

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN AND RELATING TO SWITCHES FOR ELECTRICAL ASSEMBLIES

(71) We, AMP INCORPORATED, a corporation organised and existing under the laws of the State of New Jersey, United States of America, of Eisenhower Boulevard, Harrisburg, Pennsylvania, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to electrical assemblies including switches and switches forming parts of electrical assemblies.

According to one aspect of the present invention, an electrical assembly comprises a support panel having a first surface carrying a plurality of conductive paths and a switch including a resilient contact element and a leg integral with the element and inserted in a through hole in the panel, the leg having a first shoulder engaging the first surface and a second shoulder engaging the opposite surface of the panel, the element being deflectable from a stable position spaced from the first surface to an unstable position in electrical contact with a conductive path on the first surface, the leg maintaining the element on the panel at a predetermined distance from the first surface when in its stable position.

Preferably, the contact element is in the form of a strip and has a leg integral with each end of the strip, the strip being bowed outwardly away from the first surface in the stable position of the element. According to a further aspect of the present invention a switch for mounting on a first surface of a support panel carrying a plurality of conductive paths, comprises a resilient contact element and a leg integral with the element for insertion into a through hole in the panel at a predetermined distance from the first surface, the element being deflectable from a stable position spaced from the first surface to an unstable position in electrical contact with a conductive path, the leg having a first shoulder adapted to engage the first surface and a second shoulder adapted to

engage the opposite surface of the panel. 50

Embodiments of the invention will now be described, by way of example, reference being made to the Figures of the accompanying diagrammatic drawings in which:—

Figure 1 is a perspective view of an electrical assembly comprising a plurality of switches mounted on a printed circuit board, some of the detail being cut away and shown in cross-section; 55

Figure 2 is a perspective view of a resilient contact element forming part of a switch; and 60

Figure 3 is a cross-section on the line III—III of Figure 1.

As shown in Figure 1, a support panel in the form of a printed circuit board 1 comprises a substrate of insulating material carrying on its upper surface 2 a plurality of conductive paths 3 each terminating at a conductive pad 4. Groups of through holes are formed in the board 1 at locations 30 to 36 where switches 10 are mounted or are capable of being mounted on the board 1. Referring first to locations 30, 32, 33 and 36, each switch 10 includes a resilient contact element 12 in the form of a strip, the element 12 having a leg 44 integral with and extending from each end of the element. Each leg 44 is bifurcated and has a slot 45 along each side edge defining upper and lower facing shoulders. The legs pass through holes 5 in the printed circuit board 1 and the upper shoulder engages the upper surface 2 and the lower shoulder engages the lower surface of the printed circuit board 1. 65 70 75 80 85

The contact element 12 is bowed upwardly away from the surface 2 to present a generally convex upper surface 24 and a concave lower surface 26. The element 12 is monostable, that is, it has a stable position spaced from the upper surface 2 of the board 1 but when a predetermined force is applied to the surface 24, the element 12 will move to a non-stable position at which position it will engage a conductive pad 4. Upon the force being removed, the element 12 will snap back to its stable position. The 90 95

legs 44 not only attach the element 12 to the board 1 but the shoulders maintain the element 12 at a predetermined distance from the surface 2 when the element is in its stable position.

Referring now to location 31, each switch 10 may also include a generally rectangular contact block 52 of conductive material. From opposite ends of the block extend legs 54 (only one shown). Each leg 54 extends through a hole 6 in the printed circuit board 1 to maintain the block in electrical contact with a pad 4 immediately beneath an element 12. If a contact block 52 is mounted on the board 1, then when a force is applied to the surface 24 of the element 12, the element 12 will engage the upper surface of the block 52.

In an alternative embodiment, shown in Figures 2, 3, and at locations 34 and 35, legs 14 are integral with and extend from each end of element 12. Each leg 14 has a central part 16 which passes through a rectangular cross-section hole 15 and at its free end is reversely curled to define a shoulder 18 engaging the lower surface of the board 1. On each side of the central part 16 is a curled-up tab 20 defining a shoulder 22 engaging the upper surface 2. Again, the legs 14 not only attach the element 12 to the board 1 but the shoulders 22 maintain the element at a predetermined distance from the surface 2 when the element 12 is in its stable position.

The resilient contact element 12 is formed with an embossment 60 which extends towards the upper surface 2 of the board 1. This embossment is coated with a noble metal.

Referring now to locations 34, 35 and 36, a push button 70 is located directly above each contact element 12. Each push button 70 includes a top portion 102 which has a rectangular shape, a centre portion 75 which defines with the top portion 102 an upwardly facing shoulder 76, and a bar 100 which depends from the portion 75. The top portions 102 of the push buttons 70 extend through apertures in a frame 77, the frame 77 in effect maintaining the push buttons in position over their respective elements 12. By means not shown, the frame 77 is secured in a fixed relationship with this printed circuit board 1. When a push button 70 is depressed downwards, the bar 100 will engage the contact element 12 and cause said element 12 to move from its stable position to its non-stable position in contact with a conductive pad 4 or, in the case where a block 52 is being used, in contact with the upper surface of a contact block 52. When the force is removed from the push button 70, the push button 70 is forced upwardly by the spring action of the element 12, thereby forcing the upwardly facing shoulder

76 of the centre portion 75 of the push button against the underside of the frame 77.

In a further embodiment, not illustrated, the contact element 12 can be provided with but a single leg, for example of the type shown at location 33. In such an embodiment, the element 12 will be, in effect, a cantilever supported upon the single leg but will move upwardly and downwardly with the same snap-spring action as described in relation to the previous embodiments.

The contact element 12 can be blanked and formed from a continuous strip of metal.

The lower surface of the printed circuit board 1 can have conductive paths 3 and conductive pads 4 with appropriate ones of which the upper facing shoulders on the legs 14, 44 can make electrical contact.

WHAT WE CLAIM IS:—

1. An electrical assembly comprising a support panel having a first surface carrying a plurality of conductive paths and a switch including a resilient contact element and a leg integral with the element and inserted in a through hole in the panel the leg having a first shoulder engaging the first surface and a second shoulder engaging the opposite surface of the panel, the element being deflectable from a stable position spaced from the first surface to an unstable position in electrical contact with a conductive path on the first surface, the leg maintaining the element on the panel at a predetermined distance from the first surface when in its stable position.

2. An electrical assembly as claimed in Claim 1, in which the contact element is in the form of a strip and has a leg integral with each end of the strip, the strip being bowed outwardly away from the first surface in the stable position of the element.

3. An electrical assembly as claimed in Claim 2, in which an embossment is formed on the strip extending towards the first surface and coated with a noble metal.

4. An electrical assembly as claimed in Claims 1, 2 or 3, in which a push button is provided for applying a force to the element to deflect the element from its stable to its unstable position.

5. An electrical assembly as claimed in Claim 4, in which the push button is mounted on a frame adjacent the element for movement towards and away from the element.

6. An electrical assembly as claimed in any one of Claims 1 to 5, in which an electrically conductive block is mounted on the first surface of the panel between the first surface and the contact element.

7. A switch for mounting on a first surface of a support panel carrying a plurality of conductive paths, comprising a resilient

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legs 44 not only attach the element 12 to the board 1 but the shoulders maintain the element 12 at a predetermined distance from the surface 2 when the element is in its stable position.

Referring now to location 31, each switch 10 may also include a generally rectangular contact block 52 of conductive material. From opposite ends of the block extend legs 54 (only one shown). Each leg 54 extends through a hole 6 in the printed circuit board 1 to maintain the block in electrical contact with a pad 4 immediately beneath an element 12. If a contact block 52 is mounted on the board 1, then when a force is applied to the surface 24 of the element 12, the element 12 will engage the upper surface of the block 52.

In an alternative embodiment, shown in Figures 2, 3, and at locations 34 and 35, legs 14 are integral with and extend from each end of element 12. Each leg 14 has a central part 16 which passes through a rectangular cross-section hole 15 and at its free end is reversely curled to define a shoulder 18 engaging the lower surface of the board 1. On each side of the central part 16 is a curled-up tab 20 defining a shoulder 22 engaging the upper surface 2. Again, the legs 14 not only attach the element 12 to the board 1 but the shoulders 22 maintain the element at a predetermined distance from the surface 2 when the element 12 is in its stable position.

The resilient contact element 12 is formed with an embossment 60 which extends towards the upper surface 2 of the board 1. This embossment is coated with a noble metal.

Referring now to locations 34, 35 and 36, a push button 70 is located directly above each contact element 12. Each push button 70 includes a top portion 102 which has a rectangular shape, a centre portion 75 which defines with the top portion 102 an upwardly facing shoulder 76, and a bar 100 which depends from the portion 75. The top portions 102 of the push buttons 70 extend through apertures in a frame 77, the frame 77 in effect maintaining the push buttons in position over their respective elements 12. By means not shown, the frame 77 is secured in a fixed relationship with this printed circuit board 1. When a push button 70 is depressed downwards, the bar 100 will engage the contact element 12 and cause said element 12 to move from its stable position to its non-stable position in contact with a conductive pad 4 or, in the case where a block 52 is being used, in contact with the upper surface of a contact block 52. When the force is removed from the push button 70, the push button 70 is forced upwardly by the spring action of the element 12, thereby forcing the upwardly facing shoulder

76 of the centre portion 75 of the push button against the underside of the frame 77.

In a further embodiment, not illustrated, the contact element 12 can be provided with but a single leg, for example of the type shown at location 33. In such an embodiment, the element 12 will be, in effect, a cantilever supported upon the single leg but will move upwardly and downwardly with the same snap-spring action as described in relation to the previous embodiments.

The contact element 12 can be blanked and formed from a continuous strip of metal.

The lower surface of the printed circuit board 1 can have conductive paths 3 and conductive pads 4 with appropriate ones of which the upper facing shoulders on the legs 14, 44 can make electrical contact.

WHAT WE CLAIM IS:—

1. An electrical assembly comprising a support panel having a first surface carrying a plurality of conductive paths and a switch including a resilient contact element and a leg integral with the element and inserted in a through hole in the panel the leg having a first shoulder engaging the first surface and a second shoulder engaging the opposite surface of the panel, the element being deflectable from a stable position spaced from the first surface to an unstable position in electrical contact with a conductive path on the first surface, the leg maintaining the element on the panel at a predetermined distance from the first surface when in its stable position.

2. An electrical assembly as claimed in Claim 1, in which the contact element is in the form of a strip and has a leg integral with each end of the strip, the strip being bowed outwardly away from the first surface in the stable position of the element.

3. An electrical assembly as claimed in Claim 2, in which an embossment is formed on the strip extending towards the first surface and coated with a noble metal.

4. An electrical assembly as claimed in Claims 1, 2 or 3, in which a push button is provided for applying a force to the element to deflect the element from its stable to its unstable position.

5. An electrical assembly as claimed in Claim 4, in which the push button is mounted on a frame adjacent the element for movement towards and away from the element.

6. An electrical assembly as claimed in any one of Claims 1 to 5, in which an electrically conductive block is mounted on the first surface of the panel between the first surface and the contact element.

7. A switch for mounting on a first surface of a support panel carrying a plurality of conductive paths, comprising a resilient



contact element and a leg integral with the element for insertion into a through hole in the panel for mounting the element on the panel at a predetermined distance from the first surface, the element being deflectable from a stable position spaced from the first surface to an unstable position in electrical contact with one of the conductive paths, the leg having a first shoulder adapted to engage the first surface and a second shoulder adapted to engage the opposite surface of the panel.

8. The switch as claimed in Claim 7, in which the contact element is in the form of a strip and has a leg integral with each end of the strip, the legs extending in the same direction from the strip, the strip being bowed outwardly in a direction opposite to the direction in which the legs extend.

9. The switch as claimed in Claim 8, in which an embossment is formed on the strip extending in the same direction as the legs, the embossment being coated with a noble metal.

10. An electrical assembly constructed and arranged substantially as hereinbefore described with reference to and as illustrated in Figure 1 of the accompanying drawings.

11. A switch constructed and arranged substantially as hereinbefore described with reference to and as illustrated at locations 32, 33 and 36 of Figure 1 or locations 34 and 35 of Figure 1 and Figures 2 and 3 of the accompanying drawings.

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