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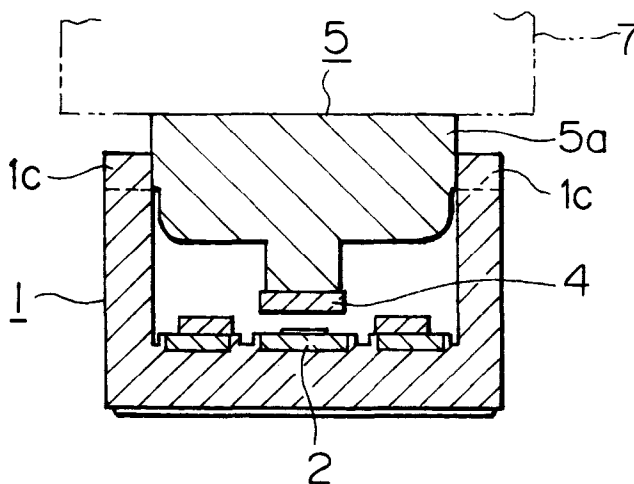
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(54) **Pushbutton switch**

(57) In a pushbutton switch, a housing 1 is provided with a stopper section 1c projecting from the rim of an opening 1a thereof. The lowermost point of a control key

7 is defined by being brought into contact with the stopper section 1c when the pushbutton switch is turned on by pushing a stem 5 a required amount through the control key 7.

FIG. 4



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Description

The present invention relates to a small pushbutton switch to be operated by being pushed by a control key.

A well-known type of pushbutton switch is generally composed of a housing with a fixed contact at the inner bottom facing an opening thereof, a movable contactor, also called a metal contact, which is housed inside the housing and is able to move into contact with and apart from the fixed contact, a vertically movable stem mounted on the movable contactor, and a metal housing mounted on the housing so that it covers the opening and thereby regulates the upward movement of the stem.

When an operating projection of the stem, which is placed opposed to a control key in the pressing direction and projects outward through the opening of the housing, is pushed by the bottom face of the control key with a predetermined stroke, the center portion of the arc-shaped movable contactor is inverted while producing a tactile feeling and is brought into contact with the fixed contact, whereby the pushbutton switch is turned on. When the pressing force exerted on the control key is removed in the switch-on state, since the inverted movable contactor is allowed by its own elasticity to recover its initial arclike shape, it separates from the fixed contact, and returns to the switch-off state. Moreover, the stem is moved up to its initial position by being pushed up by this movable contactor. The initial position of the stem is defined by the contact with the metal frame, and the stem is also prevented by the metal frame from falling out of the housing.

In the above-mentioned conventional pushbutton switch, when excessive pressing force is applied to the control key, the leading end of the stem, which receives a reaction force from the movable contactor, is deformed into a crushed shape, and this brings the working stroke out of order, and furthermore, the movable contactor undergoes plastic deformation and cannot be normally inverted, whereby reliability threatens to be affected. Accordingly, for example, the measure to disperse stress by shaping the leading end of the stem like a cylinder has been studied before. Since a positive tactile feeling is not transmitted to the finger of an operator in this case, however, operability is markedly impaired. Furthermore, though it is possible to increase the mechanical strength by employing larger parts for the stem and the movable contactor, this is not preferable because miniaturization of the pushbutton switch is hindered.

Accordingly, it is an object of the present invention to provide a small pushbutton switch having high reliability in which a stem and a movable contactor do not undergo plastic deformation even when excessive pressing force is applied to a control key.

According to an aspect of the present invention, there is provided a pushbutton switch including a housing with a fixed contact at the inner bottom facing an opening thereof, a movable contactor housed inside the

housing and being able to move into contact with and apart from the fixed contact, and a vertically movable stem mounted on the movable contactor and having an operating projection projecting upward from the housing through the opening, the movable contactor being brought into contact with the fixed contact by pushing the operating projection of the stem through a control key with a predetermined stroke, wherein the housing is provided with a stopper section projecting from the rim of the opening toward the control key, and wherein the stopper section is brought into contact with the control key when the stem is pushed a required amount by the control key.

In the pushbutton switch thus constructed, since the stem cannot be further pushed in after the control key makes contact with the stopper section of the housing, the lowermost point of the control key to be pressed can be defined by the stopper section. Therefore, there is no fear that the stem and the movable contactor will undergo plastic deformation even when excessive pressing force is applied to the control key, which makes it possible to maintain high reliability without hindering miniaturization of the pushbutton switch. Moreover, since the stopper section, which is formed integrally with the housing, can be located with a high positioning accuracy with respect to the fixed contact and the movable contactor in the housing, the lowermost point of the control key can be accurately set by the stopper section to such a height that the stem can be properly pushed.

Preferably, a metal frame for partly covering the opening and restricting the upward movement of the stem is mounted on the housing, the outer portion of the stopper section is projected as a hook portion from the outer surface of the side wall of the housing, and a mounting hole of the metal frame is retained by the outer portion. Therefore, the stopper section can be provided with a function of defining the lowermost point of the control key and a function of serving as a hook portion for mounting the metal frame.

Fig. 1 is a plan view of a pushbutton switch according to an embodiment of the present invention.

Fig. 2 is a side view of the pushbutton switch shown in Fig. 1.

Fig. 3 is a cross-sectional view taken along A-A of Fig. 1.

Fig. 4 is a cross-sectional view taken along B-B of Fig. 1, and;

Fig. 5 is an exploded perspective view of a pushbutton switch according to another embodiment of the present invention.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings.

The preferred embodiments of the present invention will now be described with reference to the attached drawings. Fig. 1 is a plan view of a pushbutton switch according to an embodiment of the present invention, Fig. 2 is a side view of the pushbutton switch shown in

Fig. 1, Fig. 3 is a cross-sectional view taken along line A-A of Fig. 1, and Fig. 4 is a cross-sectional view taken along line B-B of Fig. 1.

The pushbutton switch shown in these figures mainly includes a housing 1 molded in one piece and having a fixed contact 2 located at the inner bottom facing an opening 1a and terminals 3 led out from the sides of the housing 1, a movable contactor 4, also called a metal contact, which is housed inside the housing 1 and is able to move into contact with and apart from the fixed contact 2, and a vertically movable stem 5 which is mounted on the movable contactor 4 and is provided with an operating projection 5a projecting upward from the housing 1 through the opening 1a. The pushbutton switch is placed opposed to a control key 7 in the pressing direction. A pair of fall-preventive sections 1b for preventing the fall of the stem 5 by restricting the upward movement of the stem 5, and a pair of stopper sections 1c for making contact with the control key 7 when the control key 7 pushes the stem 5 a required amount, project from the upper end section of the housing 1 that encloses the opening 1a, provided the height of the top faces of the stopper sections 1c is precisely set at a desired height in the design stage of the housing 1 so that the bottom face of the control key 7 can properly push the operating projection 5a of the stem 5. That is, since the lowermost point of the control key 7 to be pressed is regulated by the height of the top faces of the stopper sections 1c, the height of the stopper sections 1c is properly set so that the movable contactor 4 is in secure contact with the fixed contact 2 without causing any excessive stress concentration onto the stem 5 and the movable contactor 4 when the top face of the stem 5 is pushed down to the lowermost point.

The operation of this pushbutton switch will be described next. In the switch-off state shown in Figs. 3 and 4, when the operating projection 5a of the stem 5 is pushed by the bottom face of the control key 7 with a predetermined stroke, the center portion of the arc-shaped movable contactor 4 is inverted while producing a tactile feeling and is brought into contact with the fixed contact 2. The tactile feeling is transmitted to the operator who is pressing the control key 7 with a finger, and simultaneously, the pushbutton switch is turned on. Furthermore, when the pressing force exerted on the control key 7 is removed in the switch-on state, since the inverted movable contactor 4 is allowed by its own elasticity to recover its initial curved shape, it separates from the fixed contact 2 and returns to the switch-off state. Moreover, the stem 5 is pushed up by the movable contactor 4 and is thereby moved up to its initial position shown in Figs. 3 and 4.

According to the structure of this pushbutton switch, the stem 5 cannot be further pushed in after the control key 7 makes contact with the stopper sections 1c of the housing 1, that is, the lowermost point of the control key 7 to be pressed is regulated by the stopper sections 1c. Moreover, since the height of the top faces of the stopper

sections 1c, which are formed integrally with the housing 1, with respect to the fixed contact 2 and the movable contactor 4 in the housing 1 can be determined with a high positioning accuracy, the lowermost point of the control key 7 is accurately set by the stopper sections 1c to such a height that the stem 5 can be properly pushed, as mentioned above. Consequently, even when excessive pressing force is applied to the control key 1, since it is received by the housing 1 via the pair of stopper sections 1c, there is no fear that the stem 5 and the movable contactor 4 will undergo plastic deformation resulting from such excessive force. Furthermore, in this embodiment in which the stopper sections 1c project from the housing 1, the up-and-down movement of the operating projection 5a of the stem 5 can be guided by the stopper sections 1c, as shown in Fig. 4. Therefore, the stem 5 is prevented from tilting even when the control key 7 is pressed at its edge, which enhances reliability.

Fig. 5 is an exploded perspective view of a pushbutton switch according to another embodiment of the present invention. Components corresponding to those in Figs. 1 to 4 are denoted by the same numerals.

In the pushbutton switch shown in Fig. 5, a metal frame 6 that partly covers the opening 1a to restrict the upward movement of the stem 5 is mounted on the housing 1. The fall-preventive sections 1b in the afore-said embodiment are omitted, and the stopper sections 1c are slightly different in shape from those of the afore-said embodiment. That is, in this embodiment, the outer portions of the stopper sections 1c are formed into hook portions 10c that project from the outer surfaces of side walls of the housing 1 to form overhangs, and a mounting hole 6a of the metal frame 6 is retained by the hook portions 10c. Accordingly, even if a bending length L of the metal frame 6 is set considerably shorter than the normal length, the metal frame 6 can be securely mounted on the housing 1. Moreover, since the distance between a circuit substrate, on which this pushbutton switch is surface-mounted, and the metal frame 6 is increased by shortening the bending length L and thereby increasing the distance between the lower end of the metal frame 6 and the bottom face of the housing 1, insulation failure and flux entry can be prevented more reliably.

While the present invention has been described in its preferred embodiments, it is to be understood that modifications will be apparent to those skilled in the art without departing from the spirit of the invention.

Claims

1. A pushbutton switch comprising a housing (1) with a fixed contact (2) at the inner bottom facing an opening (1a) thereof, a movable contactor (4) housed inside said housing (1) and being able to move into contact with and apart from said fixed

contact (2), and a vertically movable stem (5) mounted on said movable contactor (4) and having an operating projection (5a) projecting upward from said housing (1) through said opening (1a) said movable contactor (4) being brought into contact with said fixed contact (2) by pushing said operating projection (5a) of said stem (5) through a control key (7) with a predetermined stroke,

wherein said housing (1) is provided with a stopper section (1c) projecting from the rim of said opening 1a toward the control key (7), and wherein said stopper section (1c) is brought into contact with the control key (7) when said stem (5) is pushed a required amount by the control key (7).

2. A pushbutton switch according to claim 1, wherein a metal frame (6) for partly covering said opening (1a) and restricting the upward movement of said stem (5) is mounted on said housing (1), and the outer portion of said stopper section (1c) projects from the outer surface of the side wall of said housing (1) and retains a mounting hole (6a) of said metal frame (6).

FIG. 1

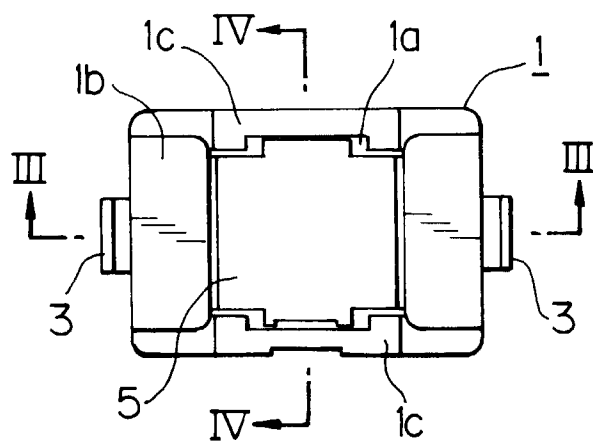


FIG. 2

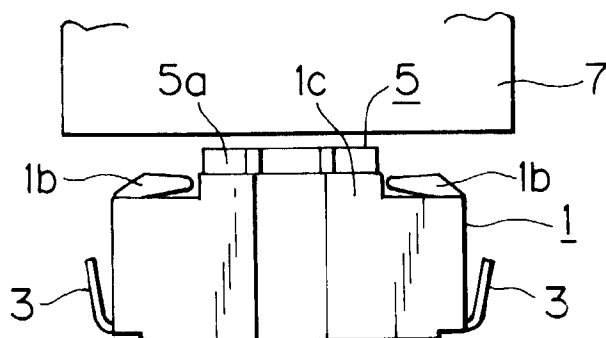


FIG. 3

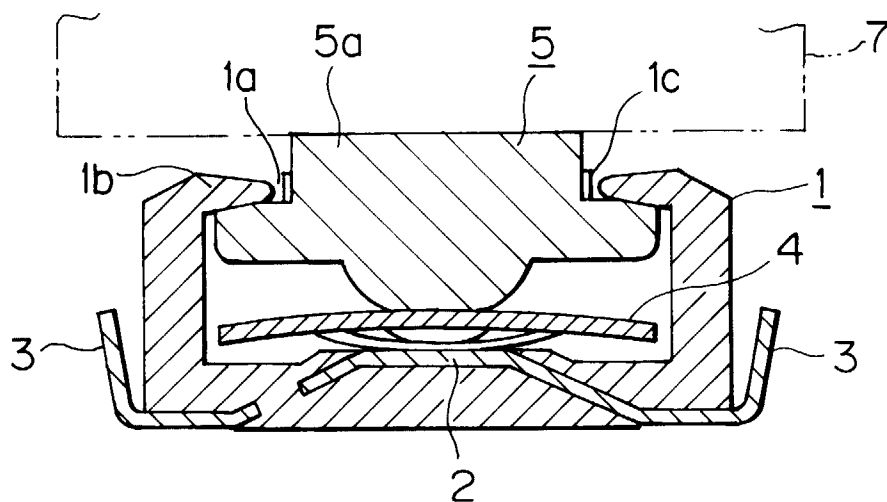


FIG. 4

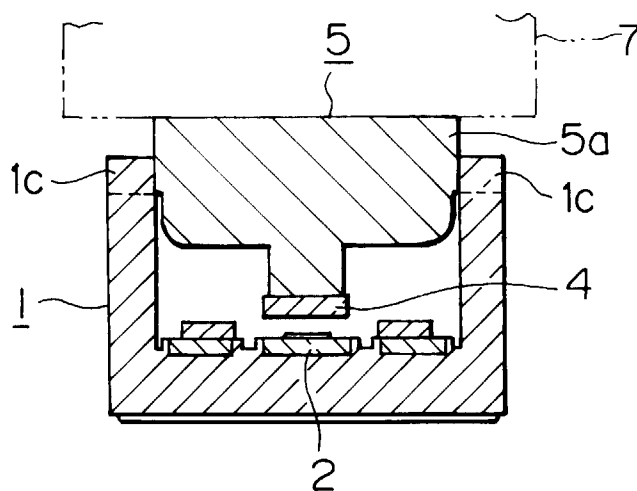


FIG. 5

