

PATENT SPECIFICATION

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(21) Application No. 21946/74 (22) Filed 17 May 1974 (19)

(31) Convention Application No. 366 926(32) Filed 4 June 1973 in

(33) United States of America (US)

(44) Complete Specification published 9 Feb. 1977

(51) INT. CL.² H01H 15/02

(52) Index at acceptance

HIN 441 446 44Y 451 597 649 654 657 664 700 704 708 734

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(54) SLIDE 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 to a switch.

The present invention is a switch comprising a housing one wall of which is formed by a printed circuit board carrying a plurality of spaced conductors, the housing having a through slot extending along an upper wall opposed to the printed circuit board, and a contact carrier received in the housing and having an elongate actuator extending through the slot and terminating in a finger-engageable portion, the contact carrier carrying a contact having a first portion which is in sliding engagement with a fixed contact extending along the inside of a side wall of the housing, which side wall extends between the upper wall and the printed circuit board, and parallel to the slot, and a second portion at the end of the contact carrier remote from the upper wall, the contact carrier being spring biased away from the upper wall towards the printed circuit board, the slot having a plurality of widened portions spaced along the slot in register with the conductors of the printed circuit board, and defining respective switch positions, and the actuator having a widened portion remote from the contact carrier, which widened portion is receivable selectively in any of the slot widened portions under the action of the spring bias, so that the second portion of the contact engages the conductor of the printed circuit board associated with that slot widened portion, and is removable from any slot widened portion by manually pulling on the finger-engageable portion against the action of the spring bias, thus enabling the actuator to

be moved along the slot with the first portion of the contact always in contact with the fixed contact on the housing, and the second portion of the contact out of engagement with the conductors of the printed circuit board.

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

Figure 1 is an enlarged exploded perspective view of a switch according to the present invention;

Figure 2 is an enlarged cross-sectional view of the switch of Figure 1 assembled and mounted on a printed circuit board;

Figure 3 is a view similar to Figure 2 but illustrating another mode of operation thereof; and

Figure 4 is an enlarged fragmentary plan view of the assembled and mounted switch with parts broken away and in section to illustrate details of the switch.

A switch 1 comprises a dielectric housing 2 generally of elongated channel shape. The housing includes an upper wall 4, opposed side walls 6 and 8, and a pair of end walls 10 and 11 which are unitary with the side walls 6, 8 and the upper wall 4. At the intersection of the end wall 10 and the side wall 8, there is provided an internal channel 12 (Figure 4) which communicates with the interior cavity of the housing defined by the encircling walls 6, 8, 10 and 12. The channel 12 is enclosed by the housing wall 10 which is formed with a projecting rectangular portion 14. The housing receives therein a strip contact 16 of electrically conducting metal. The strip contact 16 is formed at one end with a pointed portion 18 which is bent substantially out of the plane of the strip contact 16, as best seen in Figure 4. The other end of the strip contact 16 is provided with a projecting tab 20, with a notch 22 separating the tab portion 20 from the remainder of the strip contact 16. As shown, the notch 22 has a pair of outwardly flaring side wall margins 24 terminating in a generally rectangular root portion 26. The strip contact 16

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is inserted into the inverted housing 2 along the interior of the side wall 8. The pointed end 18 is forcibly registered within the channel 12 communicating with the interior of the housing in order to retain the strip contact 16 within the housing. The end wall 11 is received in the notch 22 in the strip 16, the flared side walls 24 guiding the end wall 11 into registration wedgingly into the rectangular portion 26 of the notch 22. The strip contact 16 is therefore maintained internally of the housing extending in a direction longitudinally thereof. The tab portion 20 of the contact thus protrudes externally from the end wall 11 of the housing to provide a tab type electrical terminal to which any desired external electrical circuit may be connected. The upper wall 4 of the housing 2 has a slot 28 which extends generally along the longitudinal dimension of the housing and parallel to the strip contact 16. The slot 28 has spaced widened portions formed by a plurality of opposed notches 30.

The switch housing has a pair of integral mounting flanges 32 each provided with a mounting aperture 34.

The switch also includes a generally rectangular contact carrier 36 of dielectric material. The carriage is provided with opposed planar surfaces 38 and 40. The surface 38 is slidably received against the inner surface of the side wall 6. The surface 40 is slidably received against the surface of the elongated strip contact 16. The surface 40 of the carrier 36 is provided with a generally T-shaped recess 42. A hook-shaped portion 44 overlies a portion of the recess 42 and is slidably received against the contact strip 16. A generally T-shaped electrical contact is illustrated generally at 46. The T-shaped contact includes a pair of oppositely projecting arms 48 and a stem portion 50, giving the contact its T-shaped configuration. When mounted on the carrier 46 the contact 46 has its T-shaped configuration received in the corresponding T-shaped recess 42 provided in the side wall 40 of the carrier. The hook shaped portion 44 overlies the end of the stem portion 50, with the arms 48 being bent or formed to extend in a bowed configuration outwardly from the carrier 36. Thus when the contact 46 is mounted on the carrier 36, the arms 48 thereof project outwardly toward the contact strip 16 and are compressed between the contact strip 16 and the carrier 36. The arms 48 thereby provide two-point electrical engagement of the contact 46 with the contact 16. The hook portion 44 overlies the stem portion 50 as shown in Figures 2 and 3, to retain the contact 46 in place on the carrier. The hook portion 44 also engages against the surface of the contact strip 16 to support slidably the carriage against the contact strip 16.

The under surface of carrier 36 is provided with a first projecting arcuate portion 52 over which the contact stem 50 is formed with a reversely curved portion 54. As shown in Figure 3, the free end of the contact portion 50 is bifurcated and arcuately bent at 56 to provide a pair of electrical contact fingers. As shown in Figure 3, the carrier 36 is provided on its under surface with a second protruding portion 58 adapted to be engaged against the bifurcated and arcuately bent fingers 56 when the fingers are resiliently deflected toward the carrier. The upper surface of the carrier 36 is provided with an elongate, generally rectangular actuator shaft 60 of relatively thin cross-section which may be moulded integral with the carrier 36. In addition the top surface of the carrier 36 is provided with a generally cylindrical recess 62 encircling the shaft 60. The recess 62 has a bottom wall 64 terminating short of the bottom surface of the carrier 36. A resilient coil spring, illustrated at 66 has one end thereof received against the bottom wall 64, when the spring is encircably received over the shaft 60. When the carrier is mounted within the interior of the housing as described, the rectangular cross-section of shaft 60 is received slidably through the slot 28. The other end of the spring 66 engages a washer 68 slotted at 70 to receive the shaft 60 therethrough. The shaft 60 is further provided thereon with a protruding hook portion 72 which may be moulded integrally on the shaft 60 as shown.

A finger-engaging knob 74 is provided therethrough with a generally vertically extending aperture of relatively thin cross-section 76 for receiving the shaft 60. The relatively thin rectangular cross-section of the aperture 76 receives therein the complementary cross-section of the shaft 60 to prevent rotation of the knob 74 on the shaft. As further illustrated, the knob 74 is provided with a recess 78 which is generally wider than the relatively thin aperture 76. The recess 78 has a bottom wall 80 against which the hook-shaped projection 72 registers. In assembly, the shaft 60 is inserted into the aperture 76 of the knob 74, with the hook-shaped portion 72 having an inclined projecting side wall 80 which allows the knob 74 to be forcibly wedged over the inclined side wall 80 until the hook-shaped portion 72 is in registration internally of the recess 78. When this occurs, the hook-shaped portion 72 will snap into place within the recess 78 thereby latching against the bottom wall 80 and thereby securing the shaft internally of the knob 64. The spring 66 will be maintained in compression between the carrier 36 and the upper wall 4 of the housing since the carrier is urged upwardly against the housing upper wall 4 compressing the spring, when the shaft 60

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is latched securely to the knob 74.

As shown in Figures 2, 3 and 4, the housing 2 is mounted to a printed circuit board 88, for example, by mounting bolts 86 received through the apertures 34 of the flanges 32. The printed circuit board 88 includes a plurality of printed circuits thereon in the form of electrically conducting circuit paths 90 which are spaced in a direction extending parallel to the slot 28. Such circuits may be of the familiar circuit path or a pad type circuit area normally found on a printed circuit board. Although the circuits are illustrated as circuit paths, they may take any other form, such as pads, metal contacts mounted on the printed circuit board or any other type of electrical component normally found on printed circuit boards.

It is further contemplated that the printed circuit board 88 may be mounted directly to the inverted housing so as to form a cover for the housing and thereby become an integral part of the switch itself. The contact surfaces 90 thereof will thereby be contained internally of the housing, thereby enabling modification of the preferred embodiment as a self-contained unit with all the circuit paths 90 being formed as part of the switch itself.

In the preferred embodiment, however, the housing 2 is devoid of any circuit paths therethrough, enabling it to be mounted to the printed circuit board 88. As shown in Figure 2, with the housing thus mounted on the printed circuit board 88, the contact fingers 56 will engage against the printed circuit board 88. This will cause the contact fingers 56 to be resiliently deflected from their positions shown in Figure 3 to their positions shown in Figure 2, deflected into engagement against the projecting portion 58 of the carrier 36. Thus, as shown in Figure 2, the contact fingers 56 will be maintained in compression between the printed circuit board 88 and the carrier 36, with the partially compressed resilient spring 66 further ensuring compression of the carrier 36 on the spring fingers 56. In addition, the coil spring 66 further applies pressure on the contact portion 54 by forcibly urging the projecting portion 52 of the carrier into compression on the spring portion 54 between the printed circuit board 88 and the projecting portion 52. Thus, the coil spring 66 forcibly urges the carrier 36 toward the open side of the housing toward the printed circuit board 88 in order to compress the spring fingers 56 and the contact portion 54 of the contact spring 50 into compression on the printed circuit board. Thus the contact fingers 56 and the contact portion 54 engage against a selected one of the printed circuit paths 90. Since the contact 50 also engages against the strip contact 16, contact 50 provides a bussing electrical connection between the selected circuit path 90 and the strip

contact 16, which acts (as a bussing contact for the circuit paths 90. Sufficient engagement pressure to ensure electrical connection is maintained by the partially compressed coil spring 66 providing a compression force on the contact fingers and contact portion 54 sandwiched between the carrier and the selected printed circuit path 90. In addition, the bowed configuration of the arms 48 are in compression between the carrier 36 and the strip contact 16 to ensure sufficient engagement pressure of the contact 50 with the strip contact 16.

With reference particularly to Figures 1, 2 and 3, the knob 74 is provided with a pair of integral depending projections 92 generally rectangular in cross-section. The projections 92 are spaced on either side of the shaft 60 which is received through the aperture 76 of the knob. The projections 92 are of reduced size with respect to the bottom wall 84 of the knob so that they are freely received in corresponding notched or widened portions 30 provided in the housing upper wall 4 along either side of the slot 28. Thus as shown in Figure 2, when the contact fingers 56 engage a selected circuit path 90, the projecting portions 92 will be received internally of the corresponding opposed pair of notched portions 30 provided in the housing upper wall 4. Since the projecting portions 92 are spaced apart a distance greater than the width of the slot 28, they prevent the shaft 60 from being slidably traversed along the slot 28, and thereby detent or latch the shaft 60, together with the carrier 36, in a desired position within the housing and thereby accurately position the contact fingers 56 for engagement on a selected circuit path 90. When it is desired to move the contact fingers 56 from engagement to another selected circuit path 90, the knob 74 must be lifted, in a direction as shown by the arrow in Figure 3, so as to remove the projecting portions 92 from the corresponding notch portions 30. This is accomplished by manually pulling the knob in a direction outwardly of the upper wall 4, further compressing the coil spring 66 and thereby forcibly lifting the shaft 60 and retracting the carrier 36 from the open side of the housing as shown in Figure 3. As the carrier 36 is urged upwardly as described, the compression of the projecting portions 58 and 52 on the contact portions 54 and spring fingers 56 becomes relieved. This allows the contact fingers 56 and contact portion 54 to become lifted or retracted with the carrier so as to disengage the fingers from the selected circuit path 90. The arm portions 48 of the contact 50 will be allowed to slidably traverse upwardly along the vertical surface of the strip contact 16. Since the strip contact 16 is at right angles to the circuit paths 90, the strip con-

tact 16 will not interfere with the vertical displacement of the carrier or the contact 50.

With the projecting portions 92 removed from the corresponding notches 30, the shaft 5 60 may be slidably traversed along the slot 28 taking the carrier 36 along inside the housing 4. The washer 68 will be compressed against the inner surface of the upper wall 4 of the housing and will be slidably traversed thereover. The upper wall inner surface thereby provides a sliding bearing surface allowing for low friction displacement of the washer 68 thereover. The carrier may be displaced within the housing only when in its elevated or retracted position, as shown in Figure 3. When the carrier is displaced to its desired position, the knob 74 is released to allow the compression spring 66 to elongate and thereby partially relax. The spring forcibly will displace the carrier 36 into compression against the contact fingers 56 and the reversely curved portion 54, pressing them into compressive engagement against another selected circuit path 90. The spring further will urge the projecting portions 92 of the knob 74 into registration with corresponding opposed notch portions 30 in order to detent or latch the carrier 36 in its desired position, thereby maintaining the contact fingers 56 and the contact portion 54 in engagement on the newly selected printed circuit path 90. Thus the contact fingers 56 and the contact portion 54 electrically engage the selected circuit paths 90 only upon lifting and lowering of the carrier 36 as described which prevents undesired scraping or wiping of the contact fingers and contact portion 54 across the circuit board 88 and the circuit paths 90 to eliminate excessive wearing of the printed circuit board and the circuit paths 90. Limited wiping action is permitted since, as the carrier is lowered into position, the contact fingers 56 will initially engage a selected circuit path 90 and will be resiliently deflected from its position shown in Figure 3, to its position shown in Figure 2, as the carrier is further lowered until the contact fingers 56 are resiliently deflected into engagement against the projecting portion 58 of the carrier 36. Such resilient deflection of the contact fingers 56 produces a limited wiping action on the surface of the selected circuit path 90 to provide a slight cleaning action to improve the electrical conduction therebetween.

WHAT WE CLAIM IS:—

1. A switch comprising a housing one wall of which is formed by a printed circuit board carrying a plurality of spaced conductors, the housing having a through slot extending along an upper wall opposed to the printed circuit board, and a contact carrier received in the housing and having an elongate actuator extending through the slot and terminating in a finger-engageable portion, the contact carrier carrying a contact having a first portion which is in sliding engagement with a fixed contact extending along the inside of a side wall of the housing, which side wall extends between the upper wall and the printed circuit board, and parallel to the slot, and a second portion at the end of the contact carrier remote from the upper wall, the contact carrier being spring biased away from the upper wall towards the printed circuit board, the slot having a plurality of widened portions spaced along the slot, in register with the conductors of the printed circuit board, and defining respective switch positions, and the actuator having a widened portion remote from the contact carrier, which widened portion is receivable selectively in any of the slot widened portions under the action of the spring bias, so that the second portion of the contact engages the conductor of the printed circuit board associated with that slot widened portion, and is removable from any slot widened portion by manually pulling on the finger-engageable portion against the action of the spring bias, thus enabling the actuator to be moved along the slot with the first portion of the contact always in contact with the fingered contact on the housing, and the second portion of the contact out of engagement with the conductors of the printed circuit board.

2. A switch as claimed in Claim 1, in which the spring bias is provided by a compression spring compressed between the upper wall and the contact carrier, and surrounding a portion of the actuator.

3. A switch substantially as described with reference to and as shown in the drawings.

For the Applicants:
R. G. STUART-PRINCE,
Chartered Patent Agent.

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