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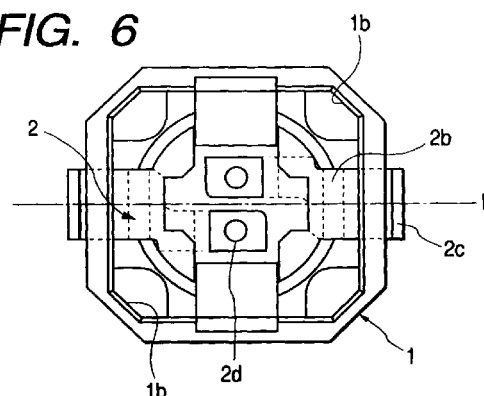
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(54) **Push switch**

(57) A layout structure of fixed terminals in a housing of a push switch is provided, the fixed terminals having a shape permitting the length in their arranged direction in the housing to be shortened and permitting the push switch to be surface-mounted onto a circuit board, and wherein even if a plurality of bent portions are formed within the housing, the spacing between contacts can be set to a minimum without being influenced by variations in machining of the bent portions, thus making it possible to reduce the size of the housing and hence of the push switch. 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, and a movable contact disposed above the fixed terminal so as to be operable in interlock with movement of the stem. The paired fixed terminals each comprises a base portion embedded in the housing, a terminal portion extending outwards of the housing, and a contact portion exposed to an inner surface of a bottom of the housing so as to be spaced a predetermined distance from a contact portion of the other fixed terminal. The paired fixed terminals are arranged so that the respective base portions are aligned with each other. The contact portions are bent and opposed to each other on a line perpendicular to the arranged direction of the base portions.

FIG. 6



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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 layout structure of fixed terminals to be disposed within a housing.

2. Description of the Prior Art

[0002] As a conventional layout structure of fixed terminals in a push switch there is known such a structure as shown in Figs. 11 and 12. Fig. 11 is a plan view showing a housing portion of the push switch and Fig. 12 is a sectional view taken on line 12-12 in Fig. 11.

[0003] According to the conventional structure shown in those figures, a housing 11 is formed in the shape of a box having an upper opening, using a molding material such as a synthetic resin. In a bottom portion of the housing 11 are formed fixed terminals 22 by an insert molding for example, using an electrically conductive metallic material such as brass. The fixed terminals 22 are embedded in the bottom portion of the housing 11 and are each composed of a base portion 22b having a plurality of bent portions 22a at intermediate positions, a terminal portion 22c extending outward of the housing 11 from the base portion 22b, and a contact portion 22d exposed to an inner surface of the bottom portion of the housing 11 and adapted to engage and disengage from a movable contact (not shown). The contact portions 22d of both fixed terminals are formed in a pair and in an opposed relation to each other.

[0004] The paired contact portions 22d are opposed to each other while being spaced a predetermined distance from each other in the arranged direction of the base portions 22b of the fixed terminals 22. The width of each contact portion 22d is set approximately equal to the width of the base portion 22b of each fixed terminal 22. In each fixed terminal 22, since the plural bent portions 22a of the base portion 22b are formed in the bottom of the housing 11, it is made possible to form the terminal portion 22c extending outwards of the housing 11 so as to be flush with a bottom surface of the housing 11. A front end of the terminal portion 22c is formed in a J bent shape raised along an outer side face of the housing 11. Since the front end of the terminal portion 22c is formed in such a J bend shape, the push switch using the housing 11 can be surface-mounted onto a circuit board.

[0005] In case of applying the housing 11 to a push switch, a known movable contact (not shown) is housed within an opening of the housing 11 and a rubber spring and a stem (neither shown), which are also known, are

mounted to complete a push switch of an existing type.

[0006] However, in the above layout structure of the fixed terminals in the housing 11 in the above conventional push switch, since the paired contact portions 22d of the fixed terminals 22 are opposed to each other while being spaced a predetermined distance from each other in the arranged direction of the base portions 22b of the fixed terminals 22, it is required that a pair of contact portions 22d be formed opposedly to each other and contiguously to the base portions 22b of the fixed terminals 22 embedded in the housing 11 in the arranged direction of the base portions, bringing a result that the length of each fixed terminal 22 in the arranged direction thereof becomes larger and the size of the housing 11 also becomes larger, thus giving rise to the problem that the size of the entire push switch becomes larger.

[0007] Further, since the front end of the terminal portion 2c of each fixed terminal 22 disposed in the housing 11 is formed in a J bent shape so as to permit surface-mounting of the push switch onto a circuit board and since the plural bent portions 22a are formed in the base portion 22b of each fixed terminal 22 within the bottom of the housing 11, there arises the problem that the spacing between contacts of the paired contact portions 22d in the fixed terminals 22 varies depending on the machining accuracy for the bent portions 22a and becomes wider.

SUMMARY OF THE INVENTION

[0008] Accordingly, it is an object of the present invention to solve the abovementioned problems and provide a layout structure of fixed terminals in a housing of a push switch, the fixed terminals having a shape permitting the length in their arranged direction to be shortened and permitting the push switch to be surface-mounted onto a circuit board, and wherein even if a plurality of bent portions are formed within the housing, the spacing between contacts can be set to a minimum without being influenced by variations in machining of the bent portions, thus making it possible to reduce the size of the housing and hence of the push switch.

[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, and a movable contact disposed above the fixed terminals so as to be operable in interlock with movement of the stem, the paired fixed terminals each comprising a base portion embedded in the housing, a terminal portion extending outwards of the housing, and a contact portion exposed to an inner surface of a bottom of the housing so as to be spaced a predetermined distance from a contact portion of the other fixed terminal, the paired fixed terminals being arranged so that the respective base portions are positioned on a straight

line, and the contact portions being bent and opposed to each other on a line perpendicular to the arranged direction of the base portions.

[0010] According to the second aspect of the present invention there is provided, in combination with the first aspect, a push switch wherein the contact portion of each fixed terminal is formed so that the width thereof in a direction perpendicular to the arranged direction of the base portions is smaller than the width of each base portion.

[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 on a line perpendicular to a center line in the arranged direction of the base portions of both fixed terminals the contact portions are opposed to each other while being displaced from each other in opposite directions with the center line therebetween.

[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 base portions of the paired fixed terminals, which are embedded in the housing, are each formed with a plurality of bent portions within the housing, whereby the outwardly extending terminal portions are formed so as to be flush with a bottom surface of the housing.

[0013] According to the fifth 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 comprises 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.

[0014] According to the sixth aspect of the present invention there is provided, in combination with the fifth 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.

[0015] According to the seventh aspect of the present invention there is provided, in combination with the fifth or the sixth aspect, a push switch wherein the contact piece of the movable contact is formed in an elliptic shape.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

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 housing 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

[0017] 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.

[0018] 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 2 in the housing 1.

[0019] 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 oppositely 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.

[0020] 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 which will be described later slide along the sliding surface portions 1b of the housing. 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] 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.

[0026] 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.

[0027] 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.

[0028] In the push switch of the present invention, as set forth above, a pair of fixed terminals are disposed so that the respective base portions are aligned with each other and so that the respective contact portions are bent and opposed to each other on a line perpendicular to the arranged direction of the base portions. Therefore, the fixed terminals can be formed small and

it is possible to shorten the length in the arranged direction of the fixed terminals within the housing and hence possible to reduce the size of the entire push switch.

[0029] Moreover, since the contact portions are each formed so that the width thereof in a direction perpendicular to the arranged direction of the base portions is smaller than the width of each base portion, the pair of contact portions opposite to each other can be formed in the minimum dimension, and it becomes possible to reduce the material cost of components used and the machining accuracy in machining the fixed terminals is improved.

[0030] Since the contact portions are disposed in an opposed relation to each other so that on a line perpendicular to a central line in the arranged direction of the base portions the contact portions are displaced from each other in opposite directions with the central line therebetween, even if the base portions are each formed with plural bent portions within the housing, the spacing between the contact portions can be set to a minimum without being influenced by variations in machining of the bent portions.

[0031] Since the base portions of the paired fixed terminals are each formed with a plurality of bent portions, the outwardly extending terminal portions of the fixed terminals are formed so as to be flush with a bottom surface of the housing. Thus, with a simple structure, the push switch can be surface-mounted onto a circuit board and there is obtained a push switch housing structure capable of being reduced in size.

[0032] Since the contact piece of the movable contact disposed above the fixed terminals is 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, it is possible to reduce the size of the entire movable contact.

[0033] Since the movable contact is formed from a resilient metallic plate and the contact piece is formed centrally of an arcuate hole by being cut and raised on the metallic plate through the connecting portion, the movable contact ensures a stable contact although the shape thereof is small-sized.

[0034] Further, since the contact piece of the movable contact is formed in an elliptic shape, it is easy to machine the contact piece and the contact piece can be positively brought into contact with the contact portions of the paired fixed terminals, thus improving the contact reliability of the contact portions.

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; and

a movable contact disposed above said fixed terminals so as to be operable in interlock with movement of said stem,

said paired fixed terminals each comprising a base portion embedded in said housing, a terminal portion extending outwards of the housing, and a contact portion exposed to an inner surface of a bottom of the housing so as to be spaced a predetermined distance from a contact portion of the other fixed terminal, said paired fixed terminals being arranged so that respective said base portions are positioned on a straight line, and said contact portions being bent and opposed to each other on a line perpendicular to the arranged direction of the base portions.

connecting portion.

7. The push switch according to claim 6, wherein said contact piece of said movable contact is formed in an elliptic shape.

2. The push switch according to claim 1, wherein said contact portion of each said fixed terminal is formed so that the width thereof in a direction perpendicular to the arranged direction of said base portions is smaller than the width of each said base portion.

3. The push switch according to claim 1 or 2, wherein on a line perpendicular to a center line in the arranged direction of said base portions of the paired fixed terminals said contact portions are opposed to each other while being displaced from each other in opposite directions with said center line therebetween.

4. The push switch according to any of claims 1 to 3, wherein said base portions of the paired fixed terminals, which are embedded in said housing, are each formed with a plurality of bent portions within the housing, whereby said outwardly extending terminal portions are formed so as to be flush with a bottom surface of said housing.

5. The push switch according to any of claims 1 to 4, wherein said movable contact disposed above said fixed terminals comprises 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.

6. The push switch according to claim 5, 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

FIG. 1

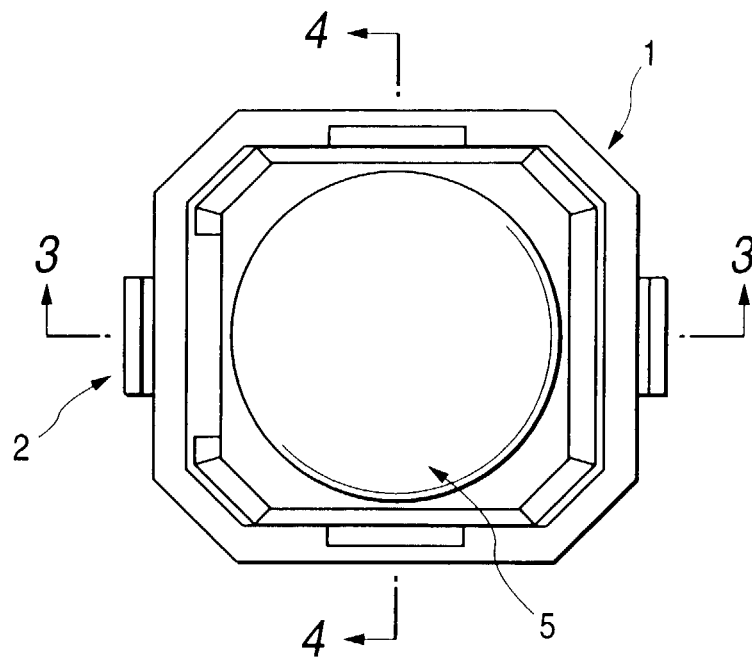


FIG. 2

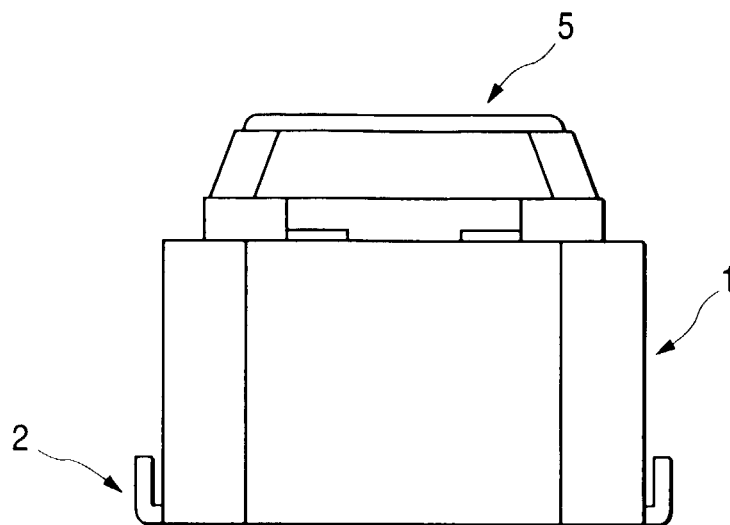


FIG. 3

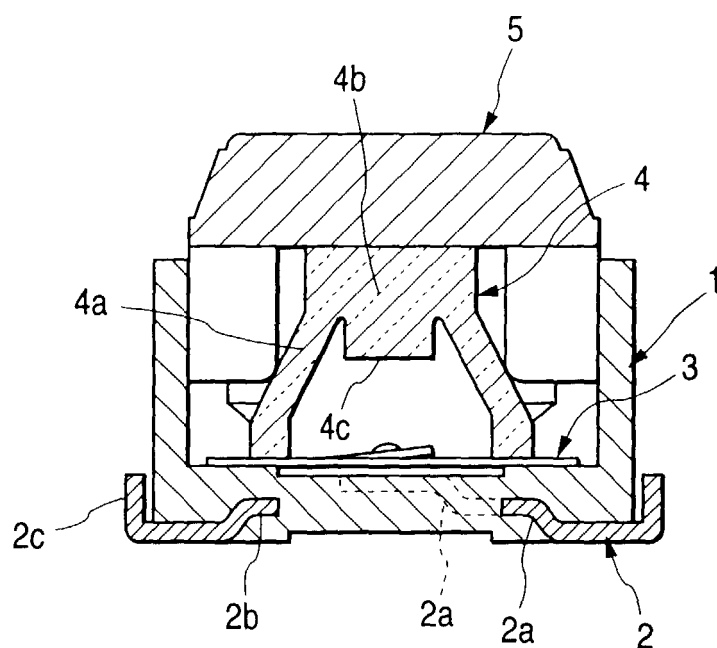


FIG. 4

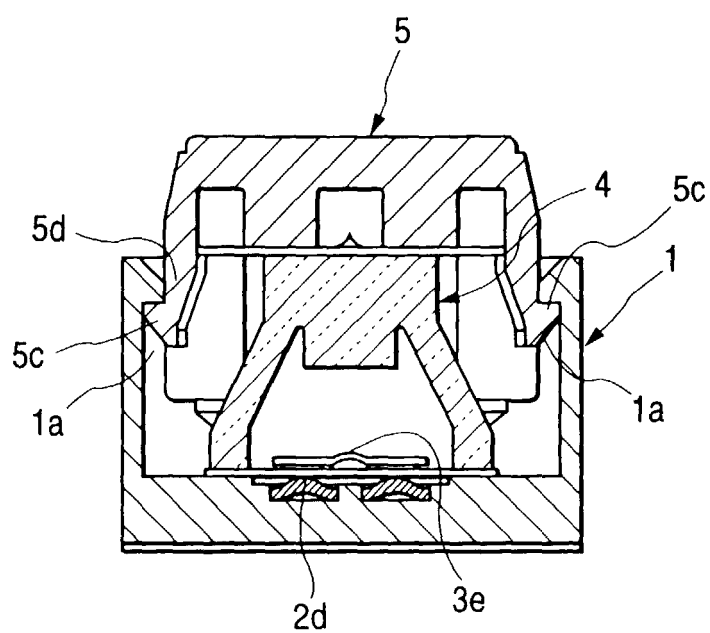


FIG. 5

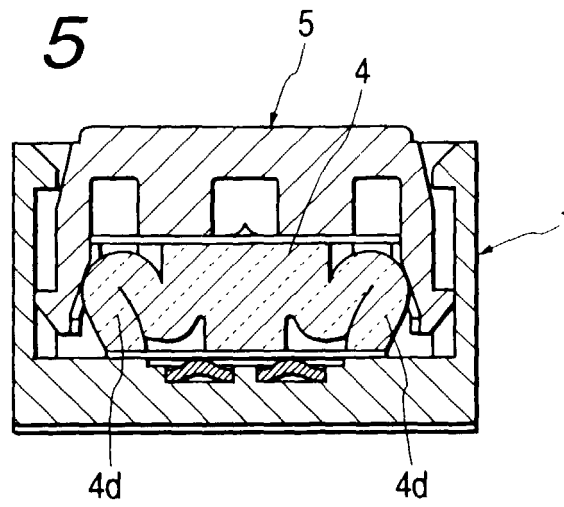


FIG. 6

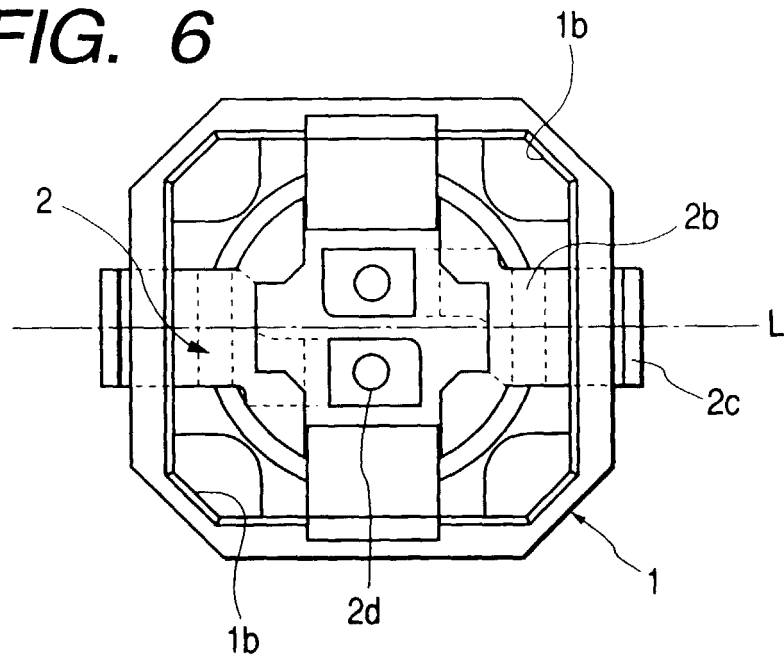


FIG. 7

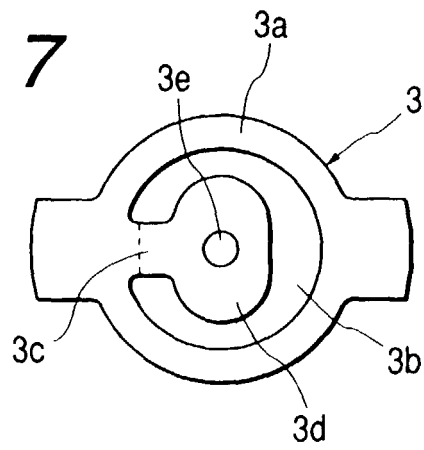


FIG. 8

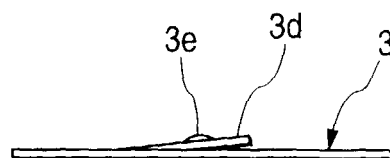


FIG. 9

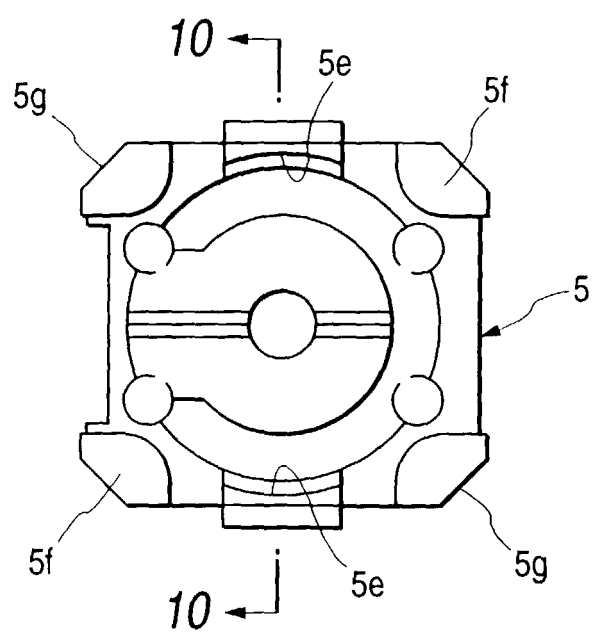


FIG. 10

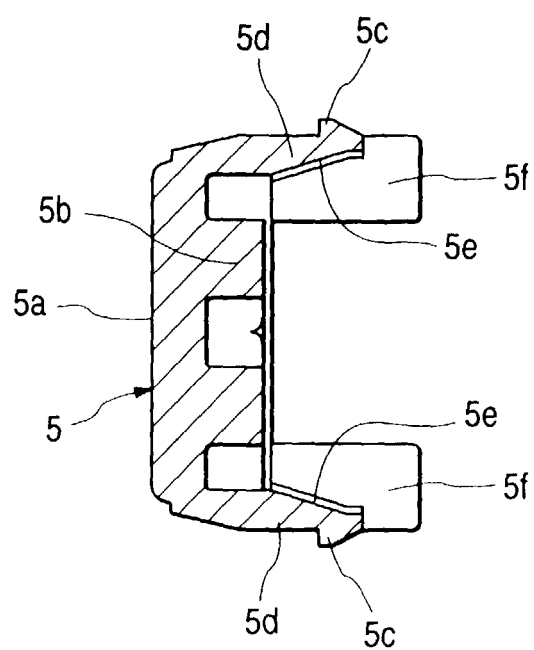


FIG. 11
PRIOR ART

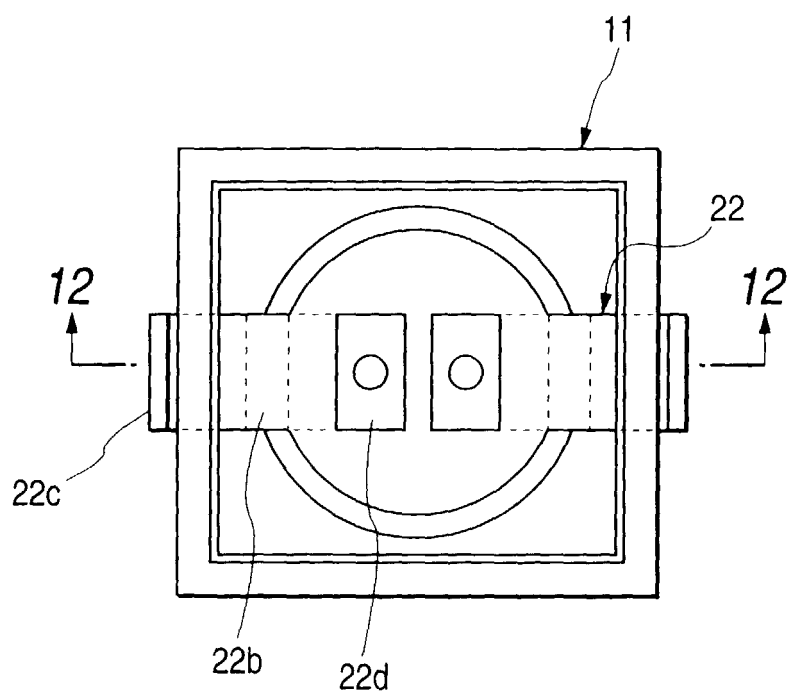


FIG. 12
PRIOR ART

