SWITCHES EMBODYING SPRING LOADED ACTUATING BUTTON MEANS

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My present invention relates to improvements in push button switches.

Push button switches are old and well known and most usually embody a coil spring which is loaded upwardly and in a downward direction which supports the push button in its initial position. In the switches of the prior art the coil springs are usually independent of the circuitry of the switch and only serve the purpose of holding the push button in its initial position. In my invention the coil springs are integrally molded with the other components of the switches so as to provide a self-contained unit.

It is an object of my invention to provide a push button switch embodying spring means effective for connecting and disconnecting the electrical terminals of the switch, and which spring means is also loaded by movement of a push button from an initial position to actuate the switch to return the push button upon release thereof to its initial position.

In the switch of my invention the aforementioned spring means in addition to serving to return the push button effects wiping engagement with the terminals of the switch so as to assure good electrical contact.

In order to achieve the foregoing objects, I propose to provide a push button switch having a housing in which a pair of electrical terminals are mounted in spaced apart and insulated relation with respect to each other. A push button is mounted for relative movement inwardly and outwardly of the housing and spring contact means of my invention is connected with the push button for electrically connecting and disconnecting the terminals of the switch. The housing for the switch is formed with guide means with which the spring contact means of my invention is connected with the push button for guiding engagement and upon movement of the push button inwardly of the housing the spring contact means is placed under load by the guide means of the housing so that upon release of the push button the loaded spring contact means effects return movement of itself and the push button.

A preferred feature of my invention resides in the provision of spring contact means as aforementioned arranged to have wiping engagement with contact end portions of the terminals of the switch.

A further preferred feature of my invention resides in providing the housing with guide surfaces extending angularly toward each other in a direction for engaging the free ends of a pair of divergent spring arms of the contact means for placing the spring arms under compression upon inward movement of the push button so that upon release of the push button the loaded spring arms effects return movement thereof and the push button engages the spring arms with the contact ends of the terminals with a wiping action.

Now in order to acquaint those skilled in the art with the manner of constructing and utilizing a push button switch in accordance with the principles of my present invention, I shall describe in connection with the accompanying drawings certain preferred embodiments of my invention.

FIGURE 1 is a perspective view of one form of a push button switch constructed in accordance with my invention;

FIGURE 2 is a vertical sectional view of the switch of FIGURE 1 with the view being taken along the line 2—2 of FIGURE 1 and looking in the direction indicated by the arrows and showing the pushing button of the switch in position for closing a circuit through the switch;

FIGURE 3 is a vertical sectional view similar to FIGURE 2 but showing the pushing button in its inwardmost position for opening a circuit through the switch;

FIGURE 4 is a vertical sectional view taken along the line 4—4 of FIGURE 2 and looking in the direction indicated by the arrows;

FIGURE 5 is a vertical sectional view taken substantially along the line 5—5 of FIGURE 3 looking in the direction indicated by the arrows;

FIGURE 6 is a sectional view taken substantially along the line 6—6 of FIGURE 3 looking in the direction indicated by the arrows;

FIGURE 7 is a perspective view of another form of push button switch constructed in accordance with my invention;

FIGURE 8 is a rear elevational view of the switch of FIGURE 7;

FIGURE 9 is a vertical sectional view, with certain parts being shown in elevation, taken substantially along the line 9—9 of FIGURE 8 looking in the direction indicated by the arrows;

FIGURE 10 is a view similar to FIGURE 9 but showing the position of parts with the push button of the switch in its inwardmost position;

FIGURE 11 is a vertical sectional view taken substantially along the line 11—11 of FIGURE 9 looking in the direction indicated by the arrows; and

FIGURE 12 is a sectional view taken substantially along the line 12—12 of FIGURE 10 looking in the direction indicated by the arrows.

Referring now to FIGURES 1 and 2 of the drawings, I have shown a push button switch constructed in accordance with my invention comprising a housing 7, a cover 8, and a pushing button 9. The housing 7 comprising a one piece member preferably molded of presently known electrically insulated plastic material having a hollow body 10 closed at one end and the four sides thereof, and having an integral annular flange 11 at its open forward end. The open forward end of the housing 7 is closed by the cover 8 which may have its annular flange 14 secured in any suitable manner to the annular flange 11 of the body member as, for example, by heat sealing of a plurality of integral circumferentially spaced projections 13 at flange 11 in bosses formed in the flange 14 of cover 8. Additionally, the peripheral edge of the cover 8 and cover 9 may be spun and heat sealed to each other.

The cover 8, as best seen in FIGURES 2 and 3 is provided with integral spaced apart lugs 17 extending inwardly of the open front end of the housing 7 with the outer surfaces of the lugs being tapered inwardly toward ends to facilitate insertion of the cover into the open end of the housing. The aforementioned cover 8 and push button 9 are preferably fabricated of any suitable electrical insulating materials, such as any of the many presently known plastic materials employed in the devices of the class of the present invention.

The housing 7 is formed with a pair of spaced apart grooves 23 inwardly of and parallel with the side walls 19 and open outwardly of the rearward closed end of housing 7. Electrical terminals 24 are mounted entirely within each of the grooves 23 and which at their inner ends are provided with angled flange portions 25 serving as contacts for the terminals. The angled flange portions 25 fit in grooves formed between the inner ends of the terminal lugs 17 and adjacent shoulders or abutments 26 inwardly of the housing 7. The housing 7 also includes guide means within the hollow body thereof defined by opposed guide surfaces 27 extending from the abutments 26 thereof rearwardly of the housing and angularly in
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wardly toward each other from the contact end portions 25 of the terminals 24 toward the closed rearward end of the housing 7. The push button 9 is mounted for sliding movement in the cover 8 inwardly and outwardly relative to the housing 7 and at its inner end is provided with an annular flange 29 on which spring contact means 30 is seated around a centering pin 32. The spring contact means 30 comprise a spring leaf spring member having a base portion 33, and a pair of divergent spring arms 34 having generally rounded outer end portions 35 for sliding engagement with the guide surfaces 27. The contact spring means 30 is assembled in the switch with the arms 34 normally biased away from each other so that in the position of the parts as shown in FIGURE 2 portions of the arms 34 intermediate their ends are spring biased into contacting engagement with the contact portions 25 of the terminals 24.

The switch above described and as shown in FIGURE 2 is a normally closed switch with the circuit between the pair of terminals 24 as shown being closed by engagement of the contact portions 25 thereof by the spring contact means 30.

Upon reference now to FIGURE 3, it will be observed upon inward movement of the push button 9 that the spring contact means 30 is advanced toward the rear of the switch 7 of the switch and that the rounded end portions 35 of the spring arms 34 are moved inwardly toward each other by their engagement with the inclined guide surfaces 27 of the housing. Such inward movement of the push button thus effects a compressive loading of the spring contact means 30. The compressed spring arms 34 upon release of the button 9 effect movement of the spring contact means 30 and button 9 to their outermost position as shown in FIGURE 2. In the return movement of the push button to its initial position of FIGURE 2, the compressed spring arms 34 effect a wiping engagement of the intermediate portions of the spring arms with the contact portions 25 of the terminals 24 to effect a wiping action upon return of the plungers 9 to close the switch.

Referring now to FIGURES 7 and 8 of the drawings, I have shown a modified form of push button switch constructed in accordance with my invention comprising a housing 7', a cover 8' and a push button 9'. The housing 7' is formed by a hollow body member 36 open along one side thereof and having an annular flange 11' at its open forward end. The open forward end of the housing is covered by the cover 8' which may have its annular flange 14' surrounding the annular flange 11' of the housing as, for example, by screws 35. The open side of body member 36 is closed by a plate member 37 which, as shown, is secured to the body member by rivets 38 extending transversely rearwardly of the plate 37 and body member 36. The cover 8', as best seen in FIGURE 3, is provided with integral spaced apart lugs 17' extending inwardly of the open end of the body member 10 with the outer surfaces of the lugs engaging the adjacent inner surface portions of the end walls 39 of body member 36. Screws 40 extend through end walls 39 and have threaded engagement as at 42 with the lugs 17' to additionally hold the cover 8' and body member 36 together. The aforementioned housing 7', cover 8' and push button 9' are preferably fabricated of any suitable electrical insulating materials.

Body member 36 is formed with a pair of spaced apart grooves 23' inwardly of and parallel with the end walls 39 and open outwardly of the rearward end of the body member 36. Electrical terminals 24' are mounted one within each of the grooves 23' and which at their inner ends are provided with angled flange portions 25' serving as contacts for the terminals. The angled flange portions 25' fit in grooves between the inner ends of the lugs 17' and 26' inwardly of the body member 36. The body member 36 also includes guide means defined by guide surfaces 27' extending rearwardly of the housing and angularly inwardly toward each other from the contact end portions 25' of the terminals 24' toward the close rearward end of the body member 36.

The push button 9' is mounted for sliding movement in the cover 8' inwardly and outwardly relative to the housing 7' and at its inner end is provided with an annular flange 29' on which spring contact means 30' is seated around a centering pin 32'. The spring contact means 30' as before comprises a leaf spring member having a base portion 33', and a pair of divergent spring arms 34' having generally rounded outer end portions 35' for sliding engagement with the guide surfaces 27'. The contact spring means 30' is assembled in the switch with the arms 34' normally biased away from each other so that in the position of the parts as shown in FIGURE 9 portions of the arms 34' intermediate their ends are spring biased into contacting engagement with the contact portions 25' of the terminals 24'.

The switch above described and as shown in FIGURE 9 is a normally closed switch with the circuit between the pair of terminals 24' as shown being closed by engagement of the contact portions thereof by the spring contact means 30.'

Upon reference now to FIGURE 10, it will be observed that before upon inward movement of the push button 9' in the spring contact means 30' is advanced toward the rear of the housing 7' of the switch and that the rounded end portions 35' of the spring arms 34' are moved inwardly toward each other by their engagement with the inclined guide surfaces 27' of the body member. Such inward movement of the push button thus effects a compressive loading of the spring contact means 30'. The compressed spring arms 34' upon release of the button 9' effect movement of the spring contact means 30' and button 9' to their outermost position as shown in FIGURE 9. In the return movement of the push button to its initial position of FIGURE 9, the compressed spring arms 34' effect a wiping engagement of the intermediate portions of the spring arms with the contact portions 25' of the terminals 24' to effect a wiping action upon return of the plungers 9' to close the switch.

The aforesaid spring contact means 30 and 30' may be constructed of any suitable flat stock spring materials such as nickel steel, phosphorous bronze, beryllium nickel or spring steel. In the use of spring steel for fabricating the spring contact means 30 or 30', it is preferable to provide it with a suitable plating for good electrical characteristics. The characteristics of the spring material can be selected to control the force required to force the push button inwardly of the switch housing, and the size and shape of the spring contact means and the terminal ends 25 and 25' of the terminals 24 and 24' may be, respectively, proportioned as desired. Further, in the switches of the present invention, the spring contact means 30 or 30' should be constructed so that when they are in their fully compressed condition the yield point of the metal has not been reached. Thus, after a prolonged period of time with the springs in their fully compressed condition, they will retain their ability to return to their original form as shown in FIGURES 3 and 9 without loss of their spring properties.

It will be noted that in the position of the parts of the switches as shown in FIGURES 3 and 9 that the annular shoulders 29 and 29' of push buttons 9 and 9' are disposed slightly inwardly of the adjacent inner surfaces of covers 8 and 8' so that the spring contact means 30 and 30' are in yielding or resilient contact with the contact portion 25 and 25' of the terminals 24 and 24', respectively. However, should the contact springs for any reason fail the annular shoulders 29 or 29' of the push buttons 9 or 9' by engaging the inner surface of the covers will be retained within the housings of the switches. Also, while the invention has been described in connection with switches which are closed in the outward positions of the push buttons the components may
be readily arranged for the switches to be open in the noted position of the push buttons.

While I have shown and described what I consider to be preferred forms of my invention, it will be understood that various modifications and rearrangements may be made therein without departing from the spirit and scope of the invention.

I claim:

1. A push button switch comprising a housing, a pair of electric terminals mounted in fixed spaced apart and insulated relation with respect to each other in said housing, a push button mounted for movement inwardly toward the rear of said housing and outwardly of the front of said housing, opposed guide surfaces in said housing lying in planes converging angularly with respect to each other from the front to the rear of said housing, contact means within said housing carried by said push button for electrically connecting said terminals in the outermost position of said push button and disconnecting said terminals upon movement of said push button inwardly of said housing, said contact means having divergent leaf spring arms provided with end portions in guiding engagement with said guide surfaces, said planes of said guide surfaces having a point of planar confluence lying between said end portions of said leaf spring arms, and said leaf spring arms being placed under compression by engagement of said outer ends of said leaf spring arms with said guide surfaces upon movement of said push button inwardly of said housing to an extent so that upon the release of said push button, said loaded leaf spring arms solely effect movement of said push button to its outermost position.

3. A push button switch comprising a housing of electrical insulating material open at one end and closed at its other end, abutments inwardly of the open end of said housing, a cover of electrical insulating material for said housing closing the open end thereof and having lugs extending into said housing, a pair of electrical terminals mounted in said housing in fixed spaced apart relation having inner contact portions between said abutments of said housing and said lugs of said cover, and outer portions exteriorly of the closed end of said housing, a push button mounted in an opening in said cover for movement axially of said housing inwardly and outwardly relative thereto, said push button having an annular shoulder of a diameter greater than the diameter of said opening of said cover and lying inwardly of the inner surface of said cover spring contact means connected at the inner end of said push button normally spring biased into engagement with said inner portions of said electrical terminals for limiting outward movement of said push button and disposing said annular shoulder thereof in spaced relation inwardly of the inner surface of said cover, said spring contact means electrically connecting said terminals in the outer most position of said push button and disconnecting said terminals upon movement of said push button in a direction inwardly of said housing, a pair of opposed guide surfaces in said housing lying in planes converging angularly with respect to each other toward the rear of said housing, said spring contact means comprising a pair of divergent leaf spring arms having their outer ends in guiding engagement with said guide surfaces, said planes of said guide surfaces having a point of confluence lying between said outer ends of said leaf spring arms, and said leaf spring arms being placed under compression by engagement of said outer ends of said leaf spring arms with said guide surfaces upon movement of said push button inwardly of said housing to an extent so that upon the release of said push button said loaded leaf spring arms solely effect movement of said push button to its outermost position and threait effecting wiping of said contact portions of said terminals by said spring contact means.

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