may be of the type having a spring-pressed valve ball 24 biased to a position wherein fluid can pass through the valve into bore 12 only on the suction stroke of piston rod 13. On the compression stroke of said piston rod the ball 24 is held on its seat.

Connected to the cylinder 11 and communicating with passage 21 is a fluid outlet check valve 25, shown in Figure 5, to which is connected the fluid outlet conduit 26. As shown in Figure 5, valve 25 may be of the type having a spring-pressed valve ball 27 biased to a position wherein fluid can pass from cylinder 11 through the valve into conduit 26 only on the compression stroke of piston rod 13. On the suction stroke of said piston rod the ball 27 is held on its seat.

Designated at 28 is an inclined vertically oscillating lever which is formed at its intermediate portion with an elongated slot 29 through which vertical bar member 15 extends. Bar member 15 is pivotally secured to lever 28 by a transverse pin 30 extending through said bar member and through the walls of slot 29. The opposite sides of lever 28 are formed with the large longitudinal grooves, shown at 31, 31. Designated at 32, 32 are respective rectangular block members slidably fitting into the grooves 31, 31.

The knee portion of the support member 16 is formed with a large inclined cylindrical bore 33 in which is slidably positioned a plunger member 34. Plunger member 34 is formed with the parallel rearwardly extending arms 35, 35 which extend on opposite sides of the lever 28, as shown in Figures 3 and 6. Designated at 36, 36 are respective transversely extending, axially aligned bolt members secured to the end portions of the arms 35, 35, as by nuts 37, 37. The heads of bolt members 36, 36, shown at 38, 38, are cylindrical in shape and are journalled in the respective block members 32, 32, as by bearing bushings 39, 39. Said block members thus serve as fulcrum means for lever 28.

Threaded axially through the plunger member 34 is a screw member 40. Screw member 40 is provided with a reduced shank 41 which extends rotatably through a rectangular cover plate 42 secured to the outside of the knee portion of support member 16 and overlying the end of bore 33. A bearing washer 43 is mounted on shank 41 between cover plate 42 and the threaded portion of screw member 40, as shown in Figures 1 and 6. Secured on the shank 41, as by a transverse pin 44, is a sleeved operating knob 45. The end portion of the sleeve of knob 45 is formed with external threads 46, and threadedly engaged thereon is the locknut member 47. By tightening locknut member 47, the shank 41 may be rigidly locked to the cover plate 42, thereby locking the screw member 40 against rotation. With the locknut 47 in a loosened position, the screw member 40 may be rotated by the knob 45, causing the plunger member 34 to be moved longitudinally in the bore 33. Since the pivotal axis of the lever 28 is defined by the pivot bolts 36, 36, carried by the plunger arms 35, 35, rotation of knob 45 shifts the location of said pivotal axis longitudinally along the axis of the bore 33, thereby varying the distance between transverse pin 30 and said pivotal axis. This varies the length of stroke of the piston rod 13.

The end portion of lever 28 opposite its pivotal axis is formed with an elongated straight slot 48. Designated at 49 is a crank bar. One end of crank bar 49 is secured to the output shaft 50 of a driving motor 51. The other end of crank bar 49 has secured thereto a headed pin member 52 extending through slot 48. Rotatably mounted on pin member 52 is a bearing bushing 53, and rotatably mounted on said pin member at opposite ends of the bushing 53 are the respective bearing washers 54, 55, engaging the opposite sides of the lever 28 adjacent the slot 48, as shown in Figure 6.

The crank circle defined by rotation of the axis of pin 52 is designated at 56 in dotted view in Figure 1. Rotation of crank arm 49 causes lever 28 to oscillate vertically between respective extreme positions wherein the longitudinal axis of the lever is tangential to said

crank circle. Figure 1 shows, for example, the lowermost position of the lever **28**, wherein the axis of said lever is tangential to crank circle **56**, and wherein the lever is at right angles to crank arm **49**.

In order to maintain the bottom clearance of the piston rod **13** constant regardless of the adjusted stroke of the rod, the axis of bore **33** is directed so that it is tangential to the lower portion of the crank circle **56**, as shown in Figure 1. Therefore, when knob **45** is rotated, the pivotal axis of lever **28** is moved along a line tangent to the crank circle, and the lever **28** cannot ever swing lower than the position shown in Figure 1, regardless of the effective adjusted length of the lever. This means that plunger rod **13** will always descend to the same position in bore **12**, regardless of its adjusted length of stroke. Therefore, the rate of delivery of the pump may be varied, by rotating knob **45** to change the length of stroke of the piston rod **13**, but the bottom clearance of the piston rod in its bore remains constant at all times.

It will also be apparent that the length of stroke of the piston rod **13** may be varied while the pump is running, since the lever **28** may oscillate continuously while the block members **32**, **32** are moved longitudinally in the opposing grooves **31**, **31** of said lever.

Although a specific embodiment of a variable stroke fluid pump has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. In a pump of the character described, a cylinder, a piston mounted in said cylinder for reciprocation therein, a lever, means pivotally connecting an intermediate portion of the lever to said piston and defining a positive pivotal connection between said lever and said piston, a crank connected to one end of said lever, a support, a guide way on said support extending along a line tangent to the lower portion of the crank circle of said crank, a bearing member slidably engaged in said guide way, and means pivotally connecting the other end of said lever to said bearing member.

2. In a pump of the character described, a cylinder, a piston mounted in said cylinder for reciprocation therein, a lever, means pivotally connecting an intermediate portion of the lever to said piston and defining a positive pivotal connection between said lever and said piston, a crank connected to one end of said lever, a support, guide means on said support extending along a line tangent to the lower portion of the crank circle of said crank, a bearing member slidably engaged with said guide means, means pivotally connecting the other end of said lever to said bearing member, a screw member threadedly engaged with the bearing member and extending parallel to said guide way, and means rotatably securing said screw member to said support.

3. In a pump of the character described, a cylinder, a piston mounted in said cylinder for reciprocation therein, a lever, means pivotally connecting an intermediate portion of the lever to said piston and defining a positive pivotal connection between said lever and said piston, one end of said lever being formed with a longitudinal slot, a rotary crank arm at one side of said cylinder, pin means extending through said slot and slidably and pivotally connecting the outer end of the crank arm to the lever, a support on the opposite side of said cylinder, said support being formed with a bore extending along a line tangent to the lower portion of the crank circle of said crank arm, a plunger member slidably positioned in said bore, means slidably and pivotally connecting the other end of said lever to said plunger member, and means locking said plunger member in an adjusted position in said bore.

4. In a pump of the character described, a cylinder, a piston mounted in said cylinder for reciprocation therein, a lever, means pivotally connecting an intermediate portion of the lever to said piston and defining a positive pivotal connection between said lever and said piston, one end of said lever being formed with a longitudinal slot, a rotary crank arm at one side of said cylinder, pin means extending through said slot and slidably and pivotally connecting the outer end of said crank arm to the lever, a support on the opposite side of said cylinder, said support being formed with a bore extending along a line tangent to the lower portion of the crank circle of said crank arm, a plunger member slidably positioned in said bore, the opposite sides of the lever being provided with longitudinal guide elements, and means pivotally connected to the plunger member and slidably engaged with said guide elements.

5. In a pump of the character described, a cylinder, a piston mounted in said cylinder for reciprocation therein, a lever pivotally connected at an intermediate portion thereof to said piston, one end of the lever being formed with a longitudinal slot, a rotary crank arm at one side of said cylinder, pin means extending through said slot and slidably and pivotally connecting the outer end of said crank arm to the lever, a support on the opposite side of said cylinder, said support being formed with a bore extending along a line tangent to the lower portion of the crank circle of said crank arm, a plunger member slidably positioned in said bore, the opposite sides of the lever being formed with longitudinal grooves, respective block elements slidably positioned in said grooves, means pivotally connecting said block elements to said plunger member on a common transverse axis, and a screw member rotatably secured to said support and extending along an axis parallel to said bore, said screw member threadedly engaging said plunger member, whereby said common transverse axis may be moved longitudinally responsive to rotation of said screw member, thereby varying the stroke of the piston.

6. In a pump of the character described, a cylinder, a piston having one end portion thereof mounted in said cylinder for reciprocation therein, a lever pivotally connected at an intermediate portion thereof to said piston, one end of the lever being formed with a longitudinal slot, a rotary crank arm at one side of said cylinder, pin means extending through said slot and slidably and pivotally connecting the outer end of said crank arm to the lever, a support on the opposite side of said cylinder, said support being formed with a bore extending along a line tangent to the lower portion of the crank circle of said crank arm, a plunger member slidably positioned in said bore, the opposite sides of the lever being formed with longitudinal grooves, respective block elements slidably positioned in said grooves, means pivotally connecting said block elements to said plunger member on a common transverse axis, a screw member rotatably secured to said support and extending along an axis parallel to said bore, said screw member threadedly engaging said plunger member, whereby said common transverse axis may be moved longitudinally responsive to rotation of said screw member, thereby varying the stroke of the piston, and guide means on said support slidably receiving the other end portion of said piston.

7. In a pump of the character described, a cylinder, a piston having one end portion thereof mounted in said cylinder for reciprocation therein, a lever pivotally connected at an intermediate portion thereof to said piston, one end of the lever being formed with a longitudinal slot, a rotary crank arm at one side of said cylinder, pin means extending through said slot and slidably and pivotally connecting the outer end of said crank arm to the lever, a support on the opposite side of said cylinder, said support being formed with a bore extending along a line tangent to the lower portion of the crank circle of said crank arm, a plunger member slidably positioned in said bore, the opposite sides of the lever being formed with longitudinal grooves, respective block elements slidably positioned in said grooves, means pivotally connecting said block elements to said plunger member on a common transverse axis, a screw member rotatably secured to said support and extending along an axis parallel to said bore, said screw member threadedly engaging said plunger member, whereby said common transverse axis may be moved longitudinally responsive to rotation of said screw member, thereby varying the stroke of the piston, and an arm on said support extending over said cylinder and slidably receiving the other end portion of said piston.

8. In a pump of the character described, a cylinder, a piston mounted in said cylinder for reciprocation therein, a lever, a positive, non-sliding, direct pivotal connection between the intermediate portion of the lever and said piston, a crank drivingly connected to one end of the lever, a support, a bearing member adjustably mounted on said support, fulcrum means slidably engaged with said lever adjacent its other end, and means pivotally

connecting said fulcrum means to said bearing member.

9. In a pump of the character described, a cylinder, a piston mounted in said cylinder for reciprocation therein, a lever, a positive, non-sliding, direct pivotal connection between the intermediate portion of the lever and said piston, a crank drivingly connected to one end of the lever, a support, a guideway on said support extending along a line tangent to the lower portion of the crank circle of said crank, a bearing member slidably engaged with said guideway, means on said support for adjusting said bearing member along said guideway, and a pivotal sliding connection between said bearing member and the other end of the lever.

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