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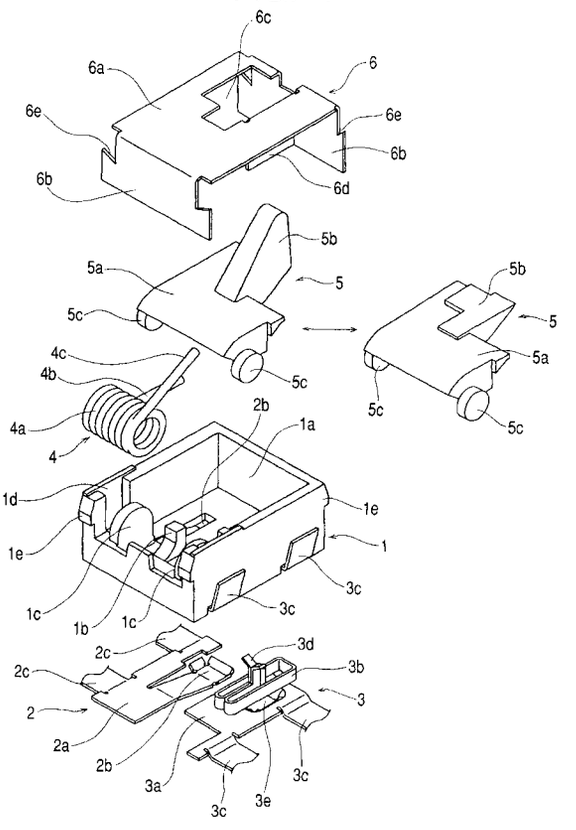
(54) Switch device

(57) A detection switch structure permitting a reduction in height of a switch body without sacrificing springing performance characteristics of a switching contact formed of a clip-shaped plate spring and capable of stabilizing operation by causing a manipulating lever and a movable contact consisting of a coil spring to turn around the same rotational center is to be provided. This structure is provided with a housing having an accommodating section; a common contact and a switching contact arranged along with each other on an inner bottom face of the accommodating section ; a movable contact consisting of a coil spring, having a first arm in contact with the common contact all the time and a second arm capable of coming into and going out of contact with the switching contact; a manipulating lever having an operating section and rotatably holding the second arm of the movable contact; and a cover covering the top of the housing, wherein the switching contact has a contact bent in a clip shape with which the second arm is to be in sliding contact, this contact is formed in parallel to an inner bottom face of the accommodating section, and the contact is provided with a guide, projecting above the contact, for guiding the sliding contact of the second arm.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the invention

[0001] The present invention relates to a switch device for use as a detection switch to be used in driving a mechanism, such as an electronic device, and more particularly to the structure of a contact using a coil spring, plate spring or the like.

2. Description of the Prior Art

[0002] Known structures of a detection switch include what uses a coil spring or a plate spring in the contact. In this structure of the contact of a detection switch according to the prior art, a coil spring is used in the movable contact and an arm is extended from this coil spring to be use as the movable contact and the coil spring is also used as the springing member to cause a manipulating lever to return to its original position.

[0003] Where this coil spring is to be fitted to the housing of a switch or the like, the wound coil of the coil spring is fixed to the housing or the like and connected to a common contact arranged on the inner bottom face. The arm extended from the coil has a bend, and this bend and the free end of the arm are formed as the movable contact. On the locus of the movement of this movable contact is formed, along with the common contact, a clip-shaped switching contact consisting of a plate spring, rising upright from the inner bottom face of the housing, so that the suppression of the arm by the manipulating lever moves the movable contact to be connected to the switching contact.

[0004] Then, the locus of the movement of movable contact takes on an arc shape having its fulcrum at the point where the arm extends from the coil, and ranges of action (sliding ranges) arise in the contact of the manipulating lever and the connecting portion to the switching contact.

[0005] However, since the above-described detection switch structure according to the prior art, in which the switching contact coming into and going out of contact with the movable contact is formed of a clip-shaped plate spring rising upright from the inner bottom face of the housing, requires a certain height in order to secure a required contact pressure and adequate springing performance characteristics against fatigue and other factors, there is a problem that the height of the switch body inevitably is considerably high, making it impossible to sufficiently reduce the overall size of the product. Moreover, as ranges of action (sliding ranges) arise in the contact between the arm of the coil spring, which is the movable contact, and the manipulating lever, there is another problem that the resultant sliding friction destabilizes the operation.

SUMMARY OF THE INVENTION

[0006] An object of the present invention, therefore, is to solve the problems noted above and provide a detection switch structure permitting a reduction in height of a switch body while securing adequate springing performance characteristics of a switching contact formed of a clip-shaped plate spring and enabling the operation to be stabilized by causing a manipulating lever and a movable contact consisting of a coil spring to turn around the same center.

[0007] In order to solve the problems noted above, according to a first aspect of the invention, there is provided a switch device provided with a housing having an accommodating section; a common contact and a switching contact arranged along with each other on an inner bottom face of the accommodating section; a movable contact consisting of a coil spring, having a first arm in contact with the common contact all the time and a second arm capable of coming into and going out of contact with the switching contact; a manipulating lever having an operating section and rotatably holding the second arm of the movable contact; and a cover covering a top of the housing, wherein the switching contact has a contact bent in a clip shape with which the second arm is to be in sliding contact, wherein this contact is formed in parallel to the inner bottom face of the accommodating section, and wherein the contact is provided with a guide, projecting above the contact, for guiding the sliding contact of the second arm.

[0008] According to a second aspect of the invention, the clip-shaped contact is arranged in parallel to the inner bottom face of the accommodating section by, after being formed upright by cutting and bending one planar metallic plate, bending it at 90 degrees over the metallic plate.

[0009] According to a third aspect of the invention, a groove permitting the second arm to turn is formed in a metallic plate matching the contact of the switching contact, and this groove is protruded downward from the inner bottom face of the accommodating section and exposed on a bottom face side of the housing.

[0010] According to a fourth aspect of the invention, the common contact is provided with a bend to come into contact with the first arm, and this bend is protruded downward from the inner bottom face of the accommodating section and exposed on the bottom face side of the housing.

[0011] According to a fifth aspect of the invention, a top face of the cover is provided with a push-through hole through which the operating section of the manipulating lever projects, and on one side of this push-through hole a dust-shielding vertical wall is formed by notching part of the top plate and bending it inward.

[0012] According to a sixth aspect of the invention, the manipulating lever and the movable contact are arranged in the housing in such a manner that a position of an axial center of a rotation shaft by which the manip-

ulating lever is rotatably borne becomes the same rotational center as a position of an axial center of the coil of the movable contact consisting of a coil spring.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 shows an exploded perspective view of a detection switch, which is a preferred embodiment of the present invention.

Fig. 2 shows a sectional profile of the detection switch embodying the invention in a state in which a manipulating lever is not yet operated.

Fig. 3 shows a sectional profile of the detection switch embodying the invention in a state in which the manipulating lever is operated and the movable contact is brought into contact with the switching contact.

Fig. 4 shows a sectional profile of the detection switch embodying the invention in a state in which the manipulating lever is pressed in to connect the movable contact to the switching contact.

Fig. 5 shows a sectional profile of the detection switch embodying the invention in a state in which the movable contact is in contact with a common contact.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0014] A preferred embodiment of the present invention will be described below with reference to Fig. 1 through Fig. 5. Fig. 1 shows an exploded perspective view of a detection switch; Fig. 2, a sectional profile of a state in which a manipulating lever is not yet operated; Fig. 3, a sectional profile of a state in which the manipulating lever is operated to bring a movable contact into contact with a switching contact; Fig. 4, a sectional profile of a state in which the manipulating lever is pressed in to connect the movable contact to the switching contact; and Fig. 5, a sectional profile of a state in which the movable contact is in contact with a common contact.

[0015] Referring to the drawings, a housing 1 is formed of an insulator, such as synthetic resin, in a box shape with an accommodating section 1a inside. At the center of the inner bottom face of the accommodating section 1a of this housing 1 are provided a common contact 2 and a switching contact 3 along with each other, each consisting of an electroconductive metallic plate and formed by insert molding or otherwise.

[0016] The common contact 2 has a base 2a punched out of a metallic plate into a substantially planar shape by pressing or otherwise; and a bend 2b slightly bent downward, provided at one end of this base 2a and in contact with a first arm 4b of a movable contact 4 to be described afterwards, while at the other end of the base 2a is formed a connection terminal 2c guided outward from the housing 1 and connected to the circuit pattern or the like of a circuit board of an electronic device (not shown) . The bend 2b, being in a state of projecting downward from the inner bottom face of the accommodating section 1a, is embedded in the housing 1, and the bottom side of this bend 2b is exposed on the bottom side of the housing 1.

[0017] The switching contact 3 has a base 3a similarly punched out of a metallic plate into a substantially planar shape by pressing or otherwise; a clip-shaped contact 3b formed over the top face of this base 3a, bent in parallel to the inner bottom face of the accommodating section 1a and being in contact with a second arm 4c of the movable contact 4 to be described afterwards. At one end of the base 3a is formed a connection terminal 3c guided outward from the housing 1 and connected to the circuit pattern or the like of a circuit board of an electronic device (not shown).

[0018] The clip-shaped contact 3b is arranged to be in parallel to the inner bottom face of the accommodating section 1a by, after being formed upright by cutting and bending a single planar metallic plate, bending at 90 degrees over the base 3a. The arrangement of the clip-shaped contact 3b in parallel to the inner bottom face of the accommodating section 1a (laterally) makes it possible to reduce the height of the housing 1 and accordingly the overall size of the device without sacrificing the springing performance characteristics of the contact 3b, including the contact pressure and fatigue strength.

[0019] Further, the contact 3b is provided with a guide 3d projecting over the contact 3b to guide the sliding contact of the second arm 4c of the movable contact 4 to be described afterwards. Formation of this guide 3d ensures the arrangement of the second arm 4c of the movable contact 4 in slidable contact with the contact 3b even where the contact 3b is disposed in parallel to the inner bottom face of the accommodating section 1a (laterally).

[0020] Also, over the base 3a matching the contact 3b, there is formed a groove 3e to permit rotation of the second arm 4c of the movable contact 4 to be described afterwards. This groove 3e, in a state in which it projects downward from the inner bottom face of the accommodating section 1a, is embedded in the housing 1, and the under side of this groove 3e is exposed on the bottom face side of the housing 1.

[0021] In this case, the bend 2b of the common contact 2, which is to be in contact with the first arm 4b of the movable contact 4 to be described afterwards and the groove 3e of the switching contact 3, which is to permit rotation of the second arm 4c of the movable contact 4 to be described afterwards, are embedded in the housing 1, both projecting downward from the inner bottom face of the accommodating section 1a. As the under sides of these bend 2b and groove 3e are formed exposed on the bottom face side of the housing 1, it is possible to reduce the height of the housing 1 while securing

a sufficient shiftable quantity for an operating section 5b of a manipulating lever 5 to be described afterwards.

[0022] Also, at one end of the accommodating section 1a of the housing 1 are formed a central projection 1b for accommodating the movable contact 4 consisting of a coil spring to be described afterwards and a pair of guide walls 1c and 1c, and a coil 4a of the movable contact 4 is positioned by these central projection 1b and pair of guide walls 1c and 1c.

[0023] In a pair of mutually opposite inner walls of the accommodating section 1a of the housing 1, shaft grooves 1d in which the rotation shafts 5c of the manipulating lever 5 to be described afterwards are rotatably borne are formed, and the configuration is such that the position of the axial center of the rotation shafts 5c of the manipulating lever 5 borne by these shaft grooves 1d becomes the same rotational center as the axial center of the coil 4a of the movable contact 4, positioned by the central projection 1b and the guide walls 1c and 1c.

[0024] Also, on the mutually opposite outer sides of the housing 1 are formed a pair each of engaging projections 1e and 1e, and pairs of notches 6c and 6c formed into side plates 6b of a cover 6 to be described afterwards are engaged with these engaging projections 1e and le.

[0025] The movable contact 4 is formed by winding an electroconductive metallic wire into a coil, and this movable contact 4 is provided with a coil 4a, and the first arm 4b and the second arm 4c extending substantially in parallel from the two ends of the coil 4a. The positioning of the movable contact 4 by being accommodated by the central projection 1b and the guide walls 1c and 1c of the accommodating section 1a serves to keep the first arm 4b in contact with the bend 2b of the common contact 2 all the time and the second arm 4c opposite the contact 3b of the switching contact 3 to be capable of coming into and going out of contact with each other.

[0026] The manipulating lever 5, formed of an insulator such as synthetic resin, has a substantially planar base 5a, the operating section 5b formed projecting from one end of this base 5a, and a pair of rotation shafts 5c and 5c formed on two sides of the other end of this operating section 5b. These rotation shafts 5c and 5c are borne by the shaft grooves 1d and 1d formed in the accommodating section 1a of the housing 1 and rotatably hold on the under face of the base 5a the second arm 4c of the movable contact 4, so that the second arm 4c come into or go away from the contact 3b of the switching contact 3 with the turning of the manipulating lever 5.

[0027] In this case, as the configuration is such that the position of the axial center of the rotation shaft 5c of the manipulating lever 5 borne by the shaft grooves 1d of the housing 1 becomes the same rotational center as the position of the axial center of the coil 4a of the movable contact 4 determined by the central projection 1b and the guide walls 1c and 1c, it is possible to avoid sliding friction of the contacts between the manipulating lever 5 and the second arm 4c of the movable contact 4, and accordingly the operating ease and the reliability of contacts are enhanced.

[0028] Incidentally, the operating section 5b of the manipulating lever 5 may be formed in a flat (planar) shape as shown in Fig. 1 and pressed in so that a member of the set to use the switch enter into the inside of the switch, and in this case the manipulating lever 5 will have no projection, making it possible to reduce the thickness of the switch body.

[0029] The cover 6, formed by punching and bending a metallic plate, consists of a top plate 6a covering the accommodating section 1a of the housing 1 and a pair of side plates 6b and 6b hung along the two sides of this top plate 6a. The top plate 6a is provided with a push-through hole 6c through which the operating section 5b of the manipulating lever 5 is inserted and projects, and on one side of this push-through hole 6c is provided, as shown in Fig. 1 and Fig. 5, an inward bent dust-shielding vertical wall 6d formed by notching part of the top plate 6a. This vertical wall 6d is formed in a position where the contact 3b of the switching contact 3 arranged in the accommodating section 1a of the housing 1 would otherwise communicate with the outside through the push-through hole 6c, and prevents dust and the like from invading the contact 3b.

[0030] Also, in the side plates 6b are formed a pair of notches 6e and 6e, and the engagement of these notches 6e and 6e with the engaging projections 1e and 1e formed on outer sides of the housing 1 enables the cover 6 to be fitted to the top face of the housing 1.

[0031] Next will be described with reference to Fig. 2 through Fig. 4 the operation of the detection switch configured as described above.

[0032] Fig. 2 illustrates a state in which the manipulating lever 5 is not yet operated. In this state, the manipulating lever 5 is projected out of the top plate 6a of the cover 6 by the energizing force of the second arm 4c of the movable contact 4. The first arm 4b of the movable contact 4 is in contact with the bend 2b of the common contact 2 all the time in this state, wherein the second arm 4c of the movable contact 4 is detached from the contact 3b of the switching contact 3 and the switch is in a turned-off state.

[0033] When the manipulating lever 5 is suppressed from this state by a drive mechanism or the like (not shown), the manipulating lever 5 turns around the rotation shaft 5c clockwise in the diagram as shown in Fig. 3, and as the second arm 4c of the movable contact 4 comes into contact with the guide 3d of the switching contact 3, the switch is turned on.

[0034] As the manipulating lever 5 is further suppressed from this state by a drive mechanism or the like, the manipulating lever 5 is turned further clockwise as shown in Fig. 4, and as the second arm 4c of the movable contact 4, guided by the guide 3d, comes into contact with the contact 3b, the common contact 2 and the switching contact 3 are connected to each other via the

first arm 4b of the movable contact 4 and the second arm 4c, the switch is turned on without fail.

[0035] In this case, the bend 2b of the common contact 2 coming into contact with the first arm 4b of the movable contact 4 and the groove 3e of the switching contact 3 for permitting the second arm 4c of the movable contact 4 to turn are embedded in the housing 1 in a state wherein both of them protrude downward from the inner bottom face of the accommodating section 1a of the housing 1. As the under sides of these bend 2b and the groove 3e are formed exposed on the bottom face side of the housing 1, the height of the housing 1 can be reduced without sacrificing the shiftable quantity of the operating section 5b of the manipulating lever 5, making it possible to reduce the overall size of the switch.

[0036] When the suppression by the drive mechanism (not shown) is released from the state illustrated in Fig. 4, the manipulating lever 5 is turned counterclockwise in the diagram by the energizing force of the movable contact 4 consisting of a coil spring and returns to its initial position shown in Fig. 2. This brings the second arm 4c and the contact 3b of the switching contact 3 out of contact with each other to turn off the switch.

[0037] As hitherto described, the switch device according to the invention is provided with a housing having an accommodating section; a common contact and a switching contact arranged along with each other on the inner bottom face of the accommodating section; a movable contact consisting of a coil spring, having a first arm in contact with the common contact all the time and a second arm capable of coming into and going out of contact with the switching contact; a manipulating lever having an operating section and rotatably holding the second arm of the movable contact; and a cover covering the top of the housing, wherein the switching contact has a contact bent in a clip shape with which the second arm is to be in sliding contact, this contact is formed in parallel to the inner bottom face of the accommodating section, and the contact is provided with a guide, projecting above the contact, for guiding the sliding contact of the second arm. Accordingly, it is made possible to reduce the product size and, even where the contact is disposed in parallel to the inner bottom face of the accommodating section (laterally), to ensure the arrangement of the second arm of the movable contact in slidable contact with the contact.

[0038] Also, as the clip-shaped contact is arranged in parallel to the inner bottom face of the accommodating section by, after being formed upright by cutting and bending one planar metallic plate, bending it at 90 degrees over the metallic plate, it is made possible to reduce the height of the housing and accordingly the overall size of the device without sacrificing the springing performance characteristics of the contact, including the contact pressure and fatigue strength.

[0039] Also, as a groove permitting the second arm to turn is formed in a metallic plate matching the contact of the switching contact, and this groove is protruded downward from the inner bottom face of the accommodating section and exposed on the bottom face side of the housing, the height of the housing can be reduced without sacrificing the shiftable quantity of the operating section of the manipulating lever, making it possible to reduce the overall size of the switch.

[0040] Also, as the common contact is provided with a bend to come into contact with the first arm, and this bend is protruded downward from the inner bottom face of the accommodating section and exposed on the bottom face side of the housing, the height of the housing can be reduced without sacrificing the shiftable quantity of the operating section of the manipulating lever, making it possible to reduce the overall size of the switch.

[0041] Also, as the top face of the cover is provided with a push-through hole through which the operating section of the manipulating lever projects, and on one side of this push-through hole a dust-shielding vertical wall is formed by notching part of the top plate and bending it inward, the contact of the switching contact arranged in the accommodating section of the housing is prevented from communicating with the outside through the push-through hole, and dust or the like is prevented from invading the contact.

[0042] Also, as the manipulating lever and the movable contact are arranged in the housing in such a manner that the position of the axial center of the rotation shaft by which the manipulating lever is rotatably borne becomes the same rotational center as the position of the axial center of the coil of the movable contact consisting of a coil spring, it is possible to avoid sliding friction of the contacts between the manipulating lever and the second arm of the movable contact, and accordingly the operating ease and the reliability of contacts are enhanced.

Claims

1. A switch device provided with a housing having an accommodating section; a common contact and a switching contact arranged along with each other on an inner bottom face of the accommodating section; a movable contact consisting of a coil spring, having a first arm in contact with the common contact all the time and a second arm capable of coming into and going out of contact with the switching contact; a manipulating lever having an operating section and rotatably holding the second arm of the movable contact; and a cover covering a top of the housing, wherein the switching contact has a contact bent in a clip shape with which the second arm is to be in sliding contact, wherein this contact is formed in parallel to the inner bottom face of the accommodating section, and wherein the contact is provided with a guide, projecting above the contact, for guiding the sliding contact of the second arm.

2. The switch device according to Claim 1, wherein the clip-shaped contact is arranged in parallel to the inner bottom face of the accommodating section by, after being formed upright by cutting and bending one planar metallic plate, bending it at 90 degrees over the metallic plate.

3. The switch device according to Claim 1 or 2, wherein a groove permitting the second arm to turn is formed in a metallic plate matching the contact of the switching contact, and wherein this groove is protruded downward from the inner bottom face of the accommodating section and exposed on a bottom face side of the housing.

4. The switch device according to any of Claims 1 to 3, wherein the common contact is provided with a bend to come into contact with the first arm, and wherein this bend is protruded downward from the inner bottom face of the accommodating section and exposed on the bottom face side of the housing.

5. The switch device according to any of Claims 1 to 4, wherein a top face of the cover is provided with a push-through hole through which the operating section of the manipulating lever projects, and wherein on one side of this push-through hole a dust-shielding vertical wall is formed by notching part of the top plate and bending it inward.

6. The switch device according to any of Claims 1 to 5, wherein the manipulating lever and the movable contact are arranged in the housing in such a manner that a position of an axial center of a rotation shaft by which the manipulating lever is rotatably borne becomes the same rotational center as a position of an axial center of a coil of the movable contact consisting of a coil spring.

FIG. 1

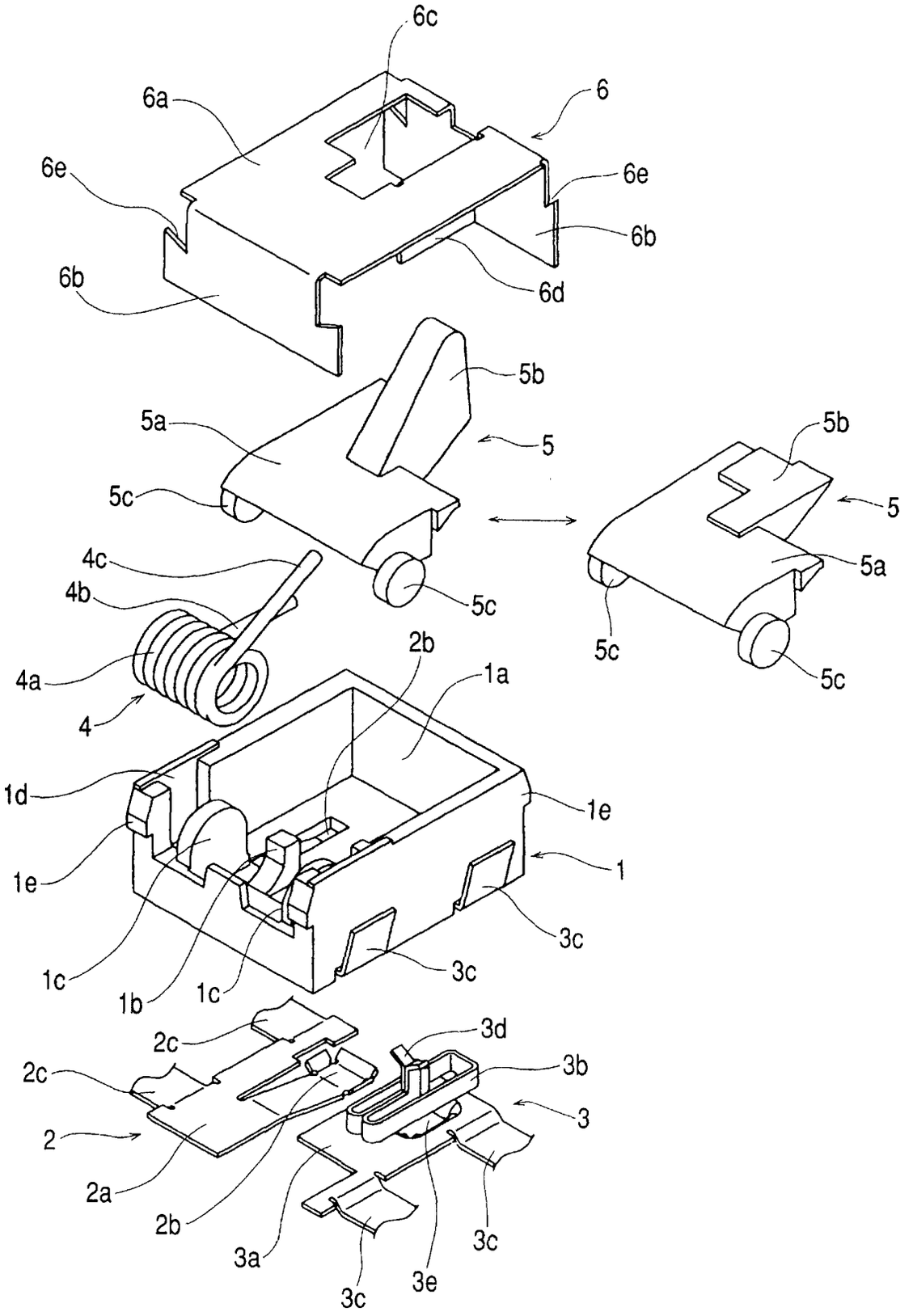
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FIG. 2

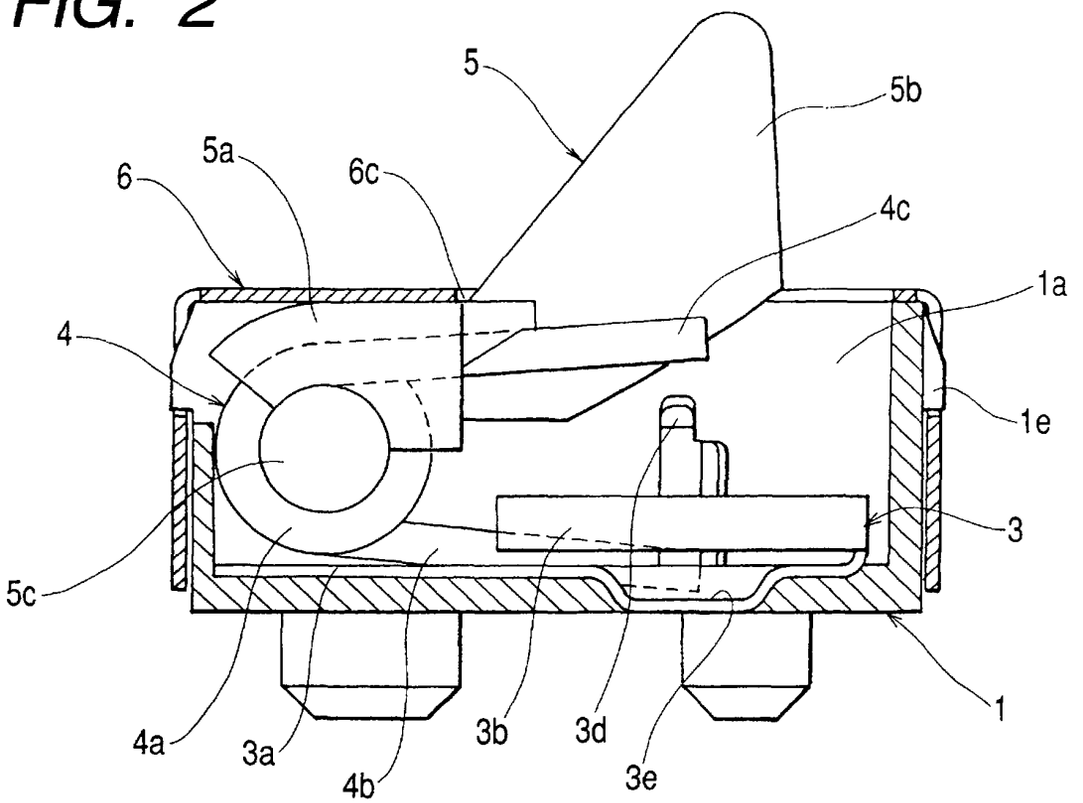
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FIG. 3

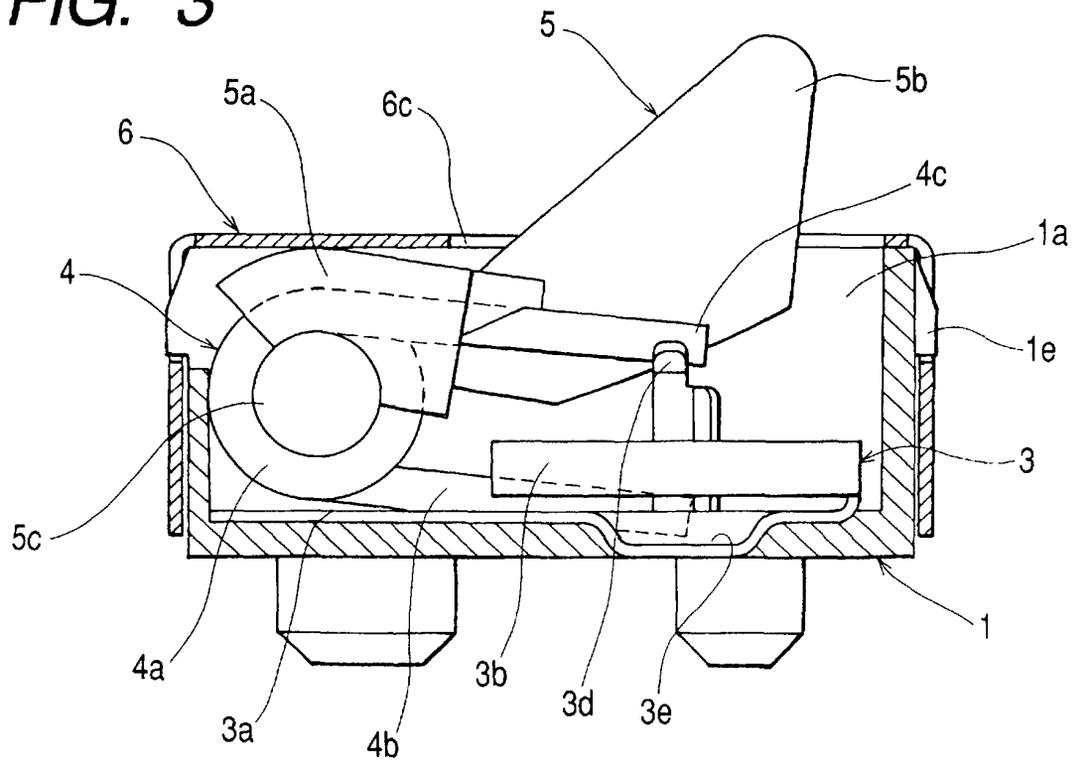
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FIG. 4

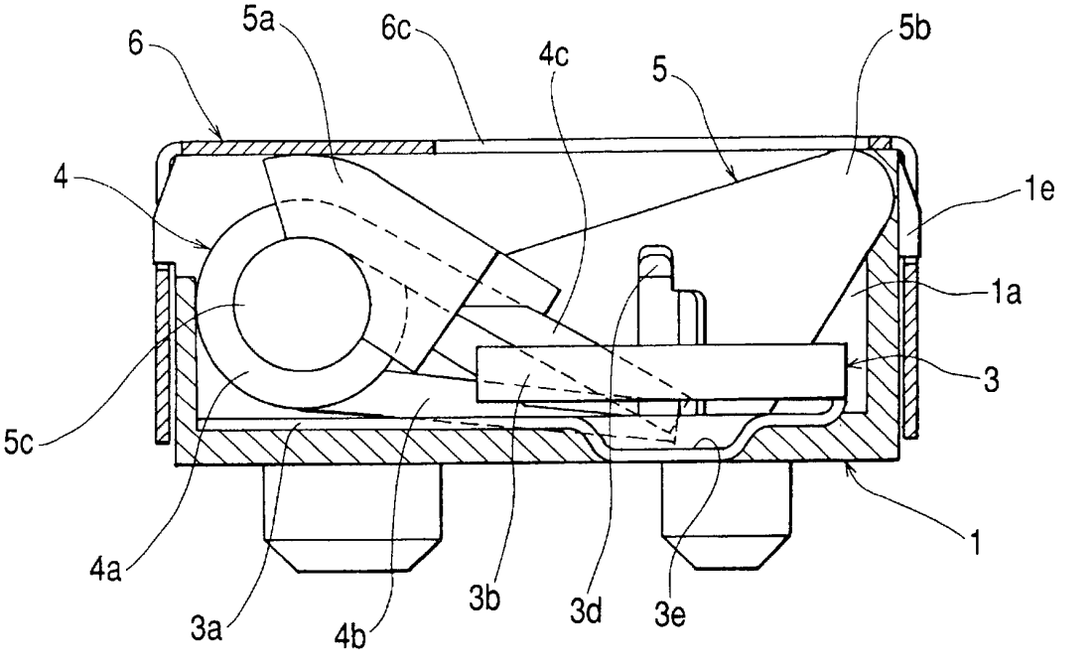
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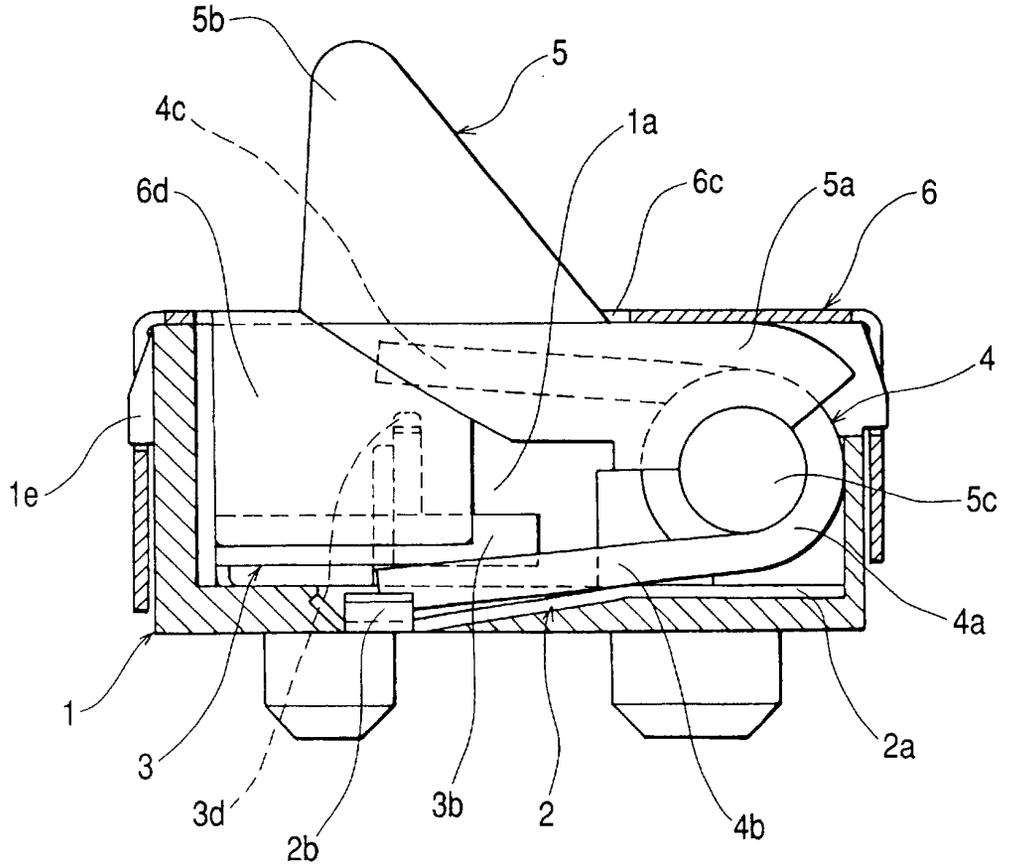
FIG. 5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