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(54) ELECTRIC SWITCH

(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:—

This invention relates generally to switches, and more particularly to switches of the type known as link line switches which are employed extensively in the telephone industry.

The present invention is a switch assembly comprising a base of insulating material which has a plurality of parallel spaced slots and a plurality of apertures intersecting, respectively, the slots, a plurality of spring contacts each of which is mounted in a respective slot of the base and each of which has a slotted blade portion extending into that aperture which intersects the respective slot to penetrate the insulation of and establish electrical connection with an insulated wire received in the aperture, the contacts having contact portions located above the base, and an actuator operable to deform at least some of the spring contacts and establish electrical connection between predetermined ones of the contact portions.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings in which:—

Figure 1 is a perspective view of a switch according to the invention at an initial stage in its assembly;

Figure 2 is a perspective view of the switch at a later stage in its assembly;

Figure 3 is a view of a detail of the switch showing in particular the termination of an insulated wire;

Figure 4 is a perspective view of a spring contact used in the switch;

Figure 5 is a perspective view of a detail of Figure 4;

Figure 6 is a top plan view of a housing forming part of the switch;

Figure 7 is an end view of the housing of Figure 6;

Figure 8 is a sectional view taken on line A—A of Figure 6;

Figure 9 is a side view showing the assembled switch defining a stable switch condition;

Figure 10 is a view similar to Figure 9 but showing the switch defining an unstable or momentary switch condition; and

Figure 11 is a side view of an actuator forming part of the switch.

With particular reference to Figures 9 and 10, the switch 10 comprises a plastics housing or base 11, a plurality of leaf spring contacts 12 mounted in the base 11, an actuator 13 for operating the contacts 12 and a metal bracket 14 for mounting the base 11 to a panel.

The base 11 has an upper surface 15 which is approximately rectangular in plan; and a plurality of parallel spaced slots 16a—16g extend inwardly of the base from the upper surface 15. As most clearly seen in Figure 6, the slots 16, except for the two on the extreme right, are alternately staggered and each slot has a widened end portion 17. Again, except for the two slots on the extreme right, the ends which are widened alternately.

The base 11 has a lower surface which is stepped along two parallel sides to provide, as seen in Figures 1 and 7, a first stepped row of planar surfaces 21a—21c extending perpendicularly to the upper surface 15 of the base 11 and a second stepped row of planar surfaces 22a—22d extending perpendicularly to the surface 15. A blind hole 23a—23c extends inwardly of each planar surface 21 and intersects a respective slot 16 at the widened portion 17 of the slot. Similarly a blind hole 24a—24d extends inwardly of each planar surface 22 and inter-

sects a respective slot 16 at the widened portion 17 of the slot. This can be seen most clearly in Figure 8. Each blind hole 23 or 24 extends slightly beyond the respective slot 17 which it intersects but stops short of the next successive slot 17.

The spring contacts 12 are similar to each other in that each has an upper bifurcated contact portion 27, a lower mounting portion 28 and a lateral wire-connecting portion 29. A typical contact 12 is shown in detail in Figures 4 and 5. Each arm 30 of the bifurcated contact portion 27 has an embossment 31 which acts as a contact surface. The mounting portion 28 of the contact 12 is provided with two upper struck out resilient tangs 32 each defining a free edge 33 directed away from the bifurcated contact portion 27, and a lower struck out resilient tang 34 defining a free edge directed towards the contact portion 27.

Two spaced ribs 35 extend virtually the length of one surface of the contact 12, one rib running along each arm 30.

The wire-connecting portion 29 is formed as a tab projecting laterally in the plane of the mounting portion 28 from one longitudinal edge of the mounting portion. The tab 29 is provided with a slot 37 shown in detail in Figure 5. The slot is V-shaped the mouth of which opens on to a lower, i.e. facing away from the contact portion 27, edge of the tab 29. The sloping sides of the slot 37 are bent 90° out of the tab plane to form triangular flanges 38.

The contacts 12 differ from each other in the following respects. The lengths of the arms 30 vary as shown in Figures 9 and 10. The embossments 31 may be formed on either side of a contact 12 or on both sides depending on the switching function desired. The shape of arms 30 varies from contact to contact depending upon the switch function desired.

The spring contacts 12 are mounted respectively in the slots 16 of the base 11 in a predetermined configuration. The contacts 12 are electrically connected to respective insulated wires 40 which have been inserted into the respective blind holes 23 and 24 by virtue of the edges of the slot 37 which pierce the insulation and contact the core as shown in Figure 3.

The bifurcated contact portion 27 of the contacts 12 define a channel along which extends the actuator 13. The actuator 13 is formed as a rod of insulating material having four annular projections 41 provided at predetermined positions on the rod and a handle 42 at one end. The actuator 13 passes through a slot 43 in the metal bracket 14 which is mounted to the base 11 by any suitable means (not shown) and which also may be connected to a mounting panel (not shown) by means of flanges 44.

Figure 9 represents the stable condition of the switch in which the net result of the inherent spring bias of the contacts 12 is to tend to move the actuator 13 to the left as indicated by the arrow 45. The projection 41 on the extreme right of the actuator 13 limits movement of the actuator in the direction of arrow 45. In this condition it can be seen that the contact surfaces 31 on some of the contacts 12 engage the contact surfaces on others of the contacts 12 while the contact surfaces of the remaining contacts are disengaged.

When the actuator 13 is pulled to the right as indicated by the arrow 46 in Figure 10, the projections 41 on engaging respective contacts 12 serve to disconnect some of the contacts 12 and establish connection between others. On release of the actuator 13 it is returned to the Figure 9 position under the action of the inherent resilience of the contacts 12.

Thus two separate switch conditions are defined by Figures 9 and 10 in which in the first condition the wires 40 are electrically interconnected via the contacts 12 according to a first predetermined configuration and in the second condition the wires 40 are interconnected electrically via the contacts 12 according to another predetermined configuration. The actual configuration chosen is irrelevant to the scope of the present invention as it can be appreciated that very many configurations are possible.

The various components of the switch are assembled together and to the wires 40 as follows. A wire 40 is fully inserted into the blind hole 23a in the planar surface 21a of the base 11 and a spring contact 12 is inserted into the slot 16a with the mounting portion 28 leading and with the tab 29 being received in the widened portion 17. As the contact is inserted the portion of the wire 40 which bridges the slot 16a is received progressively in the slot 37 of the tab 29. The triangular flanges 38 are not sharp and so they wear rather than slice through the insulation of the wire 40 to establish electrical contact with the core of the wire. It is noted that the obviation of sharp edges defining the slot 37 prevents damage to the fine gauge wire 40. Figure 3 illustrates termination of the wire 40 by the contact 12. The lower tang 34 and the ribs 35 ensure a strong force-fit between the mounting portion 23 and the sides of the slot 16a and the free edges 33 of the upper tangs 32 bear against the upper surface 28.

The remaining wires 40 are connected respectively to the remaining contacts 12 in exactly the same way as described above.

The base 11 is then mounted to the metal bracket 14 and the actuator 13 is then inserted through the slot 43 in the bracket 14 and displaced laterally of the actuator axis

to be received in the channel defined by the aligned arms 30 of the bifurcated contact portions 27 into the position shown in Figure 9.

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WHAT WE CLAIM IS:—

1. A switch assembly comprising a base of insulating material which has a plurality of parallel spaced slots and a plurality of apertures intersecting, respectively, the slots, a plurality of spring contacts each of which is mounted in a respective slot of the base and each of which has a slotted blade portion extending into that aperture which intersects the respective slot to penetrate the insulation of and establish electrical connection with an insulated wire received in the aperture, the contacts having contact portions located above the base, and an actuator operable to deform at least some of the spring contacts and establish electrical connection between predetermined ones of the contact portions.

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2. A switch assembly according to claim

1, in which the slotted plate portion is formed as a slotted tab projecting laterally of the contact in the plane of the contact.

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3. A switch according to claim 1 or claim 2, in which the slotted plate portion includes a V-shaped slot, the sloping edges of which are bent substantially 90° out of the plane of the contact to form flanges.

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4. A switch according to claim 1, 2 or 3 in which each contact has at least one resilient tang engaging a side of the respective base slot.

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5. A switch according to any preceding claim in which each contact has stop surfaces engaging an upper surface of the base to limit insertion of the contact.

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6. A switch substantially as described with reference to the accompanying drawings.

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4. A switch according to claim 1, 2 or 3 in which each contact has at least one resilient tang engaging a side of the respective base slot.

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