

12

EUROPEAN PATENT APPLICATION

21 Application number: 88312396.0

51 Int. Cl.⁴: H01H 13/10 , H01H 13/52

22 Date of filing: 29.12.88

30 Priority: 01.08.88 US 227310

43 Date of publication of application:
07.02.90 Bulletin 90/06

84 Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

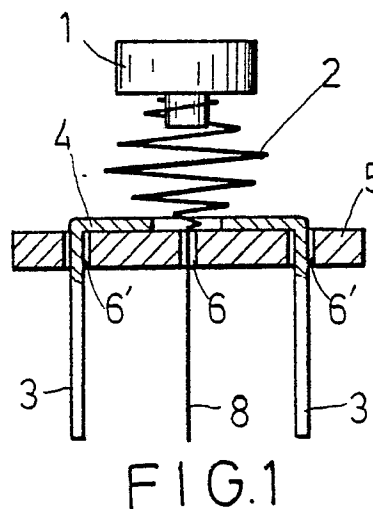
71 Applicant: Wu, I-Long
85-1, 2F Ning Han St. Shih Tun District
Taichung(TW)

72 Inventor: Wu, I-Long
85-1, 2F Ning Han St. Shih Tun District
Taichung(TW)

74 Representative: Parry, Christopher Stephen et al
PAGE, WHITE & FARRER 54 Doughty Street
London WC1N 2LS(GB)

54 **Keyswitch.**

57 A keyswitch includes a pushbutton (1, P, 1a, 1b) and a conductive coil spring (2, S, 2a, 2b) for supporting the pushbutton (1, P, 1a, 1b) on the upper end of the spring (2, S, 2a, 2b). The lower part of the spring (2, S, 2a, 2b) is in the shape of a conical helix. When the pushbutton (1, P, 1a, 1b) is depressed, the spring (2, S, 2a, 2b) forms a conductive path between two terminals (3 and 3, A and B, 3a and 8a, 3b and 3b).



KEYSWITCH

This invention relates to a keyswitch, more particularly to one which has a coil spring for biasing a pushbutton to move upward.

The problem with a conventional keyswitch is that the pushbutton is typically supported on a reed spring which cannot offer a satisfactory touching sense to the operator. A pushbutton supporting member is required as an improvement over the reed spring.

More related prior art references are Japanese Unexamined Utility Model Publication Nos. 63-111730 and 63-150436 which disclosed a switch with a coil spring.

It is therefore the main object of this invention to provide a keyswitch which can offer a satisfactory touching sense to the operator.

It is the feature of this invention to provide a keyswitch with a spiral spring for supporting the pushbutton.

According to one aspect of this invention, a keyswitch includes an electrically insulative substrate having a hole formed therethrough; a conductor attached to the upper surface of the substrate and including a terminal pin electrically connected to the conductor; a pushbutton; and an electrically conductive coil spring, in the shape of a conical helix which has a vertex at its lower end, carrying the pushbutton on its upper end and having an axial extension extending downward from its lower end through the hole of the substrate so that the pushbutton is biased to move upward. The coil spring is spaced apart from the conductor when it is in a normal position. When the pushbutton is depressed, one of the turned portion of the coil spring contacts the conductor so that an electrically conductive path is established between the terminal pin and the axial extension of the spring.

According to another aspect of this invention, a keyswitch includes an electrically insulative substrate having an upper surface on which a first electrically conductive path and a second electrically conductive path are separately formed; a pushbutton; and an electrically insulative body attached to the upper surface of the substrate and having a hole formed through the body, both a part of the first path and a part of the second path being exposed in the hole of the body; and an electrically conductive coil spring, in the shape of a conical helix which has a vertex at its upper end, carrying the pushbutton on the upper end thereof and having a large-diameter lowermost turned portion which is fixed on the upper surface of the body in such a manner that the large-diameter turned portion surrounds the hole of the body. When the pushbutton is depressed, a small-diameter turned

portion of an upper end portion of the coil spring passes through both the large-diameter turned portion and the hole of the body so as to contact both the first and second paths establishing an electrically conductive path between said first and second paths.

Other features and advantages of this invention will become apparent in the following detailed description of the preferred embodiments of this invention with reference to the accompanying drawings in which:

Fig. 1 shows an open keyswitch according to a first embodiment of this invention;

Fig. 2 shows a closed keyswitch according to the first embodiment of this invention;

Fig. 3 is a top view showing the assembly of the substrate and the conductor of the keyswitch according to the first embodiment of this invention;

Fig. 4 shows an open keyswitch according to a second embodiment of this invention;

Fig. 5 shows a closed keyswitch according to the second embodiment of this invention;

Fig. 6 is a top view showing the assembly of the substrate and the conductor of the keyswitch according to the second embodiment of this invention;

Fig. 7 shows an open keyswitch according to a third embodiment of this invention;

Fig. 8 shows a closed keyswitch according to the third embodiment of this invention;

Fig. 9 is a top view showing the insulative plate of the keyswitch according to the third embodiment of this invention;

Fig. 10 is a top view showing the substrate of the keyswitch according to the third embodiment of this invention; and

Fig. 11 shows an open keyswitch according to the fourth embodiment of this invention.

Referring to Figs. 1 and 3, a keyswitch according to a first embodiment of this invention includes a pushbutton 1 and a coil spring 2 for supporting the pushbutton 1 on the upper end thereof. Two terminal pins 3 are integral with an annular conductor 4. An insulative substrate 5 has a central hole 6, and two side holes 6' through which the terminal pins 3 are respectively passed. As illustrated, the coil spring 2 has one greatest-diameter turned portion at the middle portion thereof, and a vertex at the lower end of the spring 2 so that the lower portion of the spring 2 is in the shape of a conical helix. The spring 2 has an axial extension 8 which extends downward from the lower end of the spring 2 through the central hole 6 of the substrate 5. The spring 2 is normally spaced apart from the conductor 4. Referring to Fig. 2, when the pushbutton 1 is

depressed, an intermediate turned portion of the spring 2 contacts the conductor 4 so that a conductive path is established between the terminal pins 3 and the axial extension 8 of the spring 2. It should be appreciated that because the turned portions of the spring 2 are of different compression forces, the keyswitch can offer a satisfactory touching sense to the operator. As a modification to this embodiment, referring to Fig. 1A, a left terminal pin A contacts a coil spring S, while a right terminal pin B is spaced apart from the spring S. When a pushbutton P is depressed, the spring S separates from the left terminal pin A and contacts the right terminal pin B.

Referring to Figs. 4 and 6, a keyswitch according to a second embodiment of this invention includes a pushbutton 1a and a conductive coil spring 2a for supporting the pushbutton 1a on the upper end thereof. A second terminal pin 3a has a jaw at the upper end thereof for holding an annular conductor 4a and an insulative substrate 5a together. In this way, the second terminal pin 3a can make an electrical connection with the conductor 4a. The substrate 5a has a hole 6a formed therethrough inside of the conductor 4a. The lower portion of the spring 2a is in the shape of a conical helix which has a vertex at its lower end. A third terminal pin 8a extends downward from the lower end of the spring 2a through the hole 6a of the substrate 5a. The spring 2a is also normally spaced apart from the conductor 4a. Referring to Fig. 5, when the pushbutton 1a is depressed, an intermediate turned portion of the spring 2a contacts the conductor 4a so that a conductive path is established between the second terminal pin 3a and the third terminal pin 8a.

Referring to Figs. 7, 9 and 10, a keyswitch according to a third embodiment of this invention includes a pushbutton 1b and a conductive coil spring 2b for supporting the pushbutton 1b on the upper end thereof. Two fourth terminal pins 3b respectively have a jaw at their upper ends for holding two conductors 4b and a substrate 5b therebetween in such a manner that the conductors 4b form two separate conductive paths on the upper surface of the substrate 5b, as shown in Fig. 10. An insulative plate 7b is clamped tightly between the upper ends of the fourth terminal pins 3b positioning the plate 7b on the upper surfaces of the conductors 4b so that both the inner end portions of the conductors 4b are exposed in the central hole 8b of the plate 7b. Referring to Fig. 11, instead of the insulative plate 7b, an insulative material c may be coated on the lowermost turned portions of the spring 2b for the purpose of electrically isolating the spring 2b from the conductors 4b. The spring 2b is in the shape of a conical helix which has a vertex at the upper end thereof. The

lowermost turned portion of the spring 2b is arranged to always contact the upper surface of the plate 7b. Referring to Fig. 8, when the pushbutton 1b is depressed, an intermediate turned portion of the spring 2b passes through both the lowermost turned portion of the spring 2b and the hole 8b of the plate 7b so as to contact the conductors 4b and establish a conductive path between the conductors 4b. In this embodiment, the substrate 5b is made of a ceramic material and the conductors 4b are made of thick film conductive materials coated on the substrate 5b.

Claims

1. A keyswitch comprising:

an electrically insulative substrate (5a) having a hole (6a) formed therethrough;
a conductor (4a) attached to an upper surface of said substrate (5a) and including a terminal pin (3a) electrically connected to said conductor (4a);
a pushbutton (1a); and
an electrically conductive coil spring (2a), in the shape of a conical helix which has a vertex at its lower end, carrying said pushbutton (1a) on its upper end and including an axial extension (8a) extending downward from its lower end through said hole (6a) of said substrate (5a) so that said pushbutton (1a) is biased to move upward, said coil spring (2a) being spaced apart from said conductor (4a) when it is in a normal position;
whereby, when said pushbutton (1a) is depressed, one turned portion of said coil spring (2a) contacts said conductor (4a) so that an electrically conductive path is established between said terminal pin (3a) and said axial extension (8a) of said spring (2a).

2. A keyswitch as claimed in Claim 1, wherein said conductor (4a) is annular so as to surround said hole (6a) of said substrate (5a).

3. A keyswitch comprising:

an electrically insulative substrate (5, 5b) having an upper surface on which a first electrically conductive path and a second electrically conductive path are separately formed;
a pushbutton (1, P, 1b); and
an electrically insulative body (7b, c) attached to said upper surface of said substrate (5, 5b) and having a hole (6, 8b) formed through said body (7b, c), a part of said first path and a part of said second path being exposed in said hole (6, 8b) of said body (7b, c); and
an electrically conductive coil spring (2, S, 2b), in the shape of a conical helix which has a vertex at its upper end, carrying said pushbutton (1, P, 1b) on said upper end thereof and having at a large-diameter lowermost turned portion which is fixed

on an upper surface of said body (7b, c) in such a manner that said large-diameter turned portion surrounds said hole (6, 8b) of said body (7b, c); whereby, when said pushbutton (1, P, 1b) is depressed, a small-diameter turned portion of an upper end portion of said coil spring (2, S, 2b) passes through both said large-diameter turned portion and said hole (6, 8b) of said body (7b, c) so as to contact both said first and second paths and establish an electrically conductive path between said first and second paths.

4. A keyswitch as claimed in Claim 3, wherein said substrate (5b) is made of a ceramic material, and wherein said first and second paths are made of thick film conductive materials coated on said substrate (5b).

5. A keyswitch as claimed in claim 3, wherein said electrically insulative body is an electrically insulative material (c) coated on said lowermost turned portion of said spring (2b) for electrically isolating said spring (2b) from both said first and second paths.

25

30

35

40

45

50

55

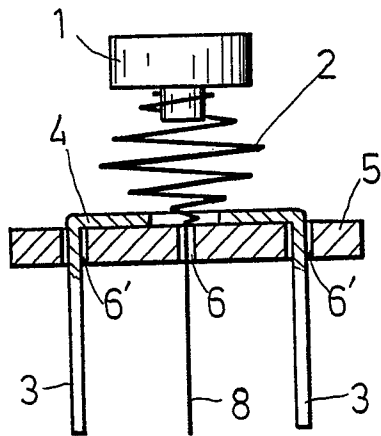


FIG.1

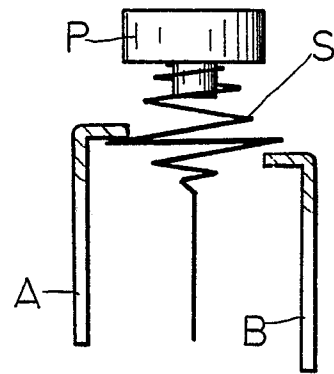


FIG.1A

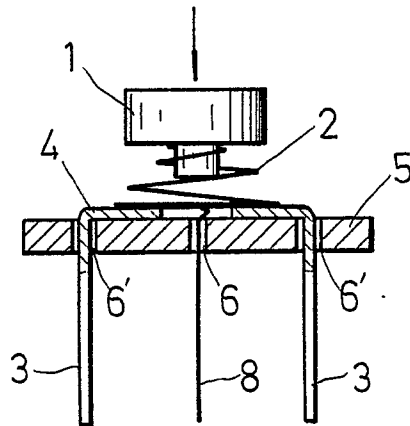


FIG.2

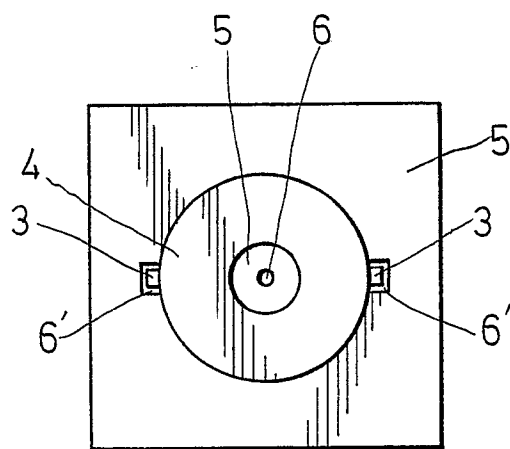


FIG.3

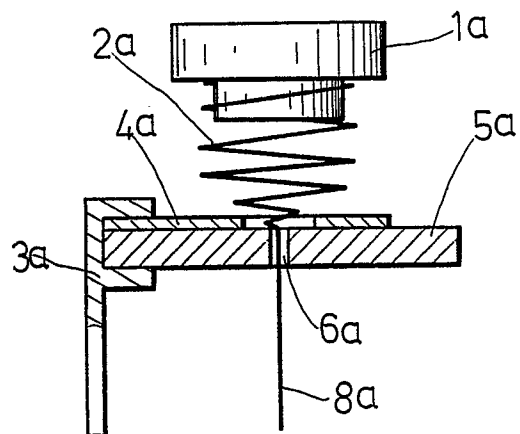


FIG. 4

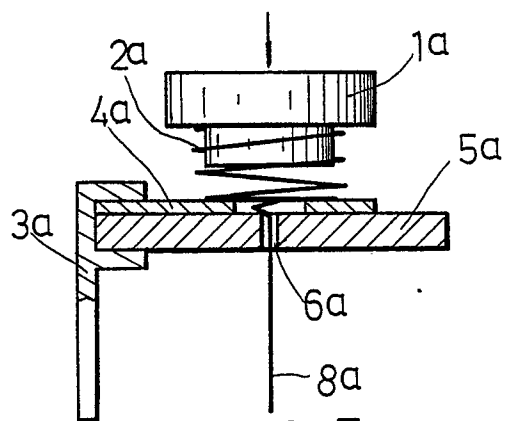


FIG. 5

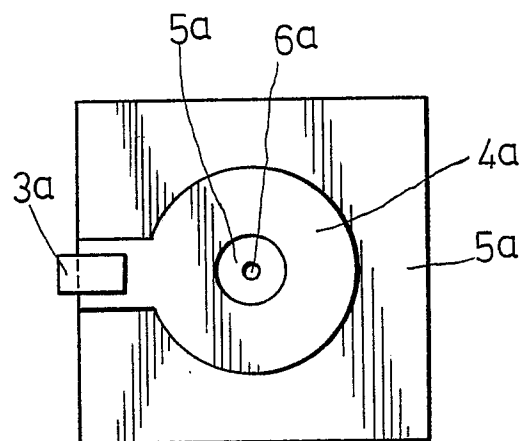


FIG. 6

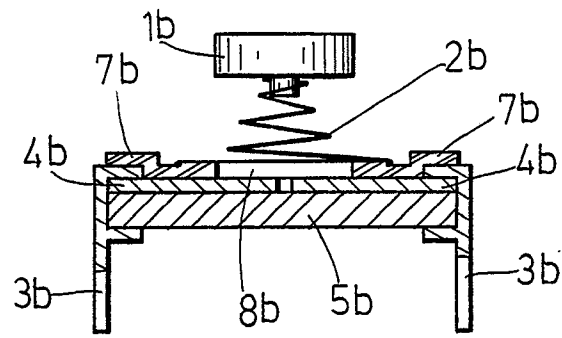


FIG. 7

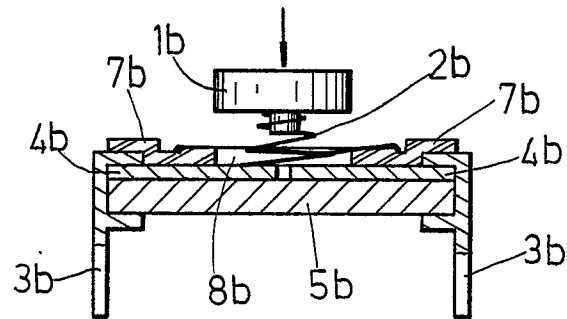


FIG. 8

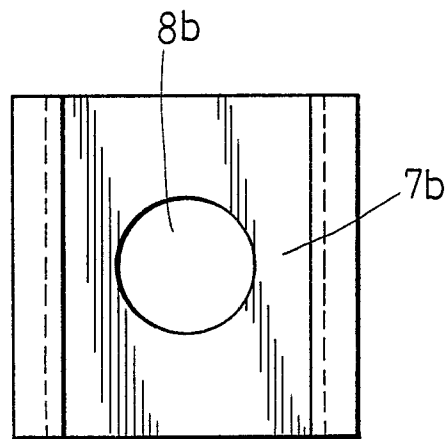


FIG. 9

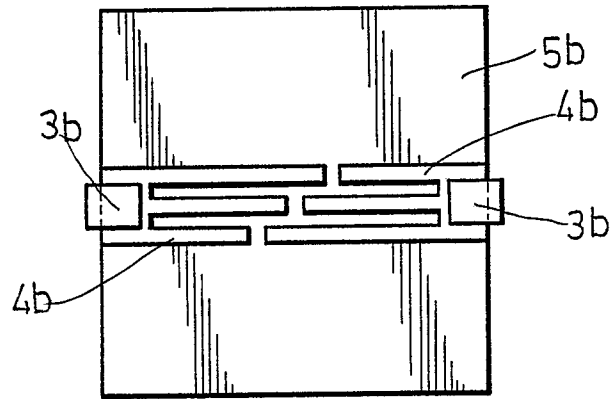


FIG. 10

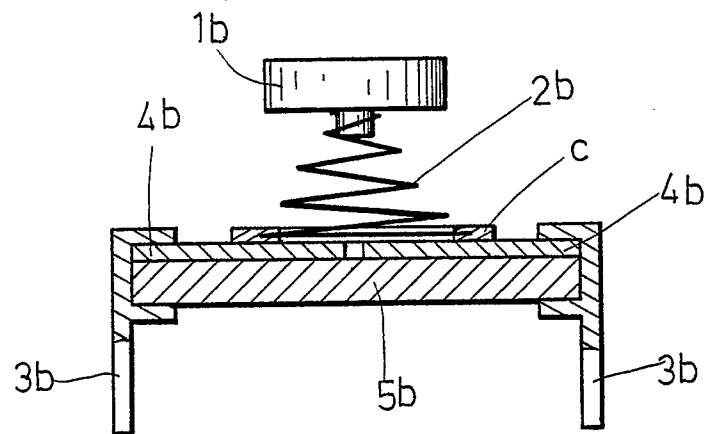


FIG. 11