March 26, 1957 R. B. IMMEL ET AL 2,786,362

LIMIT SWITCH OPERATING MECHANISM

Filed Nov. 7, 1951 2 Sheets-Sheet 1

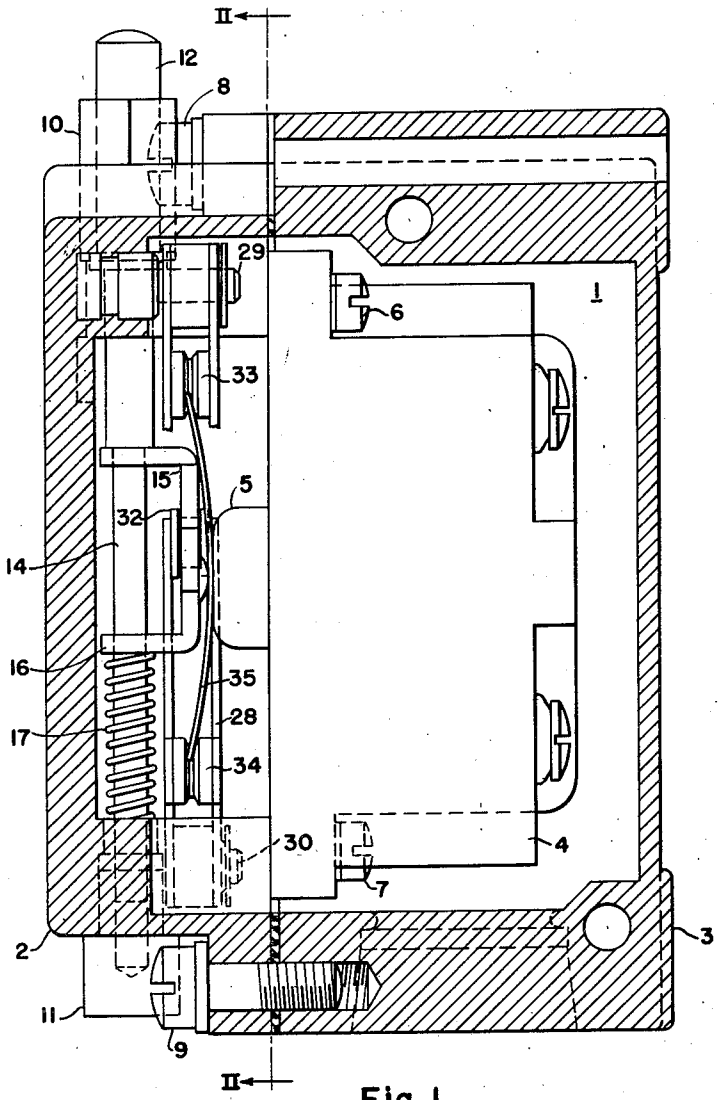


Fig. 1.

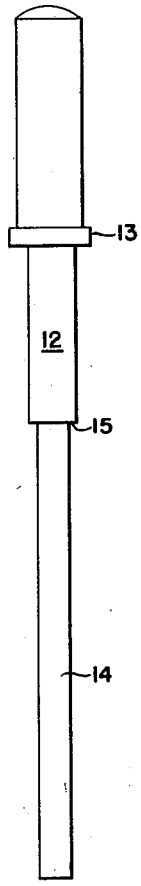


Fig. 6.

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LIMIT SWITCH OPERATING MECHANISM

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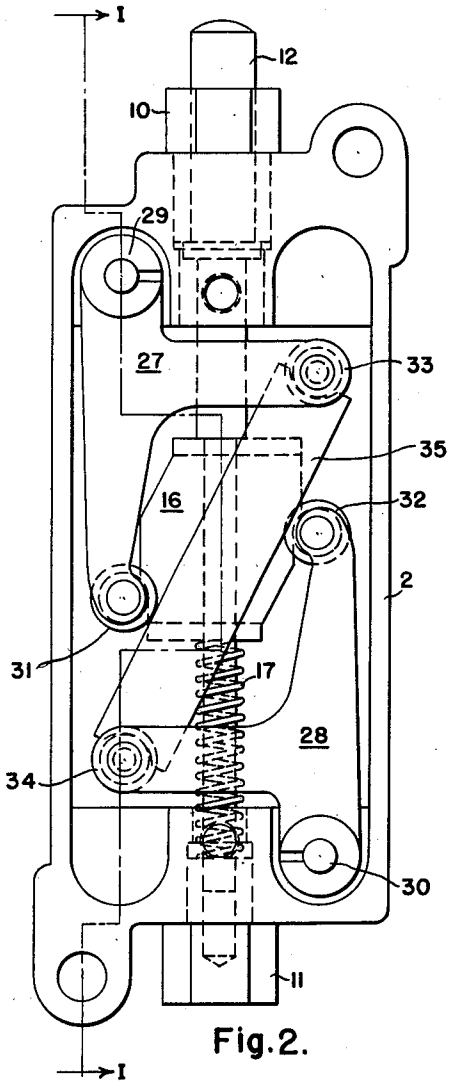


Fig. 2.

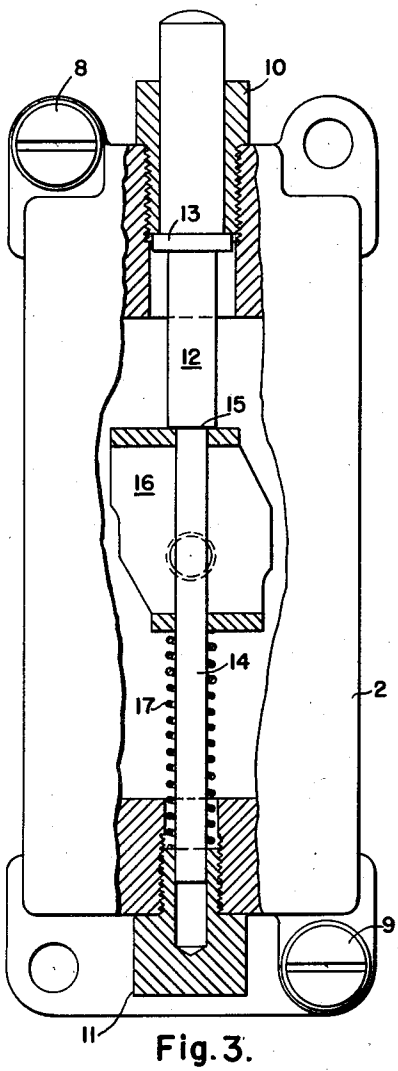


Fig. 3.

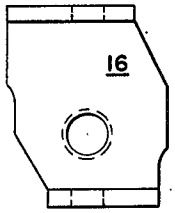


Fig. 4.

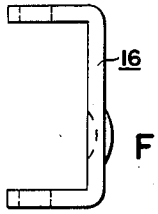


Fig. 5.

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LIMIT SWITCH OPERATING MECHANISM

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Application November 7, 1951, Serial No. 255,253

1 Claim. (Cl. 74—110)

Our invention relates to switches and more particularly to switch operating mechanisms as applied to limit switches and similar other switch uses.

It is an object of the invention to provide the trade with a reliable and dependable switch operating mechanism.

A more specific object of our invention is to provide an improved operating mechanism for a plunger actuated switch which is reliable, durable, and less expensive than prior art operating mechanisms.

A further object of our invention is the provision of an operating mechanism, for a plunger actuated switch, for translating the rectilinear motion of an operating rod actuated by some machine, such as a milling machine, into rectilinear motion perpendicular to the line of action of the operating rod.

It is an additional object of our invention to provide an operating mechanism, for a plunger actuated switch, for translating the rectilinear motion of an operating rod into rectilinear motion perpendicular to the line of action of the operating rod to actuate the plunger operated switch.

Another object of our invention is the provision of operating mechanisms, for a plunger actuated switch, for translating the rectilinear motion of an operating rod into rectilinear motion perpendicular to the line of action of the operating rod to actuate the plunger operated switch without producing a wiping or sliding motion between the operating mechanism and the switch plunger.

The aforesaid objects of our invention, and other objects of our invention not expressly recited, are achieved by providing an elongated leaf spring disposed in a slightly flexed position between two movable supports, the supports being movable linearly by equal amounts toward the middle of the spring in response to movement of the operating rod to cause the middle of the spring to move in a straight line normal to the plane of the spring to thus actuate some mechanism such as a switch.

For a better understanding of the invention reference should be made to the accompanying drawings, wherein:

Figure 1 is a vertical sectional view through the housing showing a side of one embodiment of the invention, the section being substantially on the line I—I of Fig. 2, looking in the direction indicated by the arrows at the ends of the section line;

Fig. 2 is a sectional view along line II—II of Fig. 1 looking in the direction indicated;

Fig. 3 is a front view of the device with a part of the front cover broken out and certain elements omitted;

Figs. 4 and 5 show front and side views of the operating cam; and

Fig. 6 shows a view of the operating rod.

It will be apparent from the showing in Fig. 1 that the housing 1 which encloses the operating components of the device consists of a front or cover 2 and a rear portion 3. The rear portion 3 houses a plunger actuated type switch 4. The plunger 5 of the switch projects from the switch casing and actuates the switch with a snap

action when the plunger 5 is moved axially a selected distance.

The switch 4 is rigidly secured to the cover 2 of the housing 1 by bolts 6 and 7 and the rear portion 3 of the housing 1 is rigidly secured to the cover 2 by bolts 8 and 9.

The operating components include bearing bushings 10 and 11, which act as guides and bearings for the operating rod 12, rigidly secured to the die cast cover 2, as may best be seen in Fig. 3.

The operating rod 12 is provided with an enlargement 13 which acts as a thrust bearing against the upper bushing 10 to limit the upward movement of the operating rod 12. The lower end portion 14 of the operation rod 12 is of a smaller size than the rest of the rod to provide a bearing surface 15 for the cam 16. A helical spring 17 surrounds the lower part of the reduced portion 14 of the operating rod 12 and rests on the lower bushing 11, the other end of the spring 17 supports the cam 16 and serves to bias the cam 16 into position against its bearing surface 15 on the operating rod 12, to thus bias the enlargement 13 on the operating rod 12 against the upper bushing 10.

The cam 16 is so positioned on the operating rod 12 that its surfaces are disposed between the rollers 31 and 32 on the bell crank levers 27 and 28. The bell-crank levers 27 and 28, identical in design, are provided on bearing pins 29 and 30, which are cast into the cover 2 and the horizontal arms of the bell-crank levers are provided with spring support elements 33 and 34 respectively. The spring support elements 33 and 34 are rollers with flat bottomed hardened V-shaped bearing surfaces, adapted to receive the ends of the leaf spring 35. The leaf spring 35 being so dimensioned that it is normally disposed or clipped, in an arcuate position between the rollers 33 and 34. The pivots 29 and 30 are provided for the bell-crank levers 27 and 28 in order that the spreading of the rollers 31 and 32 on the vertical arms of the bell-crank levers, upon a vertically downward movement of the cam 16 by the operating rod 12, will rotate the bell-crank levers clockwise and cause the spring support elements 33 and 34 to move equal distances toward each other, thus moving the middle of the spring 35 in the direction of the plunger 5 and in the line of movement of the plunger for actuating the switch 4. The leaf spring 35 biases the bell-crank levers for counter-clockwise movement to assure firm contact between the ends of spring 35 and spring support elements 33 and 34 on the horizontal arms of the bell-crank levers and between the cam contacting rollers 31 and 32 on the vertical arms of the bell-crank levers and the surfaces of cam 16.

When operating rod 12 is depressed, cam 16 is also moved in the same direction and the helical spring 17 is compressed. The movement of cam 16 in a downward direction causes the rollers 31 and 32 on the vertical legs of bell-crank levers 27 and 28 to ride up on the wide portion of the surfaces of the cam 16. Thus, the bell-crank levers 27 and 28 are rotated clockwise through equal angles.

The clockwise movement of bell-crank levers 27 and 28 through equal angles causes spring support elements 33 and 34 to move equal distances toward the axis of the plunger 5. This causes the middle of the leaf spring 35 to move in a straight line perpendicular to the line of movement of the operating rod 12; the line of movement of the leaf spring 35 being along the axis of the plunger 5 to actuate the snap switch 4.

The apparatus described and shown, in addition to providing a simple means for operating the switch 4 has other noteworthy features. The mechanism provides considerable movement amplification through leaf spring

35. A slight decrease in distance between the spring support elements 33 and 34 results in a relatively large deflection of the middle of leaf spring 35 perpendicular to its axis. With hardened V shaped bearing surfaces in spring support elements 33 and 34, a leaf spring 35 of proper selection, and the provision of hardened rollers and cams, the mechanism will operate for millions of operations without wear and without any change in the operating point.

The surfaces of the cam 16 above the rollers 31 and 32 are parallel to the direction of movement of the cam and the operating rod 12 so that the spring support elements 33 and 34 will be moved only a fixed distance toward each other regardless of the distance of travel of the operating rod 12.

The helical spring 17, which is subjected to compression when the operating rod 12 is depressed, returns the parts to their neutral position as soon as the operating rod is released by the actuating dog on the machine.

While but a single embodiment of the invention has been shown and described, it will be apparent to those skilled in the art that modifications may be made all within the spirit of the invention. It is to be particularly understood, therefore, that the invention is not limited to the details of the showing made but that the inventive scope is defined in the appended claim.

We claim as our invention:

In operating mechanisms for a plunger actuated device, comprising in combination, a base, a bell-crank lever pivotally mounted on the base, spring support means on one arm of the bell-crank lever, a corresponding spring support means disposed on the base in spaced relation to the spring support means on the bell-crank lever, a flat spring arcuately clipped between the spring support means, spring retaining means at the engagement of the spring ends with the spring support means, said spring retaining means and end pressure on the spring constituting the sole support for said spring, a cam disposed adjacent the other leg of the bell-crank lever, and means for imparting a rectilinear motion to the cam to rotate the bell-crank lever through a selected angle to thus effect a selected movement of the spring support means toward each other to thus make the spring arc more convex to actuate the plunger.

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