Feb. 23, 1954 J. N. ANDERSON ET AL 2,670,415

LIMIT SWITCH

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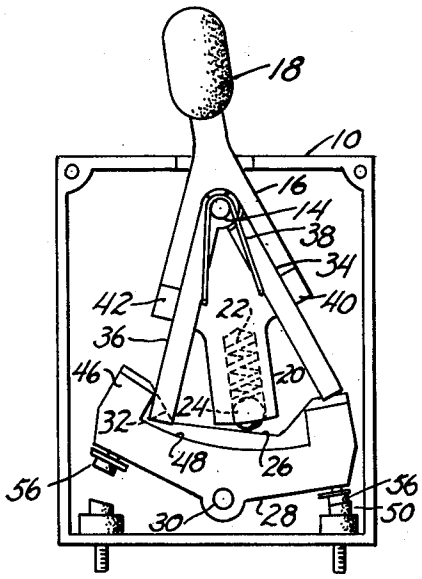


Fig. 1

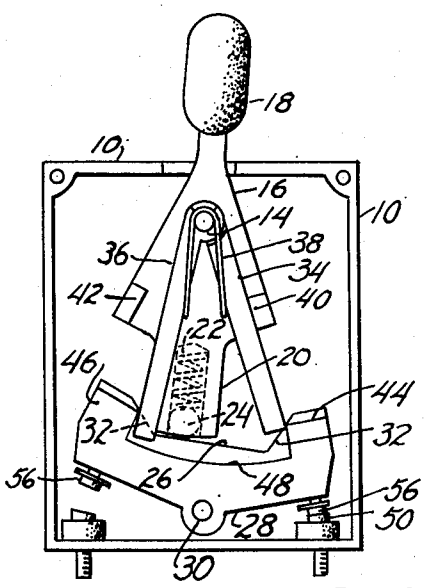


Fig. 2

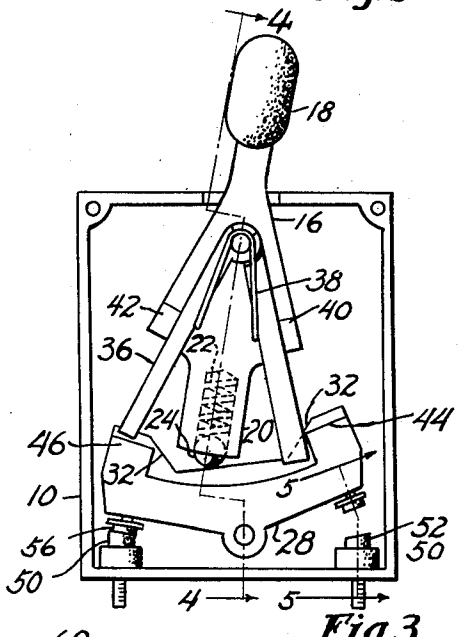


Fig. 3

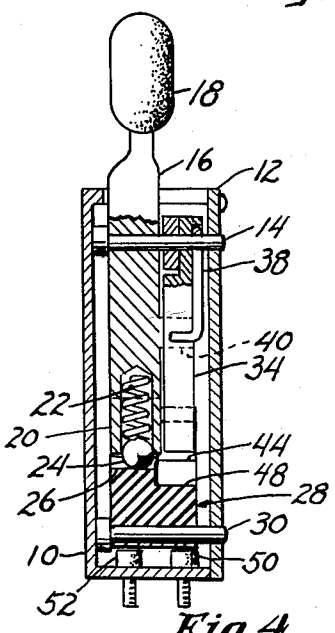


Fig. 4

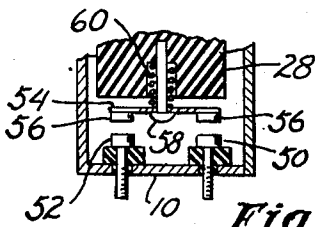


Fig. 5

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LIMIT SWITCH

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5 Claims. (Cl. 200—70)

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This invention relates to snap action electrical switches and is concerned, in particular, with a switch snap action incorporating latching arrangements.

While it is realized that the prior art teaches latching snap action switches, the switch of this invention is considered to be more simple and direct in its action than those of the prior art, and incorporates over-riding means by which action of the switch may be enforced by the operating member if, through failure of some of the switch parts, the elastic snap action fails to operate.

A typical arrangement of the switch of this invention is shown in the accompanying drawings which show the principles of operation. The embodiment shown in the drawings, however, is not deemed to limit the scope of the invention since the switch action may be adapted to a multitude of purposes for enabling precise switch operation according to the position of the operating members. A switch of this sort may, for instance, be utilized for limit stops in machine tools, in electrically actuated aircraft propellers and other environments.

Referring to the drawings, Figs. 1, 2 and 3 are frontal elevations of the switch and its component parts shown in different positions of adjustment, and Figs. 4 and 5 are sections on the lines 4—4 and 5—5 of Fig. 3.

The switch comprises a supporting structure or housing 10 which may conveniently be arranged as a closable box having a cover 12 which may be secured thereto as by screws. To one wall of the support, a pivot 14 is securely attached and upon this pivot 14 an operating member 16 is journalled, to swing back and forth through an appropriate angle. The member 16, as shown, includes an operating handle 18 which may be replaced with some device which is appropriate for cooperating with cams or other actuating devices comprising parts of a mechanism. The member 16 includes a depending portion 20 which is bored to receive a spring 22 and a ball 24, the ball bearing upon a platform 26 formed on the upper part of a rocker 28. The rocker is journalled on a pivot 30 secured to the support structure 10. The line of motion of the ball 24 as pressed by the spring 22 is on a radius from the pivot 14 as a center. With the elements in the position shown in Fig. 1, the ball 24 bears on the rocker 28 at a point off-set from the pivot 30, thereby pressing the rocker 28 in a clockwise direction. When the member 16 is swung clockwise as shown in Fig. 2, the ball travels along the platform 26

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to the other side of a line joining the pivots 14 and 30, urging the rocker 28 in a counter-clockwise direction.

At the ends of the platform 26 raised ramps 32 are provided. If the member 16 is moved far enough, for instance clockwise as shown in Fig. 2, and if the rocker 28 fails to rock in counter-clockwise direction under the influence of the spring 22, the lower end 20 of the member 16 will bear upon the left hand ramp 32 and force movement of the rocker 28 in a counter-clockwise direction.

In order to restrain rocking of the rocker 28 until a certain angular travel of the handle 18 has been effected, a pair of arms 34 and 36 are swung on the pivot 14. These arms are urged apart by a spring 38 which, as shown, embraces the pivot 14 and bears on the inner sides of the arms 34 and 36, urging them apart and into engagement with abutments 40 and 42 formed on the member 16.

On the rocker 28 and in the plane of the arms 34 and 36 we provide space for shoulders 44 and 46 which rise from a recessed portion 48 formed in the rocker. These shoulders 44 and 46 provide stops to prevent rocking of the rocker 28 when engaged by one or the other of the arms 34 and 36.

Referring to Fig. 1, it will be noted that rocker 28 is in its extreme clockwise position. When it is desired to throw the rocker in a counter-clockwise direction the handle 18 is swung clockwise. As this clockwise movement occurs, the abutment 40 presses the arm 34 to the left. When the ball 24 is over-center, the rocker 28 is urged in a counter-clockwise direction by the ball 24 but is prevented from turning by the engagement of the arm 34 with the shoulder 44. As clockwise movement of the member 16 continues, the position of Fig. 2 is reached where the arm 34 drops off the shoulder 44, leaving the spring 22 and ball 24 free to snap the rocker 28 in the counter-clockwise direction, whereupon the right hand end of the rocker 28 rises so that the arm 34 occupies the right hand end of the recess 48. During the foregoing sequence, the arm 36 which has been in the recess 48 in its left hand end, is released from the recess when the rocker snaps over, so that the arm 36 lies above the shoulder 46 as shown in Fig. 3. In this position, the rocker 28 has moved to its extreme counter-clockwise position.

When the handle 18 is moved to the left, a sequence similar to that above described takes place except in reverse. That is, the arm 36 bears

on the shoulder 46 and is gradually moved to the right off the shoulder, as the handle 18 moves counter-clockwise. At a particular point in the movement of the handle 18, the arm 36 drops off the shoulder 46 permitting the rocker 48 to snap in a clockwise direction under the influence of the spring 22.

Thus, it will be seen that we have provided a snap action arrangement where the snap of the rocker 28 in either direction is precisely controlled, in response to the direction of motion of the handle 18 and to precise positions of the handle 18 during its travel.

The switching accomplished by the rocker 28 is attained by mounting a pair of contacts 50 and 52 at the bottom of the support 10. A bridge piece 54 carrying contacts 56 is mounted on the rocker 28, which at times connects the contacts 50 and 52. The bridge piece is loosely mounted upon a pin 58 secured in the rocker 28, the bridge piece being urged downwardly by a spring 60. When the rocker 28 moves to its counter-clockwise position the contacts 56 will engage the contacts 50 and 52 to close an appropriate electrical circuit. The spring 60 is desirable to assume tolerances allowed by slight oscillation of the rocker 28 during shift of the loading ball 24 to either side of the center position defined by the line between the pivots 14 and 30. The head on the pin 58 affords positive separation of the contacts when the rocker is moved away from the fixed contacts.

A similar set of contacts to those shown in Fig. 5 may be arranged on the other side of the housing 10 so that a circuit may be made or broken for either direction of swing of the switch. Alternatively, in a manner which is well known in the art, the switch points may be rearranged to provide for the simultaneous making or breaking of two circuit lines for one throw of the switch. Various other switching combinations may be arranged.

The arrangement shown is susceptible to a variety of rearrangements in detailed structure. For instance, the spring 38 may comprise leaves or any other resilient device to separate the arms 34 and 36 and to urge them at all times into engagement with the abutments 40 and 42 respectively. The loading spring 22 is susceptible to various arrangements to provide the force necessary to urge the rocker 28 in one direction or the other, in response to movement of the operating member 16.

Preferably, the rocker 28 is provided with hard surfaces on the tops and corners of the shoulders 44 and 46, and on the platform 26, to minimize wear.

Though one embodiment of the invention is shown it is to be understood that the invention may be applied in various forms and in various enviroments. Changes may be made in the arrangements shown without departing from the spirit of the invention. Reference should be had to the appended claims for definition of the limits of the invention.

What is claimed is:

1. A snap switch comprising a support, an operating member pivoted thereon, said member including a pair of opposed abutments spaced from said pivot, and including a spring presser having a line of action radial relative to said pivot, the line of action lying substantially midway between said abutments and in a plane spaced therefrom, a pair of elements mounted on said pivot and extending along said member, lying between said abutments and each engageable with one abutment, resilient means spreading said elements apart toward engagement with respective abutments, a rocker pivoted on said support having a track engaged by said spring presser, said rocker having spaced dogs engageable at times by said elements, an electrical contact carried by said rocker, and an electrical contact on the support engageable by the rocker contact and disengageable therefrom as the rocker is swung on its pivot, said track having inclined ramps at its ends for engagement by said member for enforcing rocker movement upon failure of said spring presser to move the rocker.

2. A snap switch comprising a support, an operating member pivoted thereto for limited swinging, a rocker pivoted on the support for limited swinging, said pivots being spaced from one another, resilient means acting between the member and rocker operable to swing the rocker counter-clockwise as the member is swung clockwise and vice versa, latching means normally operative to hold the rocker against swinging movement, an abutment on the member for positively moving said latching means with the member as the latter is swung, a release shoulder on the rocker on which the latching means normally bears, said latching means upon member movement, moving off said shoulder to allow rocking of the rocker under the influence of said resilient means, and coactable electric contacts on the rocker and support, said rocker having ramps thereon engageable by the operating member to enforce rocker movement upon failure of the resilient means to move the rocker.

3. A snap switch comprising a pivoted switch rocker having a contact, a fixed contact engageable thereby; means for moving said rocker to engage and disengage said contacts including a separately pivoted operating member, resilient means between said member and rocker for urging movement of said rocker upon movement of said member; means for latching said rocker in contact-engaged and contact-disengaged positions, including spaced shoulder on the rocker, latch arms movable with and with respect to the operating member and engageable at times with said shoulders, abutments on the operating member engageable with the latch arms, and resilient means urging the latch arms into engagement with said abutments and additional abutment means on the rocker contactable by the operating member upon over-swing thereof to enforce rocker movement after release of the rocker by a latch arm, should the rocker have failed to swing under the influence of said resilient means.

4. A latching snap switch comprising a pivoted rocker having a contact thereon, a fixed contact engageable thereby, said rocker being swingable through a limited angle to engage and disengage said contacts, said rocker having a platform with a hard wear-surface and abutments at each end of the platform, said rocker also having, in a plane spaced from the platform plane, a depressed portion and shoulders at each end of the depressed portion; an operating member pivoted on an axis spaced from and parallel to the rocker pivot, said member including a resilient presser engaged with the rocker platform and movable therealong upon movement of the member to exert a force on the rocker to swing it one way or the other depending on which side of the rocker center the presser bears, said member be-

ing engageable with one or the other of said rocker platform abutments to enforce rocker swinging; a pair of swingable latch arms on said member pivot, means to urge said arms apart, spaced abutments on the member, spaced from the member pivot, one disposed on the outside of each latch arm and engageable therewith, said latch arms extending to the zone of said rocker shoulders and being engageable therewith to prevent swinging of said rocker, each said latch arm being movable at times by the member abutment to disengage the corresponding rocker shoulder, and to allow rocker swinging under the urging of said resilient presser.

5. A latching snap switch comprising a pivoted rocker having a contact thereon, a fixed contact engageable thereby, said rocker being swingable through a limited angle to engage and disengage said contacts, said rocker having a platform with a hard wear-surface and abutments at each end of the platform, said rocker also having, in a plane spaced from the platform plane, a depressed portion and shoulders at each end of the depressed portion; an operating member pivoted on an axis spaced from and parallel to the rocker pivot, said member including a resilient presser engaged with the rocker platform and movable therealong upon movement of the member to exert a force on the rocker to swing it one way or the other depending on which side of the

rocker center the presser bears, said member being engageable with one or the other of said rocker platform abutments to enforce rocker swinging; a pair of swinging latch arms pivoted on the switch, each having a portion extending to the zone of said rocker shoulders and being engageable therewith to prevent swinging of said rocker, resilient means urging said latch arms into positions to interrupt movement of said rocker, and abutment means on said operating member engageable at times with one or the other of said latch arms, each said latch arm being moveable at times by the member abutment means to disengage said rocker and to allow movement of said rocker under the urging of said resilient presser.

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