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(71) Applicant: **Panasonic Intellectual Property Management Co., Ltd.**
Osaka-shi, Osaka 540-6207 (JP)

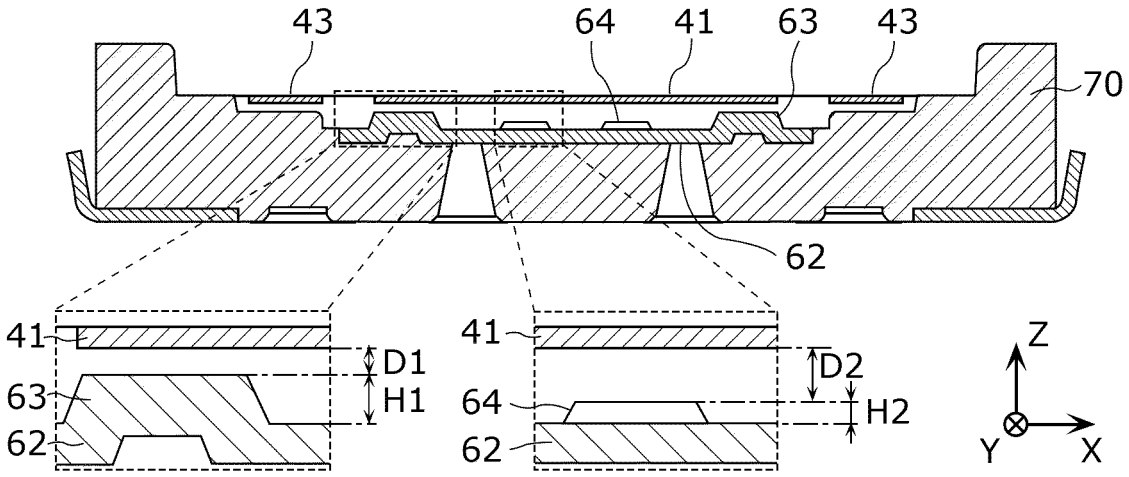
(72) Inventor: **NISHIKAWA, Koji**
Kadoma-shi, Osaka 571-0057 (JP)

(74) Representative: **Novagraaf International SA**
Chemin de l'Echo 3
1213 Onex, Geneva (CH)

(54) **PUSH SWITCH**

(57) A push switch (1) includes: a case (70) having an insulating property; a fixed contact body (60) that is fixed to the case (70); a movable contact body (40) that is disposed above the fixed contact body (60); and an operating part (21) that is disposed above the movable contact body (40) and receives a push operation. The movable contact body (40) includes a terminal part (41) that is vertically movable. The fixed contact body (60) includes a pair of first fixed contacts (63) and one or more second fixed contacts (64) disposed between the pair of first fixed contacts (63). In the movable contact body (40), when the operating part (21) receives the push operation, the terminal part (41) comes into contact with the one or more second fixed contacts (64) after coming into contact with at least one of the pair of first fixed contacts (63).

FIG. 4



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Description

[Technical Field]

[0001] The present disclosure relates to a push switch.

[Background Art]

[0002] Push switches using a dome-shaped movable contact and a fixed contact have been conventionally known as portable operation buttons (e.g., power buttons) (see, for example, Patent Literature (PTL 1)).

[Citation List]

[Patent Literature]

[0003] [PTL 1] International Publication No. 2020/153181

[Summary of Invention]

[Technical Problem]

[0004] Incidentally, when the movable contact and the fixed contact come close to each other, arc discharge may occur, and an insulator (oxide) may adhere to surfaces of the contacts. When the insulator adheres to the surfaces of the contacts, since there is a possibility that a contact resistance value increases and a conduction failure is caused, it is desired that generation of arc discharge is suppressed. However, PTL 1 does not disclose a technique of suppressing conduction failures due to arc discharge.

[0005] Therefore, the present disclosure provides a push switch capable of suppressing conduction failure due to arc discharge.

[Solution to Problem]

[0006] A push switch according to an aspect of the present disclosure includes: a case having an insulating property; a fixed contact body that is fixed to the case; a movable contact body that is disposed above the fixed contact body; and an operating part that is disposed above the movable contact body and receives a push operation, wherein the movable contact body includes a terminal part that is vertically movable, the fixed contact body includes a pair of first fixed contacts and one or more second fixed contacts disposed between the pair of first fixed contacts, and in the movable contact body, when the operating part receives the push operation, the terminal part comes into contact with the one or more second fixed contacts after coming into contact with at least one of the pair of first fixed contacts.

[Advantageous Effects of Invention]

[0007] An aspect of the present invention can realize a push switch capable of suppressing conduction failure due to arc discharge.

[Brief Description of Drawings]

[0008]

[FIG. 1]
FIG. 1 is a perspective view of an external appearance of a push switch according to an embodiment.
[FIG. 2]
FIG. 2 is an exploded perspective view of the push switch according to the embodiment.
[FIG. 3]
FIG. 3 is a perspective view of only a movable contact body and a fixed contact body of the push switch according to the embodiment.
[FIG. 4]
FIG. 4 is a cross-sectional view taken along line IV-IV in FIG. 3 and illustrating the push switch according to the embodiment.
[FIG. 5A]
FIG. 5A is a cross-sectional view corresponding to line IV-IV in FIG. 3 and illustrating a configuration when the push switch according to the embodiment is in the OFF state.
[FIG. 5B]
FIG. 5B is a cross-sectional view corresponding to line IV-IV in FIG. 3 and illustrating a configuration when the push switch according to the embodiment in the ON state.
[FIG. 6A]
FIG. 6A is a cross-sectional view taken along line IV-IV in FIG. 3 and illustrating a configuration when the push switch according to the embodiment is in the OFF state.
[FIG. 6B]
FIG. 6B is a cross-sectional view taken along line IV-IV in FIG. 3 and illustrating a configuration when a terminal part of the push switch according to the embodiment comes into contact with a first fixed contact.
[FIG. 6C]
FIG. 6C is a cross-sectional view taken along line IV-IV in FIG. 3 and illustrating a configuration when the terminal part of the push switch according to the embodiment comes into contact with a second fixed contact.
[FIG. 7A]
FIG. 7A is a cross-sectional view corresponding to line IV-IV in FIG. 3 and illustrating a configuration when a push switch according to a variation of the embodiment is in the OFF state.
[FIG. 7B]
FIG. 7B is a cross-sectional view corresponding to

line IV-IV in FIG. 3 and illustrating a configuration when the terminal part of the push switch according to the variation of the embodiment comes into contact with a first fixed contact.

[FIG. 7C]

FIG. 7C is a cross-sectional view corresponding to line IV-IV in FIG. 3 and illustrating a configuration when the terminal part of the push switch according to the variation of the embodiment comes into contact with a second fixed contact.

[Description of Embodiments]

(Circumstances Leading to the Present Disclosure)

[0009] Before describing the present disclosure, circumstances leading to the present disclosure will be described.

[0010] For example, in a case where a push switch is used with high voltage or high current, when a movable contact and a fixed contact come close to each other in an ON/OFF operation of the switch, arc discharge may occur between the movable contact and the fixed contact, and an insulator (oxide) may adhere to a surface of one of the movable contact and the fixed contact. For example, when the movable contact is made of stainless steel (SUS), a granular black foreign matter (insulator) mainly composed of iron oxide adheres to the fixed contact. In addition, when the black foreign matter adheres to the fixed contact, a recess is formed in the movable contact. Accordingly, it is estimated that the black foreign matter is caused since a base metal (iron) of the movable contact is oxidized and adheres onto the fixed contact.

[0011] It is estimated that a process until the black foreign matter adheres is that, when the movable contact and the fixed contact come close to each other, arc discharge (heat) involving melting of a material of the movable contact occurs, and the material scatters from the movable contact to the fixed contact.

[0012] Accordingly, there is a possibility that the contact resistance value between the contacts increases, and a conduction failure is caused. It should be noted that high voltage is, for example, a voltage of about a dozen V (for example, DC 16 V), and high current is, for example, a current of about several amperes.

[0013] Therefore, the present inventor has intensively studied a push switch capable of suppressing conduction failures due to arc discharge, and invented a push switch illustrated as follows. Specifically, the present inventor has invented a push switch including, in addition to a movable contact and a fixed contact for conduction confirmation, a contact to which an insulator is to adhere when arc discharge occurs (a contact serving as a substitute).

[0014] It should be noted that, even if the above-described estimation is wrong, an effect of suppressing conduction failures due to arc discharge can be obtained with a push switch having the configuration of the present disclosure described below.

[0015] A push switch according to an aspect of the present disclosure includes: a case having an insulating property; a fixed contact body that is fixed to the case; a movable contact body that is disposed above the fixed contact body; and an operating part that is disposed above the movable contact body and receives a push operation. The movable contact body includes a terminal part that is vertically movable, and the fixed contact body includes a pair of first fixed contacts and one or more second fixed contacts disposed between the pair of first fixed contacts. In the movable contact body, when the operating part receives the push operation, the terminal part comes into contact with the one or more second fixed contacts after coming into contact with at least one of the pair of first fixed contacts.

[0016] Accordingly, in the push switch, it is possible to preferentially generate arc discharge between the pair of first fixed contacts and the terminal part, among the pair of first fixed contacts and the one or more second fixed contacts. That is, in the push switch, it is possible to suppress generation of arc discharge between the one or more second fixed contacts and the terminal part, and adhesion of an insulator to a surface of the one or more second fixed contacts or a surface of a portion of the terminal part corresponding to the one or more second fixed contacts. Therefore, according to the push switch according to one aspect of the present disclosure, since it is possible to suppress occurrence of conduction failures between the one or more second fixed contacts and the terminal part, conduction failures due to arc discharge can be suppressed.

[0017] Furthermore, for example, a first distance between the pair of first fixed contacts and the terminal part may be less than a second distance between the one or more second fixed contacts and the terminal part, the movable contact body may include a connecting part connected to the terminal part, and when the operating part receives the push operation, the terminal part may move down due to the connecting part deforming.

[0018] Accordingly, in the push switch, it is possible to more positively bring the terminal part close to the pair of first fixed contacts first, by simply moving the tabular terminal part toward the fixed contacts while maintaining its shape. Therefore, the push switch can more positively suppress occurrence of conduction failures between the one or more second fixed contacts and the terminal part.

[0019] Furthermore, for example, the pair of first fixed contacts and the one or more second fixed contacts may be protrusions that protrude from the fixed contact body toward the terminal part, and a first height of the pair of first fixed contacts may be greater than a second height of the one or more second fixed contacts.

[0020] Accordingly, in the push switch, it is possible to more positively bring the terminal part close to the pair of first fixed contacts having a greater height first, by simply moving the flat tabular terminal part toward the fixed contacts while maintaining its shape. Therefore, the push

switch can more positively suppress occurrence of conduction failures between the one or more second fixed contacts and the terminal part.

[0021] Furthermore, for example, the terminal part may include a first contact region that comes into contact with the pair of first fixed contacts, and a second contact region that comes into contact with the one or more second fixed contacts, and the first contact region may be located lower than the second contact region.

[0022] Accordingly, with the shape of the movable contact body, it is possible to realize a push switch capable of suppressing conduction failures due to arc discharge.

[0023] Furthermore, for example, a protruding part may be provided in the first contact region, the protruding part protruding to be closer to the fixed contact body than the second contact region is.

[0024] Accordingly, since the movable contact body has a protruding part, it is possible to realize a push switch capable of suppressing conduction failures due to arc discharge.

[0025] Furthermore, for example, a tilted part may be provided in the first contact region, the tilted part being tilted toward the fixed contact body with respect to the second contact region.

[0026] Accordingly, since the movable contact body has a tilted part, it is possible to realize a push switch capable of suppressing conduction failures due to arc discharge.

[0027] Furthermore, for example, the terminal part may come into contact with the one or more second fixed contacts by elastically deforming, after coming into contact with at least one of the pair of first fixed contacts

[0028] Accordingly, the terminal part can more positively contact the one or more second fixed contacts. Therefore, with the shapes (for example, height) of the pair of first fixed contacts and the one or more second fixed contacts, the push switch can suppress occurrence of conduction failures between the one or more second fixed contacts and the terminal part.

[0029] Furthermore, for example, the fixed contact body may include one or more third fixed contacts different in potential from the pair of first fixed contacts and the one or more second fixed contacts. For example, the movable contact body may include a frame part that comes into contact with the one or more third fixed contacts, the connecting part may connect the terminal part and the frame part, and, in a plan view, the connecting part, the terminal part, and the one or more third fixed contacts may be disposed in stated order.

[0030] Accordingly, when the terminal part moves down, since it is possible to suppress occurrence of distortion due to the movement of the terminal part, in a portion that comes into contact with the third fixed contact in the frame part, contact between the frame part and the third fixed contact can be stabilized.

[0031] Furthermore, for example, the push switch may further include: a movable component that is disposed between the operating part and the movable contact body and is dome-shaped. For example, when the operating part receives the push operation, the movable component may elastically deform in accordance with movement of the operating part, and the connecting part may elastically deform due to stress imparted on the terminal part from the movable component that has elastically deformed.

[0032] Accordingly, the push switch can provide an operator (user) with a click feeling (an operation feel at the time when a push operation is performed) by elastic deformation of the movable component.

[0033] Furthermore, for example, the one or more second fixed contacts may comprise three or more second fixed contacts, an arrangement direction of two second fixed contacts among the three or more second fixed contacts may be parallel to an arrangement direction of the pair of first fixed contacts, and an arrangement direction of one second fixed contact among the three or more second fixed contacts and the two second fixed contacts may cross the arrangement direction of the pair of first fixed contacts.

[0034] Accordingly, for example, even when the insulator adheres to one of the second fixed contacts, the push switch can detect conduction (that is, the push operation has been performed on the operating part) by another one of the second fixed contacts. Therefore, according to the push switch, the reliability of switching operations is improved.

[0035] Hereinafter, embodiments will be described in detail with reference to the drawings.

[0036] Note that the embodiments below each describe a general or a specific example. The numerical values, shapes, elements, the arrangement and the order of connection of the elements, etc., presented in the embodiments below are mere examples, and thus are not intended to limit the present disclosure. Furthermore, among the elements in the embodiments below, those not recited in any one of the independent claims will be described as optional elements.

[0037] In addition, the drawings are schematic diagrams, and do not necessarily provide strictly accurate illustrations. Accordingly, the drawings do not necessarily coincide with one another in terms of scales and the like. Throughout the drawings, the same reference numeral is given to substantially the same element, and redundant description is omitted or simplified.

[0038] In addition, in the present description, the terms "on XX (for example, on a fixed contact body)", "upward", and "downward" are used as terms that do not indicate an upward direction (vertically upward) and a downward direction (vertically downward) in absolute spatial recognition, but specify relative positional relationship based on the order of lamination in a laminated configuration. In addition, the terms "on XX (for example, on a fixed contact body)", "upward", and "downward" are applied not only to a case where two components are disposed to be spaced apart from each other, and another component

exists between the two components, but also to a case where two components are disposed in contact with each other.

[0039] The X axis, Y axis, and Z axis in the specification and drawings of the present disclosure indicate the three axes of a right-handed three-dimensional orthogonal coordinate system. In the embodiment, the Z axis direction is a movement direction in which the operation part of a push switch moves. In addition, a view from the Z axis positive side to the Z axis negative side is also referred to as plan view.

[0040] In the Specification of the present disclosure, terms describing relationships between elements such as parallel, and the same, terms describing shapes of elements such as a quadrilateral and circular, and numerical values and numerical value ranges are not only used to express the strict meanings, but are also used to express the meanings of substantially equivalent ranges. For example, the terms, numerical values, and numerical value ranges include a difference of about several percent (or about 10%).

[0041] Furthermore, in the present Specification, unless otherwise stated, ordinal numbers such as "first" and "second" do not mean the number or order of elements, and are used for the purpose of distinguishing similar elements to avoid confusion.

[Embodiment]

[0042] Hereinafter, a push switch according to an embodiment will be described with reference to FIG. 1 through FIG. 6C.

[1. Configuration of push switch]

[0043] First, the configuration of a push switch according to the embodiment will be described with reference to FIG. 1 to FIG. 4. FIG. 1 is a perspective view of an external appearance of push switch 1 according to the embodiment. FIG. 2 is an exploded perspective view of push switch 1 according to the embodiment.

[0044] As illustrated in FIG. 1 and FIG. 2, push switch 1 includes metallic cover 10, rubber cap 20, movable component 30, movable contact body 40, film 50, fixed contact body 60, and case 70. Movable contact body 40 and fixed contact body 60 constitute switch contact part 100 (switch contact mechanism).

[0045] Push switch 1 is a device that is turned ON, and transmits (for example, wirelessly transmits) a predetermined signal to an external reception device, when operating part 21 of rubber cap 20 is pressed in a downward direction (a Z-axis negative direction) to elastically deform movable component 30, elastically deformed movable component 30 presses movable contact body 40 in the Z-axis negative direction, and movable contact body 40 and fixed contact body 60 are electrically conducted. Push switch 1 is, for example, a normally open switch that is turned ON only at the time of a push operation. In addition, although push switch 1 is used as a switch of a portable electronic device or an automotive electronic device, push switch 1 may be used by being fixed to (for example, being embedded into) a construction material or a stationary electronic device.

[0046] Metallic cover 10 is a tabular metallic component that covers flange part 23 of rubber cap 20, and is fixed to case 70. In a state in which metallic cover 10 is fixed to case 70, metallic cover 10 is in contact (e.g., surface-to-surface contact) with the upper surface (the surface on the Z axis positive side) of flange part 23.

[0047] Metallic cover 10 is in a quadrilateral shape in plan view, and includes tabular part 11, claw parts 12, and regulating parts 13. Tabular part 11, claw parts 12, and regulating parts 13 are integrally formed.

[0048] Tabular part 11 is a flat tabular part, and includes insertion through-hole 11a through which operating part 21 is inserted. The shape of insertion through-hole 11a is dependent on the shape of operating part 21.

[0049] Claw parts 12 protrude from end portions on the positive side and the negative side of the X axis of tabular component 11 toward case 70 (the Z axis negative side). Claw parts 12 fix metallic cover 10 to case 70. Claw parts 12 are caught on (engage with) projecting parts 72 provided on case 70 to fix metallic cover 10 to case 70.

[0050] Furthermore, claw parts 12 restrict movement of rubber cap 20 in the X axis direction.

[0051] Regulating parts 13 are provided protruding from end portions on the positive side and the negative side of the Y axis of tabular part 11 toward case 70. Regulating parts 13 regulate the movement of rubber cap 20 in the Y axis direction.

[0052] Note that the placement positions and the number of claw parts 12 and regulating parts 13 are not particularly limited.

[0053] Rubber cap 20 is a rubber elastic body provided so as to cover recessed part 74 of case 70. Rubber cap 20 includes operating part 21, middle part 22, and flange part 23. Operating part 21, middle part 22, and flange part 23 are integrally formed. In addition, out of operating part 21, middle part 22, and flange part 23, only operating part 21 and middle part 22 are exposed.

[0054] Operating part 21 is arranged above movable contact body 40, and has a function of making movable contact body 40 (specifically, terminal part 41) contact or separate from fixed contact body 60 (specifically, first electrode component 61). Operating part 21 is configured to be movable vertically (in the Z axis direction), and moves down (the Z axis negative side) upon reception of a force (push operation) from the outside of push switch 1, thereby moving movable contact body 40 toward fixed contact body 60 (the Z axis negative side) via movable component 30. The force from the outside is the force applied to operating part 21 by the operator (user) of push switch 1. Operating part 21 moves between a first position (a position illustrated in FIG. 5A) where movable contact body 40 does not come into contact with fixed contact body 60, and a second position (position illu-

strated in FIG. 5B) where movable contact body 40 comes into contact with fixed contact body 60. The second position is a position closer to fixed contact body 60 (the Z axis negative side) than the first position.

[0055] Operating part 21 has an upper portion that is exposed to the outside of case 70. Furthermore, operating part 21 is in, for example, a circular cylinder shape, but the shape is not limited to the foregoing.

[0056] Middle part 22 is an annular part for connecting operating part 21 and flange part 23. Middle part 22 seamlessly connects operating part 21 and flange part 23. In this embodiment, middle part 22 is in a toroidal shape. The thickness of middle part 22 (the length in the Z axis direction) is less than both the thickness of operating part 21 and the thickness of flange part 23 (see FIG. 5A), but the thickness of middle part 22 is not limited to such. In addition, middle part 22 is formed to tilt upward from flange part 23e toward operating part 21.

[0057] Flange part 23 is an annular part disposed facing upper surface 73 of lateral wall part 71 of case 70, and covers upper surface 73 of lateral wall part 71. Flange part 23 is in contact (e.g., surface-to-surface contact) with each of metallic cover 10 and upper surface 73 of lateral wall part 71. The cross-sectional shape of flange part 23 is quadrilateral. The upper surface (the surface on the positive side of the Z axis) of flange part 23 and the lower surface (the surface on the negative side of the Z axis) of flange part 23 are both flat surfaces. With this, it is possible to increase the contact area size between flange part 23 and metallic cover 10 and the contact area size between flange part 23 and upper surface 73 of lateral wall part 71.

[0058] Movable component 30 is a tabular component that is disposed above movable contact body 40, and that has conductivity and elasticity. Movable component 30 elastically deforms so as to move between an ON position where movable contact body 40 comes into contact with fixed contact body 60, and an OFF position where movable contact body 40 is separated from fixed contact body 60. In the present embodiment, movable component 30 is dome-shaped and is installed on case 70. Movable component 30 elastically deforms so that a central part moves between the ON position and the OFF position. Movable component 30 includes leg parts 31, and is installed so that leg parts 31 contact upper surfaces of reinforcing components 81 and 82 formed in case 70. Movable component 30 elastically deforms to be dome-shaped and to be convex to the Z axis positive side when OFF (normal state), and to be dome-shaped and to be convex to the Z axis negative side due to the force from operating part 21 when ON (at the time of the push operation). With this elastic deformation, a click feeling (a pressing operation feeling) can be provided to the user. In addition, with this elastic deformation, movable component 30 comes into contact with movable contact body 40 (specifically, terminal part 41).

[0059] Movable component 30 is, for example, a metal plate such as SUS. Movable component 30 is also referred to as a metal dome. It should be noted that movable component 30 should have at least elasticity, and need not have conductivity. Movable component 30 may have, for example, an insulating property.

[0060] Movable contact body 40 is an electrode (movable electrode) that is disposed on fixed contact body 60, comes into contact with fixed contact body 60 at the time of a push operation, and has conductivity. Movable contact body 40 is made of a material that has conductivity, and is made of, for example, a metal such as SUS.

[0061] Movable contact body 40 includes terminal part 41, connecting part 42, and frame part 43.

[0062] Terminal part 41 is a part that is tabular, vertically movable, and comes into contact with fixed contacts (first fixed contacts 63, second fixed contacts 64) formed in fixed contact body 60 when operating part 21 is pressed. Although terminal part 41 has an elongated shape along the X axis, and is in the shape of, for example, a strip, the shape is not limited to this. Terminal part 41 is movable between a third position (a position illustrated in FIG. 4, FIG. 5A, or FIG. 6A) where terminal part 41 is not conductive with fixed contact body 60, and a fourth position (a position illustrated in FIG. 5B or FIG. 6C) where terminal part 41 is conductive with fixed contact body 60. The third position is a position of terminal part 41 at the time when operating part 21 is located at the first position, and the fourth position indicates a position of terminal part 41 at the time when operating part 21 is located at the second position.

[0063] Connecting part 42 is a part that connects terminal part 41 and frame part 43, and has elasticity. Connecting part 42 is configured to deform and move terminal part 41 down when operating part 21 receives a push operation. Connecting part 42 is provided on the opposite side of third fixed contacts 69 with respect to terminal part 41 in a plan view. That is, connecting part 42, terminal part 41, and third fixed contacts 69 are disposed in stated order in a plan view. Accordingly, when terminal part 41 moves down, since it is possible to suppress occurrence of distortion due to the movement of terminal part 41 in portions of frame part 43 that come into contact with third fixed contacts 69, an effect of stabilizing contact between frame part 43 and third fixed contacts 69 can be expected.

[0064] The plan view shapes of connecting part 42 and terminal part 41 are, for example, T-shaped, and when operating part 21 is pressed, connecting part 42 elastically deforms so that terminal part 41 moves toward fixed contact body 60 (the Z axis negative side) while maintaining its shape.

[0065] Frame part 43 is accommodated in recessed part 74 of case 70, and is in contact with third fixed contacts 69 regardless of whether or not there is a push operation on operating part 21. That is, frame part 43 and third fixed contacts 69 are constantly in contact with each other. In the present embodiment, although frame part 43 is ring-shaped, frame part 43 may be in other shapes as long as frame part 43 can be constantly in contact with

third fixed contacts 69. Frame part 43 is provided so as to surround terminal part 41 from the outside in a plan view.

[0066] Film 50 is a sheet component that has an insulating property, and is disposed so as to cover movable contact body 40 in a plan view. Film 50 is disposed between movable contact body 40 and movable component 30. Film 50 comes in contact with frame part 43 in a state where, for example, push switch 1 is assembled. Film 50 is made of a resin or the like.

[0067] Fixed contact body 60 is an electrode (fixed electrode) that is fixed to case 70, comes into contact with movable contact body 40, and has conductivity. When operating part 21 is pressed, fixed contact body 60 comes into contact with terminal part 41. Fixed contact body 60 is made of a material that has conductivity. Fixed contact body 60 is connected to a circuit board (not illustrated) provided in case 70 (for example, in recessed part 74). At least one electronic component, such as a power supply circuit, a control circuit, a memory, and a transmission circuit, may be implemented in the built-in circuit board. This electronic component is an electronic component for transmitting a predetermined signal to the outside.

[0068] Fixed contact body 60 includes first electrode component 61 and second electrode component 67.

[0069] First electrode component 61 is a part of fixed contact body 60 that comes into contact with terminal part 41 when operating part 21 is pressed, and includes the pair of first fixed contacts 63, and one or more second fixed contacts 64 disposed between pair of first fixed contacts 63. Pair of first fixed contacts 63 and one or more second fixed contacts 64 are protrusions that protrude toward terminal part 41 (the Z axis positive side) from flat part 62 provided on the Y axis positive side of first electrode component 61.

[0070] Pair of first fixed contacts 63 function as contacts to which an insulator is to adhere (contacts serving as substitutes) when arc discharge is generated. When operating part 21 is pressed, pair of first fixed contacts 63 come close to terminal part 41 before one or more second fixed contacts 64. In the present embodiment, although pair of first fixed contacts 63 are constituted by two first fixed contacts 63, the number is not particularly limited as long as pair of first fixed contacts 63 are constituted by two or more first fixed contacts 63. Three or more first fixed contacts 63 may be disposed.

[0071] In addition, although the plan view shapes of pair of first fixed contacts 63 are, for example, quadrilateral, the plan view shapes are not limited to this, and may be circular, polygonal, or the like.

[0072] One or more second fixed contacts 64 function as spare electrodes for conduction confirmation in a case where conduction by first fixed contacts 63 does not work. In the present embodiment, although one or more second fixed contacts 64 are constituted by three second fixed contacts 64, the number of second fixed contacts 64 is not particularly limited, and may be, for example, one, or may be four or more. In addition, one or more second fixed contacts 64 are at the same potential as pair of first fixed contacts 63.

[0073] In addition, although the plan view shapes of one or more second fixed contacts 64 are, for example, circular, the plan view shapes are not limited to this, and may be quadrilateral, polygonal, or the like.

[0074] An end portion of first electrode component 61 on the Y axis negative side is exposed from case 70, and functions as an external terminal to be connected to an external circuit board or the like. An electronic component other than the above-described at least one of the power supply circuit, the control circuit, the memory, and the transmission circuit, may be implemented in the external circuit board.

[0075] First electrode component 61 is made of, for example, an alloy such as phosphor bronze or a single metal. In addition, first electrode component 61 may be integrally formed. That is, flat part 62, pair of first fixed contacts 63, and one or more second fixed contacts 64 may be integrally formed. In addition, among pair of first fixed contacts 63 and one or more second fixed contacts 64, at least pair of first fixed contact 63 may be detachably attached to flat part 62. Here, detachable means that first fixed contacts 63 can be detached from and attached to flat part 62, without breaking first electrode component 61 and first fixed contacts 63. For example, screw holes may be formed in flat part 62, and first fixed contacts 63 may be detachably attached to flat part 62 by screwing threaded first fixed contacts 63 into the screw holes.

[0076] Second electrode component 67 is a part of fixed contact body 60 that comes into contact with frame part 43 regardless of whether or not operating part 21 is pressed, and includes third fixed contacts 69. Third fixed contacts 69 are protrusions formed in flat part 68 and provided on the Y axis negative side of second electrode component 67. Third fixed contacts 69 are at a potential different from pair of first fixed contacts 63 and one or more second fixed contacts 64, and are connected to, for example, a power supply (for example, DC 16 V). In addition, third fixed contacts 69 are not electrically connected to pair of first fixed contacts 63 and one or more second fixed contacts 64 in a state (initial state) where operating part 21 is not pressed. An end portion of second electrode component 67 on the Y axis positive side is exposed from case 70, and functions as an external terminal to be connected to an external circuit board or the like.

[0077] Second electrode component 67 is made of, for example, an alloy such as phosphor bronze or a single metal. Second electrode component 67 is made of, for example, the same material as first electrode component 61. In addition, second electrode component 67 is integrally formed. That is, flat part 68 and third fixed contacts 69 are integrally formed.

[0078] Case 70 is a frame member that is below operating part 21, and in which movable component 30, movable contact body 40, film 50, and fixed contact body 60 are installed. Case 70 includes annular lateral wall part

71 and a bottom part that seals one opening (an opening on the Z axis negative side) of lateral wall part 71. Lateral wall part 71 and the bottom part are integrally formed. Lateral wall part 71 is provided upright on the Z axis positive side from a circumference of the bottom part, and forms an inner surface of recessed part 74. Recessed part 74 is circular in a plan view.

[0079] Case 70 has an insulating property. Case 70 is formed from a resin. In addition, case 70 may be harder than rubber cap 20.

[0080] Projecting parts 72, which engage with claw parts 12, are provided in four corners of external surfaces of lateral wall part 71. It should be noted that the placement positions and the number of projecting parts 72 are not particularly limited.

[0081] Here, further referring to FIG. 3 and FIG. 4, the positional relationship between movable contact body 40 and fixed contact body 60 in the initial state will be described. FIG. 3 is a perspective view illustrating only movable contact body 40, fixed contact body 60, and case 70 of push switch 1 according to the present embodiment. FIG. 4 is a cross-sectional view of push switch 1 according to the present embodiment taken along the line IV-IV in FIG. 3. FIG. 4 is a cross-sectional view illustrating the configurations of movable contact body 40, fixed contact body 60, and of case 70 in the initial state.

[0082] As illustrated in FIG. 3, each of pair of first fixed contacts 63 and one or more second fixed contacts 64 is disposed at a position that overlaps with terminal part 41 in a plan view.

[0083] One of pair of first fixed contacts 63 is disposed on the X axis positive side with respect to each of one or more second fixed contacts 64, and the other of pair of first fixed contacts 63 is disposed on the X axis negative side with respect to each of one or more second fixed contacts 64. Pair of first fixed contacts 63 are disposed at, for example, positions more distant from (outward from) the center of recessed part 74 than one or more second fixed contacts 64 in a plan view. In addition, the arrangement direction of pair of first fixed contacts 63 may be parallel to the extending direction of terminal part 41.

[0084] One or more second fixed contacts 64 are disposed between pair of first fixed contact 63 in the X axis direction. One or more second fixed contacts 64 are disposed at positions closer to (inward of) the center of recessed part 74 than pair of first fixed contacts 63 in a plan view. In addition, for example, when three or more second fixed contacts 64 are provided, the arrangement direction of two second fixed contacts 64 among three or more second fixed contacts 64 may be parallel to the arrangement direction (the X axis direction) of pair of first fixed contacts 63, and the arrangement direction (the Y axis direction) of other one second fixed contact 64 among three or more second fixed contacts 64 and two second fixed contacts 64 may cross (for example, orthogonal to) the arrangement direction of pair of first fixed contacts 63.

[0085] In addition, third fixed contacts 69 are disposed at positions that overlap with frame part 43 in a plan view.

[0086] As illustrated in FIG. 4, terminal part 41 is the tabular component in the initial state. In the initial state, a cross-sectional shape of terminal part 41 is quadrilateral. Terminal part 41 is disposed to face flat part 62. Terminal part 41 and flat part 62 are disposed, for example, in parallel.

[0087] In addition, in the initial state, terminal part 41, and pair of first fixed contacts 63 and one second fixed contact 64 do not come into contact with each other, and are disposed at a predetermined interval. For example, in the initial state, first distance D1 between pair of first fixed contacts 63 and terminal part 41 is less than second distance D2 between one or more second fixed contacts 64 and terminal part 41. First distance D1 should be a distance at which, when terminal part 41 moves to the Z axis negative side, arc discharge is generated between either of pair of first fixed contacts 63 and terminal part 41, and is, for example, a distance less than second distance D2 by 0.01 mm or more.

[0088] In the present embodiment, first height H1 of pair of first fixed contacts 63 is greater than second height H2 of one or more second fixed contacts 64. Although first height H1 is, for example, about 0.05 mm, and second height H2 is about 0.04 mm, the heights are not limited to these. First height H1 should be, for example, 0.01 mm or more, and second height H2 may be 0.00 mm or more. Second height H2 being 0.00 mm is a case where a surface of flat part 62 functions as second fixed contact 64.

[0089] It should be noted that, in FIG. 4, although the description has been given of the example in which terminal part 41 is tabular, terminal part 41 is not limited to this, and for example, terminal part 41 may include protrusions that protrude toward pair of first fixed contacts 63 at positions that overlap with pair of first fixed contact 63 in a plan view, or portions around these positions may be bent toward pair of first fixed contacts 63. In this case, the relationship of first distance D1< second distance D2 should be maintained, and first height H1 and second height H2 may be the same height, or second height H2 may be greater than first height H1.

[0090] Reinforcing components 81 and 82 are components against which lower ends of leg parts 31 of movable component 30 abut. Reinforcing components 81 and 82 are made of a metal. Accordingly, it is possible to suppress leg parts 31 of movable component 30 from rubbing against case 70 (resin) and being worn out when a switching operation is performed. It should be noted that reinforcing components 81 and 82 are not limited to being made of a metal, but may be made of a resin (for example, a resin harder than case 70).

[2. Movement of push switch]

[0091] Subsequently, referring to FIG. 5A to FIG. 6C, a description will be given of movement at the time when operating part 21 of push switch 1 configured as de-

scribed above is pressed. First, referring to FIG. 5A and FIG. 5B, a description will be given of cross-sectional configurations in cases where push switch 1 is in the ON state and the OFF state. FIG. 5A is a cross-sectional view corresponding to the line IV-IV in FIG. 3, and illustrating a configuration in the case where push switch 1 according to the present embodiment is in the OFF state. FIG. 5B is a cross-sectional view corresponding to the line IV-IV in FIG. 3, and illustrating the configuration in the case where push switch 1 according to the present embodiment is in the ON state.

[0092] As illustrated in FIG. 5A, in the state (the OFF state) where operating part 21 is not pressed, operating part 21, movable component 30, terminal part 41, pair of first fixed contacts 63, and one or more second fixed contacts 64 are disposed to be separated from each other.

[0093] As illustrated in FIG. 5B, in the state (the ON state) where operating part 21 is pressed, operating part 21, movable component 30, film 50, and terminal part 41 come into contact with each other in the stated order, and a lower surface of terminal part 41 comes into contact with pair of first fixed contacts 63 and one or more second fixed contacts 64. When operating part 21 is pressed, movable component 30 elastically deforms so as to be convex toward the Z axis negative side, a stress is applied to terminal part 41 toward the Z axis negative side due to the elastic deformation of movable component 30, and terminal part 41 comes into contact with pair of first fixed contacts 63 and one or more second fixed contacts 64.

[0094] Next, further referring to FIG. 6A to FIG. 6C, movement of movable contact body 40 in push switch 1 constituted as described above will be described. FIG. 6A is a cross-sectional view taken along the line IV-IV in FIG. 3 and illustrating a configuration in a case where push switch 1 according to the present embodiment is in the OFF state. FIG. 6B is a cross-sectional view taken along the line IV-IV in FIG. 3 and illustrating a configuration in a case where terminal part 41 of push switch 1 according to the present embodiment comes into contact with first fixed contacts 63. FIG. 6C is a cross-sectional view taken along the line IV-IV in FIG. 3 and illustrating a configuration in a case where terminal part 41 of push switch 1 according to the present embodiment comes into contact with second fixed contacts 64. FIG. 6A to FIG. 6C are cross-sectional views illustrating only movable contact body 40, fixed contact body 60, and case 70.

[0095] FIG. 6A illustrates a cross-sectional configuration in the initial state, and is a cross-sectional view similar to FIG. 4. The position of terminal part 41 illustrated in FIG. 6A is an example of the third position. Terminal part 41 and frame part 43 are disposed, for example, in the same straight line.

[0096] FIG. 6B illustrates a situation where operating part 21 is pressed, movable component 30 elastically deforms to be convex toward the Z axis negative side, terminal part 41 moves toward the Z axis negative side due to the elastic deformation, and terminal part 41 comes into contact (for example, surface contact) with pair of first fixed contacts 63. Terminal part 41 comes into contact with pair of first fixed contacts 63 before one or more second fixed contacts 64. When arc discharge is generated, the arc discharge is generated between pair of first fixed contacts 63 and portions of terminal part 41 that come close to pair of first fixed contacts 63. In other words, arc discharge is not generated between one or more second fixed contacts 64 and terminal part 41.

[0097] It should be noted that the movement of terminal part 41 as illustrated in FIG. 6A to FIG. 6B is realized when terminal part 41 receives a stress from elastically deformed movable component 30, and connecting part 42 elastically deforms toward pair of first fixed contacts 63. In this manner, movable contact body 40 is configured such that, when operating part 21 receives a push operation, movable component 30 elastically deforms in accordance with the movement of operating part 21, and connecting part 42 elastically deforms due to stress imparted on terminal part 41 from movable component 30 that has elastically deformed. In addition, the position of terminal part 41 illustrated in FIG. 6B is a position between the third position and the fourth position, and is an example of a fifth position. For example, when terminal part 41 moves from the third position to the fifth position, terminal part 41 does not elastically deform. Terminal part 41 moves from the third position to the fifth position while maintaining, for example, a parallel relationship with flat part 62. Terminal part 41 has, for example, a rigidity sufficient to prevent elastic deformation when terminal part 41 moves from the third position to the fifth position due to the stress from movable component 30. It should be noted that not elastically deforming means substantially not elastically deforming.

[0098] It should be noted that pair of first fixed contacts 63 and terminal part 41 are not limited to contacting at the same time, and one of first fixed contacts 63 may come into contact with terminal part 41, and thereafter the other of first fixed contacts 63 may come into contact with terminal part 41. In this case, arc discharge is generated preferentially between the one of first fixed contacts 63 and terminal part 41.

[0099] It should be noted that, although it is desirable that the state illustrated in FIG. 6B is the ON state of push switch 1, there is also a case where push switch 1 remains in the OFF state. For example, when an insulator has adhered to respective surfaces of pair of first fixed contacts 63, the OFF state may be maintained also in the state illustrated in FIG. 6B.

[0100] As illustrated in FIG. 6C, when operating part 21 is further pressed from the state in FIG. 6B, that is, when terminal part 41 further receives a stress from movable component 30 in a state where terminal part 41 is supported by pair of first fixed contacts 63, since terminal part 41 elastically deforms to be convex toward the Z axis negative side, terminal part 41 comes into contact (for example, surface contact) with one or more second fixed

contacts 64. Terminal part 41 is configured to, for example, come into contact with one or more second fixed contacts 64 by elastically deforming, after coming into contact with at least one of pair of first fixed contacts 63. It can be said that terminal part 41 comes into contact with one or more second fixed contacts 64 in the elastically deformed state. In addition, in the state where terminal part 41 is in contact with one or more second fixed contacts 64, contact between terminal part 41 and pair of first fixed contacts 63 is also maintained. In push switch 1, even when, for example, the switching ON caused by contact between terminal part 41 and pair of first fixed contacts 63 is inhibited by interposition of the insulator (oxide), switching ON is achieved by redundancy of contact between terminal part 41 and second fixed contacts 64.

[0101] In this manner, push switch 1 is configured such that terminal part 41 comes into contact with one or more second fixed contacts 64, after coming into contact with at least one of pair of first fixed contacts 63. It can also be said that push switch 1 is configured such that terminal part 41 (the lower surface of terminal part 41) comes into contact with pair of first fixed contacts 63 and one or more second fixed contacts 64 in this order.

[0102] Accordingly, since it is possible for push switch 1 to suppress generation of arc discharge between one or more second fixed contacts 64 and terminal part 41, occurrence of degradation of one or more second fixed contacts 64 (for example, an increase in the contact resistance value due to adhesion of an insulator to the surface) can be suppressed. Push switch 1 can delay, for example, degradation of one or more second fixed contacts 64. In addition, when pair of first fixed contacts 63 can be attached to and detached from flat part 62, push switch 1 can further delay degradation of one or more second fixed contacts 64 by exchanging first fixed contact 63 with the insulator adhering to its surface.

[Variations of Embodiment]

[0103] Hereinafter, referring to FIG. 7A to FIG. 7C, a push switch according to the present variation will be described. It should be noted that, hereinafter, differences from the embodiment will be mainly described, and a description of contents that are the same as or similar to the embodiment will be omitted or simplified. FIG. 7A is a cross-sectional view corresponding to the line IV-IV in FIG. 3 and illustrating a configuration in a case where the push switch according to the present variation is in an OFF state. FIG. 7A illustrates a cross-sectional view in a state (an initial state) where operating part 21 has not received a push operation.

[0104] In the push switch according to the present variation, the shape of terminal part 140 is different from that of terminal part 41 according to the embodiment. The push switch according to the present variation has a configuration obtained by replacing terminal part 41 with terminal part 140 in push switch 1 according to the embodiment.

[0105] As illustrated in FIG. 7A, terminal part 140 includes first contact regions 141a that overlap with pair of first fixed contacts 63, and second contact region 142a that overlaps with one or more second fixed contacts 64 in a plan view. At least a part of first contact regions 141a is located lower than second contact region 142a (located closer to fixed contact body 60).

[0106] Protruding parts 141 protruding to be closer to fixed contact body 60 (the Z axis negative side) than second contact region 142a are formed in first contact regions 141a. First contact regions 141a are regions of terminal part 140 that include protruding parts 141. Protruding parts 141 include flat surfaces on fixed contact body 60 side. For example, the flat surfaces of protruding parts 141 are located lower than the flat surface of flat part 142 on its fixed contact body 60 side (located closer to fixed contact body 60). Flat surfaces of protruding parts 141 and the flat surface of flat part 142 are parallel surfaces.

[0107] Although protruding parts 141 are produced by subjecting a flat tabular metal plate to a protruding process, the production method is not limited to this.

[0108] Flat part 142 located on the opposite side of fixed contact body 60 (the Z axis positive side) with respect to first contact regions 141a is formed in second contact region 142a. Second contact region 142a is a region of terminal part 140 that includes flat part 142. It should be noted that a protruding part having a smaller amount of protrusion toward fixed contact body 60 than protruding parts 141 may be formed in second contact region 142a.

[0109] In the initial state illustrated in FIG. 7A, the distance in the Z axis direction between protruding parts 141 and first fixed contacts 63 is smaller than the distance in the Z axis direction between flat part 142 and second fixed contacts 64.

[0110] It should be noted that, instead of protruding parts 141, tilted parts (not illustrated) formed by a bending process may be formed in first contact regions 141a. The tilted parts are bent toward fixed contact body 60 with respect to second contact region 142a, and are tilted by, for example, a predetermined angle toward fixed contact body 60 from end portions of flat part 142. At least a part of the tilted parts may be curved.

[0111] Next, referring to FIG. 7B and FIG. 7C, movement of movable contact body 40 in the push switch according to the present variation configured as described above will be described. FIG. 7B is a cross-sectional view corresponding to the line IV-IV in FIG. 3 and illustrating a configuration in a case where terminal part 140 of the push switch according to the present variation comes in contact with first fixed contacts 63. FIG. 7C is a cross-sectional view corresponding to the line IV-IV in FIG. 3 and illustrating a configuration in a case where terminal part 140 of the push switch according to the present variation comes in contact with second fixed contacts 64.

[0112] FIG. 7B illustrates a situation where operating part 21 is pressed, movable component 30 elastically deforms to be convex toward the Z axis negative side, terminal part 140 moves toward the Z axis negative side due to the elastic deformation, and protruding parts 141 come into contact (for example, surface contact) with pair of first fixed contacts 63. Terminal part 140 comes into contact with pair of first fixed contacts 63 before one or more second fixed contacts 64.

[0113] Here, first contact regions 141a are regions of terminal part 140 that come into contact with pair of first fixed contacts 63. In addition, first contact regions 141a are regions that come into contact with fixed contact body 60 before second contact region 142a.

[0114] It should be noted that the movement of terminal part 140 as illustrated in FIG. 7A to FIG. 7B is realized when terminal part 140 (for example, second contact region 142a) receives a stress from elastically deformed movable component 30, and connecting part 42 elastically deforms toward pair of first fixed contacts 63. In addition, first contact regions 141a may be regions that do not directly receive a stress from elastically deformed movable component 30.

[0115] In addition, the position of terminal part 140 illustrated in FIG. 7B is a position between the third position and the fourth position, and is an example of the fifth position. For example, when terminal part 140 moves from the third position to the fifth position, terminal part 140 does not elastically deform.

[0116] FIG. 7C illustrates a situation where, when operating part 21 is further pressed from the state in FIG. 7B, that is, when second contact region 142a (flat part 142) further receives a stress from movable component 30 in a state where first contact regions 141a (protruding parts 141) are supported by pair of first fixed contacts 63, since terminal part 140 elastically deforms toward the Z axis negative side, flat part 142 comes into contact (for example, surface contact) with one or more second fixed contacts 64. Terminal part 140 comes into contact with one or more second fixed contacts 64, after coming into contact with pair of first fixed contacts 63. Second contact region 142a is a region of terminal part 140 that comes into contact with one or more second fixed contacts 64. In addition, second contact region 142a is a region that comes into contact with fixed contact body 60 after first contact regions 141a.

[0117] In addition, in a state where flat part 142 is in contact with one or more second fixed contacts 64, contact between protruding parts 141 and pair of first fixed contact 63 is also maintained.

[0118] In this manner, the push switch according to the present variation is configured such that terminal part 140 comes into contact with one or more second fixed contacts 64, after coming into contact with at least one of pair of first fixed contacts 63.

[Other Embodiments]

[0119] Although a push switch according to one or more aspects has been described above based on the embodiment, and so on, the present disclosure is not limited to the embodiment, and so on. The present disclosure may encompass embodiments to which various modifications that may be conceived by those skilled in the art are made and embodiments achieved by combining elements in different embodiments, as long as resultant embodiments do not depart from the scope of the present disclosure.

[0120] For example, in the above-described embodiment, and so on, an example of a push switch that is in a quadrilateral shape in plan view has been described. However, the plan view shape is not limited to the such. The push switch may be in a round shape, a polygonal shape, etc.

[0121] In addition, in the above-described embodiment, and so on, although a description has been given of suppressing arc discharge at the time when first fixed contacts 63 come into contact with terminal part 41 or 140, the push switch of the present disclosure can also be expected to have an effect of suppressing arc discharge at the time when first fixed contacts 63 are separated from terminal part 41 or 140.

[0122] In addition, in the above-described embodiment, and so on, an example of a push switch provided with a cover that is metallic cover 10 has been described. However, the cover is not limited to the such. The cover may be a resin cover, etc.

[0123] In addition, fixed contact body 60 in the above-described embodiment and so on may be embedded in case 70.

[0124] In addition, in the above-described embodiment, and so on, although a description has been given of the example in which rubber cap 20 is constituted by three components (operating part 21, middle part 22, and flange part 23) with different thicknesses, rubber cap 20 is not limited to this. Rubber cap 20 may be, for example, a sheet-shaped component such as a rubber sheet.

[0125] In addition, in the above-described embodiment, and so on, although a description has been given of the example in which third fixed contacts 69 are connected to the power supply, the example is not limited to this, and pair of first fixed contacts 63 and one or more second fixed contacts 64 may be connected to the power supply.

[0126] In addition, when the insulator has not adhered to pair of first fixed contacts 63 in the above-described embodiment, and so on, it may be detected that a push operation has been performed on operating part 21, when first fixed contacts 63 come into contact with terminal part 41 or 140. That is, pair of first fixed contacts 63 may have a function of detecting that a push operation has been performed.

[0127] In addition, in the above-described embodiment, and so on, although a description has been given

of the example in which the push switch includes rubber cap 20, the push switch is not limited to this, and may include, for example, an operating part or the like that is formed from a material other than rubber, such as a resin.

(Supplementary Notes)

[0128] The techniques described below are disclosed by the description of the foregoing embodiments.

(Technique 1)

[0129] A push switch including:

a case having an insulating property;
a fixed contact body that is fixed to the case;
a movable contact body that is disposed above the fixed contact body; and
an operating part that is disposed above the movable contact body and receives a push operation, wherein
the movable contact body includes a terminal part that is vertically movable,
the fixed contact body includes a pair of first fixed contacts and one or more second fixed contacts disposed between the pair of first fixed contacts, and
in the movable contact body, when the operating part receives the push operation, the terminal part comes into contact with the one or more second fixed contacts after coming into contact with at least one of the pair of first fixed contacts.

(Technique 2)

[0130] The push switch according to Technique 1, wherein

a first distance between the pair of first fixed contacts and the terminal part is less than a second distance between the one or more second fixed contacts and the terminal part,
the movable contact body includes a connecting part connected to the terminal part, and
when the operating part receives the push operation, the terminal part moves down due to the connecting part deforming.

(Technique 3)

[0131] The push switch according to Technique 2, wherein

the pair of first fixed contacts and the one or more second fixed contacts are protrusions that protrude from the fixed contact body toward the terminal part, and
a first height of the pair of first fixed contacts is greater than a second height of the one or more second fixed contacts.

(Technique 4)

[0132] The push switch according to Technique 2, wherein

the terminal part includes a first contact region that comes into contact with the pair of first fixed contacts, and a second contact region that comes into contact with the one or more second fixed contacts, and
the first contact region is located lower than the second contact regions.

(Technique 5)

[0133] The push switch according to Technique 4, wherein
a protruding part is provided in the first contact region, the protruding part protruding to be closer to the fixed contact body than the second contact region is.

(Technique 6)

[0134] The push switch according to Technique 4, wherein
a tilted part is provided in the first contact region, the tilted part being tilted toward the fixed contact body with respect to the second contact region.

(Technique 7)

[0135] The push switch according to any one of Techniques 2 to 6, wherein
the terminal part comes into contact with the one or more second fixed contacts by elastically deforming, after coming into contact with at least one of the pair of first fixed contacts

(Technique 8)

[0136] The push switch according to any one of Techniques 2 to 7, wherein

the fixed contact body includes one or more third fixed contacts different in potential from the pair of first fixed contacts and the one or more second fixed contacts,
the movable contact body includes a frame part that comes into contact with the one or more third fixed contacts,
the connecting part connects the terminal part and the frame part, and
in a plan view, the connecting part, the terminal part, and the one or more third fixed contacts are disposed in stated order.

(Technique 9)

[0137] The push switch according to any one of Tech-

niques 2 to 8, further comprising:

a movable component that is disposed between the operating part and the movable contact body and is dome-shaped, wherein
when the operating part receives the push operation, the movable component elastically deforms in accordance with movement of the operating part, and the connecting part elastically deforms due to stress imparted on the terminal part from the movable component that has elastically deformed.

(Technique 10)

[0138] The push switch according to any one of claims 1 to 9, wherein

the one or more second fixed contacts comprises three or more second fixed contacts,
an arrangement direction of two second fixed contacts among the three or more second fixed contacts is parallel to an arrangement direction of the pair of first fixed contacts, and
an arrangement direction of one second fixed contact among the three or more second fixed contacts and the two second fixed contacts crosses the arrangement direction of the pair of first fixed contacts.

(Technique 11)

[0139] The push switch according to Technique 1, wherein
the terminal part comes into contact with the one or more second fixed contacts by elastically deforming, after coming into contact with at least one of the pair of first fixed contacts.

[Industrial Applicability]

[0140] The present disclosure is particularly useful for push switches for use with high voltage or high current.

[Reference Signs List]

[0141]

1 push switch
10 metallic cover
11 tabular part
11a insertion through-hole
12 claw part
13 regulating part
20 rubber cap
21 operating part
22 middle part
23 flange part
30 movable component
31 leg part
40 movable contact body
41, 140 terminal part
42 connecting part
43 frame part
50 film
60 fixed contact body
61 first electrode component
62, 68, 142 flat part
63 first fixed contact
64 second fixed contact
67 second electrode component
69 third fixed contact
70 case
71 lateral wall part
72 projecting part
73 upper surface
74 recessed part
81, 82 reinforcing component
100 switch contact part (switch contact mechanism)
141 protruding part
141a first contact region
142a second contact region
D1 first distance
D2 second distance
H1 first height
H2 second height

Claims

1. A push switch comprising:

a case having an insulating property;
a fixed contact body that is fixed to the case;
a movable contact body that is disposed above the fixed contact body; and
an operating part that is disposed above the movable contact body and receives a push operation, wherein
the movable contact body includes a terminal part that is vertically movable,
the fixed contact body includes a pair of first fixed contacts and one or more second fixed contacts disposed between the pair of first fixed contacts, and
in the movable contact body, when the operating part receives the push operation, the terminal part comes into contact with the one or more second fixed contacts after coming into contact with at least one of the pair of first fixed contacts.

2. The push switch according to claim 1, wherein

a first distance between the pair of first fixed contacts and the terminal part is less than a second distance between the one or more second fixed contacts and the terminal part,
the movable contact body includes a connecting

part connected to the terminal part, and
when the operating part receives the push operation, the terminal part moves down due to the connecting part deforming.

3. The push switch according to claim 2, wherein

the pair of first fixed contacts and the one or more second fixed contacts are protrusions that protrude from the fixed contact body toward the terminal part, and
a first height of the pair of first fixed contacts is greater than a second height of the one or more second fixed contacts.

4. The push switch according to claim 2, wherein

the terminal part includes a first contact region that comes into contact with the pair of first fixed contacts, and a second contact region that comes into contact with the one or more second fixed contacts, and
the first contact region is located lower than the second contact region.

5. The push switch according to claim 4, wherein
a protruding part is provided in the first contact region, the protruding part protruding to be closer to the fixed contact body than the second contact region is.

6. The push switch according to claim 4, wherein
a tilted part is provided in the first contact region, the tilted part being tilted toward the fixed contact body with respect to the second contact region.

7. The push switch according to any one of claims 3 to 6, wherein
the terminal part comes into contact with the one or more second fixed contacts by elastically deforming, after coming into contact with at least one of the pair of first fixed contacts.

8. The push switch according to any one of claims 2 to 6, wherein

the fixed contact body includes one or more third fixed contacts different in potential from the pair of first fixed contacts and the one or more second fixed contacts,
the movable contact body includes a frame part that comes into contact with the one or more third fixed contacts,
the connecting part connects the terminal part and the frame part, and
in a plan view, the connecting part, the terminal part, and the one or more third fixed contacts are disposed in stated order.

9. The push switch according to any one of claims 2 to 6, further comprising:

a movable component that is disposed between the operating part and the movable contact body and is dome-shaped, wherein
when the operating part receives the push operation, the movable component elastically deforms in accordance with movement of the operating part, and the connecting part elastically deforms due to stress imparted on the terminal part from the movable component that has elastically deformed.

10. The push switch according to any one of claims 1 to 6, wherein

the one or more second fixed contacts comprises three or more second fixed contacts,
an arrangement direction of two second fixed contacts among the three or more second fixed contacts is parallel to an arrangement direction of the pair of first fixed contacts, and
an arrangement direction of one second fixed contact among the three or more second fixed contacts and the two second fixed contacts crosses the arrangement direction of the pair of first fixed contacts.

FIG. 1

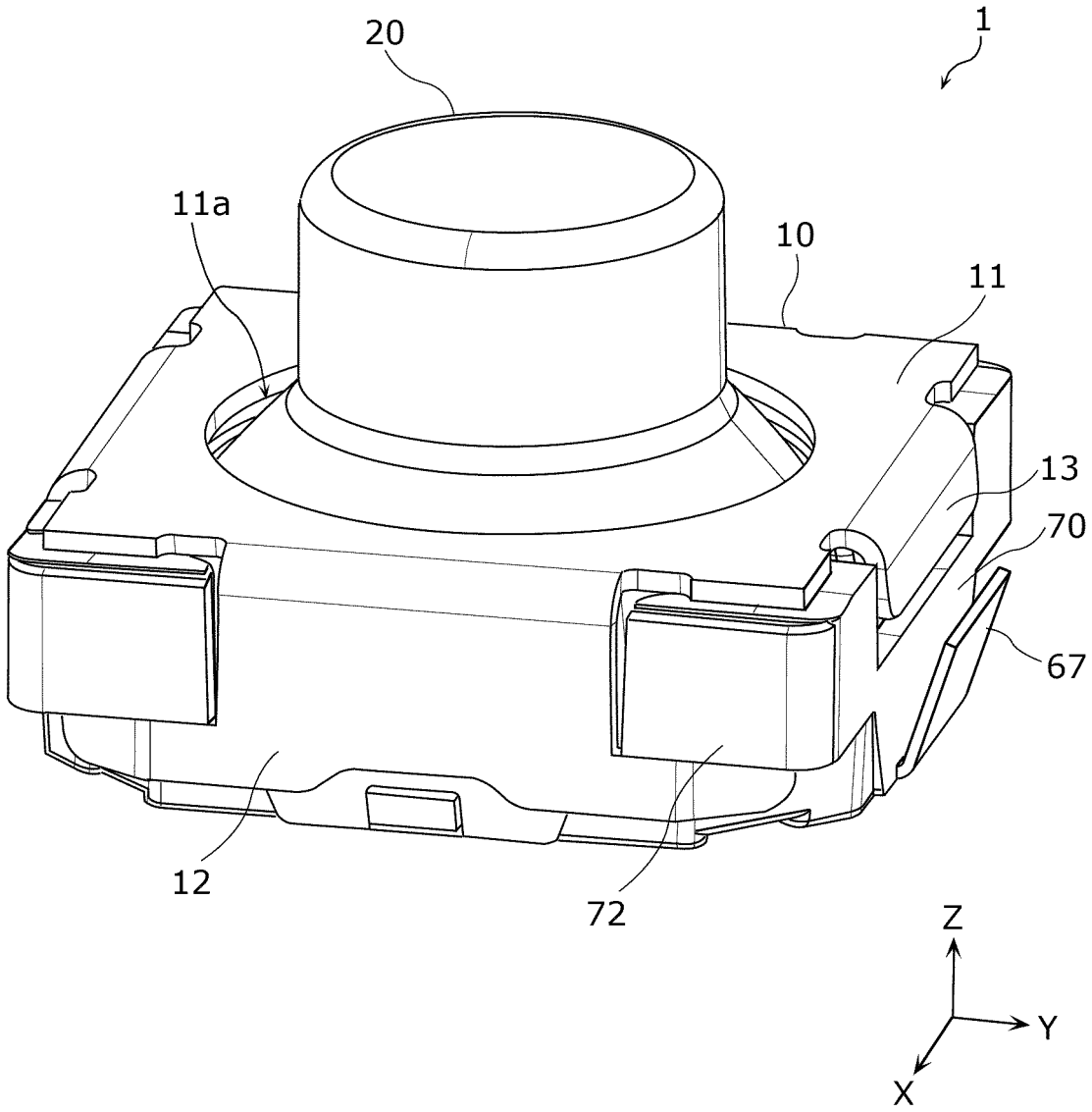


FIG. 2

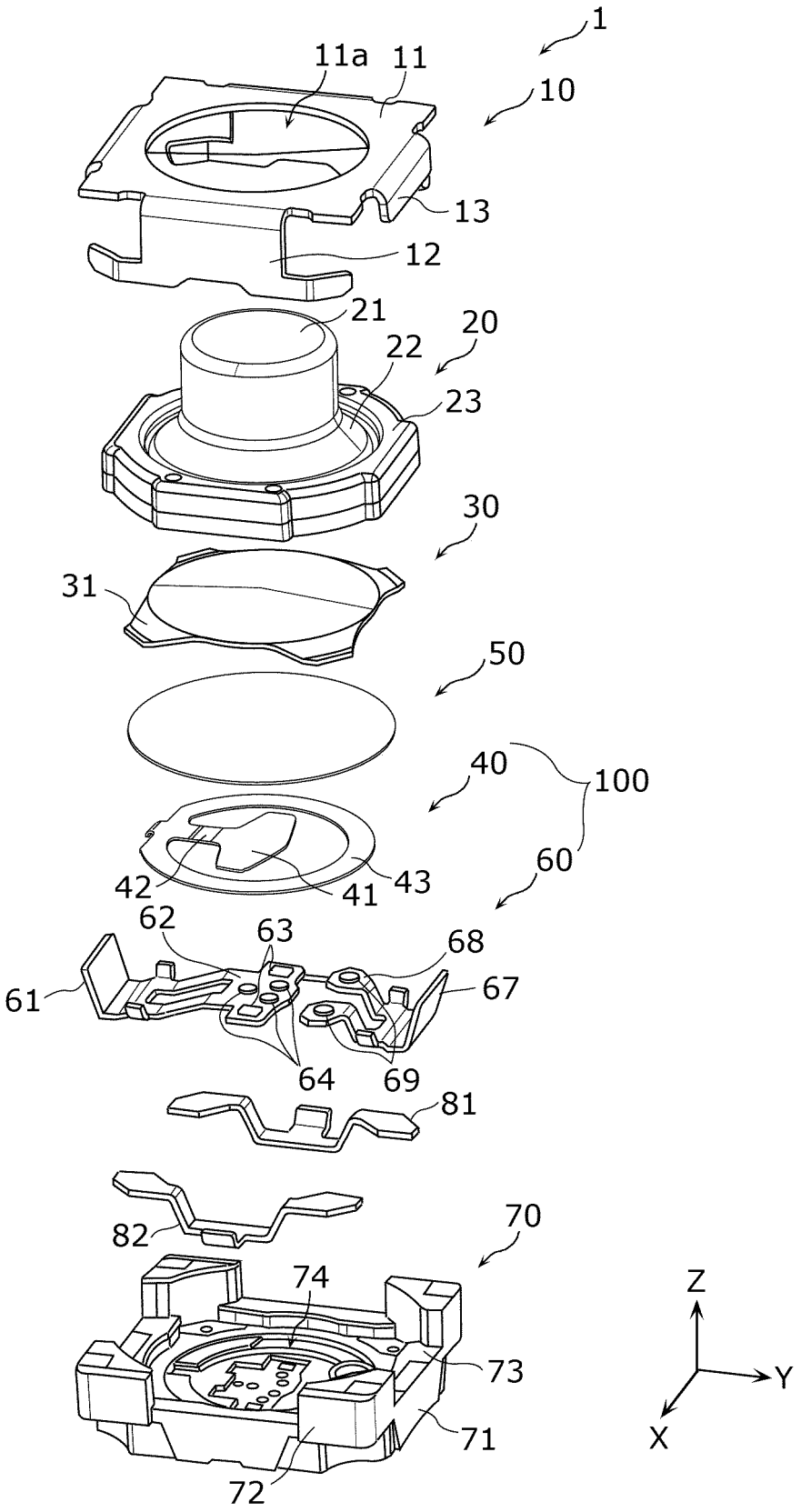

1
11a
11
10
13
12
21
20
22
23
30
31
50
40
100
42
41
43
60
62
63
68
61
67
64
69
81
82
70
74
73
71
72
Z
Y
X

FIG. 3

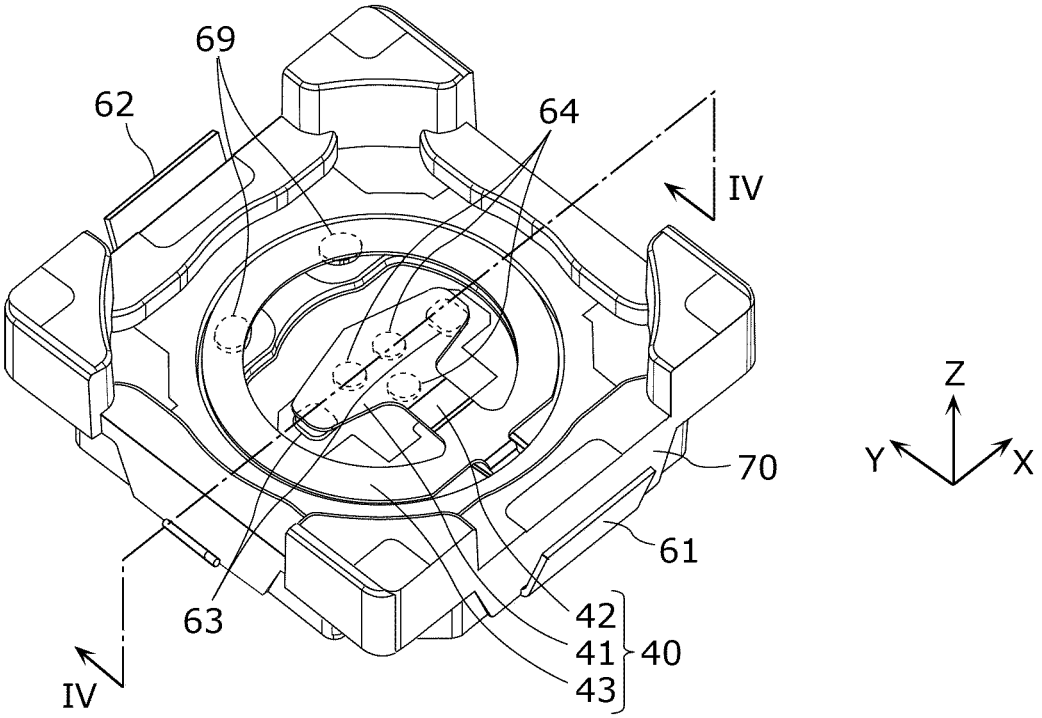

69
62
64
IV
70
61
63
42
41
43
40
IV
Z
Y
X

FIG. 4

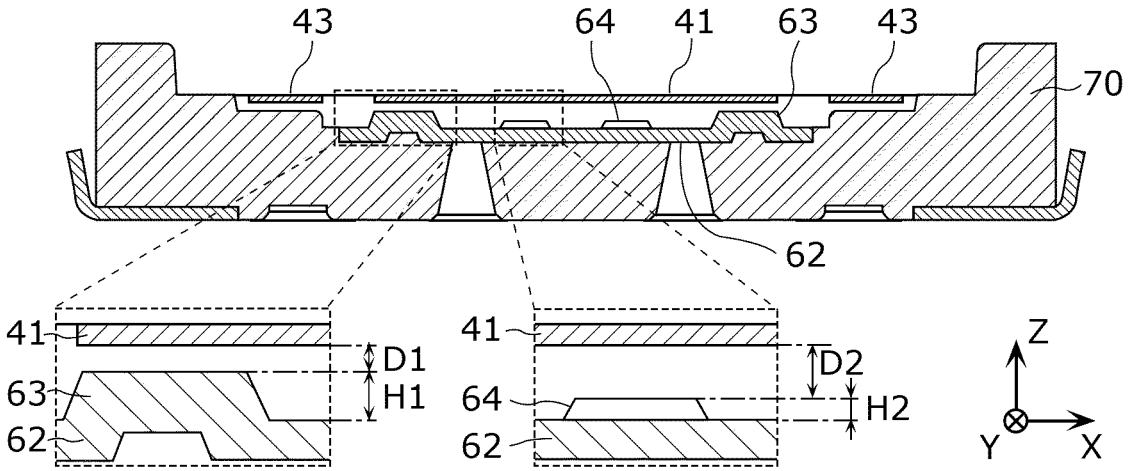

43
64
41
63
43
70
62
41
D1
63
H1
62
41
D2
64
H2
62
Z
Y
X

FIG. 5A

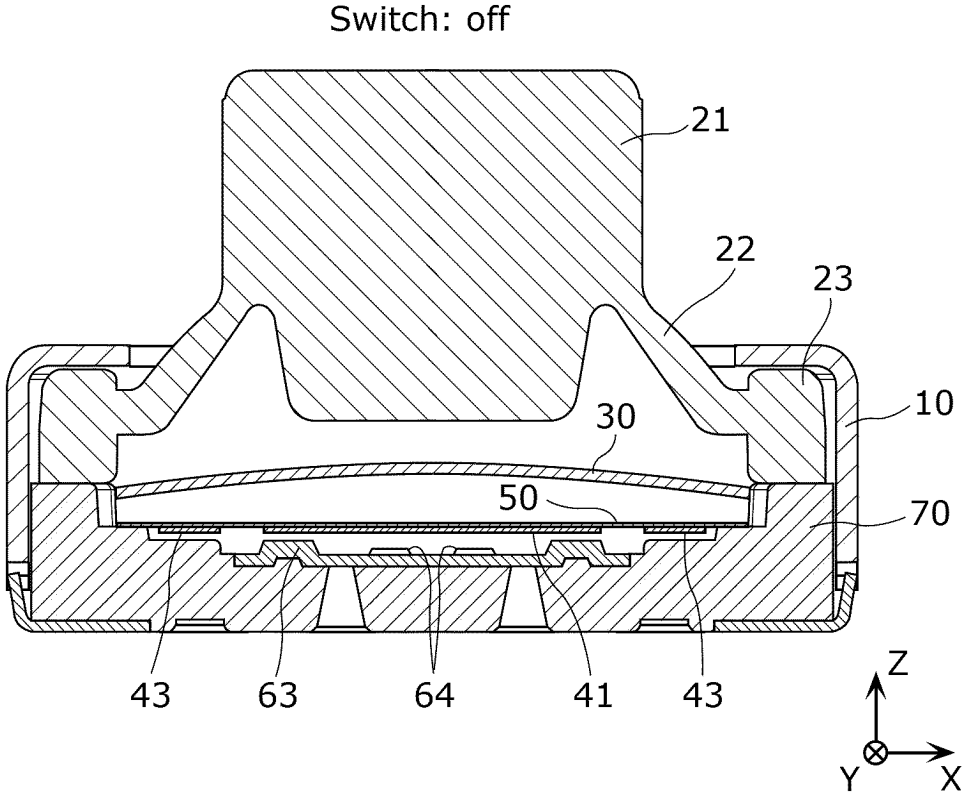

Switch: off
21
22
23
10
30
50
70
43
63
64
41
43
Z
Y
X

FIG. 5B

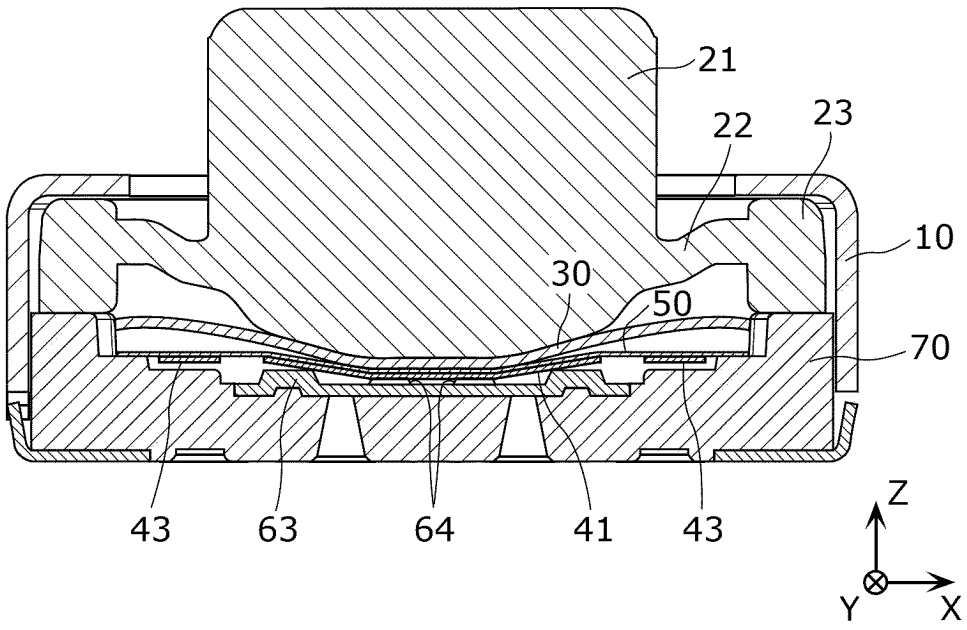

Switch: on
21
22
23
10
30
50
70
43
63
64
41
43
Z
Y
X

FIG. 6A

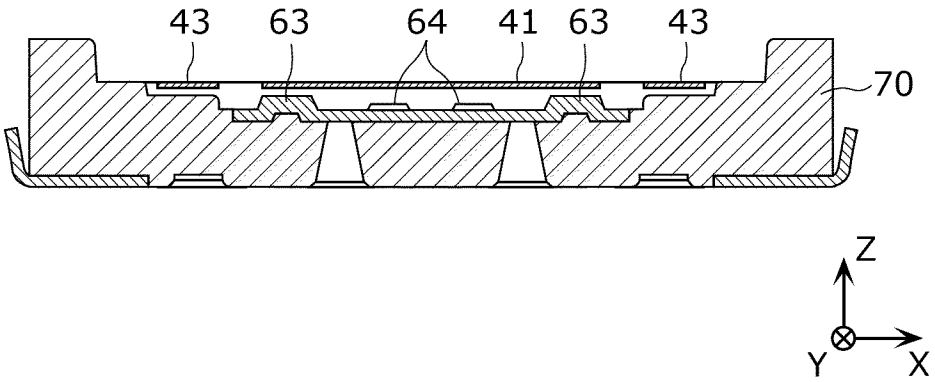


FIG. 6B

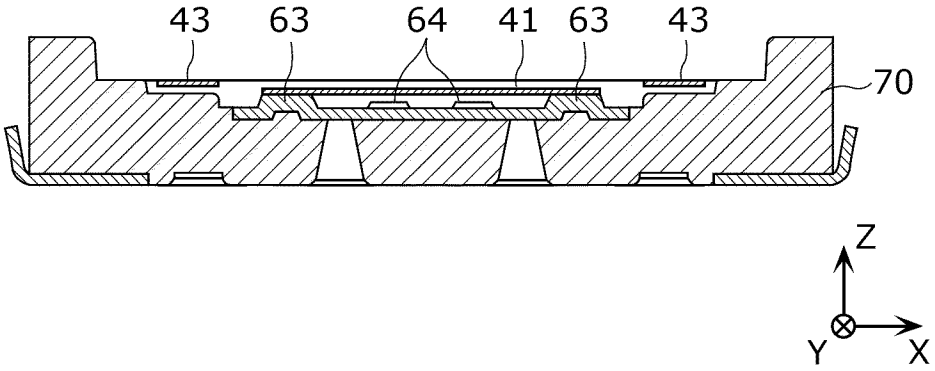


FIG. 6C

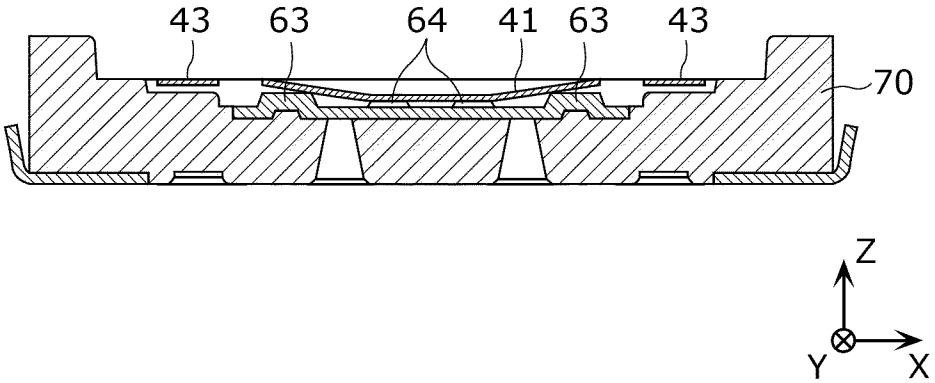


FIG. 7A

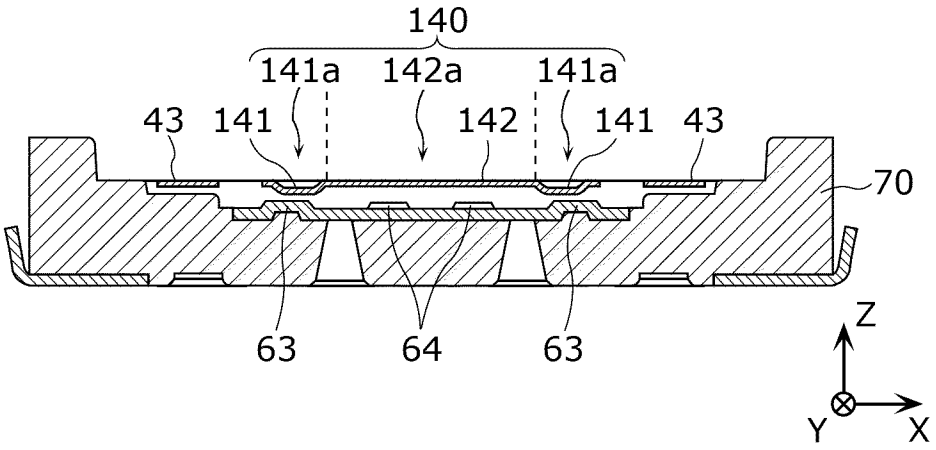


FIG. 7B

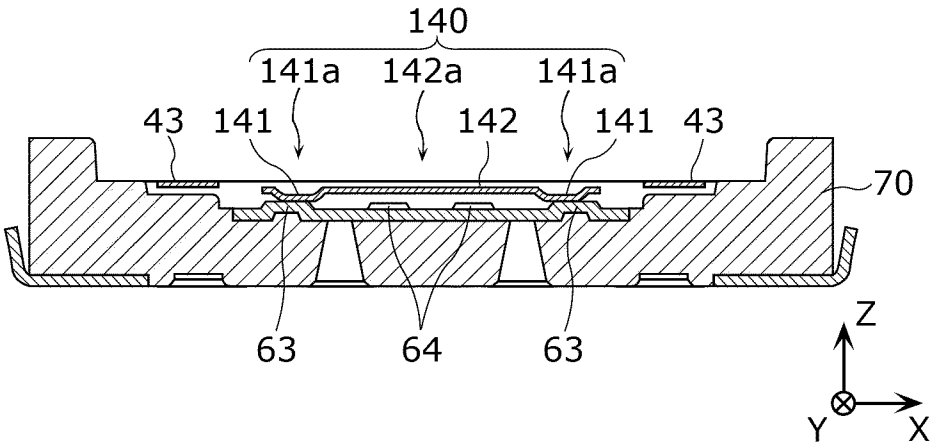
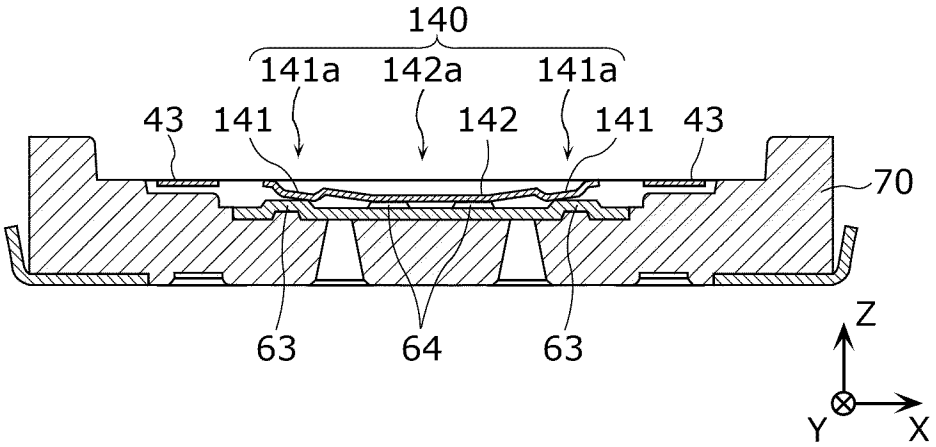


FIG. 7C



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/015435

A. CLASSIFICATION OF SUBJECT MATTER

H01H 1/06(2006.01)i; ***H01H 1/12***(2006.01)i; ***H01H 13/52***(2006.01)i
FI: H01H13/52 B; H01H1/06 M; H01H1/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01H1/06; H01H1/12; H01H13/52

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2023
Registered utility model specifications of Japan 1996-2023
Published registered utility model applications of Japan 1994-2023

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 11-232962 A (MATSUSHITA ELECTRIC IND CO LTD) 27 August 1999 (1999-08-27) paragraphs [0057], [0058], fig. 14-16	1
Y		2-9
A		10
Y	JP 54-122888 A (SAKURA KK) 22 September 1979 (1979-09-22) gazette, p. 4, lower left column, line 16 to lower right column, line 1, p. 4, lower right column, lines 10-11, fig. 7	2-9
Y	JP 10-208582 A (FUJI PHOTO FILM CO LTD) 07 August 1998 (1998-08-07) fig. 4	4-9
Y	JP 2002-352664 A (SMK CORP) 06 December 2002 (2002-12-06) paragraph [0038], fig. 3	8
Y	JP 10-112240 A (TEIKOKU TSUSHIN KOGYO CO LTD) 28 April 1998 (1998-04-28) fig. 1	9

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 June 2023	**27 June 2023**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/015435

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2013-080653 A (HOSIDEN CORP) 02 May 2013 (2013-05-02) entire text, all drawings	1-10
A	JP 2006-012937 A (HITACHI AIC INC) 12 January 2006 (2006-01-12) entire text, all drawings	1-10
A	JP 11-162286 A (C & K COMPONENTS INC) 18 June 1999 (1999-06-18) entire text, all drawings	1-10
A	WO 2020/153181 A1 (PANASONIC INTELLECTUAL PROPERTY MANAGEMENT CO., LTD.) 30 July 2020 (2020-07-30) entire text, all drawings	1-10

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2023/015435

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 11-232962 A	27 August 1999	(Family: none)	
JP 54-122888 A	22 September 1979	US 4207443 A column 7, lines 49-51, 62-64, fig. 9 GB 2018024 A	
JP 10-208582 A	07 August 1998	(Family: none)	
JP 2002-352664 A	06 December 2002	(Family: none)	
JP 10-112240 A	28 April 1998	(Family: none)	
JP 2013-080653 A	02 May 2013	(Family: none)	
JP 2006-012937 A	12 January 2006	(Family: none)	
JP 11-162286 A	18 June 1999	US 5898147 A entire text, all drawings EP 920040 A2 DE 69835329 T2	
WO 2020/153181 A1	30 July 2020	US 2022/102090 A1 entire text, all drawings EP 3916747 A1 CN 215451206 U	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2020153181 A **[0003]**