United States Patent

Yamamoto et al.

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[54] **REVERSING MECHANISM OF SWITCH**

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[52] **U.S. Cl.** .....**200/153 K**

[51] **Int. Cl.** **H01h 3/04**

[58] **Field of Search** .....200/153 R, 166 R

[56] **References Cited**

UNITED STATES PATENTS

3,529,109 9/1970 Cross .....200/153 K

3,785,255 3/1957 Elliott .....200/153 K

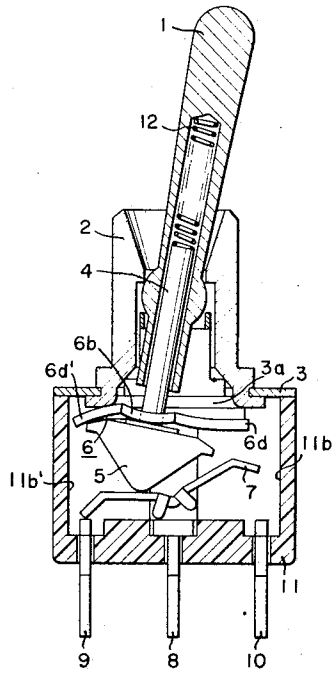
Primary Examiner—H. O. Jones

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[57] **ABSTRACT**

A reversing mechanism for switches comprises a reversing member made of an elastic pliable sheet material. The reversing member is arranged within a switch box and associated with a push rod of the switch, by which a movable contact can be actuated, so that the ON-OFF-ON characteristic of the switch may be automatically controlled. The reversing member is shifted sidewise with the push rod to deflect and curve the member into downwardly convexed form, thereby storing energy for returning the push rod to neutral position.

8 Claims, 9 Drawing Figures



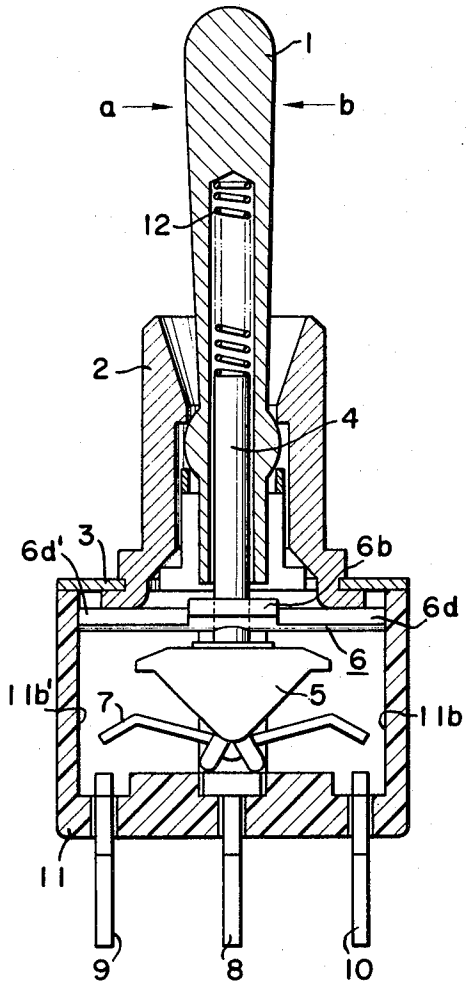


FIG. 1

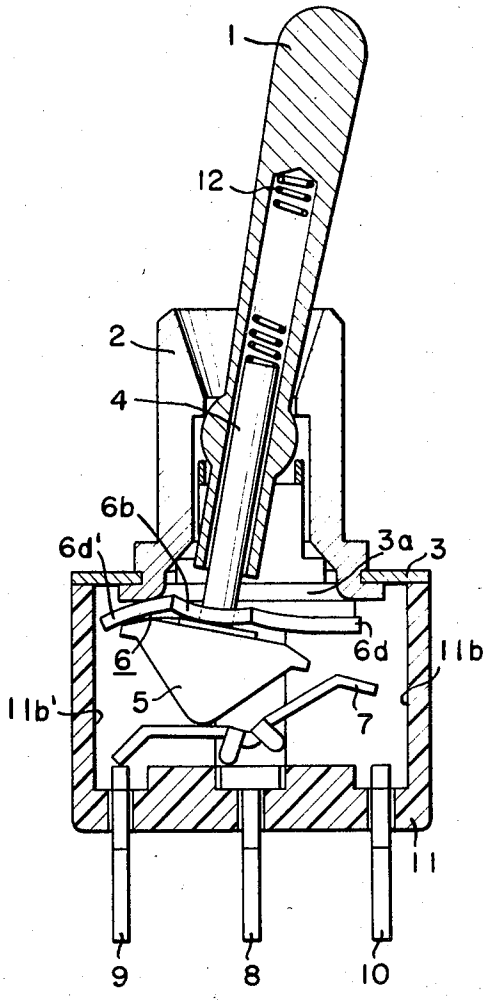


FIG. 2

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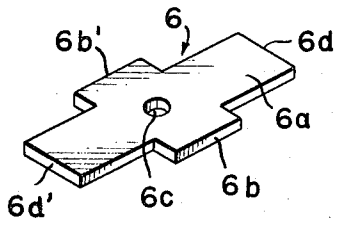


FIG. 3

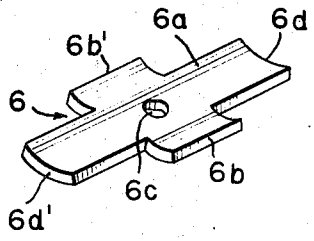


FIG. 4

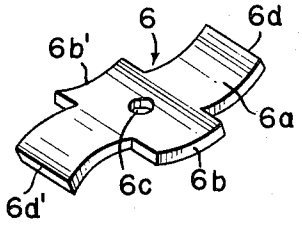


FIG. 5

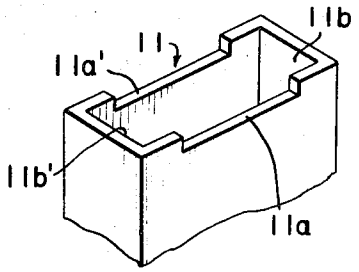


FIG. 6

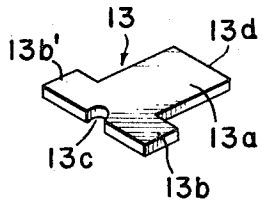


FIG. 7

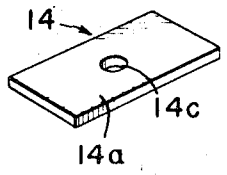


FIG. 8

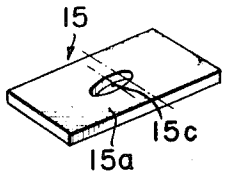


FIG. 9

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REVERSING MECHANISM OF SWITCH

BACKGROUND OF THE INVENTION

Heretofore, there have been proposed a variety of automatically reversing mechanisms for switches. One of these reversing mechanisms employs a leaf spring. In this automatically reversing mechanism, a leaf spring formed in a generally reverse W-shape is fixed on a movable contact piece. A push rod secured through a spring to the lower portion of a switch handle is arranged on the valley portion of the leaf spring. When the push rod slides along and climbs up the slope of the leaf spring (In this time, the push rod is slightly retracted due to deflection of the spring.), the circuit is switched to an ON-state. Then, when a driving force which has been applied to the handle is removed, the push rod automatically climbs down the slope of the leaf spring and returns to the origin owing to expansion of the spring and thus the circuit is switched to an OFF-state.

However, this reversing mechanism has disadvantages that the overall vertical height of the switch becomes considerably high, because a slope which the push rod climbs up and down is required, and therefore the reduction of the size of switch is limited and that it is difficult to fabricate and assemble parts thereof.

Another of the conventional reversing mechanisms employs a coil spring. In this automatically reversing mechanism, a coil spring bent in a U-shape and connected between an insulating plate and a frame latches the lower portion of a switch handle in the bent portion of the coil spring. When a driving force is applied to the handle in the same direction as the mounting direction of the coil spring, the coil spring is expanded toward the left side and at the same time the movable contact piece is swung by the lower end of the handle to change one circuit to an OFF-state and the other circuit to an ON-state. Then, if a driving force which has been applied to the handle is removed, the handle is automatically returned to the origin by a deflecting force of the coil spring and thus said one circuit is changed to an ON-state and said other circuit is changed to an OFF-state.

However, this reversing mechanism has disadvantages that the overall vertical height of the switch necessarily becomes high because the coil spring is provided between the insulating plate and the frame and therefore the reduction of the size of switch is limited and that it is difficult to assemble parts thereof.

Thus, a main object of this invention is to provide an automatically reversing mechanism for switches having none of the defects of conventional systems as mentioned above.

SUMMARY OF THE INVENTION

This invention relates to an automatically reversing mechanism for switches.

According to this invention, a reversing mechanism comprises a reversing member made of an elastic pliable sheet material, said reversing member being arranged within a switch box and associated with a push rod of the switch, by which a movable contact can be actuated, so that the ON-OFF-ON characteristic of the switch may be automatically controlled.

The reversing mechanism of this invention has the following advantages:

Since it is possible to reduce the height of the switch box, the reduction of the overall size of the switch can be achieved.

It is easy to fabricate and assemble parts of the switch.

The application of this invention to conventional methods ensures that the switch handle can be automatically returned.

This invention will be described in detail in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional view of the first embodiment of a switch according to this invention in an OFF-state;

FIG. 2 is a view similar to FIG. 1, but showing the switch in an ON-state;

FIG. 3 is a perspective view of an elastic reversing member as used in the embodiment of FIG. 1, showing the member before assembling;

FIG. 4 is a view similar to FIG. 3, but showing the shape which the member takes in the state of the switch as shown in FIG. 1;

FIG. 5 is a view similar to FIG. 3, but showing the shape which the member takes in the state of the switch as shown in FIG. 2;

FIG. 6 is a perspective view of a switch box;

FIG. 7 is a perspective view of the second embodiment of elastic reversing member according to this invention before assembling;

FIG. 8 is a view similar to FIG. 7, but showing the third embodiment of elastic reversing member according to this invention; and

FIG. 9 is a view similar to FIG. 7, but showing the fourth embodiment of elastic reversing member according to this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 and 2 are sectional view of an assembled switch constituted according to the first embodiment, in which FIG. 1 shows the "OFF" state, and FIG. 2 shows the "ON" state.

In FIGS. 1 and 2, reference numeral 1 represents a handle, 2 a sleeve, 3 a frame, 4 a push rod, 5 a push rod receiver, 6 an elastic reversing member, 7 a movable contact, 8 a support used also as a common terminal, 9 and 10 terminals, 11 a box and 12 a spring. The elastic reversing member 6 is an essential part of the present device, and it will be explained later in detail with reference to FIGS. 4 and 5.

In assembling a switch shown in FIGS. 1 and 2, a suitable circuit-conducting mechanism having an ON-OFF-ON characteristic is built in the box 11 (FIG. 6). The handle 1 is mounted in the sleeve 2 in a pivotal manner. The push rod 4 passing through an opening 6c (FIG. 3) in the elastic reversing member 6, is inserted through an axial bore in the handle 1, and is urged downwardly by the action of the spring 12, with the lower end of the push rod 4 being in engagement with the upper end of the push-rod receiver 5. The lower end of the push-rod receiver 5 is abutted against the upper surface of the movable contact 7 which is in turn supported by the common terminal 8 in a rockable manner. The terminals 9 and 10 of any suitable construction may be used, and they are arranged in opposition to the side edges of the common terminal 8.

Next, the elastic reversing member 6 which is the essential part of the present device will be explained in detail.

The elastic reversing member 6 of the first embodiment is made of an elastic pliable sheet material such as rubber, and as shown in FIG. 3, laterally projecting portions 6*b* and 6*b* ' are provided on opposed sides of the main portion 6*a*. In the center of the main portion 6*a*, there is provided an opening (in the first embodiment, a through-hole 6*c*, the projecting portions 6*b* and 6*b* ' have such dimensions that they jut out slightly of the notched portions 11*a* and lla ' formed in the side walls of the box 11, shown in FIG. 6.

In assembling, the projecting portions 6*b* and 6*b'* are mounted on the notched portions 11*a* and 11*a'* in the side walls of box 11, respectively, and the projecting portions 6*b* and 6*b'* are somewhat jutted out of the notched portions 11*a* and 11*a'* of the box 11, respectively. Now, when the side surfaces 3*a* and 3*a'* of the frame 3 (since FIGS. 1 and 2 are sectional views showing rear halves of the switch, the side surface 3*a'*, on the near half of the switch is not visible) are clamped in place to cover the side walls of the box 1, the projecting portions 6*b* and 6*a'* of the member 6 are engaged and urged inwardly by the side surfaces 3*a* and 3*a'* to slightly bow the member 6, as shown in FIG. 4. Thus, as shown in FIG. 1 and FIG. 4, the main portion 6*a* is curved, as shown, in an upwardly convexed form by the inward pressure on the normally projecting portions 6*b* and 6*b'* with the lengthwise direction of the main portion 6*a* as the axis, thus a repulsive force is stored against the curvature in the lengthwise direction. The end portions 6*d* and 6*d'* of the plastic reversing member 6 are in close contact with the inner walls 11*b* and 11*b'* of the box 11, respectively. The widths of the projecting portions 6*d* and 6*d'* are so determined that they are narrower than the widths of the notched portions 11*a* and 11*a'* of the side surfaces of the box 11.

The foregoing description is made for the state shown in FIG. 1, that is, in which the handle 1 is in the neutral position, and the switch is in "OFF" state. However, in this state, when the handle 1 is moved in a direction shown by an arrow *a* or *b* by applying an external force, the switch is turned into ON-state. FIG. 2 shows a state in which the handle 1 is moved in a direction shown by the arrow *a*.

In this operating state, when the handle 1 is moved against the main portion 6*a* of the elastic reversing member 6 in which a repulsive force is stored against the curvature in the longitudinal direction, the main portion 6*a* is shifted to the left, and the end portion 6*d'* is intensely contacted against the inner wall 116 of the box 11, thereby the end portion 6*d'* of the elastic reversing member 6 is curved in a "downwardly convexed form" (see FIG. 5) and the elastic force is stored therein, and the other end 6*d* is separated from the inner wall 11*b* of the box. The state of the elastic reversing member 6 at this time is shown in FIG. 5 by a perspective view. With this right hand inclination of the handle 1, the push-rod receiver 5 slides the movable contact 7 to the left, whereby the common terminal 8 and the terminal 9 is short-circuited, and the circuit is switched "ON." Thus as long as an external force is applied on the handle 1, the ON-state is maintained. When the external force is removed, the handle 1 is returned automatically to the neutral position shown in FIG. 1 by the elastic force stored in the down-flexed, elastic end portion 6*d'* and by the repulsive force acting to remove the longitudinal curvature produced by the "downwardly convexed deflection" of main portion 6*a* of the elastic reversing member 6, and the common terminal 8 and the terminal 9 are opened and returned to the OFF-state. And when the handle 1 is operated to move in a direction shown by the arrow *b*, a similar operation will, of course, be effected as before.

The foregoing description is made on the first embodiment according to the present invention. However, in a switch having ON-OFF-ON characteristic, when it is desired to switch "OFF" automatically the circuit only when one of either is "ON," the second embodiment according to the present invention shown in FIG. 7 may be used.

The elastic reversing member 13 in this second embodiment is made of the same material as the elastic reversing member 6 of the first embodiment, and it is constructed by cutting the elastic reversing member 6 at the central positions of the projecting portion 6*b*, hole 6*c* and the projection 6*b'*. The main portion 13*a* is thus formed into "T" shape having a projecting portions 13*b* and 13*b'*, and at the central position of the edge, opposite to the end portion 6*d*, there is formed an opening (a notch 13*c* in the second embodiment). The assembling and the operation are similar to those of the first example.

A reversing member as illustrated in FIG. 8 may be used in place of the reversing member of FIG. 3. The reversing member 14 of FIG. 8 comprises a main body 14*a* made of an elastic sheet material and formed in a generally rectangular shape. The main body 14*a* is provided at its center with an aperture 14*c*. A switch employing a reversing member as shown in FIG. 8 has the same ON-OFF-ON characteristic as the switch as shown in FIGS. 1 to 6.

A reversing member as illustrated in FIG. 9 may also be used in place of the reversing member of FIG. 7. The reversing member 15 of FIG. 9 comprises a main body 15a made of an elastic sheet material and formed in a generally rectangular shape. An elliptical aperture 15*c* is pierced at an off-center position along the longitudinal center line of the main body 15*a*. A switch employing a reversing member as shown in FIG. 9 has the same ON-OFF-ON characteristic as the switch employing the reversing member 13 of FIG. 7.

While the application of this invention to the switches of ON-OFF-ON characteristic has been described with particularity, it is recognized that this invention may be applied to switches of any other characteristics, for example, ON-ON-ON or ON-OFF characteristic.

The advantageous features of the present invention will be mentioned.

1. Since the member is made of a pliable material having elasticity and has a construction of a simple flat plate, the manufacture is easy and is adapted for mass production.

2. Assembling is simple and easy to be automized successfully.

3. The reversing member withstands frequent bending stresses, and the life thereof is longer than those made of spring wires, etc.

While four specific embodiments of the reversing member according to this invention have been described with particularity, it is recognized that various modifications thereof will occur to those skilled in the art. For example, the shape of the elastic sheet of the reversing member may be variously modified. Therefore, these various embodiments are intended to be included in the scope of this invention.

What we claim is:

1. In combination with a switch having a switch box, a movable see-saw contact and an actuating push rod, a reversing member made of normally flat, pliable elastic sheet material and formed in a generally rectangular shape substantially co-extensive in length with the length of said switch box, said reversing member having a central aperture receiving said push rod and being shiftable lengthwise of said switch box with said push rod to be deflected against the adjacent inner wall of said switch box to store energy for reversing said push rod.

2. A reversing mechanism as claimed in claim 1 wherein the reversing member has projections at both sides thereof, said switch includes a cover and said switch box has opposite side walls with notches, said projections being adapted to engage with said cover and rest in said notches to normally bow said reversing member when in said switch box.

3. A switch as specified in claim 1, wherein the length of said reversing member is substantially equal to a half of that of said switch box, said reversing member being arranged within said switch box, said reversing member being provided at its inner end with a semi-circular recess engaging said push rod, said reversing member having projections at both sides thereof and adjacent said recess, said switch box having side walls with notches therein and said projections being adapted to engage with said notches of the switch box.

4. A reversing mechanism for switches comprising a reversing member made of a flat, pliable, elastic sheet material and formed in a generally rectangular shape, and having at an off-center position thereof an elliptical aperture for receiving a push rod of a switch,

and said switch, including said push rod and a switch box having inner walls at a predetermined distance apart on each opposite side of said push rod,

whereby said reversing member is shifted by said push rod toward one said inner wall or the other, to deflect said reversing member and store elastic energy for returning said push rod to neutral, central position.

5. The combination of:

a switch box having opposite end walls and opposite side walls jointly defining a cross sectional area of predetermined length and width;

switching mechanism within said switch box including a movable see-saw contact and a push rod for tilting said contact, said push rod extending upwardly through the center of said area;

a reversing member, operably connected to said push rod, said member formed of a normally flat piece of pliable, elastic sheet material, having a central aperture receiving said push rod and extending across said switch box from one said end wall to the other and substantially co-extensive in length therewith;

said member being shifted sidewise with said push rod from a central "off" position toward an "on" position at either opposite end of said switch box and arranged to contact the adjacent end wall to curve in downwardly flexed form to store energy to return said push rod to central "off" position.

6. A combination as specified in claim 5, wherein:

the side walls of said switch box include oppositely disposed notches in the upper edges thereof;

said reversing member includes a pair of central projections arranged to be received in said notches; and

said switch includes a cover member, clamped over said switch box to apply inward pressure on the ends of said projections and thereby normally bow said member while in said switch box into upwardly convexed form.

7. A combination as specified in claim 5, wherein:

said aperture in said member is elliptical in configuration.

8. A combination as specified in claim 6, wherein:

said member is formed in two halves, with said central aperture formed by a semi-circular recess in each half.

whereby ease of assembly is accomplished.

* * * * *