(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 037 224 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
20.09.2000 Bulletin 2000/38

(51) Int. Cl.[7]: **H01H 13/14**

(21) Application number: **00105078.0**

(22) Date of filing: **10.03.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **11.03.1999 JP 6559899**

(71) Applicant:
ALPS ELECTRIC CO., LTD.
Ota-ku Tokyo (JP)

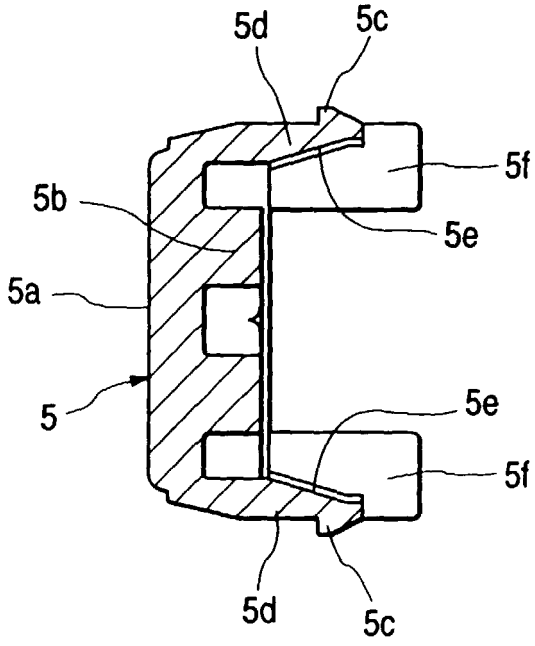
(72) Inventor:
Hayakawa, Kazuki,
c/o Alps Electric Co., Ltd.
Tokyo (JP)

(74) Representative:
Klunker . Schmitt-Nilson . Hirsch
Winzererstrasse 106
80797 München (DE)

(54) Push switch

(57) A structure of a stem in a push switch is provided which can ensure a sufficient engaging strength of hook portions of the stem even if the hook portions are not equal in wall thickness and which can reduce the size of the entire stem. The push switch comprises a box-shaped housing a, a pair of fixed terminals fixed within the housing 1, a stem 5 held slidably by inner side faces of the housing 1, a movable contact 3 disposed above the fixed terminals 2 so as to be operable in interlock with movement of the stem 5, and a rubber spring 4 which causes the movable contact 3 to move into contact with and away from the fixed terminals 2 and which causes the stem to return. The stem 5 is formed with hook portions having retaining portions respectively for engagement with retaining grooves formed in the inner side faces of the housing, the hook portions 5d being respectively formed with relief portions on sides thereof opposed to the rubber spring 4 to receive therein bent portions of the rubber spring.

FIG. 10



EP 1 037 224 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a structure of a push switch to be used as an operating switch for various electronic devices. Particularly, the invention is concerned with a structure of a stem which is held slidably within a housing.

2. Description of the Prior Art

[0002] As a structure of a stem in a conventional push switch there is known such a structure as shown in Figs. 11 and 12. Fig. 11 is a plan view of a stem and Fig. 12 is a sectional view taken on line 12-12 in Fig. 11.

[0003] A stem 15 is formed in a generally square shape using a molding material such as a synthetic resin. An upper surface of the stem 15 is formed with a planar pressing portion 15a which is operated with a human finger or the like. On a lower surface side opposed to the pressing portion 15a is formed a pressing projection 15b for abutment against an upper surface of a rubber spring (not shown). On a pair of opposed side face portions of the stem 15 are formed a pair of hook portions 15d having retaining projections 15c respectively, the retaining projections 15c being brought into engagement with retaining grooves formed in inner side faces of a housing (not shown) to restrict the position of the stem 15 within the housing during movement and return of the stem 15. In a central space formed between the hook portions 15d is disposed a rubber spring (not shown) for restoring the stem 15 to its initial position. The hook portions 15d are formed projectingly from the stem 15 at a position where they do not strike against the outside of the rubber spring when the rubber spring is deflected.

[0004] The hook portions 15d are formed so as to be equal in their wall thickness throughout the whole thereof in order to ensure a sufficient strength in their engagement with the housing (not shown). For ensuring such a wall thickness, an external form of the stem 15 is determined in conformity with the hook portions 15d.

[0005] At the four corners of the stem 15 are formed leg portions 15f respectively for sliding motion along inner side faces of the housing (not shown). Through the leg portions 15f and the hook portions 15d the stem 15 is received slidably within the housing.

[0006] In case of using the stem 15 in a push switch, a known movable contact and a known rubber spring (neither shown) are housed within an opening of the housing and the stem 15 is mounted thereon to complete a push switch of an existing type.

[0007] According to the stem structure in the conventional push switch described above, however, the hook portions 15d are formed so as to be equal in wall thickness throughout the whole thereof for the purpose of ensuring a sufficient strength of engagement thereof with the housing and an external form of the stem 15 is determined in conformity with the thickness of each hook portion 15d, so the larger the thickness of each hook portion 15d, the larger the external form of the stem 15, thus giving rise to the problem of increase in size of the stem 15.

SUMMARY OF THE INVENTION

[0008] Accordingly, it is an object of the present invention to solve the abovementioned problems and provide a structure of a stem capable of ensuring a sufficient engaging strength of hook portions of the stem even if the hook portions are not uniform in wall thickness and capable of thereby reducing the size of the entire stem.

[0009] In order to solve the abovementioned problems, according to the first aspect of the present invention there is provided a push switch comprising a box-shaped housing, a pair of fixed terminals fixed within the housing, a stem held slidably by inner side faces of the housing, a movable contact disposed above the fixed terminals so as to be operable in interlock with movement of the stem, and a rubber spring which causes the movable contact to move into contact with and away from the fixed terminals and which causes the stem to return, the stem being formed with hook portions having retaining projections respectively for engagement with retaining grooves formed in the inner side faces of the housing, the hook portions being respectively formed with relief portions on sides thereof opposed to the rubber spring to receive therein bent portions of the rubber spring.

[0010] According to the second aspect of the present invention there is provided, in combination with the first aspect, a push switch wherein the relief portions of the hook portions are formed in an arcuate shape conforming to an external form of the rubber spring.

[0011] According to the third aspect of the present invention there is provided, in combination with the first or the second aspect, a push switch wherein the hook portions are each formed so as to be thicker at both side portions thereof than at a central portion thereof in the extending direction thereof.

[0012] According to the fourth aspect of the present invention there is provided, in combination with any of the first to the third aspect, a push switch wherein the movable contact disposed above the fixed terminals is formed using a resilient metallic plate and is disposed between the rubber spring and the fixed terminals.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a plan view of a push switch according to

the first embodiment of the present invention;

Fig. 2 is a front view thereof;

Fig. 3 is a sectional view taken on line 3-3 in Fig. 1;

Fig. 4 is a sectional view taken on line 4-4 in Fig. 1;

Fig. 5 is an explanatory diagram showing a state in which a stem has been moved from an initial state thereof shown in Fig. 4 to bend a rubber spring;

Fig. 6 is a plan view of a housing used in the first embodiment;

Fig. 7 is a plan view of a movable contact used in the first embodiment;

Fig. 8 is a front view thereof;

Fig. 9 is a bottom view of the stem used in the first embodiment;

Fig. 10 is a sectional view taken on line 10-10 in Fig. 9;

Fig. 11 is a plan view of a stem used in a conventional push switch; and

Fig. 12 is a sectional view taken on line 12-12 in Fig. 11.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0014] A push switch according to an embodiment of the present invention will be described hereunder with reference to Figs. 1 to 10, of which Fig. 1 is a plan view of the push switch, Fig. 2 is a front view thereof, Fig. 3 is a sectional view taken on line 3-3 in Fig. 1, Fig. 4 is a sectional view taken on line 4-4 in Fig. 1, Fig. 5 is an explanatory diagram showing a state in which a stem has been moved from an initial state thereof shown in Fig. 4 to bend a rubber spring, Fig. 6 is a plan view of a housing, Fig. 7 is a plan view of a movable contact, Fig. 8 is a front view thereof, Fig. 9 is a bottom view of the stem, and Fig. 10 is a sectional view taken on line 10-10 in Fig. 9.

[0015] A housing 1 is formed in the shape of a box having a bottom and an upper opening, using a molding material such as a synthetic resin. In the bottom of the housing 1 are formed fixed terminals 2 by molding, say, insert molding, integrally with the housing 1 using an electrically conductive metallic material such as brass. The fixed terminals 2 are embedded in the bottom of the housing 1 and are each provided intermediate the embedded portion with a base portion 2b having a plurality of bent portions 2a, a terminal portion 2c integrated with the base portion 2b and extending outwards of the housing 1, and a contact portion 2d. The contact portions 2d of both fixed terminals 2 are formed in a pair while being spaced a predetermined distance from each other. The paired contact portions 2d are bent and opposed to each other on a line perpendicular to the arranged direction of the base portion 2b of both fixed terminals. The contact portion 2d of each fixed terminal is formed so that the width thereof in a direction perpendicular to the arranged direction of the base portion 2b is smaller than the width of the base portion 2b. Further, on a line perpendicular to a center line L in the arranged direction of the base portions 2b of both fixed terminals the contact portions 2d are opposed to each other while being displaced in opposite directions with the center line L therebetween. By so arranging the contact portions 2d it becomes possible to shorten the length in the arranged direction of each fixed terminal 2 in the housing 1.

[0016] The base portions 2b of the fixed terminals are each formed with plural bent portions 2a within the housing 1, whereby the terminal portions 2c extending outwards of the housing 1 are formed so as to be flush with a bottom surface of the housing 1. A front end of each terminal portion 2c is formed in a J bent shape raised along an outer side face of the housing 1. Since the front end of each terminal portion 2c is formed in such a J bent shape, the push switch using the housing 1 can be surface-mounted onto a circuit board. In this case, the paired contact portions 2d are disposed opposedly to each other in a direction in which the base portions 2b are not distorted by machining of the plural bent portions 2a, that is, on a line perpendicular to the arranged direction of the base portions 2b. Thus, even with plural bent portions 2a present within the housing 1, the spacing between the contacts can be set highly accurately without being influenced by variations in machining of the bent portions 2a. Further, it becomes possible to reduce the size of the housing 1.

[0017] In a pair of opposed inner side faces of the housing 1 are formed retaining grooves 1a respectively for engagement with retaining projections formed in hook portions of a stem which will be described later. With the retaining grooves 1a, the stem can be guided into the housing 1 and can be restricted its position during movement and return of the stem as will be described later. Inside the four corners of the housing 1 which is in a square shape there are formed planar sliding surface portions 1b so that a sliding motion is performed between them and sliding surface portions of the stem which will be described later. The provision of the sliding surface portions 1b permits a stable sliding motion of the stem even when a corner portion of the stem is pushed obliquely, whereby the feeling in operation is improved. The shape of each sliding surface portion 1b formed in the housing 1 is not limited to a planar shape, but may be an arcuate shape.

[0018] A movable contact 3 is formed using a resilient phosphor bronze plate or stainless steel plate. An external shape thereof is generally circular, with a ring-like frame portion 3a being formed outside and an arcuate hole 3b formed centrally of the frame portion 3a. Further, centrally of the hole 3b is formed a contact piece 3d connected at one end thereof to the frame portion 3a through a connecting portion 3c, an opposite end of the contact piece 3d being cut and raised integrally. The contact piece 3d is connected rockably to the frame portion 3a through the connecting portion 3c and a front end side thereof is bent at a certain angle so as

to tilt somewhat upward. The contact piece 3d is formed in an elliptic shape so that a major axis of the ellipse is aligned with the arranged direction of the contact portions 2d of the paired fixed terminals 2. By forming the contact piece 3d in an elliptic shape it is possible to make the length (movable span) of the connecting portion 3c large, with the result that the degree of freedom in designing a contact spring load increases, thus affording a stable click feeling. It also becomes possible to reduce the size of the entire movable contact 3.

[0019] A protuberance 3e for abutment with a rubber spring to be described later is formed on the contact piece 3d on the side opposed to the rubber spring, that is, on the raised, inclined, bent, upper side of the contact piece. The number of the protuberance 3e is not limited to one, but a plurality of such protuberances may be formed. Also as to the shape thereof, it is not limited to one shape. Various shapes of such protuberances may be formed, including arcuate and annular shapes. Since the protuberance 3e is formed, sticking of the rubber spring to be described later and the contact piece 3d is prevented and it is possible to prevent the occurrence of a metallic noise when both are disengaged from each other in operation. In addition, there is attained a stable state of contact because the contact piece 3d is pushed at a nearly central part thereof.

[0020] A rubber spring 4 is formed in a dome shape having a lower opening as an external shape using a flexible elastomer or silicone rubber. The rubber spring 4 comprises a skirt portion 4a which is bent and is given an elastic force at the time of movement and return of the stem as will be described later and an operating portion 4b formed above the skirt portion 4a. On a lower surface side of the operating portion 4b is formed an operating projection 4c, whose lower end comes into abutment with the protuberance 3e formed on the contact piece 3d of the movable contact 3. Although in this embodiment the movable contact 3 is formed using a resilient metallic plate and is disposed between the fixed terminals 2 and the rubber spring 4, a known carbon ink contact for example may be formed integrally on the underside of the operating projection 4c of the rubber spring 4. In this case, the movable contact 3 becomes unnecessary and therefore the number of components is reduced.

[0021] A stem 5 is formed in a generally square shape using a molding material such as a synthetic resin and an upper surface thereof is provided with a planar pressing portion 5a which is operated with a human finger or the like. On a lower surface side opposed to the pressing portion 5a is formed a pressing projection 5b projecting downward, which projection 5b comes into abutment with an upper surface of the operating portion 4b of the rubber spring 4 to bend the rubber spring 4 toward the movable contact 3. A pair of opposed side faces of the stem 5 are formed with a pair of hook portions 5d having retaining projections 5c engaged with the retaining grooves 1a formed in inner side faces of the housing 1 to restrict the position of the stem 5 within the housing 1. Inside the hook portions 5d, that is, on the side opposed to the skirt portion 4a of the rubber spring 4, are formed relief portions 5e which are arcuately concaved along the external form of the skirt portion 4a to receive bending portions 4d, the bending portions 4d being adapted to bend when the skirt portion 4a is pressed. The provision of the relief portions 5e permits the reduction in size of the stem 5.

[0022] In the presence of the relief portions 5e the hook portions 5d are each reduced in the thickness of a central part thereof in its extending direction, that is, in the thickness of each relief portion 5e, so that the strength of the hook portions 5d decreases. However, since both side portions are formed thick relative to the relief portions 5e, a sufficient bending strength of the whole of the hook portions 5d is ensured even if the relief portions 5e of the hook portions are formed thin, and it is not necessary to make the whole of each hook portion 5d large (thick), so it becomes possible to reduce the size of the stem 5. Although in this embodiment the relief portions 5e are each formed in an arcuate shape along the external form of the skirt portion 4a of the rubber spring 4, the shape of each relief portion 5e is not limited thereto. For example, the relief portions 5e may be each formed in the shape of a square recess capable of receiving the associated bending portion 4d of the skirt portion 4a.

[0023] At the four corners of the square shape of the stem 5 are provided leg portions 5f extending toward the inside bottom of the housing 1. Outer corners of the leg portions 5f are chamfered to form planar sliding surface portions 5g, which are adapted to slide relative to the sliding surface portions 1b formed at the four corners of the inner side faces of the housing 1. The provision of the leg portions 5f at the four corners of the square stem 5 is advantageous in that the sliding motion between the inner side faces of the housing 1 and the outer side faces of the stem 5 becomes stable and the sliding motion of the stem 5 within the housing 1 is ensured.

[0024] Moreover, since the sliding surface portions 5g are formed at outer corners of the leg portions 5f of the stem 5, even when the stem 5 is pushed obliquely at a corner thereof, a sliding motion of the stem is ensured relative to the sliding surface portions 1b formed at the four corners of the inner side faces of the housing 1, whereby it becomes possible for the stem 5 to slide in a more stable manner and hence possible to improve the operation feeling of the stem 5. The shape of the sliding surface portions 5g of the stem 5 is not limited to a planar shape, but it may be an arcuate shape.

[0025] In the push switch of the present invention, as set forth above, since the hook portions of the stem having retaining projections are respectively formed with relief portions for receiving bent portions of the rubber spring therein on the side opposed to the rubber spring, the whole of each hook portion can be made

small in thickness by an amount corresponding to the thickness of each relief portion. Consequently, it becomes possible to attain the reduction in size of the stem, of the housing, and hence of the entire push switch.

[0026] In addition, since the relief portions of the hook portions are each formed in an arcuate shape conforming to the external form of the rubber spring, there is no fear that the rubber spring may strike against the hook portions even when the rubber spring is bent by being pressed with the stem, thus ensuring a stable sliding motion of the stem.

[0027] Moreover, the hook portions are each formed thicker at both side portions thereof than at a central portion thereof in its extending direction, and thus although their central portions are thin, their strength is fully covered up by their both side portions, so a simple shape suffices to ensure a sufficient bending strength (engaging strength) of the entire hook portions.

[0028] Further, since the movable contact disposed above the fixed terminals is formed using a resilient metallic plate and is disposed between the rubber spring and the paired fixed terminals, it can be surely brought into contact with contact portions of the fixed terminals and thus the contact reliability of the contact portions is improved.

Claims

1. A push switch comprising:

a box-shaped housing;
a pair of fixed terminals fixed within said housing;
a stem held slidably by inner side faces of said housing;
a movable contact disposed above said fixed terminals so as to be operable in interlock with movement of said stem, and
a rubber spring which causes said movable contact to move into contact with and away from said fixed terminals and which causes said stem to return,
said stem being formed with hook portions having retaining projections respectively for engagement with retaining grooves formed in the inner side faces of said housing, said hook portions being respectively formed with relief portions on sides thereof opposed to said rubber spring to receive therein bent portions of the rubber spring.

2. The push switch according to claim 1, wherein said relief portions of said hook portions are formed in an arcuate shape conforming to an external form of said rubber spring.

3. The push switch according to claim 1 or 2, wherein said hook portions are each formed so as to be thicker at both side portions thereof than at a central portion thereof in the extending direction thereof.

4. The push switch according to any of claims 1 to 3, wherein said movable contact disposed above said fixed terminals is formed using a resilient metallic plate and is disposed between said rubber spring and said fixed terminals.

FIG. 1

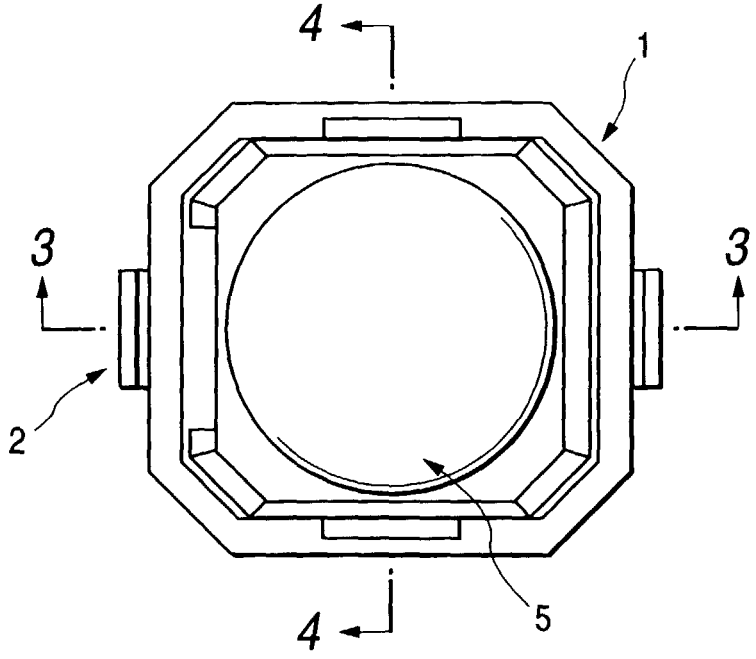


FIG. 2

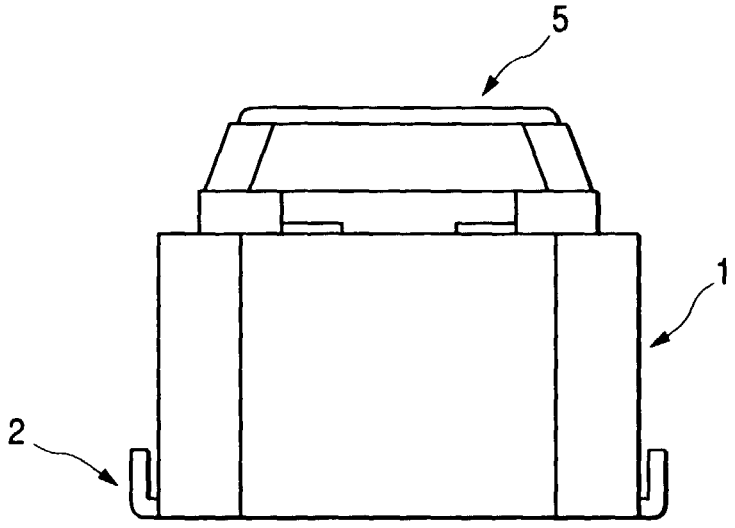


FIG. 3

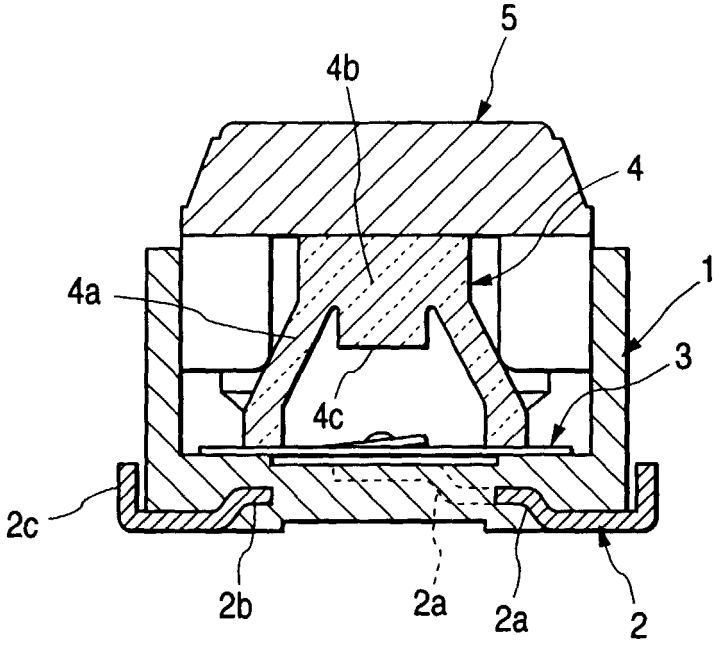


FIG. 4

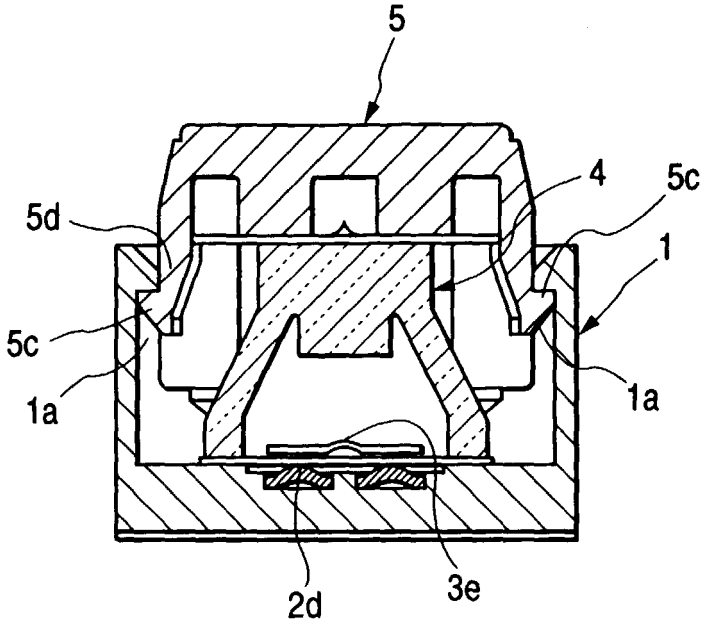


FIG. 5

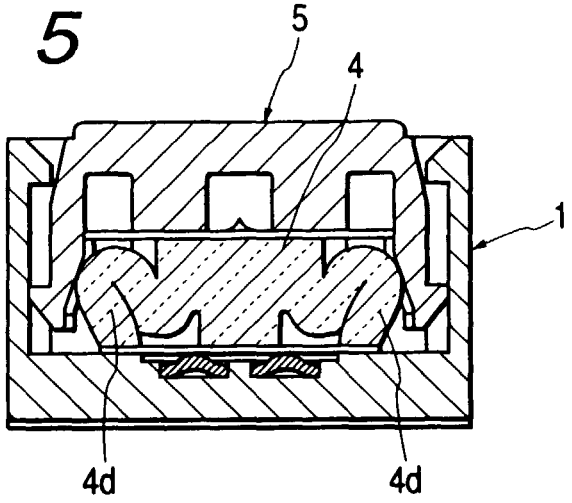


FIG. 6

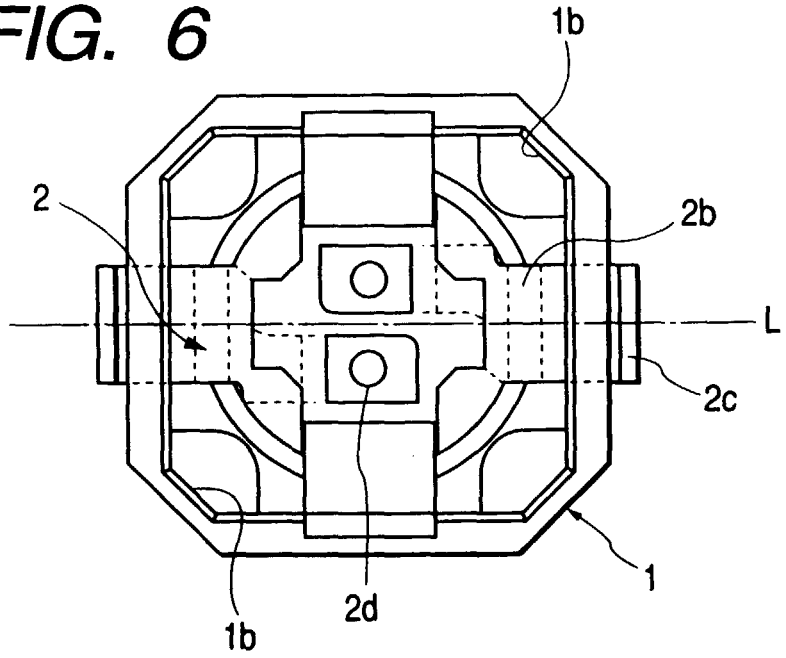


FIG. 7

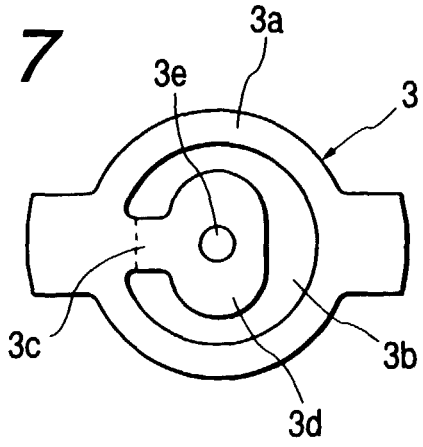


FIG. 8

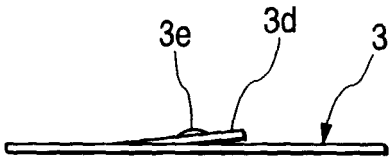


FIG. 9

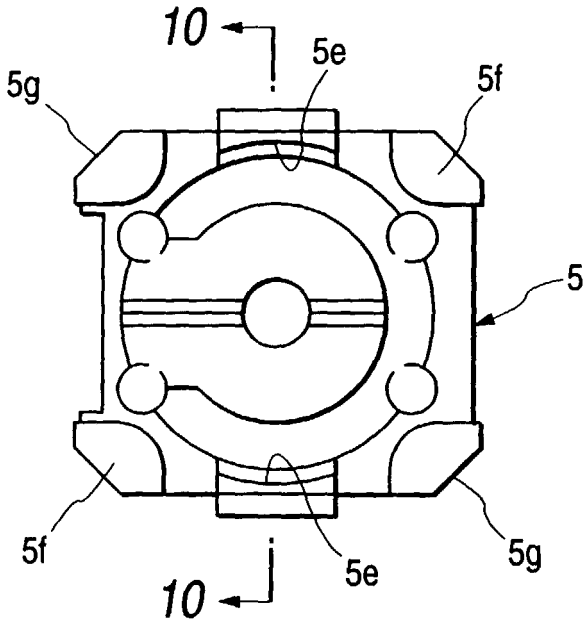


FIG. 10

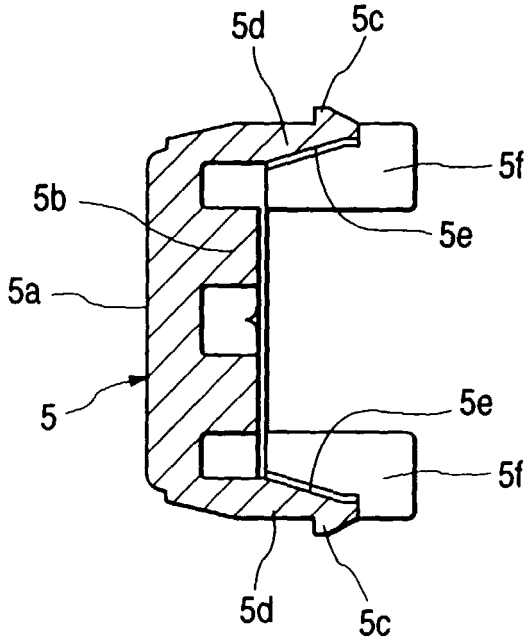


FIG. 11
PRIOR ART

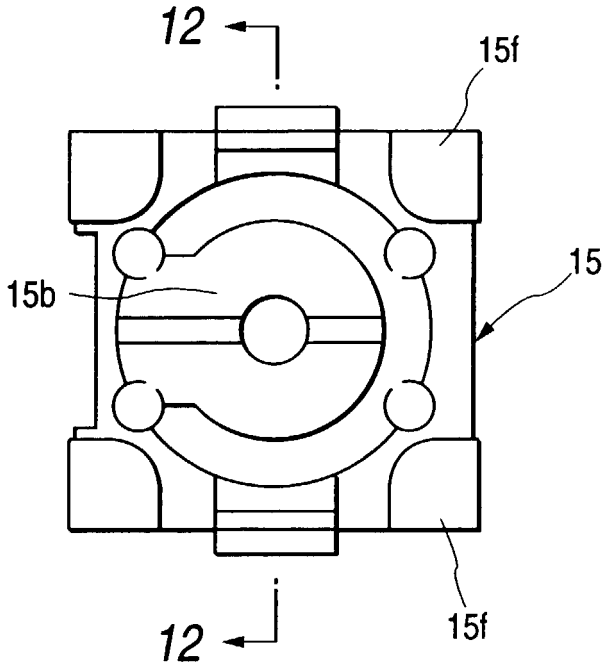


FIG. 12
PRIOR ART