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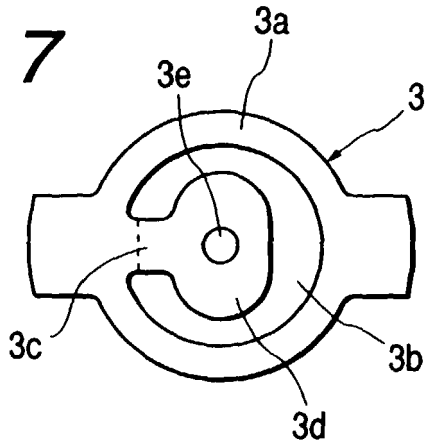
## (54) Push switch

(57) Provided is a movable contact structure in a push switch permitting a contact piece and a connecting portion in the movable contact to be formed long, capable of affording a stable click feeling, capable of reducing the size of the entire movable contact, and capable of preventing the occurrence of a metallic noise in operation for a rubber spring. The push switch comprises 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 disposed between the movable contact and the stem, the rubber spring causing the movable contact to move into contact with and away from the fixed terminals in interlock with movement of the stem and causing the stem to return, the movable contact comprising a frame portion formed outside, a connecting portion extending from the frame portion, and a contact piece connected rockably to the frame portion through the connecting portion, the contact piece of the movable contact being formed so that its length in the extending direction of the connecting portion is shorter than its length in a direction perpendicular to the extending direction of the connecting portion.

FIG. 7

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**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 movable contact disposed above fixed terminals which are fixed within a housing.

2. Description of the Prior Art

**[0002]** As a structure of a movable contact 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 the movable contact and Fig. 12 is a front view thereof.

**[0003]** According to the conventional structure shown in those figures, a movable contact 13 is formed using, for example, a resilient phosphor bronze plate or a stainless steel plate and has a generally circular external shape. A ring-like frame portion 13a is formed outside. Centrally of the frame portion 13a is formed an arcuate hole 13b and centrally of the hole 13b is formed a contact piece 13d one end of which is connected to the frame portion 13a through a connecting portion 13c and an opposite end of which is cut and raised integrally so that a front end side thereof is bent upward at an angle. The contact piece 13d is connected rockably to the frame portion 13a through the connecting portion 13c. The contact piece 13d is formed planarly in a circular shape and the arcuate hole 13b is formed along the circular contact piece 13d. Further, outside and along the arcuate hole 13b is formed the ring-like frame portion 13a.

**[0004]** In case of using the movable contact 13 in a push switch, the movable contact 13 is disposed above fixed terminals fixed to a bottom portion within a housing which is already known, then a rubber spring and a stem (neither shown), which are also known, are mounted to complete a push switch of an existing type.

**[0005]** However, in the above structure of the movable contact in the conventional push switch, the shape of the contact piece 13d formed in the movable contact 13 is a circular shape having the same size of length and width, so it is required that the size of the circle be determined in proportion to the length of a pair of contact portions formed in the arranged direction of fixed terminals which are arranged opposedly to each other while being spaced a predetermined from each other, with consequent increase in external form of the contact piece 13d and hence increase in size of the movable contact 13.

**[0006]** Since the contact piece 13d formed in the movable contact 13 is formed in a planar shape, an abutment portion of the rubber spring which is brought into abutment with the movable contact 13 to bring the contact piece 13d into contact with the contact portions of the fixed terminals is also formed in a planar shape. Consequently, the rubber spring and the contact piece are affixed to each other, and in operation there occurs a metallic noise caused by engagement and disengagement of the two, thus giving rise to the problem that the operability is poor.

SUMMARY OF THE INVENTION

**[0007]** Accordingly, it is an object of the present invention to solve the abovementioned problems and provide a structure of a movable contact permitting its contact piece and connecting portion to be formed long, capable of affording a stable click feeling, capable of reducing the size of the entire movable contact, and capable of preventing the occurrence of a metallic noise at the time of operation together with a rubber spring.

**[0008]** 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 disposed between the movable contact and the stem, the rubber spring causing the movable contact to move into contact with and away from the fixed terminals in interlock with movement of the stem and causing the stem to return, the movable contact comprising a frame portion formed outside, a connecting portion extending from the frame portion, and a contact piece connected rockably to the frame portion through the connecting portion, the contact piece of the movable contact being formed so that its length in the extending direction of the connecting portion is shorter than its length in a direction perpendicular to the extending direction of the connecting portion.

**[0009]** According to the second aspect of the present invention there is provided, in combination with the first aspect, a push switch wherein the movable contact is formed using a resilient metallic plate, the frame portion has an arcuate hole formed centrally, and the contact piece is formed centrally of the arcuate hole by being cut and raised integrally on the metallic plate through the connecting portion.

**[0010]** According to third aspect of the present invention there is provided, in combination with the first or the second aspect, a push switch wherein the contact piece of the movable contact is formed in an elliptic shape.

**[0011]** 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 contact piece of the movable contact is formed with an abutting protuberance on a side thereof opposed to the

rubber spring.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0012]**

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 movable contact used in a conventional push switch; and
Fig. 12 is a front view thereof.

## DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

**[0013]** 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.

**[0014]** 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 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. 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 in the housing 1.

**[0015]** 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.

**[0016]** 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 sliding surface portions of the stem to be described later slide along them. 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.

**[0017]** 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 contact and a stable click feeling. In addition, since the contact piece 3d can be formed short, it becomes possible to reduce the size of the entire movable contact 3.

**[0018]** 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 caused by engagement and disengagement of the two in operation, whereby the operability is improved. In addition, there is attained a stable state of contact because the contact piece 3d is pushed at a nearly central part thereof.

**[0019]** 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.

**[0020]** 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 during movement and return of the stem 5. 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 4e permits the reduction in size of the stem 5.

**[0021]** 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 5d 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.

**[0022]** 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 along 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 of the outer side faces of the stem 5 relative to the inner side faces of the housing 1 becomes stable and the sliding motion of the stem 5 within the housing 1 is ensured.

**[0023]** 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.

**[0024]** In the push switch of the present invention, as set forth above, the movable contact is provided with a frame portion formed outside and a contact piece connected rockably to the frame portion through a connecting portion, the contact piece being formed so that its length in the extending direction of the connecting portion is shorter than its length in a direction perpendicular to the extending direction of the connecting portion. Therefore, the length (movable span) of the connecting portion can be made long, whereby the degree of freedom in designing a contact spring load of the contact piece increases and there is obtained a stable contact and a stable click feeling. Moreover, since the length of the contact piece can be made short, the whole of the movable contact can be formed small in size.

**[0025]** Moreover, since the movable contact is formed using a resilient metallic plate, an arcuate hole is formed in the frame portion, and the contact piece is formed centrally of the hole by being cut and raised integrally through the connecting portion, it is not required to enlarge the external form of the movable contact, but the movable contact can be formed in a simple shape so as to permit a stable contact.

**[0026]** Moreover, since the contact piece of the movable contact is formed in an elliptic shape, it is easy to fabricate the mold concerned and there is attained a high machining performance for components. In addition, since the contact piece can be surely brought into contact with the contact portions of a pair of fixed terminals, the contact reliability of the contact portions is improved.

**[0027]** Further, since the contact piece of the movable contact is formed with an abutting protuberance on its side opposed to the rubber spring, sticking of the rubber spring and the contact piece is prevented and hence it is possible to prevent the occurrence of a metallic noise caused by engagement and disengagement of the two in operation, whereby the operability is improved. Further, since the contact piece is pushed at a nearly central part thereof, there is attained a stable contact.

## 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 disposed between said movable contact and said stem, said rubber spring causing the movable contact to move into contact with and away from the fixed terminals in interlock with movement of the stem and causing said stem to return,
said movable contact comprising a frame portion formed outside, a connecting portion extending from said frame portion, and a contact piece connected rockably to said frame portion through said connecting portion, said contact piece of said movable contact being formed so that its length in the extending direction of said connecting portion is shorter than its length in a direction perpendicular to the extending direction of the connecting portion.

**2.** The push switch according to claim 1, wherein said movable contact is formed using a resilient metallic plate, said frame portion has an arcuate hole formed centrally, and said contact piece is formed centrally of said arcuate hole by being cut and raised integrally on the metallic plate through said connecting portion.

**3.** The push switch according to claim 1 or 2, wherein said contact piece of said movable contact is formed in an elliptic shape.

**4.** The push switch according to any of claims 1 to 3, wherein said contact piece of said movable contact is formed with an abutting protuberance on a side thereof opposed to said rubber spring.

FIG. 1

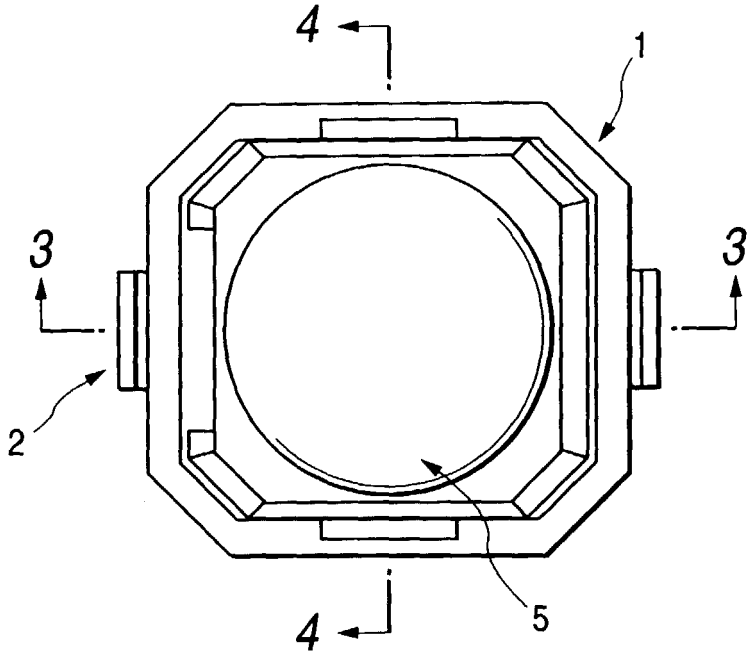


FIG. 2

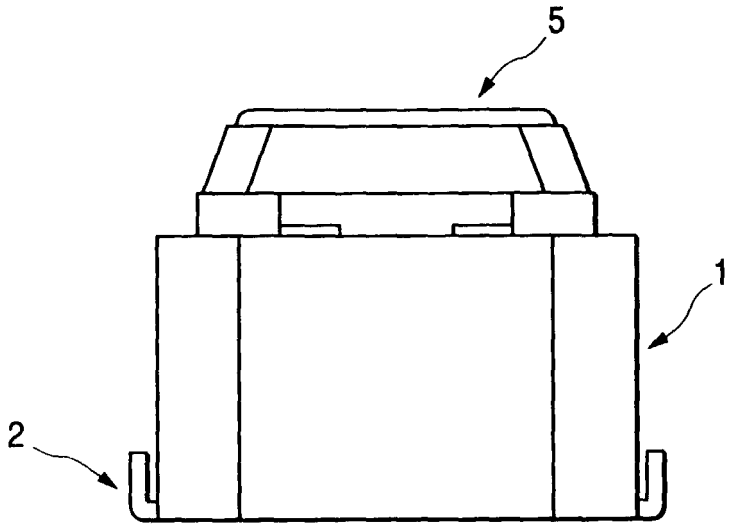

FIG. 3

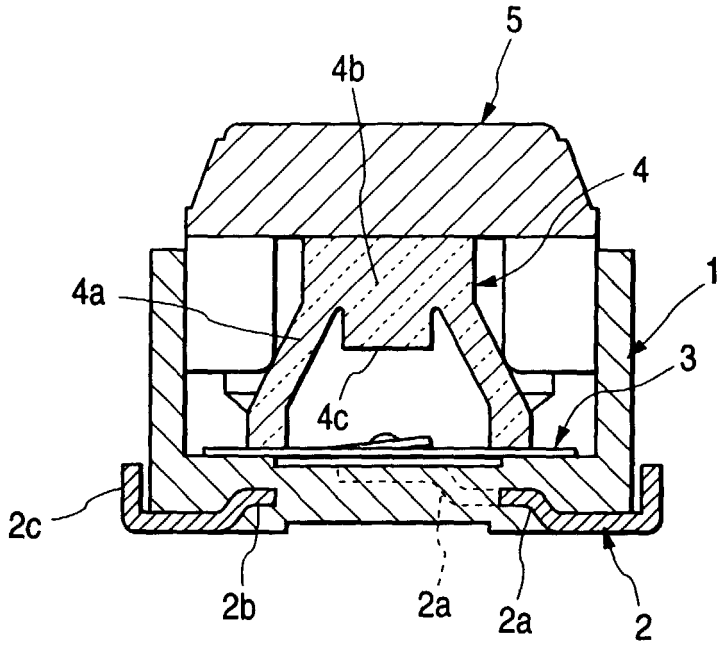


FIG. 4

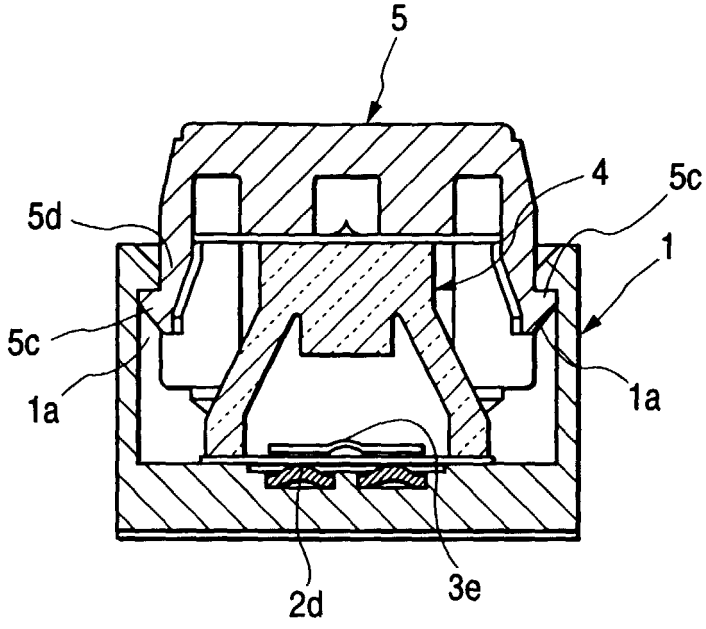

FIG. 5

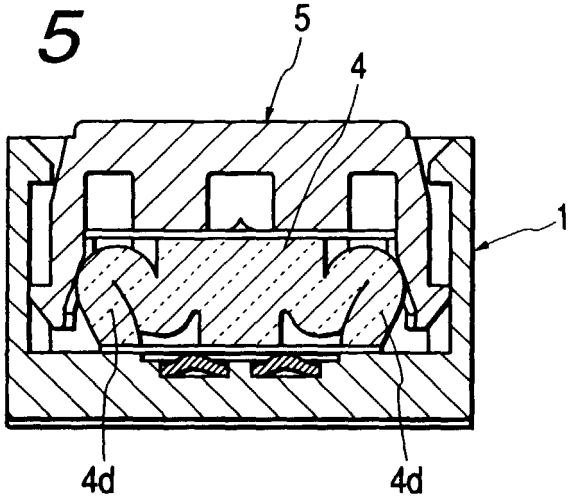


FIG. 6

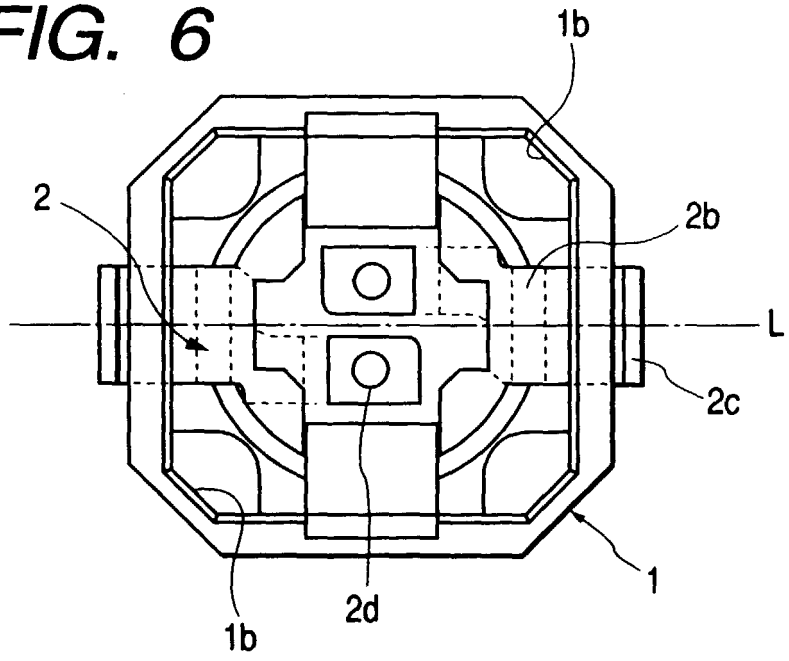


FIG. 7

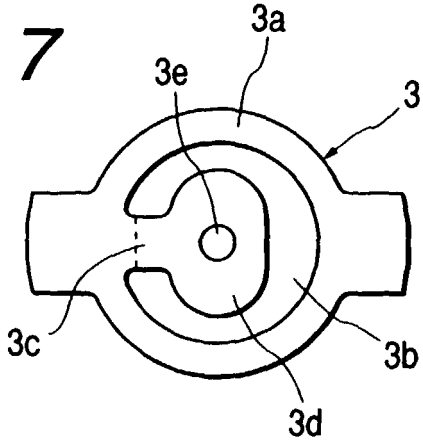

FIG. 8

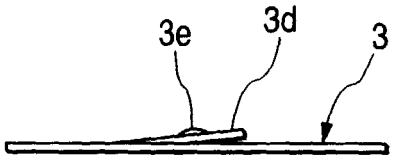


FIG. 9

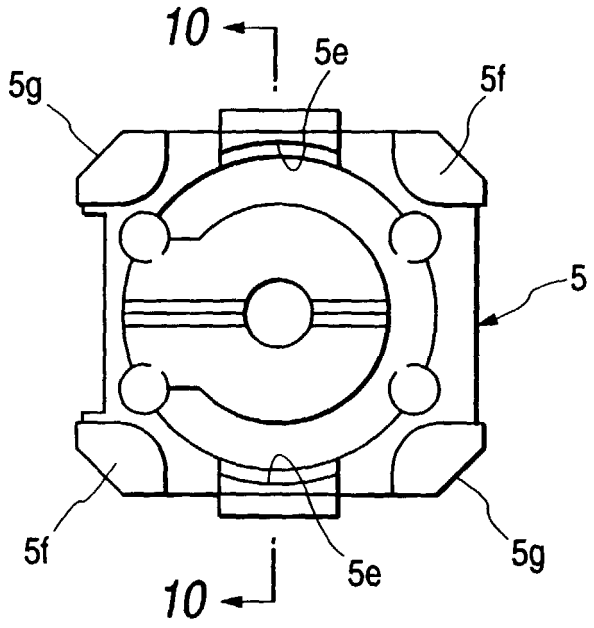


FIG. 10

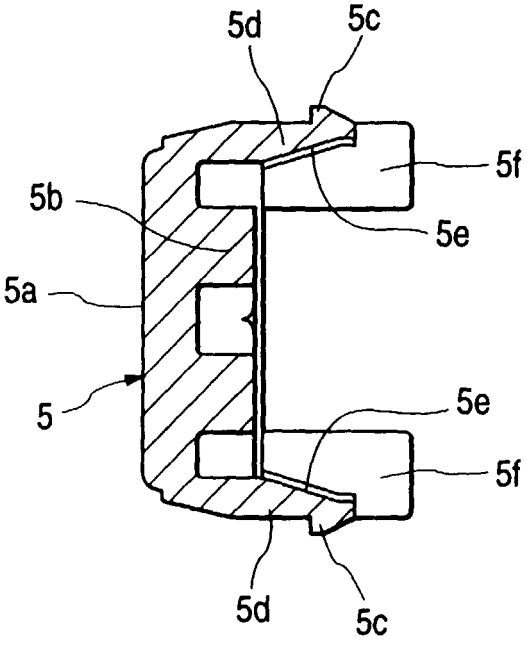

FIG. 11
PRIOR ART

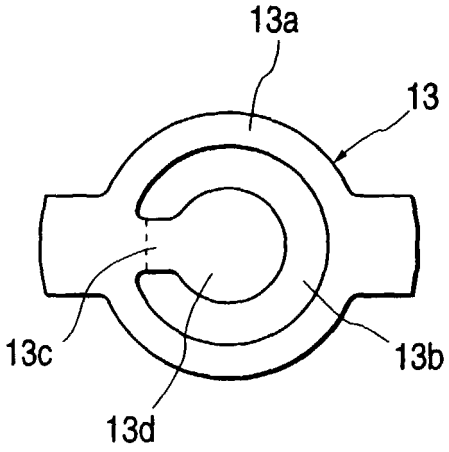


FIG. 12
PRIOR ART