

[54] **PUSH-BUTTON SWITCH HAVING
IMPROVED LOCKING STRUCTURE TO
INHIBIT WITHDRAWAL OF A SLIDABLE
SWITCH BODY FROM ITS ASSOCIATED
CASING**

[75] Inventor: **Kiyotaka Nakaya**, Isezaki, Japan
[73] Assignee: **Tokyo Hoshiden Kabushiki Kaisha**,
Gumma-ken, Japan
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29/453, 622

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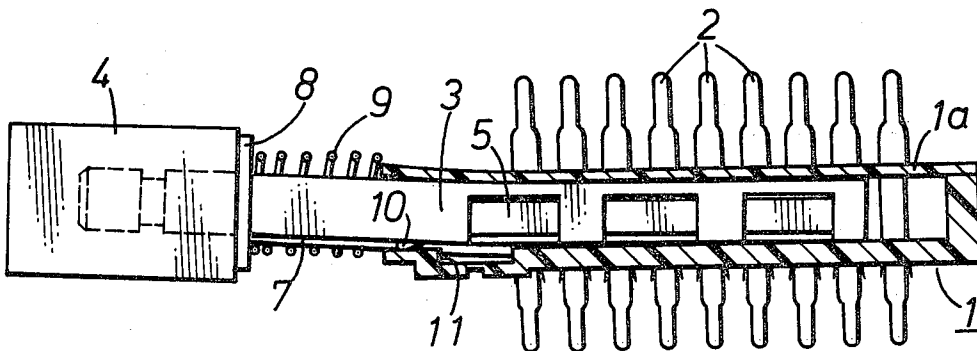
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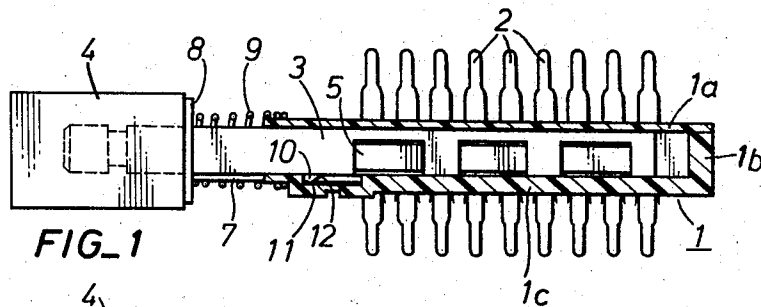
Primary Examiner—Robert K. Schaefer
Assistant Examiner—William J. Smith
Attorney, Agent, or Firm—Elliott I. Pollock

[57] **ABSTRACT**

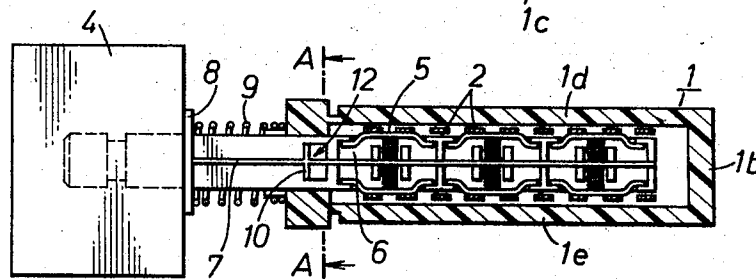
A push-button switch is provided in which a body is inserted into a casing against a bias applied so that contacts carried by the body within the casing may be brought into or out of switching engagement with a plurality of terminals mounted on the inside of the casing. A stop in the form of projection is formed on either the inner surface of the casing or the body on the side of the terminal mounting position which is nearer the projecting end of the body, and a recess which is receivedly engaged by the stop is formed in the other of the inner surface of the casing and the body. The engagement between the stop and the recess provides a locking means which prevents the body from being withdrawn from the casing.

8 Claims, 5 Drawing Figures

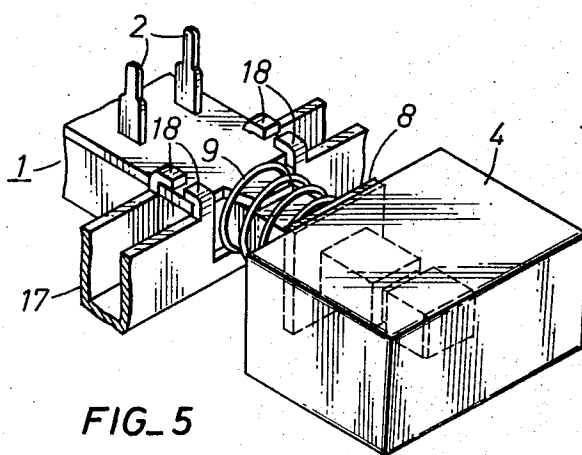




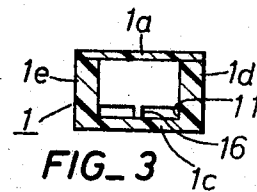
FIG_1



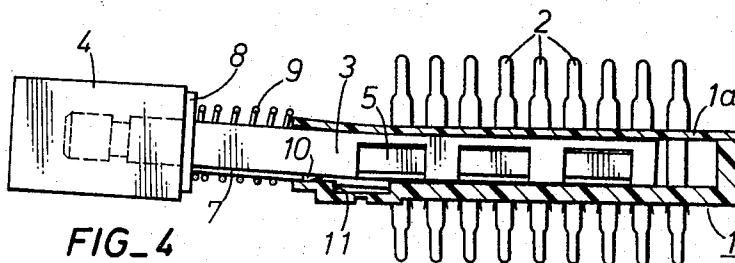
FIG_2



FIG_5



FIG_3



FIG_4

PUSH-BUTTON SWITCH HAVING IMPROVED LOCKING STRUCTURE TO INHIBIT WITHDRAWAL OF A SLIDABLE SWITCH BODY FROM ITS ASSOCIATED CASING

BACKGROUND OF THE INVENTION

The invention relates to a push-button switch in which a body is inserted into a casing against a bias applied so that contacts carried by the body may be brought into and out of switching contact with terminals mounted on the casing, and more particularly to a locking structure which prevents withdrawal of the body.

A locking structure for the push-button switch of the kind described heretofore comprised a stop integrally formed with a body carrying a number of contacts, and a recess formed in a casing and engaged by the stop. The rear end of the casing, that is, the end opposite from the end of the body on which a button is mounted, is left open for insertion of the body therethrough to be moved forwardly through the casing, with a channel-shaped recess formed in the casing and extending from the open end for receiving the stop. As a result of such construction, the stop is generally located in the middle portion of the body. A coiled spring is interposed between a flange on the projecting portion of the body and the front surface of the casing to provide a bias for urging the body forwardly. It will be appreciated that the flange can not be formed integrally with the body, since this will prevent the insertion of the body through the rear end of the casing and its passage through the front end thereof. Consequently, the flange comprised a U-shaped metal fastener or so-called E-ring formed as a separate member from the body and which is mounted on the body after it has been extended through the front end of the casing.

It is noted that in the push-button switch of such prior art construction, the rear end of the casing remains open in order to permit the insertion of the body, and thus allows the ingress of dusts. Such ingress can only be prevented by providing an additional part and requiring an increased number of assembling steps. When such push-button switch is mounted on an equipment, the body can only be removed through the rear end thereof, which is inconvenient when repair is required. For this reason, there has been proposed and used a push-button switch in which the body can be inserted through the front end of the casing. However, the conventional push-button switch of this type used a small stop member which is inserted through a small aperture formed in the side wall of the casing after the body has been inserted therein, in order to prevent withdrawal of the body. However, the stop member is too small to be screwed into place, and had to be assembled into the casing to retain it in position, with resulting relatively complex configuration and a very troublesome operation for mounting the stop member on the casing. For these reasons, the use of the push-button switch mentioned above which can be inserted from the front end of the casing has been limited, and push-button switches which can only be inserted from the rear surface of the casing have been used for most practical purposes despite the disadvantages previously mentioned.

It is an object of the invention to provide a push-button switch having a reduced number of parts to fa-

cilitate the assembly and in which a body can be inserted into a casing from the front end thereof.

It is another object of the invention to provide a push-button switch including a body which has integrally formed therewith a flange which provides an abutment for a biasing coiled spring.

It is a further object of the invention to provide a push-button switch in which the rear end of its casing is closed by an integral member with the casing.

SUMMARY OF THE INVENTION

In accordance with the invention, a stop is integrally formed with a body at a position not rearward thereof, but on the side nearer the projecting end of the body than the position at which terminals are mounted on the casing. A recess is formed in the forward portion of the casing for receiving the stop. The stop is adapted to abut against the forward end wall of the recess to prevent the body from being withdrawn from the casing.

The insertion of the body into the casing takes place in a simple manner by causing part of a side plate of the casing, for example, the forward portion of a side plate forming a separate lid from the casing and on which terminals are mounted, to be elastically deformed to increase the front opening of the casing as the body is inserted. Because the body is inserted from the front end of the casing, the flange which provides an abutment for a spring which biases the body can be integrally formed with the body, and the rear end of the casing can be blocked by an integral member thereof.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a side elevation showing one embodiment of the push-button switch according to the invention, with the casing being shown in section;

FIG. 2 is a top view of the push-button switch of FIG. 1, with the casing shown in section;

FIG. 3 is a cross section of the casing alone, taken along the line A—A shown in FIG. 2;

FIG. 4 is a side elevation of the push-button switch according to the invention in the course of pressing the button, with the casing shown in section; and

FIG. 5 is a perspective view of the push-button switch as mounted on a rack.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, the casing of the push-button switch is generally shown at 1 in the form of a hollow parallelepiped, with its rear end 1b is blocked while the front end being left open. The casing 1 is moulded from synthetic resin material such as polyacetal, except for one side plate 1a to provide side plates 1c, 1d and 1e as well as rear plate 1b. The separate side plate 1a comprises a lamination of phenol resin. A plurality of terminals 2 are arranged along the inner walls of the opposed side plates 1d and 1e of the moulded casing 1, respectively. These terminals 2 extend through the side plate 1a and opposite side plate 1c to the exterior thereof, and serve to secure the separate side plate 1a to the moulded casing. Specifically, terminals 2 inserted through slots in the side plate 1a engage the side plate 1a at their portions having an increased width to be retained thereby, while terminals 2 which project through slots formed in the side plate 1c have a cut formed in the side wall of their base to be crimped or welded.

A body 3 formed of an insulating material such as polyacetal is slidably inserted into the casing 1. A button 4 is mounted on the end of the body 3 which projects forwardly from the casing 1. The body 3 carries contacts 5 in an area located within the casing 1 for switching contact with the terminals 2. Specifically, the opposite side surfaces of the body 3 which confront the terminals 2 are formed with a plurality of recesses 6 which extend lengthwise of the body. Each of the recesses 6 receives a folded blade contact 5, which is adapted to bear against a pair of immediately adjacent terminals 2 in a resilient manner. By moving the body 3 lengthwise relative to the casing 1 by a small distance, the contact 5 may be moved by a distance corresponding to one pitch of terminals 2 in the array to switch the pair of contacts 2 which are bridged by the contact 5.

To assist in guiding the sliding movement of the body 3, it is formed with an integral rib 7 centrally on its surface confronting the side plate 1c, the rib 7 extending lengthwise thereof. As shown in FIG. 3, a groove 16 is formed in and extends lengthwise of the side plate 1c of the casing 1 for receiving the rib 7. The guide groove 16 extends to the front opening of the casing 1. The body 3 is biased in a direction to be withdrawn from the casing 1. At this end, a flange 8 is integrally formed with that portion of the body 3 which projects outwardly of the casing 1 and at a position adjacent to the button 4, and a coiled spring 9 is disposed around the body 3 between the flange 8 and the front surface of the casing 1.

In accordance with the invention, a stop 10 is integrally formed with the body 3 as a projection therefrom at a position nearer the button 4 than the position at which the terminals 2 are mounted on the casing 1. The stop 10 is formed on that surface of the body which is on the opposite side from the surface which confronts the lid plate 1a of the casing 1 and thus is located adjacent to the side plate 1c of the casing. A recess 11 is formed in the side plate 1c for receiving and engaging with the stop 10. In one example, the stop 10 is formed in two parts located on the opposite sides of the rib 7 to provide a balanced structure, and part of the guide groove 16 is laterally extended to both sides to provide the recess 11. While that surface of the stop 10 which faces the button 4 may extend in a direction perpendicular to the surface of the body 3, the opposite side is preferably formed with a tapered surface 12 having a progressively decreasing thickness as the rear end 1b of the casing 1 is approached. the recess 11 extends toward the rear plate 1b over a distance which corresponds to the stroke of travel of the body 3, and its forward end wall is formed to be perpendicular to the longitudinal direction of the body for abutment with the forward surface of the stop 10.

With the push-button switch constructed according to the invention, when the button 4 is pressed against the bias provided by the spring 9, the bearing engagement between the contacts 5 and the terminals 2 is switched, and when the button 4 is released, the body 3 moves in a direction away from the casing 1 under the bias of the spring 9, whereby the bearing engagement between the contacts 5 and the terminal 2 is restored to its original relationship. At this position, the stop 10 abuts against the forward end wall of the recess 11 to prevent withdrawal of the body 3 from the casing 1.

When assembling the push-button switch, the body 3 may be inserted through the front opening of the casing 1. As the stop 10 moves past the opening, the forward portion of the lid plate 1a of the casing is elastically deformed to increase the front opening of the casing 1, as shown in FIG. 4, and since the forward portion of the recess 11 is located forwardly of the position at which the side plate 1a is secured by the terminals 2, the stop 10 can be snapped into the recess 11. The use of a lamination of phenol resin for the lid plate 1a is effective in obtaining a necessary degree of flexibility. When the stop 10 is positioned within the recess 11, the body 3 is locked, that is, it can no longer be withdrawn from the casing. However, in practice, a plurality of such push-button switches are frequently mounted on a single metal rack or a frame for practical use. For example, FIG. 5 shows a metal rack 17 having a number of notches formed therein for receiving the forward portion of the casing 1 and also having integral pawls 18 which are bent over the casing to secure it in place. such securement also serves hold the side plate 1a against the moulded casing 1, whereby the possibility that withdrawal of the body 3 from the casing 1 may result from a flexure of the side plate 1a is avoided. Where the push-button switch is used as a single switching member, the flexure of the side plate 1a can be prevented by mounting it on a fixture member corresponding to the frame 17. Alternatively, at least one end of the coiled spring 9 which is located nearer the casing 1 may be increased in diameter so that a forward extension of the side plate 1a may be inserted into the coiled spring 9 to thereby prevent its flexure. This does not interfere with the insertion of the body into the casing.

With the push-button switch according to the invention mentioned above, the body 3 can be inserted into the casing 1 from the front end thereof, so that the casing 1 may be entirely closed at its rear end, preventing ingress of dusts from the exterior which might impair the physical contact between the contacts 5 and the terminals 2. When a repair is required, the body 3 can be removed forwardly of the casing while the switch is mounted on an equipment. The assembly of the push-button switch takes place very simply by pushing the body 3 into the casing 1. The presence of the tapered surface 12 facilitates a smooth insertion of the body 3 into the casing 1. Because the body 3 is not provided with a separate stop member, the number of parts required is reduced. The flange 8 can be integrally formed with the body 3, without requiring an E-ring, thus further reducing the number of parts required.

If required, the rear plate 1b may be omitted, thus leaving this end open. It will be appreciated that the stop 10 may be formed on the inner surface of the casing 1 with the recess 11 being formed in the body 3. In this instance, the stop 10 will be formed with a tapered surface on the side nearer the button 4. It will be understood that the shape and the number of the contacts 5 are not limited to those disclosed in the above described embodiment.

Having described the invention, what is claimed is:

1. A push-button switch comprising a casing, a body inserted into the casing and biased in a direction to be withdrawn therefrom, contacts carried by that portion of the body which is located within the casing, a plurality of terminals mounted within the casing for switching contact with the contacts upon movement of the body

against said bias, a stop integrally formed with the body as a projection therefrom at a position forwardly of the terminals, a recess formed in the inner surface of the casing and in which the stop is receivedly engaged to prevent withdrawal of the body from the casing, a rib integrally formed on one surface of the body and extending lengthwise thereof, and a guide groove formed in the inner surface of the casing and extending from the forward end thereof for receivedly guiding the rib, said stop being formed on both lateral sides of the rib, and part of the guide groove being laterally extended to provide said recess.

2. A push-button switch comprising a casing, a body inserted into the casing and biased in a direction to be withdrawn therefrom, contacts carried by that portion of the body which is located within the casing, a plurality of terminals mounted within the casing for switching contact with the contacts upon movement of the body against said bias, a stop integrally formed with the body as a projection therefrom at a position forwardly of the terminals, a recess formed in the inner surface of the casing and in which the stop is receivedly engaged to prevent withdrawal of the body from the casing, a flange integrally formed with that portion of the body which projects out of the casing, and a coiled spring disposed about the projecting portion of the body between said flange and the front end surface of the casing to bias the body in a direction to project from the casing.

3. A push-button switch comprising an elongated casing of rectangular cross-section having three side plates integral with one another and molded from a synthetic resin material and a separate side plate fabricated of a flexible insulating material, said casing having an open front end, an elongated body of insulating material extending through the open front end of the casing, said body being movable axially of the casing and having a portion projecting outwardly of the front end of the casing, a plurality of terminals extending through said separate side plate and through the oppositely located side plate of the casing to mechanically secure said separate side plate to the molded part of the casing, said terminals being disposed along the inner surfaces of their associated side plates in an array extending in the direction of axial movement of the body, a plurality of contacts carried by said body and disposed in an axial array adjacent the terminals for switching contact with said terminals, a button attached to the end of the body which projects out of the casing, a coiled spring disposed around said body between said button and the casing for biasing the body in a direction to project outwardly from the casing, a recess formed in the inner surface of that one of the side plates which is located opposite to said separate side plate, said recess being positioned between said button and said terminals; and a stop formed on the body as a projection therefrom, said stop being engageable with a portion of said recess

to lock the body against withdrawal from the casing, the height of said stop being such that the stop can be disengaged from the recess by an elastic deformation of said separate side plate when said separate side plate and the molded part of said casing are secured together by said terminals.

4. A push-button switch according to claim 3 in which portion of the stop located nearer the rear end of the casing is formed with a tapered surface having a reduced thickness as the rear end is approached.

5. A push-button switch according to claim 3 in which the forward portion of the casing is mounted on a rack in a manner such that said separate side plate is held together with the molded part of the casing as a result of such mounting.

6. A push-button switch according to claim 3 in which the rear end surface of the casing is closed by a rear plate which is integral with said three integral side plates of the casing.

7. A push-button switch according to claim 3 in which a part of the separate side plate is inserted into the coiled spring, whereby said part is held against the remainder of the casing by the coiled spring.

8. A push-button switch comprising an elongated casing of rectangular cross-section having three side plates integrally molded from a synthetic resin material and a separate side plate fabricated of a flexible insulating material, said casing having an open front end, an elongated body of an insulating material extending through the open front end of the casing, said body being movable axially of the casing and having a portion projecting outwardly of the front end of the casing, a plurality of terminals extending through the separate side plate and through the oppositely located side plate of the casing to mechanically secure the separate side plate and the molded part of the casing together, said terminals being disposed along the inner surfaces of their associated side plates in an array extending in the direction of movement of the body, a plurality of contacts carried by the body and disposed in an axial array adjacent said terminals for switching contact with the terminals, a button attached to the projecting end of the body, a coiled spring disposed around the body intermediate the button and the casing for biasing the body in a direction to project outwardly from the casing, a recess formed in said body at a position between said button and said contacts, and a stop formed on said casing as a projection therefrom adjacent the open front end of the casing, said stop being engageable with the recess to lock the body against withdrawal from the casing, the height of said stop being such that the stop can be disengaged from the recess by an elastic deformation of said separate side plate when said separate side plate and the molded part of said casing are secured together by said terminals.

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