

SELF-RESETTING PUSH SWITCH

The present invention relates to a push switch, more specifically, to a self-resetting push switch that can be assembled easily and efficiently.

Conventional self-resetting push switches are shown in, for example, Denpa Shinbun "Special Edition on Switches" (issued on March 24, 1980), and "The Latest Audio Encyclopedia" (published by Radio Gijutsusha).

The prior art shown in these publications are switches which are operated vertically relative to their main bodies.

Among switches having this arrangement, the single acting type and the interlocking type, in which a plurality of switches form a block structure, are well-known.

A switch of either of the types comprises movable contacts moving as a ^{push button} ~~switch rod~~ moves, and a housing holding the ^{push button} ~~switch rod~~ and accommodating stationary contact members as well as a spring for limiting the range of movement and for returning the ^{push button.} ~~switch rod.~~

In the above-described prior art, it has recently been regarded as of importance to reduce the size and weight of switches in order to make them more applicable to actual mounting or assembly by the users.

Therefore, manufacturers have improved the level of reliability and operability. Consequently, however, the total number of the component parts has increased, and the efficiency of assembly by the manufacturers is lowered. When low efficiency of assembly is combined with increase in material and labor cost, the prices of products may increase, and this may weaken the competitive power of the manufactures in the international market.

The present invention sets out to mitigate one or more of the above-described problems.

An advantage of a preferred embodiment is to provide a self-resetting push switch whose assembly can dispense with screws that may increase the total number of component parts or a soldering process that may increase the total number of assembly processes, and whose various component parts are inserted into others utilizing the resilience of the materials they are formed of, thereby enabling easier and more

efficient assembly without degrading reliability and operability.

According to the present invention there is provided a self-resetting push switch comprising:

an electrically insulating housing having a bottom surface defining a closed end to said housing, and an open end opposite said closed end, and first and second pairs of opposing inner wall surfaces extending from said bottom surface;

a pair of first grooves formed on respective ones of said first pair of opposing inner wall surfaces;

a second groove formed on at least one of said second pair of said opposing inner wall surfaces, said second groove having a projection formed therein;

a first stationary contact piece inserted in one of said first grooves;

a push button having an integral sliding sleeve defining a lower surface, and first and second movable contact pieces projecting outwardly from said sliding sleeve, said first movable contact piece being capable of coming into sliding contact with said first stationary contact piece, said sliding sleeve having at least one engagement piece engageable with said projection within said second groove to limit upward movement of the push button away from the closed end of the housing;

a spring interposed between the bottom surface of said housing and the lower surface of said sliding sleeve, said spring urging said push button in a direction which causes a part of said push button to project outwardly from said

housing; and

a frame having a pair of conductive and resilient fixing pieces, and, integral with said fixing pieces, a second stationary contact piece located in the other of said first grooves and capable of coming into sliding contact with said second movable contact piece, said frame being coupled to an upper portion of said housing such that said pair of conductive and resilient fixing pieces are disposed on opposing side portions of said housing and whereby said fixing pieces can co-operate with a hole in an associated plate to mount the switch in said plate.

Such a self-resetting push switch advantageously operates in the following manner. Normally, the movable contact pieces are kept in contact with the corresponding stationary contact pieces. When the push button is pushed down against the force of the spring, one of the movable contact pieces is released from its contact with the associated stationary contact piece, thereby disconnecting the electrical connection between the two stationary contact pieces. Thereafter, when the force applied to the push button to push it down is released, the force of the spring causes the movable contact pieces and the push button to ascend to return to their normal position. Following this action, the two stationary contact pieces are electrically connected with each other through the movable contact pieces, and the circuit is closed.

One of the two stationary contact pieces, more specifically the second stationary contact piece, is formed to be integral with the pair of conductive and resilient

fixing pieces. Therefore, grounding of e.g. the body of a vehicle can be achieved through the conductive and resilient fixing pieces, and the contact piece need not be fixed to the body by screws.

The accompanying drawings illustrate one embodiment of the present invention, by way of example, and specifically

Fig. 1 is an exploded perspective view of a self-resetting push switch;

Fig. 2 is an enlarged vertical section of a waterproof cap;

Fig. 3 is an enlarged vertical section of an assembly in which movable contact pieces and a spring are mounted on a sliding sleeve;

Fig. 4 is an enlarged vertical section of another assembly in which a stationary contact piece and a pair of conductive and resilient fixing pieces are mounted on a housing;

Fig. 5 is an enlarged and exploded vertical section of the assembly shown in Fig. 4;

Fig. 6 is an exploded view of a member including the conductive and resilient fixing pieces;

Fig. 7 is a plan view of the push switch as a finished product;

Fig. 8 is a left side view of the push switch shown in Fig. 7;

Fig. 9 is an enlarged section taken along the line A-A shown in Fig. 7;

Fig. 10 is an enlarged section taken along the line B-B shown in Fig. 7;

Fig. 11 is an enlarged section taken along the line C-C shown in Fig. 8; and

Fig. 12 is an enlarged section showing a state different from that shown in Fig. 11.

A push switch according to one embodiment of the present invention mainly comprises, as shown in Fig. 1, a housing 11, a first stationary contact piece 2, a movable contact member including movable contact pieces 3, ^{push button}~~operation rod~~ 4, a spring 5,

a frame 62 including a second stationary contact piece 63, and a waterproof cap 7.

The housing 11 has an insulating base 1 which is formed by molding plastic material, as shown in Figs. 1, 5 and 9.

The housing 11 has a closed-end angular cylindrical configuration with a cavity 12 defined by two pairs of opposing inner wall surfaces 11A and 11B. One pair of opposing inner wall surfaces 11A have grooves 12A and 12B formed thereon. Grooves 14 are formed on the other pair of opposing inner wall surfaces 11B, and they have projections 13 formed at an intermediate height of the grooves 14, each projection 13 having a sloped surface and a horizontal surface. A pair of engagement holes 15 are formed through upper portions of the housing 11.

The first stationary contact piece 2 has an engagement pawl 21 engageable with an engagement stepped portion 12a of the groove 12A formed on the inner wall surface 11A of the housing 11. The stationary contact piece 2 is inserted into the housing 11 by bringing the pawl 21 into engagement with the portion 12a, as shown in Figs. 4 and 11. A lower portion of the contact piece 2 allows a lead to be extended therefrom.

One of the movable contact pieces 3 is capable of coming into sliding contact with the first stationary contact piece 2, and

the other with the second stationary contact piece 63. The movable contact pieces 3 are formed of a conductive and elastic material, and they have a flattened and inverted V-shape. The ~~operation rod~~ ^{push button} 4 has a sliding sleeve 41 formed integrally with a lower portion of the ~~rod~~ ^{push button} 4 and provided with a projection end 44. The movable contact pieces 3 are disposed in such a manner as to project outwardly through notches 45 of the sleeve 41, as shown in Figs. 1, 3 and 11. A pair of resilient engagement pieces 42 are formed on the sliding sleeve 41, as shown in Figs. 1, 9, 10 and 11. The engagement pieces 42 respectively have one each of sloped surfaces and horizontal surfaces, and they are engageable with the projections 13 within the grooves 14. Slits 46 are formed to allow the engagement pieces 42 to exhibit resilience.

Part of the ~~operation rod~~ ^{push button} 4 is always projected from the cavity 12 by a spring 15 interposed between the bottom 11C of the housing 11 and the lower surface of the sliding sleeve 41, as shown in Figs. 1 and 3. The sliding sleeve 41 is slidable inside the cavity 12 along the grooves 14, and the resilient engagement pieces 42 can be pushed down below the projections 13, as shown in Figs. 9, 10 and 11.

Although two resilient engagement pieces 42 are provided in the illustrated embodiment, only one resilient engagement piece may

be provided.

As shown in Figs. 1, 4, 5 and 6, a pair of conductive and resilient fixing pieces 6 is formed on two opposite sides of the frame 62, and they have a pair of engagement pawls 61 engageable with the engagement holes 15. The second stationary contact piece 63 has a length corresponding to about one half of the depth of the cavity 12. As shown in Figs. 9 and 11, the conductive and resilient fixing pieces 6 are mounted on the housing 11 with their engagement pawls 61 kept in engagement with the holes 15, while the stationary contact piece 63 is kept in engagement with the groove 12B formed in the associated inner wall surface 11A of the housing 11.

The flexible waterproof cap 7 shown in Figs. 1 and 2 is disposed on the outer edge of the insulating base 1, as shown in Figs. 9 and 11 in case such is required depending on the location of use. When the cap 7 is employed, the switch serves as a waterproof self-resetting push switch.

If the stationary contact piece 2 is substituted by a known tab terminal 10 having a lead 9, shown in Fig. 1, its connection with an external circuit is facilitated.

The housing 11 and the ^{push button}~~operation~~ rod 4 are formed of insulating

material such as synthetic resin that can be poured into a mold. The stationary contact piece 2, the movable contact pieces 3, the conductive and resilient fixing pieces 6, the spring 5, and the stationary contact piece 63 are formed of metal material. In particular, the stationary contact piece 2 and the movable contact piece 3 are formed of elastic and highly conductive materials, such as phosphor bronze.

The waterproof cap 7 is formed of soft rubber.

The switch is assembled in the following manner:

First, as shown in Figs. 1, 3 and 4, the movable contact member is inserted into the sliding sleeve 41 of the ^{push button}~~operation~~ rod 4 in such a manner that the movable contact pieces 3 project outwardly through the notches 45 of the sleeve 41. The projecting end 44 of the sleeve 41 is pushed through a mounting hole of the movable contact member.

Thereafter, the projecting end 44 extending through the mounting hole is inserted into a first end of the spring 5 to be fixed thereon.

The thus obtained assembly is inserted into the cavity 12 of the housing 11 shown in Fig. 5 while the assembly is positioned in such a manner that the resilient engagement pieces 42, which serve to prevent the sliding sleeve 41 from slipping-off, are received in the grooves 14, as shown in Fig. 9. During this insertion, the projecting portions of the movable contact pieces 3 are pressed inward against their resilience to be retracted.

When the sloped surfaces of the resilient slip-prevention engagement pieces 42 slide on the sloped surfaces of the projections 13 at intermediate portions of the grooves 14, the resilient engagement pieces 42 retract inwardly by virtue of the formation of the slits 46. When the resilient slip-prevention engagement pieces 42 have cleared the projections 13, the horizontal surfaces of the projections 42 contact the horizontal surfaces of the projections 13. In this condition, the sliding sleeve 41 is prevented from slipping off the cavity 12, as shown in Fig. 9.

During this insertion, a projecting portion 12E at the center of the bottom 11C in the cavity 12 is inserted into a second end of the spring 5.

The stationary contact piece 2 shown in Fig. 1 is inserted from an insertion opening 12b of the housing 11 into the groove 12A.

During this insertion, after the engagement pawl 21 has passed the insertion opening 12b, it recovers its original position to engage with the inner surface at the engagement stepped portion 12a, as shown in Fig. 4. By virtue of this engagement, the stationary contact piece 2 is mounted thereon not to be slipped off.

Thereafter, while the stationary contact piece 63 is brought into engagement with the groove 12B, the engagement pawls 61 of the conductive and resilient fixing pieces 6 are brought into engagement with the engagement holes 15. When the pawls 61 are pressed against the lower surface of the insulating base 1, as shown in Fig. 4, the frame 62 including the conductive and resilient fixing pieces 6 is fixed to the insulating base 1.

The push switch, assembled in this way without using any fixing means such as screws or soldering, is used after assuming the state shown in Figs. 9 and 10, in which the housing 11 is inserted into a housing mounting hole 31 formed through a mounting plate 30 against the resilience of the conductive and resilient fixing pieces 6, and it is then held in place utilizing the resilience of the pieces 6.

Since the lower surface of the insulating base 1 defines a stepped portion 1A, a gap is formed between this lower surface

and the upper surface of the mounting plate 30. The waterproof cap 7 may be fitted around the insulating base 1 with the outer edge of the cap 7 filling the gap. If the cap 7 is used, the self-resetting push switch is waterproof.

The self-resetting push switch as illustrated is a normal closed switch. In its normal state shown in Fig. 11, the movable contact pieces 3 are kept in contact with the stationary contact piece 2 and the stationary contact piece 63.

If the push switch is to be used as a door switch of a vehicle, the negative terminal of the battery is connected to the chassis serving as the housing mounting plate 30, while the positive terminal of the battery is connected through the associated door lamp to the stationary contact piece 2. With this arrangement, when the door is opened, the door lamp is turned on. When the door is closed, the door lamp is turned off because, as shown in Fig. 12, the ^{push button}~~operation rod~~ 4 is pushed into the cavity 12 of the housing 11 against the force of the spring 5, causing the movable contact piece 3 to be released from its contact with the stationary contact piece 63 which extends through about one half of the depth of the cavity 12.

In the above described example, the first stationary contact piece 2 may be substituted by the tab terminal 10 (shown in Fig.

1) provided with a lead 9.

When a self-resetting push switch as specifically described herein is to be assembled or when it is to be actually mounted onto, e.g., the body of a vehicle, the switch can be assembled or mounted by fitting its various component parts into others or by fitting it into a suitable portion, without requiring any fixing means such as screws or soldering. Such fitting is advantageous in that the total number of the component parts as well as the total number of assembly or mounting processes can be reduced thereby enabling reduction in production cost. Furthermore, since the assembly or mounting can be automated, mass production is possible. In addition, after the push switch has been assembled, the spring 5 and the ^{push button}~~operation rod~~ 4 are held within the housing 11 by the resilient engagement pieces 42, and the ^{push button}~~operation rod~~ 4 is prevented from slipping off. This means that the conductive and resilient fixing pieces 6 can be assembled onto the insulating base 1 at a separate location, thereby making it possible to divide the entire assembly processes. In this case, assembly work can be performed in narrow places, and it is possible to avoid contamination of the switch contact portions by substances, such as dust, which might hinder electrical contact.

Another noteworthy feature of the present invention is that the second stationary contact piece 63, among said two stationary contacts, is formed to be integral with the conductive and resilient fixing pieces 6. This enables grounding of e.g. the body of the vehicle to be achieved through the conductive and resilient fixing pieces 6, without requiring the contact piece 63 to be fixed to the body by screws.

If the push switch includes a flexible waterproof cap 7 disposed around the outer edge of the housing 11, the push switch serves as a waterproof self-resetting push switch.

If the stationary contact piece 2 is substituted by a tab terminal 10 having a lead 9, this facilitates its connection with an external circuit.



CLAIMS

1. A self-resetting push switch comprising:

an electrically insulating housing having a bottom surface defining a closed end to said housing, and an open end opposite said closed end, and first and second pairs of opposing inner wall surfaces extending from said bottom surface;

a pair of first grooves formed on respective ones of said first pair of opposing inner wall surfaces;

a second groove formed on at least one of said second pair of said opposing inner wall surfaces, said second groove having a projection formed therein;

a first stationary contact piece inserted in one of said first grooves;

a push button having an integral sliding sleeve defining a lower surface, and first and second movable contact pieces projecting outwardly from said sliding sleeve, said first movable contact piece being capable of coming into sliding contact with said first stationary contact piece, said sliding sleeve having at least one engagement piece engageable with said projection within said second groove to limit upward movement of the push button away from the closed end of the housing;

a spring interposed between the bottom surface of said housing and the lower surface of said sliding sleeve, said spring urging said push button in a direction which causes a part of said push button to project outwardly from said housing; and

a frame having a pair of conductive and resilient fixing



pieces, and, integral with said fixing pieces, a second stationary contact piece located in the other of said first grooves and capable of coming into sliding contact with said second movable contact piece, said frame being coupled to an upper portion of said housing such that said pair of conductive and resilient fixing pieces are disposed on opposing side portions of said housing and whereby said fixing pieces can co-operate with a hole in an associated plate to mount the switch in said plate.

2. A self-resetting push switch according to claim 1, further comprising a flexible waterproof cap disposed on the upper portion of said housing in such a manner as to cover said open end of the housing.

3. A self-resetting push switch according to claim 1 or 2, wherein said first stationary contact piece comprises a tab terminal having a lead.

4. A self-resetting push switch arranged and adapted to operate substantially as herein described with reference to and as shown in the accompanying drawings.
