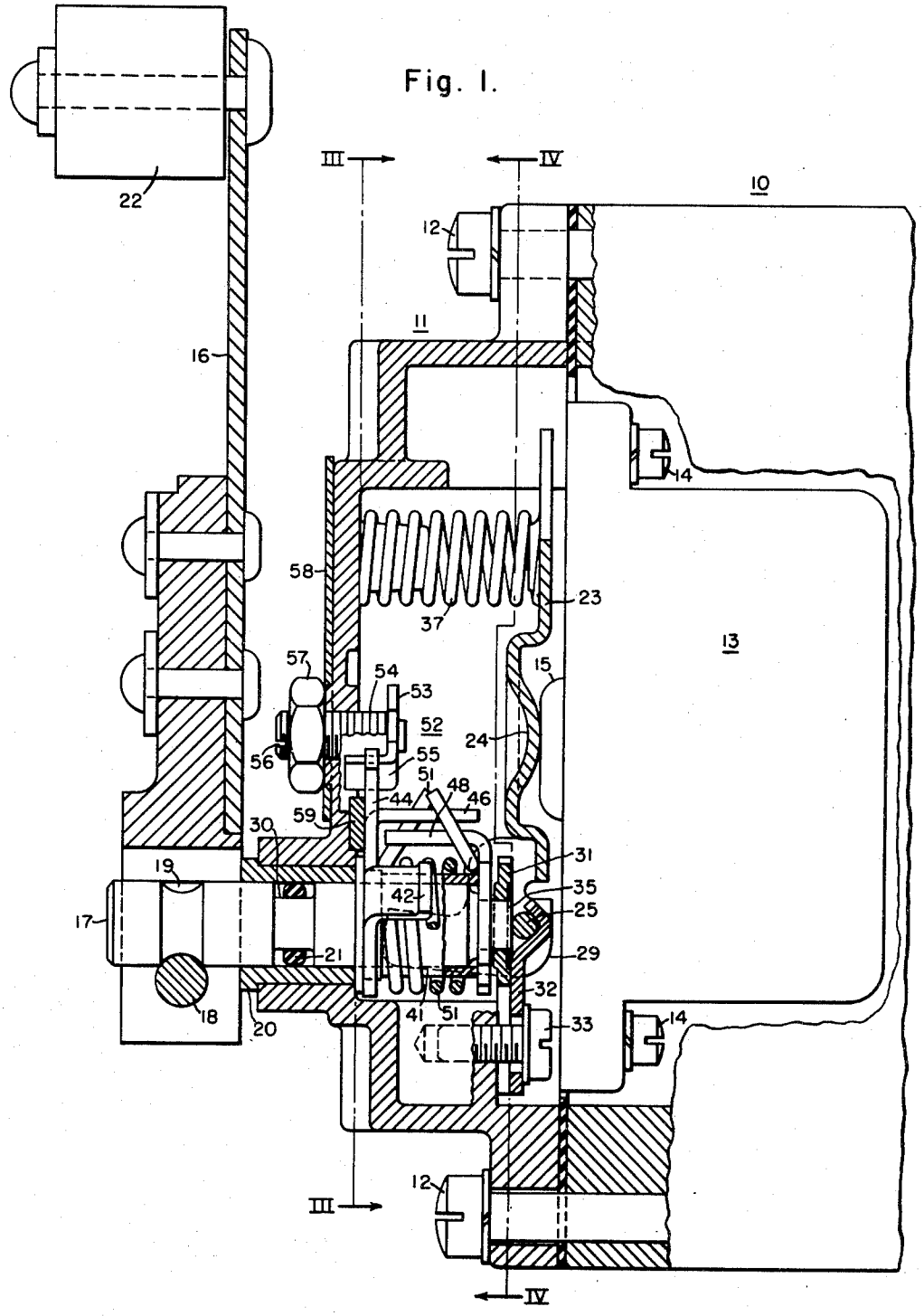
April 9, 1957 F. C. IGLEHART ET AL 2,788,402

SWITCH-ACTUATING MECHANISM

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Fig. 1.

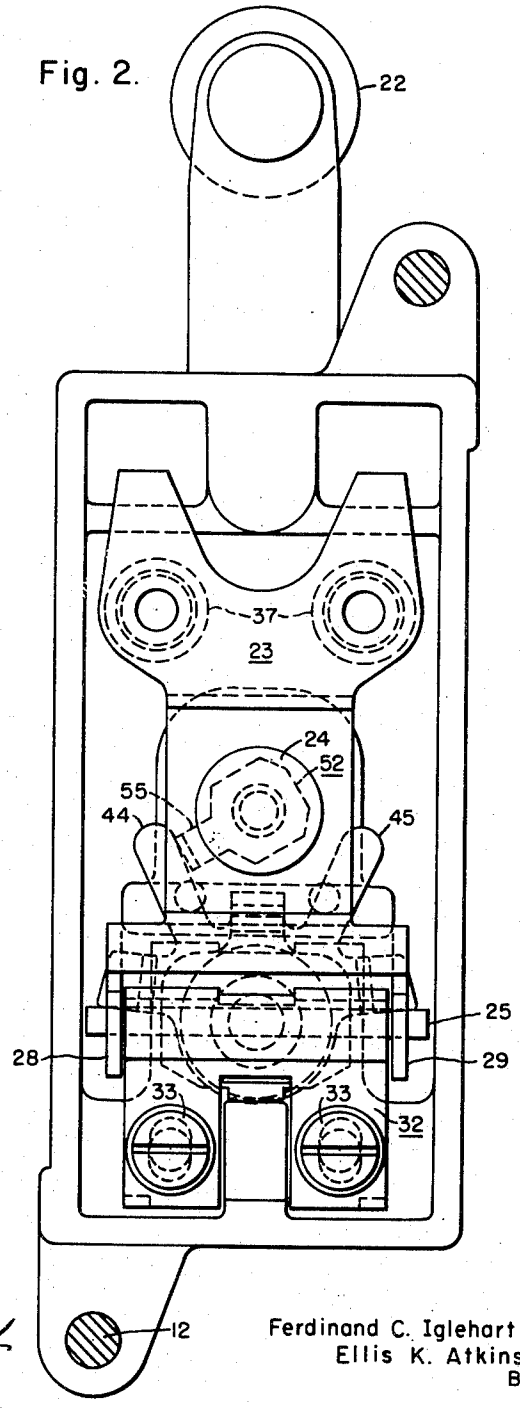


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SWITCH-ACTUATING MECHANISM

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Fig. 2.



WITNESSES

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BY

ATTORNEY

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SWITCH-ACTUATING MECHANISM

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Fig. 3.

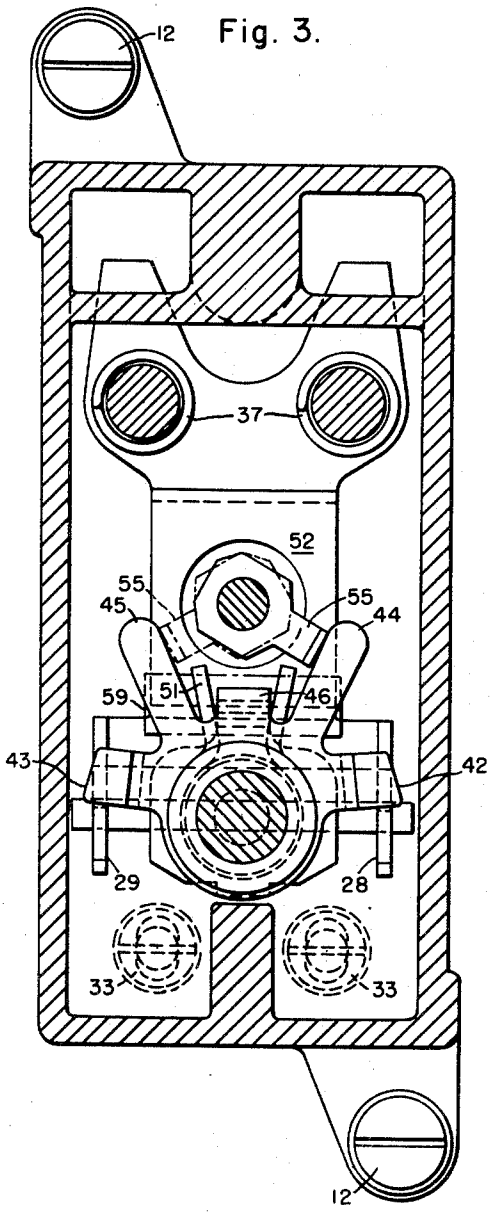
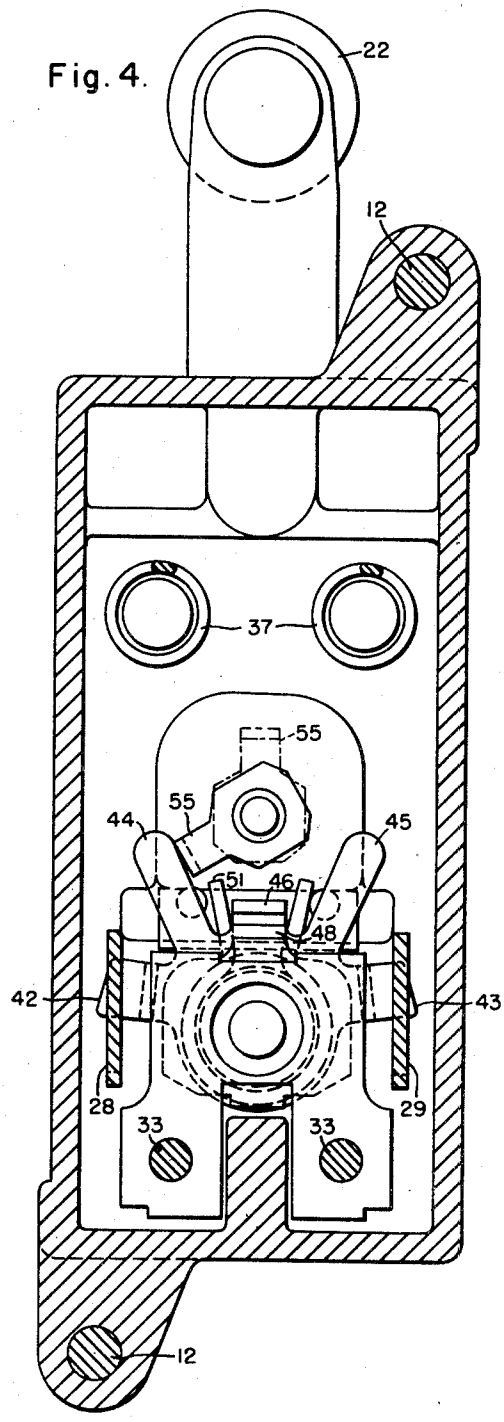


Fig. 4.



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SWITCH-ACTUATING MECHANISM

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Fig. 5.

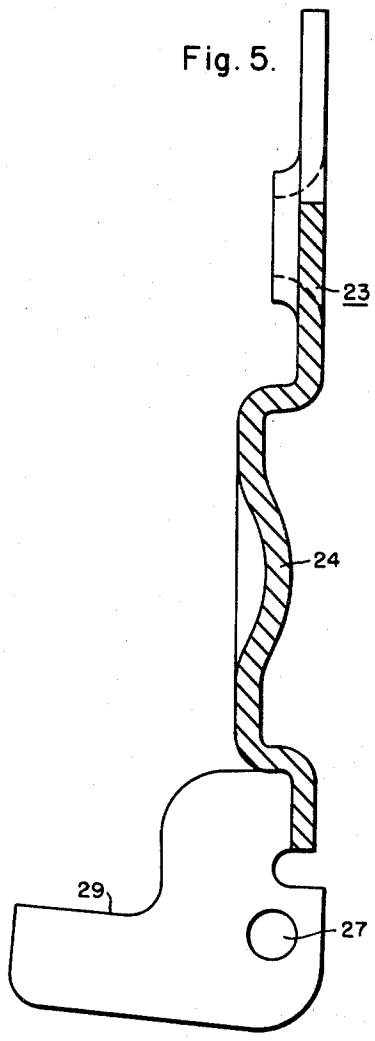


Fig. 6.

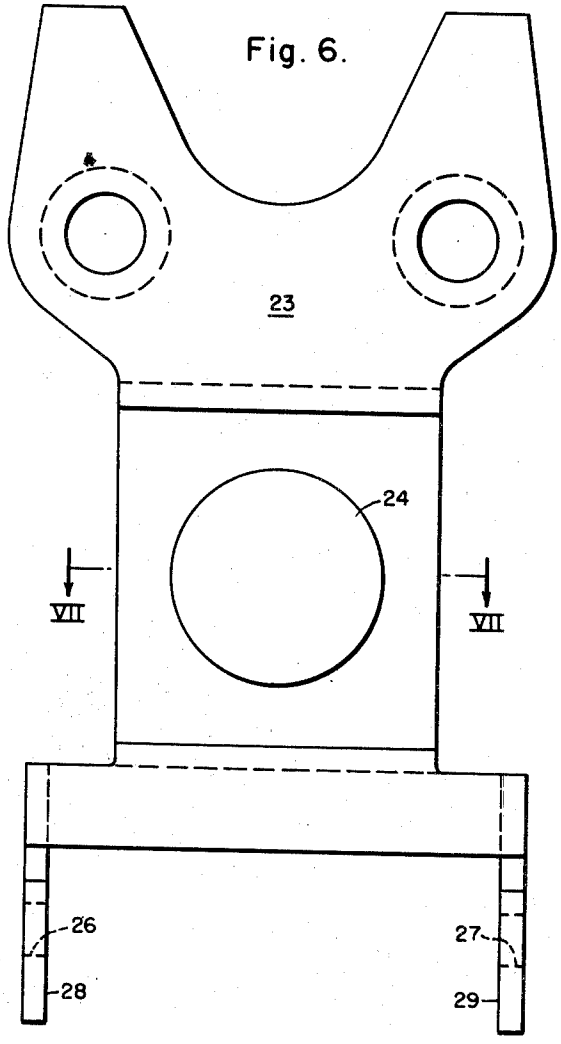


Fig. 7.

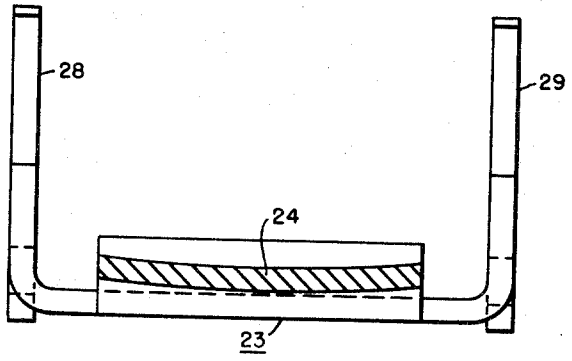


Fig. 8.

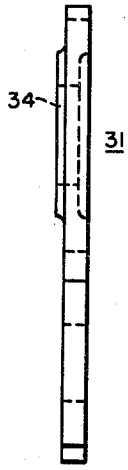


Fig. 9.

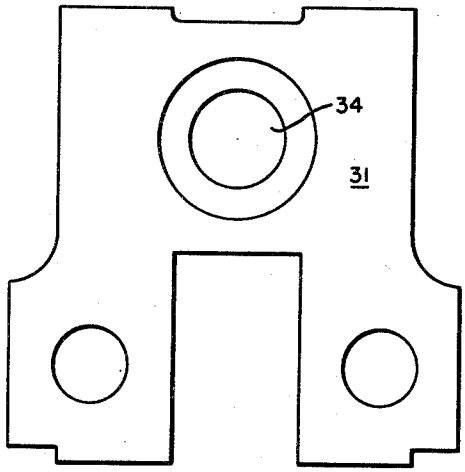


Fig. 10.

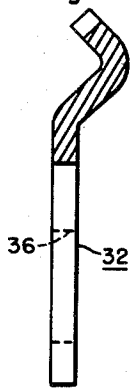


Fig. 11.

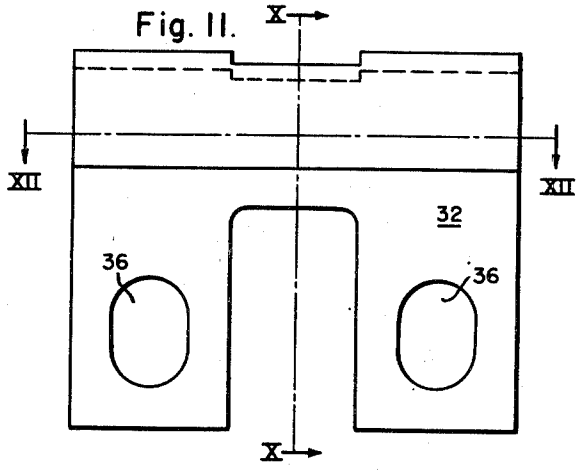
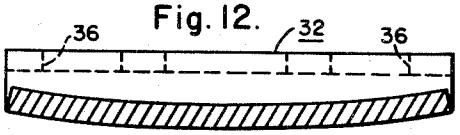


Fig. 12.



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SWITCH-ACTUATING MECHANISM

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Fig. 13.

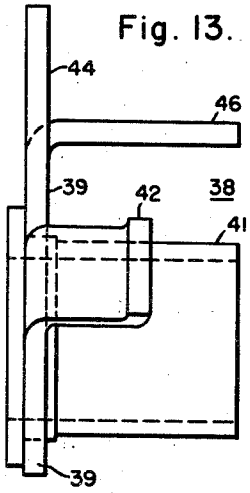


Fig. 14.

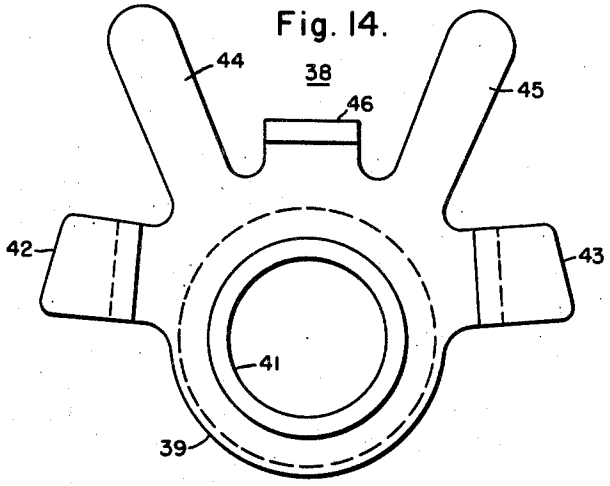


Fig. 15.

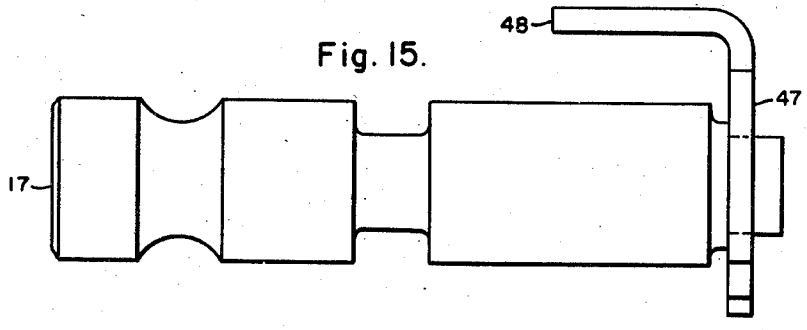


Fig. 17.

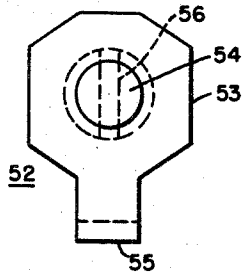


Fig. 16.

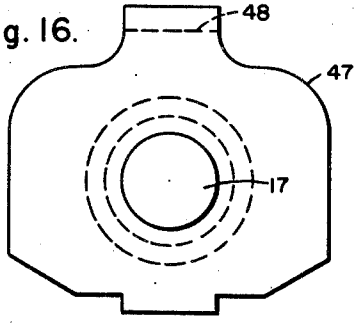
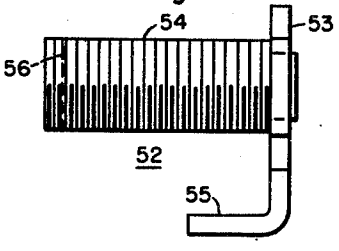


Fig. 18.



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2,788,402

SWITCH-ACTUATING MECHANISM

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Application May 10, 1955, Serial No. 507,196

10 Claims. (Cl. 200—47)

Our invention relates, generally, to switch-actuating mechanisms and, more particularly, to mechanisms for actuating limit switches.

Limit switches which are operated by rotatable lever arms are utilized to control the operation of machine tools and other electrically driven apparatus. It is desirable that the switches be capable of being set by the user to cause operation of the contained contact members upon clockwise rotation of the lever arm, or as an alternative upon counterclockwise rotation of the lever arm, or as a further alternative upon rotation of the lever arm in either of the two directions from an initial or neutral position. Heretofore, the manner of setting a switch for the desired operation has been somewhat complicated and required the removal and rearranging of certain parts of the switch.

An object of our invention, generally stated, is to provide a switch-actuating mechanism which shall be simple and efficient in operation and which may be economically manufactured and installed.

A more specific object of our invention is to provide a lever-operated limit switch which may be readily set for clockwise rotation of the operating lever arm, or for counterclockwise rotation, or for rotation of the lever arm in either direction from a neutral position.

Another object of our invention is to provide for returning the lever arm of a limit switch to an intermediate or neutral position after each operation in either a clockwise or a counterclockwise direction.

A further object of our invention is to provide an enclosed limit switch which may be changed from operation in one direction to operation in another direction without removing any parts from the enclosure.

Other objects of our invention will be explained fully hereinafter or will be apparent to those skilled in the art.

In accordance with one embodiment of our invention, the actuating plunger of a switch is normally held in one position by a spring-biased, pivotally mounted lever having two spaced arms which extend substantially at right angles to the lever. This lever is actuated to overcome the biasing spring pressure by an actuator having arms disposed to engage the arms on the lever. The actuator is selectively rotated in either direction by a plate secured to one end of a rotatable shaft having a lever arm secured to its other end. The plate drives the actuator through a torsion spring which permits the shaft to rotate when movement of the actuator is blocked by a selector which may be set for clockwise operation of the lever arm or for counterclockwise operation. The selector may also be set for operation of the lever arm in either direction from a neutral position. Setting of the selector may be done without removing the cover of the housing enclosing the switch and actuating mechanism.

For a better understanding of the nature and objects of the invention, reference may be had to the following

detailed description, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a view, partly in section and partly in side elevation, of a switch actuating mechanism embodying the principal features of the invention;

Fig. 2 is a view, in rear elevation of the mechanism shown in Fig. 1, part of the structure being removed;

Figs. 3 and 4 are views, in section, taken substantially along the lines III—III and IV—IV, respectively, in Fig. 1;

Fig. 5 is an enlarged view, partly in section and partly in side elevation, of a lever utilized in the actuating mechanism;

Fig. 6 is an enlarged view, in rear elevation, of the lever shown in Fig. 5;

Fig. 7 is an enlarged view, taken along the line VII—VII in Fig. 6;

Figs. 8 and 9 are enlarged views, in side and rear elevation, respectively, of a bearing plate utilized in the actuating mechanism;

Fig. 10 is an enlarged view, in section, taken along the line X—X of Fig. 11;

Fig. 11 is an enlarged view, in rear elevation of a clamping plate utilized in the mechanism;

Fig. 12 is an enlarged view, in section, taken along the line XII—XII in Fig. 11;

Figs. 13 and 14 are enlarged views, in side and rear elevation, respectively, of an actuator utilized in the mechanism;

Figs. 15 and 16 are enlarged views, in side and end elevation, respectively, of a shaft and actuating member utilized in the mechanism; and,

Figs. 17 and 18 are enlarged views, in rear and side elevation, respectively, of a selector utilized in the mechanism.

Referring to the drawings, and particularly to Fig. 1, the structure shown therein comprises a casing **10** having a cover **11** removably attached to the casing **10** by screws **12**. A snap-acting switch **13** is disposed inside the casing **10** and mounted on the cover **11** by means of screws **14**. The switch **13** may be of the type described in the copending application of R. B. Immel and M. Wibell, Serial No. 352,096, filed April 30, 1953, now Patent No. 2,773,144, issued December 4, 1956. The switch **13** has a bridging contact member (not shown) which is actuated from one position to another by means of an operating plunger **15**. The plunger **15** is biased outwardly by a spring disposed inside the housing which encloses the contact members of the switch **13**. In the present drawing, the plunger **15** is shown in the depressed position.

A lever arm **16** is clamped on the outer end of a shaft **17** by means of a bolt **18** disposed in a groove **19** in the shaft **17**. It will be noted that the angular position of the lever **16** on the shaft **17** may be changed through 360° since the groove **19** surrounds the shaft **17**. A bearing sleeve **20** is provided in the cover **11** for the shaft **17**. A rubber O-ring **21** in a groove **30** in the shaft **17** forms an oil seal in the bearing **20**. A roller **22** is mounted at the end of the lever **16** opposite the end attached to the shaft **17**. It will be understood that the roller **22** may be engaged by a member on the machine being controlled, thereby actuating the lever **16** to operate the switch **13** in the manner described hereinafter.

A lever **23**, having a curved portion **24** engaging the plunger **15**, is disposed to pivot about a pin **25**. The pin **25** passes through openings **26** and **27** provided in arms **28** and **29**, respectively, which extend from the lever **23** substantially at right angles to the base of the lever **23**. The structure of the lever **23** is shown in detail in Figs. 5, 6, and 7 of the drawings.

The pivot pin 25 is clamped to a bearing plate 31 by means of a clamping plate 32. The bearing plate 31 and the clamping plate 32 are attached to the cover 11 by screws 33. As shown in Figs. 8 and 9, the bearing plate 31 has an opening 34 therein. As shown in Fig. 1, the inner end 35 of the shaft 17 is mounted in the opening 34 in the bearing plate 31. The structure of the clamping plate 32 is shown in detail in Figs. 10, 11, and 12 of the drawings. As shown, the clamping plate 32 has elongated openings 36 therein for receiving the screws 33. Thus, the clamping plate 32 and the lever 23 may be adjustably mounted on the bearing plate 31.

As shown in Fig. 1, the upper end of the lever 23 is biased to the right by compression springs 37 which are disposed between the cover 11 and the lever 23. The two springs 37 are of sufficient strength to overcome the biasing force of the spring in the switch 13 which biases the plunger 15 to the left as shown in Fig. 1. Thus, the lever 23 normally maintains the plunger 15 in its depressed position.

In order to overcome the force of the springs 37, an actuator 38 is rotatably mounted on the shaft 17 for actuating the lever 23 about the pivot pin 25. As shown most clearly in Figs. 13 and 14, the actuator 38 comprises a member 39 which is secured to a flanged bushing 41. The member 39 has integrally formed arms 42 and 43 which extend rearwardly and outwardly. The member 39 also has integrally formed arms 44 and 45 which extend upwardly at an oblique angle. An arm 46 extends rearwardly substantially parallel to the bushing 41. As previously explained, the bushing 41 is rotatably mounted on the shaft 17. Thus, the shaft 17 is free to rotate inside the bushing 41.

As shown most clearly in Figs. 15 and 16, a plate or member 47 is secured to the inner end of the shaft 17. The plate 47 has an arm 48 which is bent to extend along the shaft substantially parallel to the shaft.

As shown in Fig. 1, the arm 46 on the actuator 38 overlaps the arm 48. As also shown in Fig. 1, the ends of a torsion spring 51 which surrounds the bushing 41 are disposed to engage the arms 46 and 48. Thus, the spring 51 functions to normally maintain the shaft 17 and the lever arm 16 in their neutral position, since the arms 42 and 43 of the actuator 38 normally engage the arms 28 and 29, respectively, of the lever 23. As previously explained, the lever 23 is normally biased to the right, as shown in Fig. 1, by the compression springs 37. The movement of the lever 23 to the right is limited by the arms 28 and 29 on the lever engaging the arms 42 and 43, respectively, on the actuator, thereby centering the actuator which, in turn, maintains the lever arm 16 in a mid or neutral position by means of the torsion spring 51.

As shown in Figs. 1, 17, and 18, a selector 52 is provided for selectively controlling the operation of the switch 13 by means of the lever arm 16. The selector 52 comprises a plate 53 secured to one end of a threaded stud 54. The plate 53 has an arm 55 which is bent to extend along the stud 54 substantially parallel to the stud.

As shown in Fig. 1, the stud 54 is threaded into the cover 11. A slot 56 is provided in the outer end of the stud 54 to permit the position of the arm 55 to be set from outside the cover 11 by means of a screwdriver or other tool without removing the cover from the casing 10. A lock nut 57 may be tightened on the stud 54 to retain the arm 55 in the desired position.

A name plate 58 on the front of the cover 11 may be provided with suitable indicia indicating the proper position of the selector 52 for obtaining the desired operation of the switch 13. It will be noted that the slot 56 is in alignment with the arm 55 of the selector, thereby indicating the position of the arm 55 inside the cover 11. A stop member 59 is provided for limiting the rotation of the selector 52 to approximately ⅔ of a revolution.

As shown in the drawings, the selector 52 is set to engage the arm 44 of the actuator 38. The lever arm 16 is shown in its neutral or undeflected position. When the lever arm 16 is rotated clockwise, as viewed from the front or left of the structure as shown in Fig. 1, the arm 48 which rotates with the shaft 17 transmits torque through the spring 51 to the arm 46 of the actuator 38, thereby rotating the actuator clockwise. The rotation of the actuator causes its arm 42 to depress the arm 28 of the lever 23, thereby actuating the lever about its pivot pin 25 to compress the springs 37 which, in turn, permits the plunger 15 of the switch 13 to be biased outwardly by the biasing spring within the switch 13. In this manner, the contact members of the switch 13 are actuated from one position to another. It is to be noted that the torsion spring 51 is of sufficient strength to overcome the compression springs 37 with little or no deflection of the spring 51.

Rotation of the lever arm 16 counterclockwise produces a corresponding rotation of the shaft 17 and the arm 48 of the plate 47. However, in this case, rotation of the actuator 38 is prevented by the arm 55 of the selector 52 engaging the arm 44 of the actuator 38. In this case, the torsion spring 51 deflects thereby permitting the lever arm 16 to move without producing operation of the switch.

When the arm 55 of the selector 52 is rotated to the position shown by the broken lines in Fig. 3 in which it engages the arm 45 of the actuator 38, counterclockwise rotation of the lever arm 16, as viewed from the front of the device, produces actuation of the contact members of the switch 13. In this case, counterclockwise torque is transmitted by the torsion spring 51 to the actuator 38 causing the arm 43 of the actuator to depress the arm 29 of the lever 23 to actuate the lever about the pivot pin 25 and compress the springs 37 to release the plunger 15 of the switch 13. Clockwise rotation of the lever 16 in this case produces merely a deflection of the torsion spring 51 since rotation of the actuator arm 45 is blocked by the selector arm 55.

When the selector arm 55 is set in a vertical position, as shown by the broken lines in Fig. 4, no obstruction is provided to prevent rotation of the actuator 38 in either direction. Therefore, rotation of the lever arm 16 in either clockwise or counterclockwise direction from its neutral position functions to release the plunger 15 of the switch 13, thereby actuating the contact members of the switch. Thus, the selector 52 may be set to cause operation of the switch 13 for either clockwise or counterclockwise rotation of the external lever arm 16. The selector may also be set to produce operation of the switch 13 with movement of the external lever arm in either direction from a neutral position.

From the foregoing description it is apparent that we have provided an actuating mechanism particularly suitable for operating limit switches which control the operation of machine tools or other electrically driven machines. However, the present mechanism is not necessarily limited in its application to the operation of limit switches.

The present mechanism is relatively simple in construction and it may be readily set or adjusted for different conditions of operation without it being necessary to remove any parts of the mechanism from the enclosing structure. In fact, the necessary adjustments can be made without it being necessary to remove the cover of the enclosing housing.

Since numerous changes may be made in the above-described construction, and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. In a switch-actuating mechanism, in combination, a switch having an operating plunger, a pivotally mounted lever for depressing said plunger, spring means for biasing said lever in one direction, a rotatable actuator for actuating the lever in the opposite direction, a rotatable shaft, means secured to the shaft for rotating the actuator, a torsion spring interposed between said means and the actuator for transmitting torque to the actuator, a selector for selecting the direction of rotation of the actuator, and a lever arm for driving said shaft.

2. In a switch-actuating mechanism, in combination, a switch having an operating plunger, a pivotally mounted lever for depressing said plunger, spring means for biasing said lever in one direction, a rotatable actuator for actuating the lever in the opposite direction, a rotatable shaft, means secured to the shaft for rotating the actuator, a torsion spring interposed between said means and the actuator for transmitting torque to the actuator, a selector for selecting the direction of rotation of the actuator, a lever arm for driving said shaft, and means for changing the position of said selector.

3. In a switch-actuating mechanism, in combination, a switch having an operating plunger, a pivotally mounted lever for depressing said plunger, spring means for biasing said lever in one direction, a rotatable actuator for actuating the lever in the opposite direction, a rotatable shaft, means secured to the shaft for rotating the actuator, a torsion spring interposed between said means and the actuator for transmitting torque to the actuator, a selector for selecting the direction of rotation of the actuator, a lever arm for driving said shaft, and means for changing the position of said selector, the position of said selector being changeable without removing it from the mechanism.

4. In a switch-actuating mechanism, in combination, a switch having an operating plunger, a pivotally mounted lever for depressing said plunger, said lever having a pair of spaced arms thereon, spring means for biasing said lever in one direction, a rotatable actuator for actuating the lever in the opposite direction, said actuator having oppositely disposed arms engaging the arms on the lever, a rotatable shaft, a lever arm for driving the shaft in opposite directions, a member secured to the shaft for rotating the actuator, a torsion spring connecting said member and said actuator, and a selector for selectively controlling the direction of rotation of the actuator to cause operation of the switch when the shaft is rotated in one direction and prevent operation of the switch when the shaft is rotated in the other direction.

5. In a switch-actuating mechanism, in combination, a switch having an operating plunger, a pivotally mounted lever for depressing said plunger, said lever having a pair of spaced arms thereon, spring means for biasing said lever in one direction, a rotatable actuator for actuating the lever in the opposite direction, said actuator having oppositely disposed arms engaging the arms on the lever, a rotatable shaft, a lever arm for driving the shaft in opposite directions, a member secured to the shaft for rotating the actuator, a torsion spring connecting said member and said actuator, a selector for selectively controlling the direction of rotation of the actuator to cause operation of the switch when the shaft is rotated in one direction and prevent operation of the switch when the shaft is rotated in the other direction, and means for positioning said selector to change the conditions of operation of the switch in accordance with the direction of rotation of the shaft.

6. A mechanism for actuating a switch having an operating plunger comprising a pivotally mounted lever for depressing the plunger, spring means for biasing said lever in one direction, a rotatable actuator for actuating the lever in the opposite direction, a rotatable shaft, means for driving the shaft in opposite directions, actuating means secured to the shaft for rotating the actuator, a spring connecting said actuating means and said actuator, and a selector for selectively controlling the direction of rotation of the actuator to cause operation of the switch when the shaft is rotated in one direction and prevent operation of the switch when the shaft is rotated in the other direction.

7. A mechanism for actuating a switch having an operating plunger comprising a pivotally mounted lever for depressing the plunger, spring means for biasing said lever in one direction, a rotatable actuator for actuating the lever in the opposite direction, a rotatable shaft, means for driving the shaft in opposite directions, actuating means secured to the shaft for rotating the actuator, a spring connecting said actuating means and said actuator, a selector for selectively controlling the direction of rotation of the actuator to cause operation of the switch when the shaft is rotated in one direction and prevent operation of the switch when the shaft is rotated in the other direction, and means for changing the position of said selector with respect to said actuator.

8. A mechanism for actuating a switch having an operating plunger comprising a pivotally mounted lever for depressing the plunger, spring means for biasing said lever in one direction, a rotatable actuator for actuating the lever in the opposite direction, a rotatable shaft, means for driving the shaft in opposite directions, actuating means secured to the shaft for rotating the actuator, a spring connecting said actuating means and said actuator, and a selector cooperating with said actuator to control the operation of the switch in accordance with the direction of rotation of the shaft.

9. A mechanism for actuating a switch having an operating plunger comprising a pivotally mounted lever for depressing the plunger, spring means for biasing said lever in one direction, a rotatable actuator for actuating the lever in the opposite direction, a rotatable shaft, means for driving the shaft in opposite directions, actuating means secured to the shaft for rotating the actuator, a spring connecting said actuating means and said actuator, and a selector cooperating with said actuator to cause operation of the switch when the shaft is rotated in one direction, said selector being movable to a position causing operation of the switch when the shaft is rotated in the other direction.

10. A mechanism for actuating a switch having an operating plunger comprising a pivotally mounted lever for depressing the plunger, spring means for biasing said lever in one direction, a rotatable actuator for actuating the lever in the opposite direction, a rotatable shaft, means for driving the shaft in opposite directions, actuating means secured to the shaft for rotating the actuator, a spring connecting said actuating means and said actuator, and a selector cooperating with said actuator to cause operation of the switch when the shaft is rotated in one direction, said selector being movable to a position causing operation of the switch when the shaft is rotated in the other direction, said selector also being movable to a position causing operation of the switch when the shaft is rotated in either direction from a neutral position.

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