A microminiature switch having a housing base and a housing cover, a pair of contacts in the base with a ball member held in place by the cover for closing the circuit. One contact is at least partially resilient, and has a movable portion overhanging a stationary contact. The ball member is moved by an exterior actuator over an apex of the movable contact to cam it into engagement with the stationary contact.

In another modification the ball bridges two contacts, rather than camming them together.

11 Claims, 8 Drawing Figures
MICROMINATURE SWITCH CONSTRUCTION

BACKGROUND OF THE INVENTION

The invention relates to microminiature switches, and more particularly to switches utilizing a ball wedged between a cover and the electrical switch contacts.

It has been a common practice in the electrical communication art to vary the resistance in a particular circuit by using an infinitely adjustable resistor or screw-type resistors wherein a plurality of resistors are inserted in or removed from a circuit by screw actuators. This is obviously extremely time-consuming.

OBJECTS AND SUMMARY

It is a purpose of the instant invention to provide a switch mechanism for use in inserting resistances into a circuit or removing them therefrom by providing easily actuated, positive action, ball switches.

Another object is to provide a switch that cannot be energized or deenergized without an appropriate tool.

A further object is the provision of a switch design which lends itself to microminiature fabrication and use on printed circuit boards with integrated circuitry.

In one modification of the invention, a resilient movable contact with a depending wiping contact portion is positioned over a stationary contact. A ball-cam located in a housing between the cover and an upstanding ledge is moved over the apex of the movable contact, whereby the movable contact is depressed onto and makes engagement with the stationary contact. An actuator having pointed actuating surfaces is used to move the ball into and out of contact engagement.

In another modification, the ball functions as the contact itself to bridge a pair of contacts, at least one of which is resilient. A modification of the latter form includes bifurcated contacts to double the contacting surface.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will become more apparent following the detailed description and accompanying drawings wherein:

FIG. 1 is an enlarged plan view of the microminiature switch of the present invention;

FIG. 2 is an enlarged transverse sectional view, taken along line 2—2 of FIG. 1;

FIG. 3 is a fragmentary longitudinal sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is a perspective view of one form of an actuator for use with the microminiature switch;

FIG. 5 is an enlarged plan view of a modification of the present invention;

FIG. 6 is an enlarged transverse sectional view taken along line 6—6 in FIG. 5;

FIG. 7 is a fragmentary longitudinal sectional view, taken along line 7—7 of FIG. 6; and

FIG. 8 is an enlarged plan view of a modification of the invention shown in FIGS. 5—7.

DETAILED DESCRIPTION OF THE INVENTION

Ball-Cam Embodiment

Referring now to FIGS. 1—3, a bank of microminiature switches is seen having a housing base 1 and a housing cover 3. The actual size for the nine bank switch may be in the order of $1 \frac{1}{8} \times \frac{3}{4} \times \frac{1}{4}$ inch. The base is substantially rectangular having a ledge 5 and a plurality of upstanding switch dividers 7. The dividers 7 are positioned between each of the switches.

A first stationary contact 9 is molded into the housing base and has a terminal portion 11 extending exterior to the housing. Stationary contact 9 has an angled contact portion 13 extending into the switch cavity area between upstanding portions 7. A movable contact 15 with a depending terminal portion 17 is also molded into the other side of the housing. An angular portion 19 directed toward the stationary contact 13 has an overhanging portion 21 connected thereto at an apex 22.

The cover 3 has a depending skirt 23 surrounding the switch and positioned on ledge 5. As seen in FIG. 3, a central portion 25 has a pair of beveled interior edges 27 directed toward the interior of the respective switches. Positioned between the portions 25 are openings 29.

A ball track 31 is formed by the top edge of upstanding divider 7. A ball 33 rides along the tracks 31 and is held in place by means of the beveled portions 27 of cover 3. As seen in FIG. 2, the ball is capable of moving from a left-hand position to a right-hand position closing the switch contacts between overhanging portion 21 and stationary portion 13. The closing operation is accomplished by cam action wherein ball 33 is pushed against the angular portion 19, camming it downward, thus bringing overhanging portion 21 in contact with the stationary portion 13. A slight wiping action is achieved as the contacts mate. In the right-hand position, the switch is held closed by the ball securely in place between the beveled portions 27, closed contact 21, a side 35 of housing 3, and the apex 22 of the bent contact 21.

The closing operation is accomplished by means of an actuator 40 seen in FIG. 4. The actuator has a large central portion 42, a short axial portion 44, and a longer, narrower portion 46. Positioned at the end of narrow portion 46 is a pointed actuator 48 of about the same width as axial portion 46. A smaller, pointed actuator 50 is positioned on the shorter, axially extending portion 44. Depending upon the size of the opening 29, pointed actuator portions 48 or 50 will be used.

Ball-Switch Embodiment

As illustrated in FIGS. 5—7, a housing base 101 having a peripheral ledge 103 has a pair of contacts 105 and 107 embedded therein. Contacts 105 and 107 have terminal portions 109 and 111 extending exterior to the housing. Contact 107 has a short, inclined portion 113 and a vertically depending portion 115 positioned in a recess 117 in housing base 101. The angle of portion 113 is at about 15° below the horizontal.

Contact 105 is somewhat more resilient than contact 107 and has a depending portion 119 positioned in a recess 121. A 15° angled portion 123 having an apex 125 connects portions 119 and 123 with a concave dent portion 127 of about 150°.

A housing cover 129 has four side walls 131 with a peripheral recess 133 conforming with ledge 103. The housing cover has a plurality of openings 135 having substantially vertical portions 137. Inclined surfaces 139 connect portions 137 to a plurality of partitions 141. A ball contact 143 is positioned between a point 144 where inclined surfaces 139 join vertical portions 137 and the contacts 105 and 107. In the "open" posi-
tion, the ball 143 rests in the concave portion 127. As the ball is forced to the right by actuator 40, it rests on portions 113 and 123 bridging the contacts. Since contact 105 is resilient there will be flexure at apex 125 as the ball exerts a downward force thereon.

Obviously, depending portion 119 can be shaped in various configurations. For example, in place of the vertically depending portion 119, it can be curved in the form of a backward "C" having the lower curved portion resting in the bottom of recess 121 so that the contact will more easily flex upon exertion of pressure on apex 125.

The switch illustrated in FIG. 8 is substantially identical to that shown in FIGS. 5-7. The only distinction is in the fact that contacts 105 and 107 are bifurcated, having portions 105' and 107'. Since the switch contact is essentially a point contact, twice the contact area will be achieved with the bifurcated modification.

While two basic embodiments of the invention have been described, it will be understood that it is capable of many further modifications and this application is intended to cover any variations, uses, or adaptations of the invention following in general, the principles of the invention and including such departures from the present disclosure as come within knowledge or customary practice in the art to which the invention pertains, and as may be applied to the essential features hereinbefore set forth and fall within the scope of the invention or the limits of the appended claims.

What is claimed is:

1. An electrical switch comprising:
   a. a housing including a base member and a cover member for providing physical and visual access to the interior of the housing;
   b. a pair of contacts in said housing adjacent to said opening;
   c. one of said contacts being at least partially resilient and having a raised portion adjacent said opening;
   d. a substantially round movable member being positioned in said housing adjacent said opening and being held in a given position in said housing between said cover member and said base member, said opening having a longitudinal dimension substantially greater than the diameter of said round movable member, a portion of said round movable member being accessible through said opening whereby longitudinal movement of said round movable member can be achieved through said opening for causing a circuit to be opened or closed through said contacts by said round movable member.

2. An electrical switch as defined in claim 1 wherein said member is a ball.

3. An electrical switch as defined in claim 1 wherein said base has a track of insulating material thereon, said cover having edges adjacent said opening, and said member being positioned to move between said edges and said track.

4. An electrical switch as defined in claim 1 wherein movement of said round movable member over said raised portion causes the one of said contacts to engage the other of said contacts.

5. An electrical switch as defined in claim 1 wherein said contacts are separated from each other, and said round movable member is movable from a bridging to a non-bridging position and vice versa.

6. An electrical switch as defined in claim 1 wherein one of said contacts has a concave detent formed therein for locating the round movable member therein.

7. An electrical switch as defined in claim 1 wherein a plurality of switch elements are located in one housing, said switch elements being separated by an insulated divider.

8. An electrical switch as defined in claim 1 wherein said round movable member is of conducting material.

9. An electrical switch as defined in claim 1 wherein said contacts are bifurcated.

10. An electrical switch as defined in claim 1 wherein each of said contacts has a terminal portion extending through said housing, the one of said contacts has an angled portion adjacent the terminal portion and an overhanging portion attached to said angled portion at an apex formed at the raised portion, the other of said contacts having an angled stationary portion adjacent the terminal portion, said overhanging portion being positioned closely adjacent said angled stationary portion.

11. An electrical switch as defined in claim 1 including an actuator adapted to be inserted in said opening, said actuator having a pointed portion thereon for engagement with said round movable member to cause said round movable member to move.

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