

[54] SAFETY REVERSING SWITCH

[75] Inventors: Robert E. Sheahan, Woodbridge;
Frank J. Plumb, Prospect, both of
Conn.

[73] Assignee: JBT Instruments, Inc., New Haven,
Conn.

[22] Filed: July 28, 1972

[21] Appl. No.: 276,248

[52] U.S. Cl.200/78, 200/67 A

[51] Int. Cl.H01h 15/18

[58] Field of Search200/67 A, 67 R, 78

[56] References Cited

UNITED STATES PATENTS

2,205,483 6/1940 Krieger.....200/78
2,242,167 5/1941 Bentley et al.....200/78

Primary Examiner—David Smith, Jr.

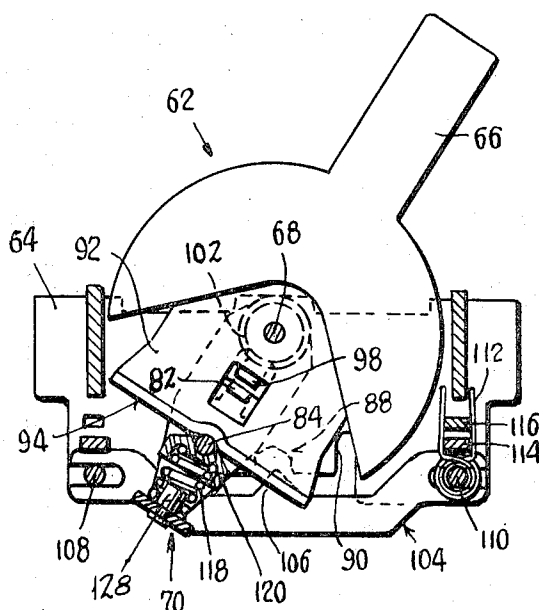
Attorney—H. Gibner Lehmann

[57] ABSTRACT

A lever-type operating mechanism for a safety reversing switch, comprising a manually operable

lever having pivot means enabling it to undergo swinging movement, a U-shaped operating member disposed adjacent and actuated by the lever and having a pair of arms with elongate slots. A control means, which includes a cross pin extending through the slots, effects a snap movement of the operating member and pin when the lever is actuated. The mechanism includes an insulating slide plate which carries a switch contact and which has a slot through which the cross pin extends. The slide plate is characterized by a pair of hardened steel wear shoes, having flanges which extend into the slot of the plate to sustain impact forces from the pin during the snap movements of the latter taken over a long period of time. The wear shoes are disposed on opposite sides respectively of the slide plate and have two sets of aligned apertures by which they are rigidly fastened thereto by means of rivets. The control means further comprises a compression spring carried by the operating member and a cup also carried thereby and having an indented bottom which engages the cross pin. One end of the spring is received in the cup, such that the spring is securely positioned or oriented as it biases the cross pin toward one set of corresponding ends of the elongate slots in the arms of the operating member.

5 Claims, 17 Drawing Figures



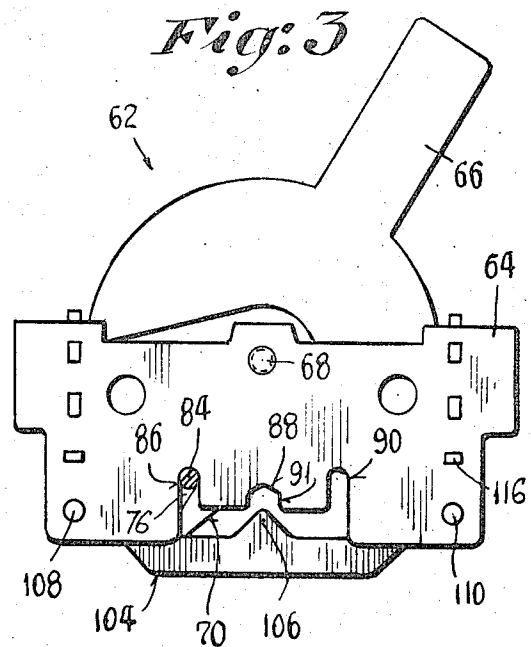
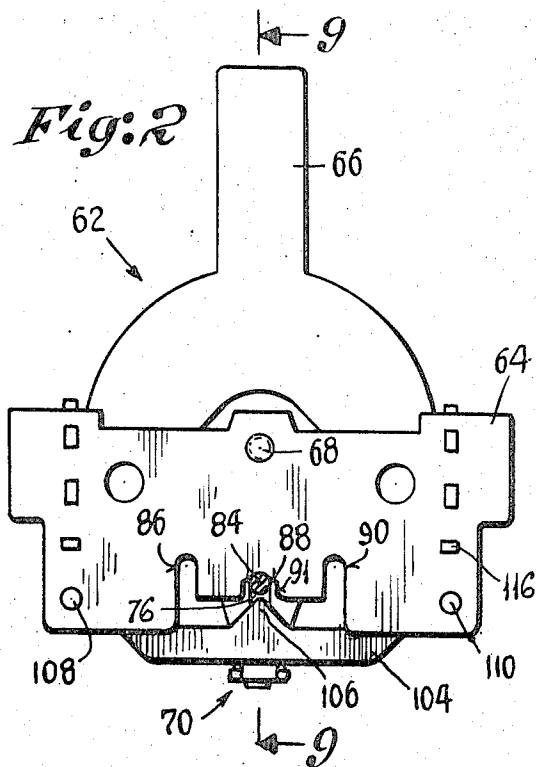
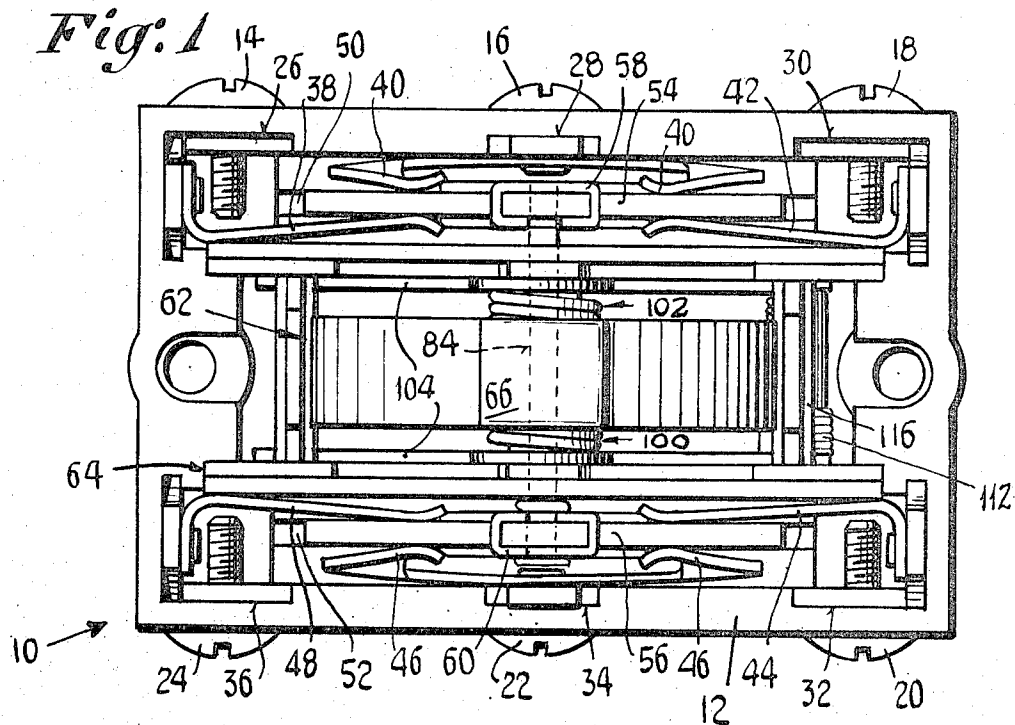


Fig. 4

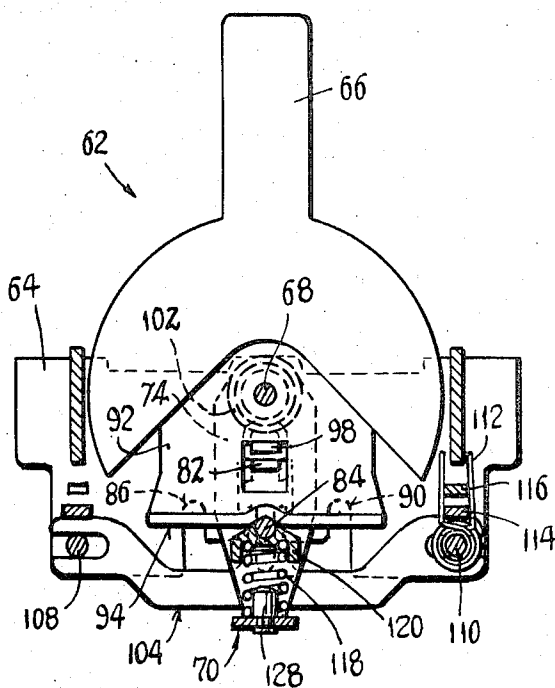


Fig. 5

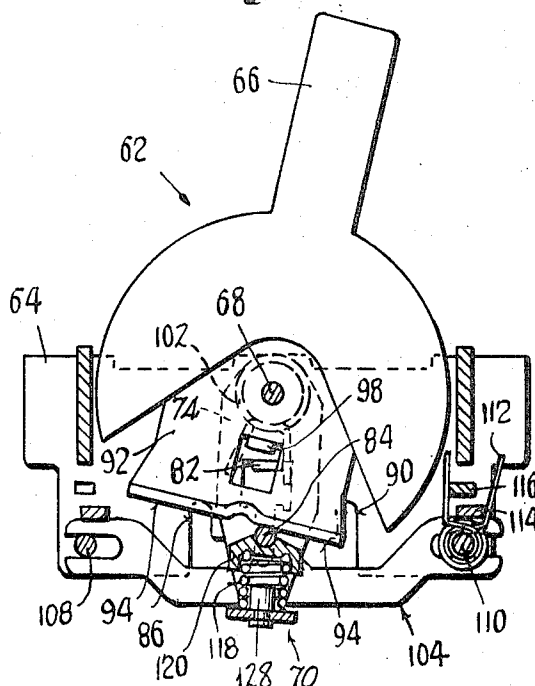


Fig. 6

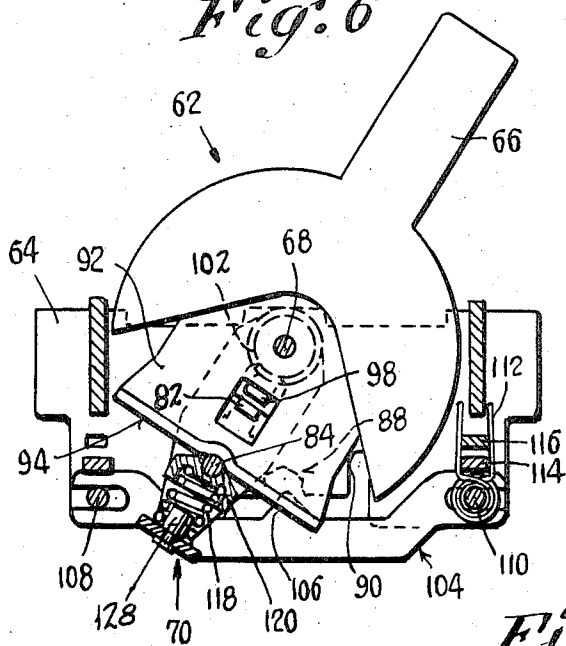


Fig. 7

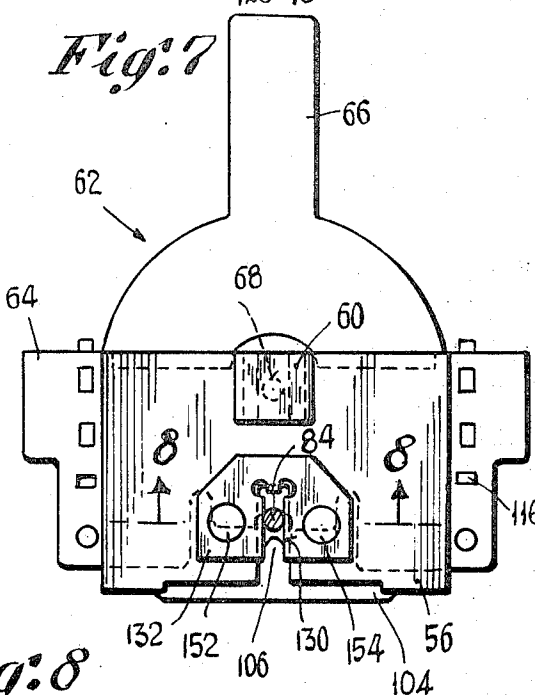
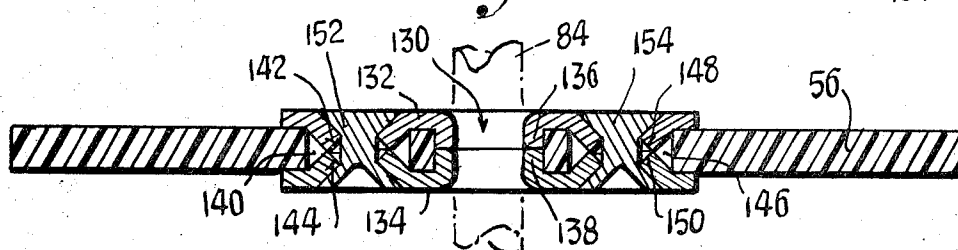
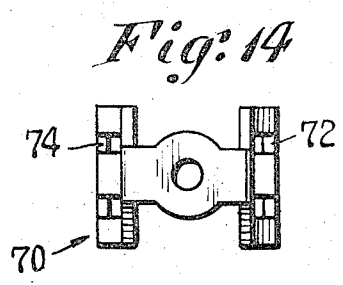
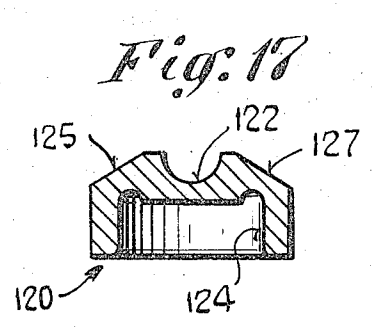
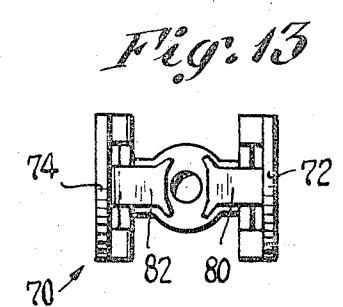
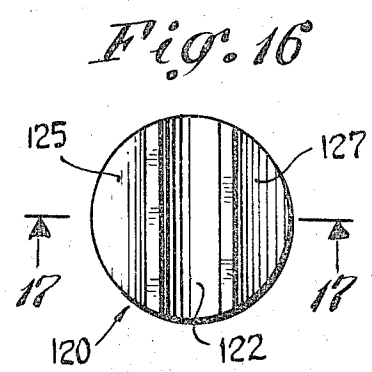
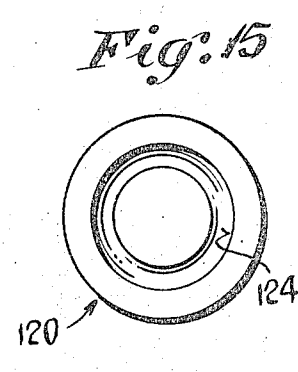
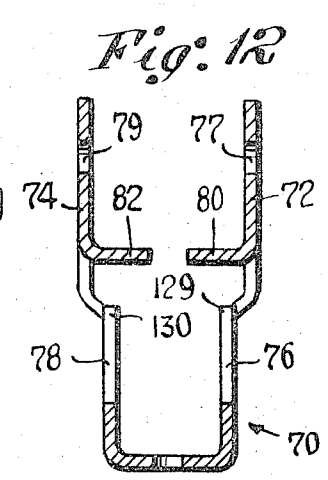
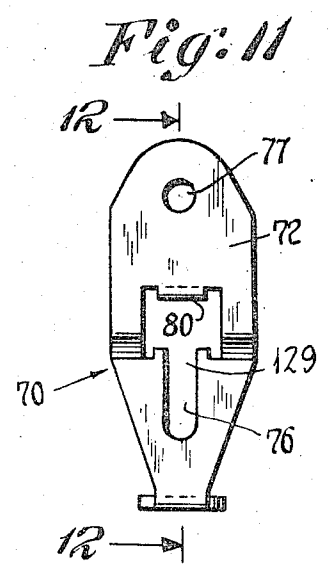
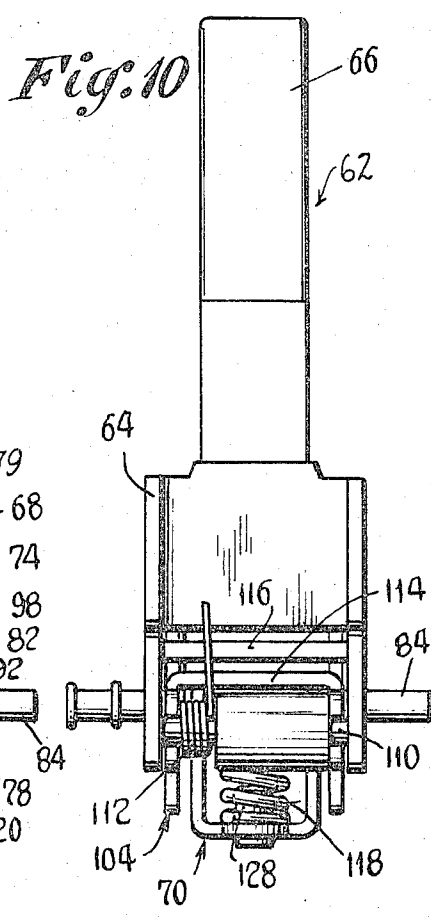
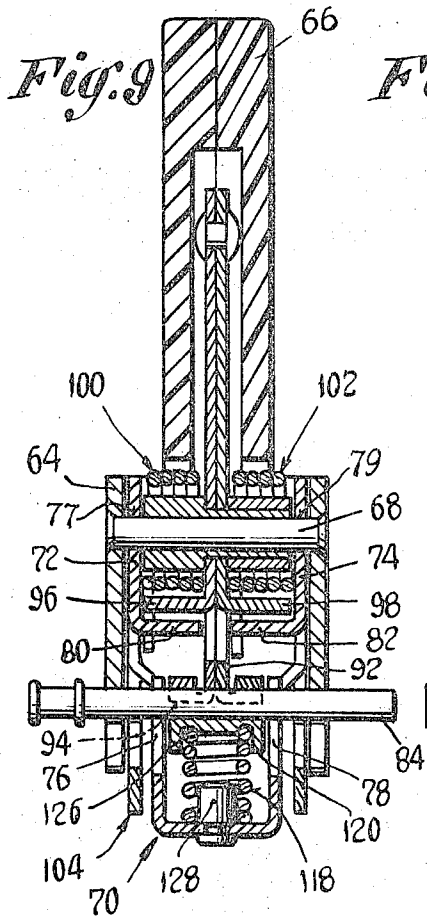


Fig. 8





SAFETY REVERSING SWITCH

NO CROSS REFERENCES TO RELATED APPLICATIONS

BACKGROUND

This invention relates generally to lever-type toggle switches, and more particularly to multi-position switches of the kind having safety detent means for preventing continuous actuation of the switch contacts from one "energized" position to a second "energized" position without first undergoing a momentary dwell at an intermediate or "off" position. Such a safety reversing switch is disclosed in U.S. Pat. No. 2,242,167 entitled, "Multiposition Electric Switch." One embodiment of the switch disclosed therein provides a manually operable lever for actuating a pivotally mounted operating member (designated by the numeral 62 in the patent). The operating member carries a cross pin (32) which extends sufficiently far in one direction to engage a slot (31) in an insulating slide member (28) on which there is carried an electrical contact (24, FIG. 4 of the patent). The operating member and pin are so arranged as to undergo snap movement when the manually operable lever is actuated. Due to the continued impact of the pin (32) on the edge portions of the slot (31), the relatively soft insulating material of which the slide member was constituted suffered fatigue after relatively few operations. This in turn led to cracking of the slide member in the vicinity of the slot, and resulted in completely unsatisfactory operation of the switch mechanism after a period of time.

The prior patented switch mechanism carries a compression spring to bias a yoke and pin toward slot ends in metal stampings (64, 66). It was found that during the operating of the switch, the spring would become misaligned because of lack of suitable guide means therefor. An alternate prior construction wherein the one end of the spring directly engaged the cross pin was also found to be less than satisfactory, since the lateral surface of the pin did not present an adequate "seat" for the spring. As a result, the operation of this prior switch was often erratic; and after repeated actuation, failure inevitably occurred.

SUMMARY

The above disadvantages and drawbacks of this prior patented switch construction are obviated by the present invention, which has for an object the provision of a novel and improved lever type safety, reversing switch operating mechanism which is especially simple in construction and extremely reliable in operation. A related object is the provision of a heavy-duty operating mechanism as above characterized, wherein the likelihood of premature failure is significantly reduced, thus lessening the need for frequent maintenance or servicing.

These objects are accomplished by an improved operating mechanism comprising a lever actuated U-shaped operating member having a pair of arms provided with elongate slots, in conjunction with control means including a cross pin extending through the slots in the arms, for effecting snap movement of the operating member and pin when the lever is operated. There is provided an insulating slide plate carrying a switch

contact and having a slot through which the cross pin extends, the slot being characterized by a pair of hardened steel wear shoes which are riveted to the slide plate and provide reinforcement therefor. The control means includes a compression spring carried by the operating member and a cup also carried thereby, the cup having an indented bottom which is engaged by the cross pin, such that the spring is accurately and reliably confined, and biases the pin toward one set of corresponding ends of the elongate slots in the arms of the operating member.

Other features and advantages will hereinafter appear.

In the drawings, illustrating one embodiment of the invention:

FIG. 1 is a top plan view of a safety reversing switch incorporating the improved operating mechanism of the present invention, the switch being shown with its cover removed.

FIG. 2 is a side elevational view of a portion of the operating mechanism of the present invention, wherein the operating member and the cross pin are shown occupying an intermediate or "off" position.

FIG. 3 is a view like that of FIG. 2 but showing the operating member and cross pin in an extreme or end "on" position.

FIG. 4 is a vertical sectional view of the portion of the operating mechanism of FIGS. 2 and 3, wherein the operating member and the cross pin occupy the "off" position illustrated in FIG. 2.

FIG. 5 is a view like that of FIG. 4 but showing the positions of the operating member and the cross pin as the manually operable lever is being actuated.

FIG. 6 is a view like that of FIGS. 4 and 5 but showing the extreme end positions of the operating member and the cross pin.

FIG. 7 is a side elevational view of the operating mechanism of the present invention, particularly illustrating the slotted slide member and wear shoes therefor.

FIG. 8 is a fragmentary section taken on line 8—8 of FIG. 7.

FIG. 9 is a vertical sectional view of a portion of the operating mechanism, taken on line 9—9 of FIG. 2.

FIG. 10 is a right end elevational view of that portion of the operating mechanism which is illustrated in FIG. 2.

FIG. 11 is a front elevational view of the U-shaped operating member employed in the operating mechanism of the present invention.

FIG. 12 is a section of the operating member, taken on line 12—12 of FIG. 11.

FIG. 13 is a top plan view of the operating member of FIG. 11.

FIG. 14 is a bottom plan view of the operating member of FIG. 11.

FIG. 15 is a bottom plan view of a spring support cup carried by the operating member of the mechanism of the present invention.

FIG. 16 is a top plan view of the cup of FIG. 15.

FIG. 17 is a section taken on line 17—17 of FIG. 16.

Referring first to FIG. 1 there is illustrated a multiposition snap switch generally designated by the numeral 10, the switch being shown with its top cover plate removed. The switch 10 comprises a hollow cas-

ing 12 on which there are mounted screw terminals 14, 16, 18, 20, 22 and 24, suitable for connection to leads from an external circuit. The casing 12 is provided with recessed portions 26, 28, 30, 32, 34 and 36 which receive the screw terminals respectively, and hold the same captive in fixed positions. The terminals 14-24 are connected with resilient contact fingers designated 38, 40, 42, 44, 46 and 48 respectively, preferably constituted of spring material such as phosphor-bronze.

The casing 12 has two longitudinally extending grooves 50 and 52 in which there are received insulating slide members 54 and 56 respectively, adapted to move longitudinally between oppositely disposed extreme positions. The slide member 54 carries a contact 58 which is engageable with the resilient contact fingers 38 and 40 to electrically connect these when the slide member 54 is in one extreme position, and which is engageable with the resilient contact fingers 40 and 42 to electrically connect these latter when the member 54 is in its other extreme position. In a similar manner, the slide member 56 carries a contact 60 which alternately engages either the resilient contact fingers 46 and 48 or else the fingers 44 and 46 as the member moves between extreme positions.

The slide members 54 and 56 are simultaneously shifted by means of a lever-type actuator mechanism generally designated 62 in FIG. 1. The mechanism 62 is illustrated in more detail in FIGS. 2-7 and 9-10, and comprises a frame 64 and a manually operable lever 66 pivotally mounted on the frame by means of a pivot pin 68 and capable of undergoing swinging movement with respect to the frame. The operating mechanism 62 further includes a U-shaped operating member 70 particularly illustrated in FIGS. 11-14. The operating member 70 has a pair of arms 72 and 74 having elongate slots 76 and 78 respectively, and is pivotally mounted on the frame 64 by means of the pivot pin 68 extending through holes 77, 79 in the arms 72 and 74 respectively. A pair of spring-engaging lugs 80, 82 (FIGS. 11-13) extend inwardly from the arms 72 and 74; the function of these will be explained below.

The operating mechanism 62 further comprises a control means including a cross-pin 84 for effecting a snap movement of the member 64 and pin 84. As best illustrated in FIG. 9 the cross pin 84 extends through the slots 76 and 78 in the arms 72 and 74 respectively of the U-shaped operating member 70. In addition, referring to FIGS. 2 and 3 the frame 64 of the operating mechanism is provided with three pairs of slots designated 86, 88 and 90 respectively, which selectively receive the cross pin 84 one pair at a time depending on the position of the operating member 70 with respect to the frame 64. The cross pin 84 is adapted to be engaged by a cam plate 92 (FIGS. 4-6) rigid with and also arcuately movable with the lever 66, the cam plate having a broad cam surface 94 which cams the pin downwardly in FIG. 5 as the lever 66 is shifted from an intermediate position to an end position, or vice-versa. The cam plate 92 has a pair of lugs 96, 98, as best illustrated in FIG. 9. The lug 96 engages one end of a torsion spring 100 which is concentrically disposed with respect to the axis of the pivot pin 68. The other end of the torsion spring 100 engages the lug 80 on the arm 72 of the operating member 70. Similarly, the lug 98 engages one end of another torsion spring 102. The other

end of this torsion spring engages the lug 82 on the arm 74 of the operating member. By this arrangement, the manually operable lever 66 is normally spring biased (by torsion springs 100, 102) to one of three stationary positions corresponding to the engagement of the cross pin 84 with one of the frame slot pairs 86, 88 or 90. In addition, the torque supplied to the operating member 70 to effect swinging movement thereof by the manually operable lever 66 is applied through these torsion springs 100, 102.

Referring now to FIGS. 2, 3 and 10, there is illustrated a reciprocating stop member 104 having an upstanding projection 106. The stop member is movably carried on the frame between two guide pins 108 and 110, the ends of the stop member being slotted as illustrated to enable limited reciprocating movement thereof to occur. As best illustrated in FIG. 10, the guide pin 110 carries a centralizing spring 112 for the stop member. The spring has upwardly projecting end portions which extend past a transverse bar 114 carried by the stop member 104 and a transverse pin 116 mounted on the frame and roughly vertically in line with the bar 114. The spring 112 acts to maintain the vertical alignment of the bar 114 and pin 116 and thus maintain the stop member 104 in the central position illustrated in FIG. 2, in the absence of any shifting force applied to the member by the cross pin 84.

In accordance with the present invention there is provided a novel and improved control means for effecting snap movement of the U-shaped operating member 70 and cross pin 84, comprising a compression spring 118 carried by the operating member and disposed between the arms 72 and 74 thereof, and a cup 120 also carried by the operating member and having an indented bottom 122, the cup being adapted to engage the lateral surface of the cross pin 84. The cup is illustrated in detail in FIGS. 15-17. The cup 120 has relieved bottom edges 125 and 127 which provide clearance for the movement of the cam plate, as will be discussed below. In FIG. 9, one end 126 of the compression spring 118 is received in the hollowed portion 124 of the cup, the depth of this portion being sufficient to confine several convolutions of the spring, thus providing lateral support for the latter and preventing excessive lateral deformation thereof. The other end of the spring 118 engages an inwardly projecting hub 128 on the operating member 70, the hub being of smaller diameter than the spring 118 and extending therein for a distance along the spring axis as illustrated in FIGS. 9 and 10. By the above arrangement, the spring 118, acting through the cup 120, biases the cross pin 84 into continuous engagement with the broad cam surface 94 of the cam plate 92. The cross pin 84 is thus urged toward one set of corresponding ends 129, 130 of the slots 76, 78 of the arms 72, 74 respectively of the operating member 70, and in addition, engages the end portions of one pair of the frame slots 86, 88 or 90 depending on the position of the operating member at any given time.

The operation of the improved mechanism of the present invention can now be readily understood by referring to FIGS. 2-6. Assuming that the manually operable lever 66 is in the intermediate position shown in FIG. 4 it will be seen that the compression spring 118 will tend to bias the cross pin 84 into engagement with

the end portions of the frame slot pair 88. As the lever 66 is manually swung toward the right in FIG. 5, the broad cam surface 94 of the cam plate 92 urges the cross pin 84 and cup 120 downwardly and toward the left against the bias of the spring 118. (It is to be noted that the slot pair 88 is of substantially greater width than the diameter of the cross pin 84.) Due to the relieved bottom edges 125 and 127 of the cup, the cam surface 94 comes in contact only with the lateral surface of the cross pin 84 and does not engage the cup itself. This is an important feature of the present invention, since such an engagement of the cup itself, by the cam surface 94 could conceivably cause an adverse tilting of the cup and of the spring 118, and result in malfunction of the operating mechanism 62. As the cross pin 84 is urged downwardly in FIG. 5, (against the biasing force of the spring 118) the stop member 104 is urged toward the right by the descending cross pin 84 which engages the stop member projection 106 (FIG. 2). As the cross pin 84 emerges from the slot 88, it is immediately driven toward the left by the operating member 70 which is experiencing a clockwise torque from the lever 66 acting through the torsion springs 100, 102. Upon its arrival at the opening of the slot pair 86, the cross pin 84 is biased upwardly into engagement with the end portions thereof by the compression spring 118 acting through the cup 120. After the shifting of the operating member 70 has occurred, the torsion springs 100, 102 then operate to spring bias or to maintain the lever 66 in the position illustrated in FIG. 6 as can be well understood.

In a similar manner, switching from the position of FIG. 6 back to the intermediate position of FIG. 4 is readily accomplished, with one difference, however. After the cross pin 84 has left the slot pair 86 and progresses toward the right in FIG. 6, it is prevented from by-passing the slot pair 88 and jumping into the slot pair 90 by the action of stop member 104. As the cross pin 84 travels toward the right, it engages the projection 106 (FIG. 3) and causes the stop member 104 to shift toward the right against the bias of the relatively weaker spring 112 to a position wherein further travel of the cross pin toward the right is prevented, since the space between the shoulder 91 and the projection 106 has become sufficiently narrow to block passage of the cross pin therebetween. Upon release of the lever 66, the cross pin 84 again becomes biased into engagement with the end of slot pair 88, by the spring 118 and the stop member 104 assumes its central position once again. By such an arrangement, the operating mechanism prevents instant shifting of the cross pin from one extreme position directly to the opposite extreme position. Instead, from either extreme position, the lever 66 must be operated to effect a shifting to the intermediate position, then momentarily released and subsequently operated again to effect shifting to the opposite extreme position.

Referring now to FIGS. 1, 7 and 8, the insulating slide plate 56 is provided with a slot 130 which is engaged by the cross pin 84. It will be understood that the snap movement of the latter effects longitudinal shifting or sliding of the slide plate such that the contact 60 can engage one pair of the resilient contact fingers, either 44, 46, or 46, 48, or can remain in an intermediate position illustrated in FIG. 1 wherein the con-

tact is not in engagement with either pair of contact fingers.

In accordance with the present invention there is provided a pair of hardened steel wear shoes 132, 134 disposed on opposite sides of the slide plate 56.

In the present case, the wear shoes are considered as a portion of the operating mechanism of the safety reversing switch of the present invention. The wear shoes 132, 134 are provided with flanges 136, 138 respectively, extending into the slot 130 of the slide plate. The slide plate 56 and the wear shoes 132 and 134 have two sets of aligned apertures. As illustrated in FIG. 8 the slide plate aperture 140 is in alignment with the aperture 142 in wear shoe 132 and with the aperture 144 in wear shoe 134. Similarly, the other slide plate aperture 146 is in alignment with the aperture 148 in the wear shoe 132 and with the aperture 150 in the wear shoe 134. As illustrated, the one set of aligned apertures 146, 148 and 150 is disposed on the opposite side of the slot 130 from the other set of aligned apertures 140, 142 and 144. The wear shoes are rigidly fastened to the slide-plate by means of rivets 152 and 154 passing through the aligned sets of apertures, respectively.

By this arrangement, the impact forces which would normally be applied to a relatively small portion of the slide plate adjacent the slot 130 by the snap movement of the cross pin 84 are effectively distributed by the hardened wear shoes over a relatively much larger surface of the plate. Thus, the tendency for the insulating slide plate to suffer fatigue or disintegration from the repeated impact of the cross pin 84 is greatly reduced. As a result, the operating life of the switch is significantly greater than was the case without the wear shoes, and the likelihood of unsatisfactory operation of the switch due to weakening of the relatively soft insulating material of which the slide plate is constituted is greatly reduced.

It will be readily understood that the other slide plate 54 is also provided with wear shoes substantially identical to those described above. As illustrated in FIG. 1, the cross pin extends sufficiently far in both directions so as to engage the slot in the slide plate 54 as well. The contact arrangement of the switch in FIG. 1 is thus seen to be double pole, double throw configuration.

From the above, it can be seen that I have provided a novel and improved lever operating mechanism for a safety type reversing switch, which is relatively simple in construction, and which provides greatly improved operation and significantly longer operating life than switches of this type heretofore known. The switch construction thus presents a distinct advance and improvement in the field of reversing switch technology.

Variations and modifications are possible without departing from the spirit of the invention.

I claim:

1. A lever type operating mechanism for a safety reversing switch, comprising in combination:
 - a. a manually operable lever having pivot means enabling it to undergo swinging movement,
 - b. a U-shaped operating member adjacent to the lever and having a pair of arms with elongate slots,
 - c. control means, including a cross pin extending through said slots, for effecting snap movement of the operating member and pin,

- d. an insulating slide plate carrying a switch contact and having a slot through which the cross pin extends,
- e. a pair of hardened steel wear shoes disposed on opposite sides of the slide plate, each shoe having a flange extending into the slot of the slide plate and being engageable by the cross pin to sustain impact forces from the pin due to snap movement of the pin and operating member,
- f. said wear shoes and insulating slide plate having aligned apertures, and
- g. rivets passing through said aligned apertures for securing the wear shoes rigidly to the slide plate.
2. The invention as set forth in claim 1, wherein:
- a. the slide plate and the wear shoes have two sets of aligned apertures,
- b. said sets being disposed on opposite sides of the slot in the slide plate,
- c. said rivets being disposed respectively in said sets of apertures.
3. The invention as set forth in claim 1, wherein:
- a. said control means comprises a compression spring carried by said operating member and

- disposed between the arms thereof, and
- b. a cup having an indented bottom engaged by said cross pin,
- c. one end of said spring being received in the cup whereby the spring tends to bias the cross pin toward one set of corresponding ends of the elongate slots in the arms of the operating member.
4. The invention as set forth in claim 3, wherein:
- a. said cup is sufficiently deep to confine several convolutions at the end of said spring, thereby to prevent excessive lateral deformation of the latter.
5. The invention as set forth in claim 3, and further including:
- a. a cam plate rigidly affixed to the lever and arcuately movable therewith,
- b. said cam plate being engageable with the cross pin to shift the latter in the slots of the operating member against the action of said compression spring,
- c. said cup having relieved bottom edges providing clearance to prevent its engagement by the cam plate, whereby tilting of the spring is avoided.

* * * * *