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SAFETY SWITCH DEVICE

Filed Nov. 29, 1968

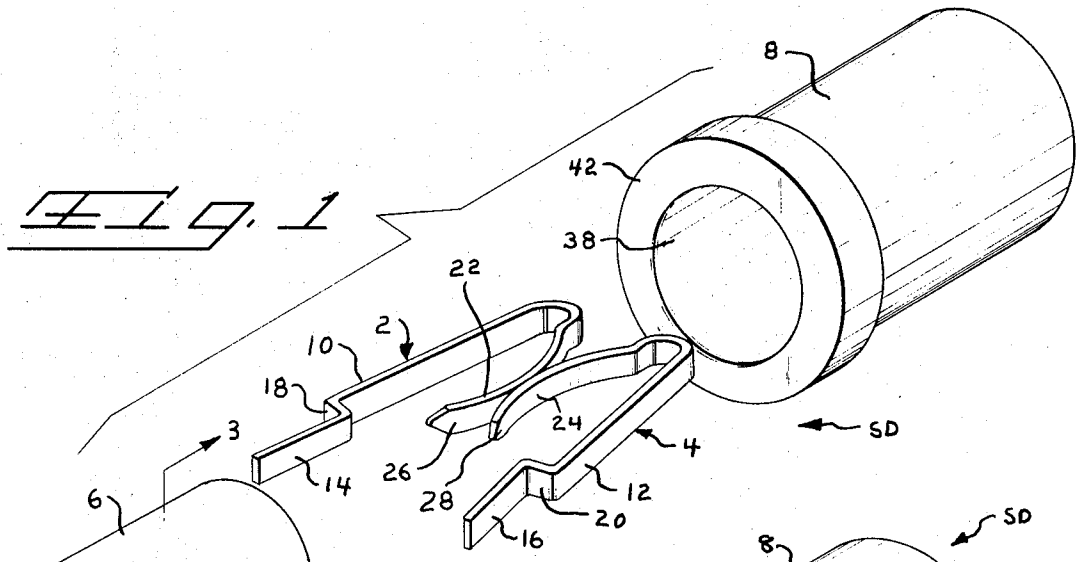


FIG. 1

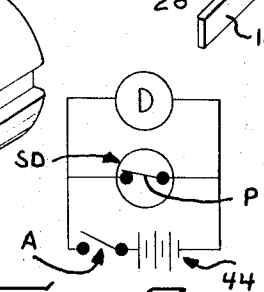


FIG. 7

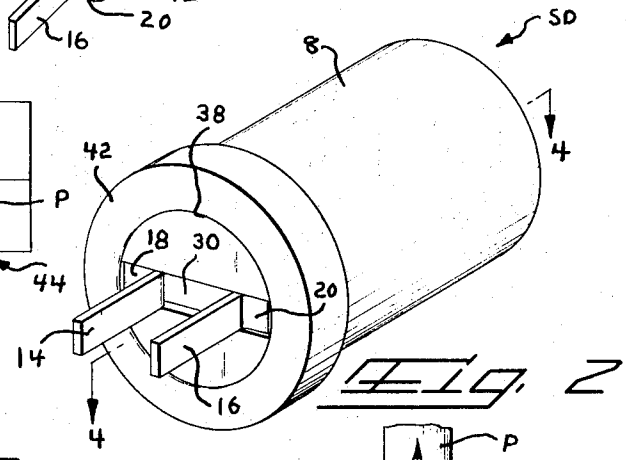


FIG. 2

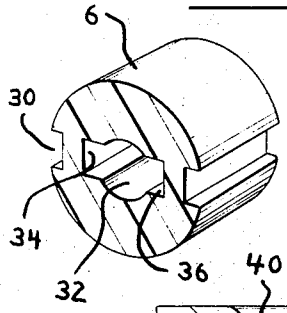


FIG. 3

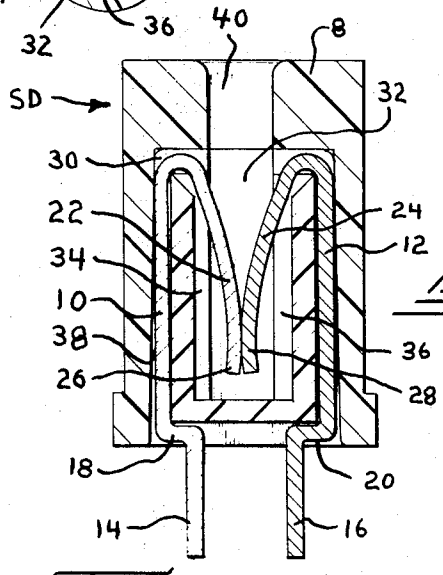


FIG. 4

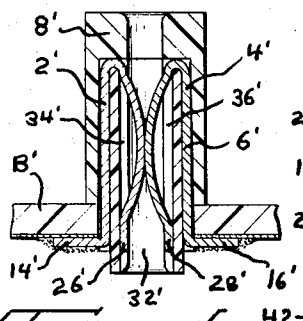


FIG. 6

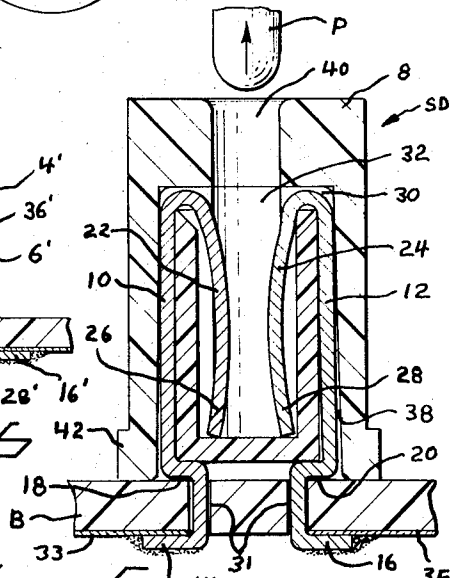


FIG. 5

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SAFETY SWITCH DEVICE

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U.S. Cl. 200—51.1 6 Claims

ABSTRACT OF THE DISCLOSURE

A switch device is provided for primary use in conjunction with printed circuit boards. The switch device is adatped normally to close and short circuit the conductor path to which it is secured and subsequently short an element further along in the circuit. The device has a dielectric housing with a pair of contact means therein which are in engagement with each other and which are deformable away from each other upon the insertion and subsequent withdrawal of a pin. Upon withdrawal of the pin, the short circuit is removed and the circuit electrical path is open to the element.

This invention relates to switch devices and more particularly to a so-called "unshorting" switch device of novel construction which is adapted to be installed on a printed circuit board, and which is further adapted to normally short circuit an electrical element on the circuit board. The device is operable to remove the short circuit automatically in response to the insertion and subsequent withdrawal of a pin. The switch device is of simple construction, has few parts and is adapted for manufacture at low cost. The device may be defined as an expandable item, and may be employed in particular use in conjunction with explosive elements wherein the switch device is destroyed with the explosive element.

One object of the invention is to provide a new and improved switch device for electrical circuits.

Another object is to provide a switch device defined by deformable contact means mounted on an intermediate dielectric member and surrounded by a dielectric housing means.

A further object is to provide a switch device which may be secured to a printed circuit board and which is operable upon the withdrawal of a pre-inserted pin.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there are shown and described illustrative embodiments of the invention; it is to be understood, however, that these embodiments are not intended to be exhaustive nor limiting of the invention but are given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

FIG. 1 is an exploded perspective view of a switch device according to the present invention;

FIG. 2 is an assembled perspective view of a switch device;

FIG. 3 is a sectional view taken along the lines 3—3 of FIG. 1;

FIG. 4 is a sectional view taken through the lines 4—4 of FIG. 2;

FIG. 5 is a sectional view of a switch device secured to a printed circuit board and set for use;

FIG. 6 is a reduced cross-sectional view of another switch device secured to a printed circuit board; and

FIG. 7 is a schematic view showing a switch device in use.

Referring to FIGS. 1–4, a switch device SD employing the principles of this invention comprises a pair of contacts 2 and 4 which are made from electrically conductive metal such as steel and which may be plated with tin, silver or the like. Contacts 2 and 4 are subassembled around an inner dielectric member in the form of a plug 6, and the sub-assembly is insertably secured to an outer dielectric housing 8. Member 6 and housing 8 may be made from nylon or other suitable plastic material.

Contacts 2 and 4 are identical and comprise strip members including intermediate straight portions 10 and 12, each of which have short terminating ends 14 and 16 thereon defining solder tabs. The transition between the straight portions and ends 14 and 16 includes inwardly-directed sections 18 and 20. The straight portions 10 and 12 have portions 22 and 24 at their other ends. The portions 22 and 24 being bent back over straight portions 10 and 12 and providing first arcuate sections and second arcuate sections the first arcuate sections have a smaller radius than the second arcuate sections. The free ends 26 and 28 of portions 22 and 24 are directed toward solder tabs 14 and 16.

Referring to FIGS. 1 and 3, inner dielectric member 6 is generally cylindrical, and it has a continuous slot 30 formed across the rear end, along the sides and across the top thereof. Slot 30 is utilized in conjunction with other slots for mounting the contacts 2 and 4, as will be described hereinafter. A longitudinal hole 32 is formed in member 6, and it terminates near the bottom end of member 6. Laterally-opposed longitudinal slots 34 and 36 are formed in communication with hole 32.

Outer dielectric housing 8 is generally cylindrical, and it has a passageway 38. An entrance 40 is located at one end of housing 8 and it has a diameter smaller than that of passageway 38. The diameter of passageway 38 is slightly larger than the outer diameter of member 6. A flange 42 is formed on the lower end of housing 8.

ASSEMBLY

Referring to FIGS. 1–4, contacts 2 and 4 are subassembled to member 6 such that straight portions 10 and 12 reside in slot 30 along the sides of member 6. Sections 18 and 20 effectively snap into place in slot 30 at the base of member 6 such that solder tabs 14 and 16 project beyond the base of member 6. The first arcuate sections of portions 22 and 24 reside in slot 30 at the entrance to hole 32 while the second arcuate sections of portions 22 and 24 are disposed in hole 32 of member 6 such that they are in normal engagement and ends 26 and 28 are in line with and adjacent to slots 34 and 36. The sub-assembly of contacts 2 and 4 and member 6 is then inserted into passageway 38 of housing 8, see FIGS. 2 and 4. Member 6 is frictionally held in housing 8 and the second arcuate sections are maintained in normal resilient engagement via portions 10 and 12 being in engagement with passageway 38. The diameters of entrance 40 and hole 32 are equal and axially aligned to receive pin P therein.

OPERATION

Referring to FIG. 5, an assembled switch device SD is secured to a printed circuit board B by inserting solder tabs 14 and 16 through appropriate openings 31 in the board and subsequently bending and soldering tabs 14 and 16 to respective conductors 33, 35 on the underside of board B. With a switch device in place on a board and in its normal state with the second arcuate sections of portions 22 and 24 in normal resilient engagement with each other, the switch is closed. By this means, current is carried from one circuit path 33 on the board to the other circuit path 35 via the normally-closed switch.

In use as shown by FIG. 7, a safety switch device may be installed in an electrical circuit having a power source **44** and a detonator device D. The switch device acts as a short circuit means and closes the circuit to the detonator D. When a pin P is inserted and subsequently withdrawn the contacts of the switch device are deformed away from each other, and the circuit between the power source **44** and detonator D is open. Detonator D may then be fired by closure of an actuating switch A in the circuit.

Referring to FIG. 6, an alternative switch device is generally similar to the one described above, and includes a pair of similar contacts **2'** and **4'**, an inner dielectric member **6'** and an outer dielectric housing **8'**. This device features a longitudinal hole **32'** running through inner dielectric member **6'** and through the switch device. This arrangement permits a pin (not shown) to pass through several switch devices so that devices may be stacked if desired. Also, printed circuit boards with switch devices installed thereon may be stacked on a pin. By this arrangement, the detonator D is set to fire when boards are withdrawn from the pin. In this embodiment, a hole having an inside diameter proximating the outside diameter of member **6'** is drilled or otherwise formed through a printed circuit board B'. The device is secured to the board B' by pushing member **6'** through the hole in the board B' and bending and soldering the tabs **14'** and **16'** to the conductors on the underside of the board B'.

Free ends **26'**, **28'** of contacts **2'**, **4'** are disposed within slots **34'**, **36'** respectively, free ends being slidable along slots **34'**, **36'** when the pin P is inserted into hole **32'**. Free ends **26'**, **28'** in slots **34'**, **36'** assure that no misalignment occurs therebetween as could be the case in the embodiment of FIGS. 1–5, therefore the free ends **26'**, **28'** could be disposed in slots **34'**, **36'** in like manner, if desired.

It will, therefore, be appreciated that the aforementioned and other desirable objectives have been achieved; however, it should be emphasized that the particular embodiments of the invention, which are shown and described herein, are intended as merely illustrative and not as restrictive of the invention.

The invention is claimed in accordance with the following:

1. A switch device having a pair of normally engaging spring contacts adapted for deformation away from each other, comprising:

a housing provided with a passageway portion and a reduced geometry entrance communicating with said passageway portion,

a plug provided with a longitudinal hole terminating near an end portion of said plug, said plug being further provided with a pair of slots internally of said longitudinal hole,

the outer periphery of said plug being provided with longitudinal slot portions,

a pair of spring contacts including first portions received in said plug hole and initially mutually engaged, said spring contacts including second portions respectively received within the confines of said plug

outer peripheral slot portions, said spring contacts additionally including tab portions,

said plug outer periphery and said housing passageway portion being of complementary mating geometries with said plug so constructed and arranged to be received in said housing passageway portion with said plug hole and said housing entrance in mutual communication and alignment exposing said initially mutually engaged portions of said spring contacts and with said tab portions protruding from said housing passageway portion, and

said engaged portions of said spring contacts being adapted for mutual deformation away from each other to positions within the confines of said slots internally of said longitudinal hole.

2. The structure as recited in claim **1**, wherein said plug includes a second outer peripheral slot portion communicating with said longitudinal slot portions, and

each of said spring contacts being provided with a third portion adjacent to said protruding tab and received within said second slot portion.

3. The structure as recited in claim **1**, wherein said plug longitudinal hole extends entirely through said plug exposing said initially contacting portions of said spring contacts through said housing entrance and entirely through said plug.

4. The structure as recited in claim **1**, wherein said housing entrance and said plug hole are of equal inner diameter cylindrical configurations adapted to receive a common cylindrical pin therein.

5. The structure as recited in claim **1**, wherein said plug includes a third slot portion across said plug hole and communicating with said plug outer peripheral slot portions and said slots internally of said plug hole, and

said spring contacts further include third portions substantially within the confines of said plug third slot portion.

6. The structure as recited in claim **3**, wherein said plug includes a third slot portion across said plug hole and communicating with said plug outer peripheral slot portions and said slots internally of said plug hole, and said spring contacts include third portions substantially within the confines of said plug third slot portions.

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U.S. Cl. X.R.

179—96; 317—101; 339—183