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(71) Applicant: **Alps Electric Co., Ltd.**
Tokyo 145-8501 (JP)

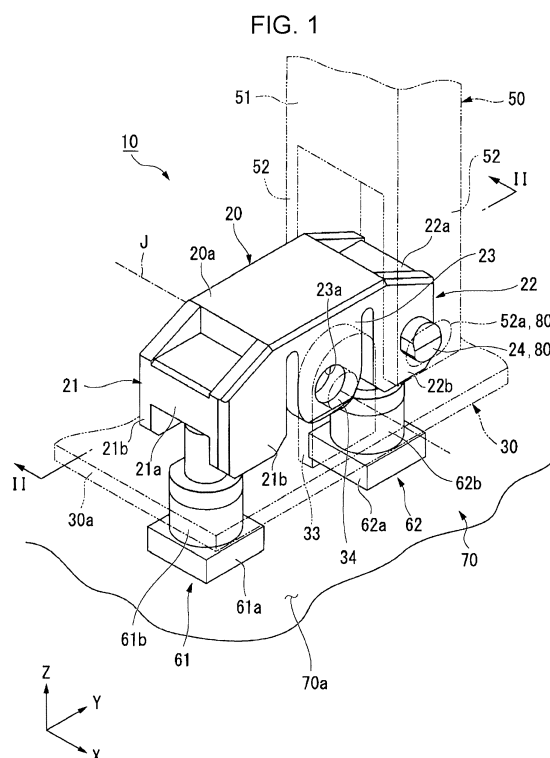
(72) Inventor: **Sato, Takashi**
Ota-ku, Tokyo 145-8501 (JP)

(74) Representative: **Schmitt-Nilson Schraud Waibel Wohlfrom**
Patentanwälte Partnerschaft mbB
Destouchesstraße 68
80796 München (DE)

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(54) **PUSH-PULL SWITCH DEVICE**

(57) A push-pull switch device (10, 110) according to an aspect of the present invention includes an operation portion (50, 150), a movable portion (20, 120) that moves with the movement in a first direction of the operation portion (50, 150), a first switch (61, 161) and a second switch (62, 162) that are activated by the movement of the movable portion (20, 120), and a board (70) to one surface of which the first switch (61, 161) and the second switch (62, 162) are attached. The movable portion (20, 120) performs a first moving operation with the movement of the operation portion (50, 150) in one sense in the first direction, and performs a second moving operation different from the first moving operation with the movement of the operation portion (50, 150) in the other sense in the first direction. The first moving operation differs from the movement of the operation portion (50, 150) in one sense in the first direction. The second moving operation differs from the movement of the operation portion (50, 150) in the other sense in the first direction. The first switch (61, 161) is activated by the first moving operation of the movable portion (20, 120). The second switch (62, 162) is activated by the second moving operation of the movable portion (20, 120).



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a push-pull switch device.

2. Description of the Related Art

[0002] A push-pull switch in which the short circuit between contact portions is switched by pushing and pulling an operation button is known (see, for example, Japanese Examined Utility Model Registration Application Publication No. 62-13303). In the push-pull switch of Japanese Examined Utility Model Registration Application Publication No. 62-13303, a contact portion is provided on each of both surfaces of a switch board, and the short circuit of each contact portion is switched in response to pushing and pulling of an operation button.

SUMMARY OF THE INVENTION

[0003] In a push-pull switch such as that described above, there is a problem in that, since a contact portion (switch) is provided on each of both surfaces of a switch board, it takes time to mount the contact portions on the switch board. Therefore, there is a problem in that the assemblability of the push-pull switch device is low.

[0004] In view of the above problem, an aspect of the present invention provides a push-pull switch device having excellent assemblability.

[0005] In an aspect of the present invention, a push-pull switch device includes an operation portion, a movable portion that moves with the movement in a first direction of the operation portion, a first switch and a second switch that are activated by the movement of the movable portion, and a board to one surface of which the first switch and the second switch are attached. The movable portion performs a first moving operation with the movement of the operation portion in one sense in the first direction, and performs a second moving operation different from the first moving operation with the movement of the operation portion in the other sense in the first direction. The first moving operation differs from the movement of the operation portion in one sense in the first direction. The second moving operation differs from the movement of the operation portion in the other sense in the first direction. The first switch is activated by the first moving operation of the movable portion. The second switch is activated by the second moving operation of the movable portion.

[0006] The first moving operation and the second moving operation may be rotational operations in which the movable portion rotates about a predetermined axis.

[0007] The predetermined axis may be parallel to a second direction perpendicular to the first direction, and

may be located between the first switch and the second switch in a third direction perpendicular to both the first direction and the second direction.

[0008] The movable portion may be rotatably connected to the operation portion by a connecting mechanism, and the connecting mechanism may be disposed on the second switch side of the predetermined axis in the third direction.

[0009] The distance in the third direction between the connecting mechanism and the predetermined axis may be greater than the distance in the third direction between a part of the movable portion that is in contact with the first switch and the predetermined axis.

[0010] The connecting mechanism may be formed by a holding hole provided in one of the operation portion and the movable portion, and a pin provided on the other of the operation portion and the movable portion and inserted into the holding hole.

[0011] The first moving operation and the second moving operation may be moving operations in which the movable portion moves linearly.

[0012] An aspect of the present invention provides a push-pull switch device having excellent assemblability.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a perspective view showing a push-pull switch device of a first embodiment;

Fig. 2 is a sectional view showing the push-pull switch device of the first embodiment;

Fig. 3 is a sectional view showing the push-pull switch device of the first embodiment;

Fig. 4 is a sectional view showing the push-pull switch device of the first embodiment;

Fig. 5 is a sectional view showing a push-pull switch device of a second embodiment;

Fig. 6 is a sectional view showing the push-pull switch device of the second embodiment; and

Fig. 7 is a sectional view showing the push-pull switch device of the second embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Push-pull switch devices according to embodiments of the present invention will be described below with reference to the drawings. The scope of the present invention is not limited to the following embodiments, and changes may be made without departing from the technical idea of the present invention. In the following drawings, in order to make each configuration understandable, the scale, number, and so forth in each structure may differ from the scale, number, and so forth in the actual structure.

[0015] In the following description, the positional relationship between parts will be described with reference to the three-dimensional orthogonal coordinate system

(XYZ coordinate system) shown in each figure. The Z-axis direction is a first direction in which an operation portion is moved. The Y-axis direction is a direction perpendicular to the Z-axis direction. The X-axis direction is a direction perpendicular to both the Z-axis direction and the Y-axis direction.

[0016] In the following description, the Z-axis direction may be referred to as "vertical direction (first direction)," the Y-axis direction may be referred to as "left-right direction (third direction)," and the X-axis direction may be referred to as "front-back direction (second direction)." The positive side (+Z side) in the Z-axis direction may be referred to as "upper side," and the negative side (-Z side) in the Z-axis direction may be referred to as "lower side." The positive side (+Y side) in the Y-axis direction may be referred to as "right side," and the negative side (-Y side) in the Y-axis direction may be referred to as "left side." The vertical direction, left-right direction, front-back direction, upper side, lower side, right side, and left side are merely terms for describing the positional relationship between parts, and do not limit the positional relationship between the actual parts and the use aspect and posture of the actual push-pull switch device.

First Embodiment

[0017] Fig. 1 is a perspective view showing a push-pull switch device 10 of this embodiment. Fig. 2 is a sectional view taken along line II-II of Fig. 1. Fig. 3 and Fig. 4 are sectional views showing the same section as Fig. 2. In Fig. 3 and Fig. 4, the state of the push-pull switch device 10 differs from the state of the push-pull switch device 10 shown in Fig. 1 and Fig. 2.

[0018] The push-pull switch device 10 of this embodiment includes, as shown in in Fig. 1 and Fig. 2, an operation portion 50, a supporting member 30, a movable portion 20, a board 70, a first switch 61 and a second switch 62, a first pressing member 41, and a second pressing member 42.

[0019] The operation portion 50 is moved in the vertical direction by an operator. The movable portion 20 moves with the movement in the vertical direction of the operation portion 50. The supporting member 30 movably supports the movable portion 20. The first switch 61 and the second switch 62 are attached to the board 70. The first switch 61 and the second switch 62 are activated by the movement of the movable portion 20. The first switch 61 and the second switch 62 are activated by being pushed via the first pressing member 41 and the second pressing member 42 by the movable portion 20.

[0020] The push-pull switch device 10 is switched in response to the operation of the operation portion 50 between three states: a neutral state, a first state, and a second state. The neutral state is a state in which neither the first switch 61 nor the second switch 62 are activated. The first state is a state in which the first switch 61 is activated. The second state is a state in which the second switch 62 is activated. Fig. 1 and Fig. 2 show the neutral

state. Fig. 3 shows the first state. Fig. 4 shows the second state.

[0021] In this specification, "the movable portion moves" includes that the position of at least part of the movable portion changes. That is, in this specification, "the movable portion moves" includes that the movable portion rotates about an axis, moves linearly along a direction, moves in a curve, or performs a movement that combines these movements. For example, in this embodiment, the movable portion 20 rotates about a central axis (predetermined axis) J. The central axis J is a virtual axis parallel to the front-back direction (X-axis direction).

[0022] In the following description, in relation to an object, the side nearer to the central axis J in the left-right direction may be referred to as "inner side in the left-right direction," and the side farther from the central axis J in the left-right direction may be referred to as "outer side in the left-right direction." In relation to an object, the side nearer to the center of the movable portion 20 in the front-back direction may be referred to as "inner side in the front-back direction," and the side farther from the center of the movable portion 20 in the front-back direction may be referred to as "outer side in the front-back direction."

[0023] The operation portion 50 is held so as to be movable in the vertical direction relative to an apparatus on which the push-pull switch device 10 is mounted. The movement in the left-right direction of the operation portion 50 is restricted. The operation portion 50 extends in the vertical direction. The operation portion 50 has a main body portion 51 and a pair of connecting plate portions 52. The main body portion 51 has, for example, a vertically long rectangular parallelepiped shape. The pair of connecting plate portions 52 extend, as shown in Fig. 1, downward from both ends in the front-back direction of the lower end of the main body portion 51. The connecting plate portions 52 have a plate-like shape extending in a plane (YZ plane) perpendicular to the front-back direction. Holding holes 52a penetrating the connecting plate portions 52 in the front-back direction are formed in the lower parts of the connecting plate portions 52. The holding holes 52a are elongate holes extending in the left-right direction.

[0024] The supporting member 30 has, as shown in Fig. 2, a base portion 30a, a first guide portion 31, a second guide portion 32, and a pair of supporting plate portions 33. The base portion 30a extends in a plane (XY plane) perpendicular to the vertical direction. The first guide portion 31 and the second guide portion 32 protrude upward from the upper surface of the base portion 30a. The first guide portion 31 and the second guide portion 32 are spaced in the left-right direction. The first guide portion 31 is disposed on the left side (-Y side) of the central axis J. The second guide portion 32 is disposed on the right side (+Y side) of the central axis J.

[0025] The upper surface of the first guide portion 31 is a flat first inclined surface 31a that inclines downward from the inner side in the left-right direction (+Y side) to the outer side in the left-right direction (-Y side). A first

guide hole 31b that vertically penetrates the first guide portion 31 and the base portion 30a is formed in the first guide portion 31. The cross-sectional shape of the first guide hole 31b is, for example, circular.

[0026] The upper surface of the second guide portion 32 is a flat second inclined surface 32a that inclines downward from the inner side in the left-right direction (-Y side) to the outer side in the left-right direction (+Y side). A second guide hole 32b that vertically penetrates the second guide portion 32 and the base portion 30a is formed in the second guide portion 32. The cross-sectional shape of the second guide hole 32b is, for example, circular.

[0027] The supporting plate portions 33 extend, as shown in Fig. 1 and Fig. 2, upward from the upper surface of the base portion 30a. The supporting plate portions 33 has a plate-like shape extending in a plane (YZ plane) perpendicular to the front-back direction. The supporting plate portions 33 are located between the first guide portion 31 and the second guide portion 32 in the left-right direction. The pair of supporting plate portions 33 are spaced in the front-back direction. The pair of supporting plate portions 33 each have a shaft portion 34 protruding toward the other supporting plate portion 33 (protruding to the inner side in the front-back direction). The shaft portions 34 of the pair of supporting plate portions 33 both have a cylindrical shape centered on the central axis J.

[0028] The movable portion 20 has a base portion 20a, a first portion 21, a second portion 22, a pair of central plate portions 23, and a pair of pins 24. The base portion 20a extends in the left-right direction. The first portion 21 is provided at the left side (-Y side) end of the base portion 20a. The first portion 21 has a first main body portion 21a and a pair of first plate portions 21b. The first main body portion 21a has a substantially rectangular parallelepiped shape. As shown in Fig. 2, a first contact surface 21c that is the lower surface of the first main body portion 21a faces the first inclined surface 31a of the first guide portion 31 in the vertical direction. The pair of first plate portions 21b extend, as shown in Fig. 1, downward from both ends in the front-back direction of the first main body portion 21a. The first plate portions 21b have a plate-like shape extending in a plane (YZ plane) perpendicular to the front-back direction.

[0029] The second portion 22 is provided at the right side (+Y side) end of the base portion 20a. The second portion 22 has a second main body portion 22a and a pair of second plate portions 22b. The second main body portion 22a has a substantially rectangular parallelepiped shape. As shown in Fig. 2, a second contact surface 22c that is the lower surface of the second main body portion 22a faces the second inclined surface 32a of the second guide portion 32 in the vertical direction. The pair of second plate portions 22b extend downward from both ends in the front-back direction of the second main body portion 22a. The second plate portions 22b have a plate-like shape extending in a plane (YZ plane) perpendicular

to the front-back direction.

[0030] The pair of central plate portions 23 extend, as shown in Fig. 1 and Fig. 2, downward from both ends in the front-back direction of the center in the left-right direction of the base portion 20a. The central plate portions 23 has a plate-like shape extending in a plane (YZ plane) perpendicular to the front-back direction. Shaft holes 23a penetrating the central plate portions 23 in the front-back direction are formed in the pair of central plate portions 23. The cross-sectional shape of the shaft holes 23a is, for example, circular, and the central axis J passes through the centers of the shaft holes 23a. The shaft portions 34 of the pair of supporting plate portions 33 are inserted and fitted into the shaft holes 23a of the pair of central plate portions 23 from the outer side in the front-back direction. The movable portion 20 is thereby supported by the supporting member 30 rotatably about the central axis J.

[0031] The pair of pins 24 protrude from the pair of second plate portions 22b to the outer side in the front-back direction. The pins 24 are substantially cylindrical in shape. The pins 24 are inserted into the holding holes 52a of the connecting plate portions 52 from the inner side in the front-back direction. Both ends in the vertical direction of the pins 24 are in contact, for example, with the inner surfaces in the vertical direction of the holding holes 52a. In this embodiment, the pins 24 are disposed at substantially the same position as the center of the second switch 62 and the center of the operation portion 50 in the left-right direction.

[0032] The holding holes 52a and the pins 24 form a connecting mechanism 80 that converts the movement of the operation portion 50 and transmits it to the movable portion 20. In this embodiment, the movable portion 20 is rotatably connected to the operation portion 50 by the connecting mechanism 80. The connecting mechanism 80 is disposed on the second switch 62 side (right side, +Y side) of the central axis J in the left-right direction. In this embodiment, the connecting mechanism 80 is disposed at substantially the same position as the center of the second switch 62 and the center of the operation portion 50 in the left-right direction. The movable portion 20 is, for example, a single member and is manufactured by injection molding or the like.

[0033] The board 70 is disposed on the lower side of the supporting member 30. The board 70 has a plate-like shape extending in a plane (XY plane) perpendicular to the vertical direction. The board 70 is fixed, for example, to the supporting member 30. The first switch 61 and the second switch 62 are attached to the upper surface 70a of the board 70.

[0034] The first switch 61 and the second switch 62 are, for example, tactile switches. The first switch 61 is disposed so as to face the first guide hole 31b in the vertical direction. The first switch 61 has a first housing portion 61a and a first button portion 61b. The first housing portion 61a has a hollow box shape that is square in plan view. The first button portion 61b has a cylindrical

shape. The first button portion 61b is attached to the first housing portion 61a movably in the vertical direction.

[0035] In a state in which the first switch 61 is not activated shown in Fig. 2, the first button portion 61b protrudes upward from the first housing portion 61a. The first switch 61 is activated when the first button portion 61b is pushed into the inside of the first housing portion 61a as shown in Fig. 3.

The second switch 62 is disposed so as to face the second guide hole 32b in the vertical direction. The second switch 62 has a second housing portion 62a and a second button portion 62b. The second housing portion 62a has a hollow box shape that is square in plan view. The second button portion 62b has a cylindrical shape. The second button portion 62b is attached to the second housing portion 62a movably in the vertical direction.

[0036] In a state in which the second switch 62 is not activated shown in Fig. 2, the second button portion 62b protrudes upward from the second housing portion 62a. The second switch 62 is activated when the second button portion 62b is pushed into the inside of the second housing portion 62a as shown in Fig. 4.

[0037] In Fig. 2 to Fig. 4, the first switch 61 and the second switch 62 are schematically shown as an integral member.

[0038] The first pressing member 41 is disposed on the upper surface of the first button portion 61b of the first switch 61. The first pressing member 41 has a first slide portion 41a and a first flange portion 41b. The first slide portion 41a has a cylindrical shape extending in the vertical direction. The first slide portion 41a is fitted in the first guide hole 31b. The first slide portion 41a is movable in the first guide hole 31b in the vertical direction. The upper end of the first slide portion 41a faces the first contact surface 21c in the vertical direction. The upper end of the first slide portion 41a is hemispherical in shape. When the first switch 61 is not activated, the upper end of the first slide portion 41a is protruding upward from the first guide hole 31b.

[0039] The first flange portion 41b extends from the lower end of the first slide portion 41a outward in the radial direction of the first slide portion 41a. The lower surface of the first flange portion 41b is in contact with the upper surface of the first button portion 61b. The upper surface of the first flange portion 41b is in contact with the lower surface of the base portion 30a of the supporting member 30, for example, when the first switch 61 is not activated. In this embodiment, the movable portion 20 is indirectly in contact with the first switch 61 with the first pressing member 41 interposed therebetween.

[0040] The second pressing member 42 is disposed on the upper surface of the second button portion 62b of the second switch 62. The second pressing member 42 has a second slide portion 42a and a second flange portion 42b. The second slide portion 42a has a cylindrical shape extending in the vertical direction. The second slide portion 42a is fitted in the second guide hole 32b. The second slide portion 42a is movable in the second

guide hole 32b in the vertical direction. The upper end of the second slide portion 42a faces the second contact surface 22c in the vertical direction. The upper end of the second slide portion 42a is hemispherical in shape. When the second switch 62 is not activated, the upper end of the second slide portion 42a is protruding upward from the second guide hole 32b.

[0041] The second flange portion 42b extends from the lower end of the second slide portion 42a outward in the radial direction of the second slide portion 42a. The lower surface of the second flange portion 42b is in contact with the upper surface of the second button portion 62b. The upper surface of the second flange portion 42b is in contact with the lower surface of the base portion 30a of the supporting member 30, for example, when the second switch 62 is not activated. In this embodiment, the movable portion 20 is indirectly in contact with the second switch 62 with the second pressing member 42 interposed therebetween.

[0042] In Fig. 2, the distance L1 in the left-right direction between a part of the movable portion 20 that is in contact with the first switch 61 and the central axis J and the distance L2 in the left-right direction between the connecting mechanism 80 and the central axis J are, for example, equal. In this embodiment, a part of the movable portion 20 that is in contact with the first switch 61 is a part of the movable portion 20 that is indirectly in contact with the first switch 61, that is, a part in contact with the upper end of the first pressing member 41. In this embodiment, the distance L2 in the left-right direction between the connecting mechanism 80 and the central axis J is the distance in the left-right direction between the center of the pins 24 and the central axis J.

[0043] In this embodiment, the distance L1 is equal to the distance in the left-right direction between the center in the left-right direction of the first button portion 61b of the first switch 61 and the central axis J. In this embodiment, the distance L2 is equal to the distance in the left-right direction between the center in the left-right direction of the second button portion 62b of the second switch 62 and the central axis J.

[0044] Next, the operation of the push-pull switch device 10 will be described. The movable portion 20 performs a first moving operation with the upward movement (the movement in one sense in the first direction) of the operation portion 50, and performs a second operation different from the first moving operation with the downward movement (the movement in the other sense in the first direction) of the operation portion 50. The first moving operation differs from the upward movement of the operation portion 50, and the second moving operation differs from the downward movement of the operation portion 50. In this embodiment, the first moving operation and the second moving operation are rotational operations in which the movable portion 20 rotates about the central axis J. The first switch 61 is activated by the first moving operation, and the second switch 62 is activated by the second moving operation.

[0045] In this specification, "the first moving operation and the second moving operation differ from each other" includes that the first moving operation and the second moving operation differ from each other in at least one of the type of movement of the movable portion, the direction in which the movable portion moves, the distance that the movable portion moves, and so forth. For example, when the first moving operation and the second moving operation are moving operations in which the movable portion moves in the same sense, but differ in the distance that the movable portion moves, the first moving operation and the second moving operation differ from each other.

[0046] In this specification, "the first moving operation and the second moving operation differ from each other" includes that, when the movement of the operation portion causes the movable portion to perform moving operation, at least part of the movable portion moves in a direction different from the moving direction of the operation portion.

[0047] As shown in Fig. 2, in the neutral state, the first contact surface 21c and the second contact surface 22c are perpendicular to the vertical direction. The first contact surface 21c is in contact with the upper end of the first pressing member 41. The second contact surface 22c is in contact with the upper end of the second pressing member 42. When the operation portion 50 is operated and the first moving operation of the movable portion 20 is performed, the push-pull switch device 10 is brought from the neutral state into the first state. When the operation portion 50 is operated and the second moving operation of the movable portion 20 is performed, the push-pull switch device 10 is brought from the neutral state into the second state.

[0048] In this embodiment, the first moving operation is an operation in which, as shown in Fig. 3, the movable portion 20 rotates about the central axis J counterclockwise in the front view (as viewed from the +X side to the -X side). The operation portion 50 is pulled upward, and an upward force is thereby applied through the connecting mechanism 80 to the second portion 22 of the movable portion 20. More specifically, the lower inner surfaces of the holding holes 52a push up the pins 24 from below, and an upward force is thereby applied to the second portion 22. The movable portion 20 thereby rotates about the central axis J counterclockwise, and the first moving operation is performed.

[0049] When the first moving operation is performed, the second portion 22 moves upward, and the first portion 21 moves downward. The first pressing member 41 is thereby pushed downward by the first contact surface 21c of the first portion 21. Then, the first button portion 61b of the first switch 61 is pushed downward by the first pressing member 41, and the first switch 61 is activated. The push-pull switch device 10 is thereby brought into the first state.

[0050] In the first state, the first contact surface 21c and the first inclined surface 31a are, for example, parallel

to and in contact with each other. In the first state, the second switch 62 is not activated. In the first state, the second contact surface 22c is upwardly separated from the second pressing member 42.

[0051] In this embodiment, the second moving operation is an operation in which, as shown in Fig. 4, the movable portion 20 rotates about the central axis J clockwise in the front view (as viewed from the +X side to the -X side). The operation portion 50 is pushed downward, and a downward force is thereby applied through the connecting mechanism 80 to the second portion 22 of the movable portion 20. More specifically, the upper inner surfaces of the holding holes 52a push down the pins 24 from above, and a downward force is thereby applied to the second portion 22. The movable portion 20 thereby rotates about the central axis J clockwise, and the second moving operation is performed.

[0052] When the second moving operation is performed, the first portion 21 moves upward, and the second portion 22 moves downward. The second pressing member 42 is thereby pushed downward by the second contact surface 22c of the second portion 22. Then, the second button portion 62b of the second switch 62 is pushed downward by the second pressing member 42, and the second switch 62 is activated. The push-pull switch device 10 is thereby brought into the second state.

[0053] In the second state, the second contact surface 22c and the second inclined surface 32a are, for example, parallel to and in contact with each other. In the second state, the first switch 61 is not activated. In the second state, the first contact surface 21c is upwardly separated from the first pressing member 41.

[0054] In this way, the push-pull switch device 10 is switched among three states. Therefore, in an apparatus on which the push-pull switch device 10 is mounted, for example, various functions can be switched.

[0055] Since the movable portion 20 rotates in the first moving operation and the second moving operation, the position in the left-right direction of the pins 24 changes. Since the holding holes 52a into which the pins 24 are inserted are elongate holes extending in the left-right direction, the pins 24 are allowed to move in the left-right direction.

[0056] For example, suppose that the operating states of two switches are switched by just using the movement in the vertical direction of an operation portion directly. In this case, the operation portion can basically perform only a monotonic operation in which the operation portion simply moves toward or away from one surface of a board. Therefore, it is difficult to individually switch the operating states of two switches attached to one surface of a board. Therefore, in this case, in order to switch the operating states of two switches, it is necessary, for example, as described in Japanese Examined Utility Model Registration Application Publication No. 62-13303, to attach a switch to each of both surfaces of a board.

[0057] In contrast, this embodiment is provided with the movable portion 20 that performs the first moving

operation and the second moving operation different from each other in response respectively to the upward movement and the downward movement of the operation portion 50. The first moving operation differs from the upward movement of the operation portion 50, and the second moving operation differs from the downward movement of the operation portion 50. In other words, this embodiment is provided with the movable portion 20 to which the movement in the vertical direction of the operation portion 50 is converted into two different moving operations and transmitted. This enables approaches to one surface (the upper surface 70a) of the board 70 that differ between the first moving operation and the second moving operation of the movable portion 20. Therefore, by interposing the movable portion 20, it is made possible that the operating states of the first switch 61 and the second switch 62 attached to one surface (the upper surface 70a) of the board 70 are individually switched by the movement in the vertical direction of the operation portion 50.

[0058] As described above, in this embodiment, both the first switch 61 and the second switch 62 can be attached to one surface (the upper surface 70a) of the board 70, and the time required for assembling the push-pull switch device 10 can be reduced. Therefore, a push-pull switch device 10 having excellent assemblability can be obtained. Since the first switch 61 and the second switch 62 can be attached to one surface of the board 70, the other surface (the lower surface) of the board 70 can be effectively utilized.

[0059] In this embodiment, the first moving operation and the second moving operation are rotational operations. Therefore, by rotatably supporting the movable portion 20 at one point (the central axis J), the movement in the vertical direction of the operation portion 50 can be easily converted into the first moving operation and the second moving operation of the movable portion 20. Therefore, the structure of the push-pull switch device 10 can be simplified.

[0060] In this embodiment, the central axis J about which the movable portion 20 rotates is located between the first switch 61 and the second switch 62 in the left-right direction. Therefore, the sense in which the movable portion 20 rotates in the first moving operation and the sense in which the movable portion 20 rotates in the second moving operation can be opposite to each other, and the moving operations can be used as operations to activate the switches. Therefore, each switch can be easily reliably activated with a simple structure.

[0061] In this embodiment, the connecting mechanism 80 connecting the movable portion 20 and the operation portion 50 is disposed on the second switch 62 side of the central axis J. Therefore, the movement in the vertical direction of the operation portion 50 can be easily converted into rotational operation of the movable portion 20 through the connecting mechanism 80, and the sense in which the movable portion 20 rotates in the first moving operation and the sense in which the movable portion 20

rotates in the second moving operation can be opposite to each other.

[0062] In this embodiment, the connecting mechanism 80 includes holding holes 52a provided in the operation portion 50, and pins 24 provided on the movable portion 20 and inserted into the holding holes 52a. Therefore, the configuration of the connecting mechanism 80 can be simplified, and the manufacturing cost of the push-pull switch device 10 can be reduced. When, as in this embodiment, the pins 24 are provided integrally with the movable portion 20, an increase in the number of parts of the push-pull switch device 10 can be suppressed, and an increase in the man-hour for the assembly of the push-pull switch device 10 can be suppressed.

[0063] In this embodiment, the connecting mechanism 80 is disposed at substantially the same position as the center of the second switch 62 and the center of the operation portion 50 in the left-right direction. Therefore, when moving the operation portion 50 downward to cause the movable portion 20 to perform the second moving operation, the operating force applied to the operation portion 50 is easily transmitted to the second switch 62. Therefore, when causing the movable portion 20 to perform the second moving operation, the operating force applied to the operation portion 50 can be reduced.

[0064] Since, in the first state, the first contact surface 21c and the first inclined surface 31a come into contact with each other, the movable portion 20 is prevented from rotating counterclockwise beyond the position shown in Fig. 3. Since, in the second state, the second contact surface 22c and the second inclined surface 32a come into contact with each other, the movable portion 20 is prevented from rotating clockwise beyond the position shown in Fig. 4. Therefore, the first button portion 61b of the first switch 61 and the second button portion 62b of the second switch 62 can be prevented from being pushed downward more than necessary, and the first switch 61 and the second switch 62 can be prevented from being damaged.

[0065] Since the first contact surface 21c and the first inclined surface 31a are parallel to and in contact with each other in the first state, the rotation of the movable portion 20 can be stably restricted. Since the second contact surface 22c and the second inclined surface 32a are parallel to and in contact with each other in the second state, the rotation of the movable portion 20 can be stably restricted.

[0066] The present invention is not limited to the above-described embodiment, and other configurations can be used. The same reference signs will be used to designate the same components as those in the above-described embodiment, and the description thereof may be omitted.

[0067] The distance L1 in the left-right direction between a part of the movable portion 20 that is in contact with the first switch 61 and the central axis J and the distance L2 in the left-right direction between the connecting mechanism 80 and the central axis J may differ

from each other. For example, the distance L2 may be greater than the distance L1.

[0068] For example, when moving the operation portion 50 downward to cause the movable portion 20 to perform the second moving operation, the weight of the operation portion 50 itself can be utilized, and therefore the second switch 62 is easily activated if the force applied to the operation portion 50 is relatively small. On the other hand, when moving the operation portion 50 upward to cause the movable portion 20 to perform the first moving operation, the force lifting the operation portion 50 itself is required in addition to the force required to activate the first switch 61. Therefore, the operating force applied to the operation portion 50 needs to be relatively large.

[0069] In contrast, in the above-described configuration, since the distance L2 is greater than the distance L1, the force acting on the first switch 61 when moving the operation portion 50 upward can be increased by the principle of leverage. Therefore, the operating force required to move the operation portion 50 upward to cause the movable portion 20 to perform the first moving operation can be reduced. Therefore, both when causing the movable portion 20 to perform the first moving operation and when causing the movable portion 20 to perform the second moving operation, the operating force applied to the operation portion 50 can be relatively small. As a result, the operability of the push-pull switch device 10 can be improved, and the convenience for the operator can be improved. This is very effective particularly when the operation portion 50 is relatively heavy in weight.

[0070] As described above, since the central axis J about which the movable portion 20 rotates is between the first switch 61 and the second switch 62, the distance L1 and the distance L2 can be adjusted to improve the operability of the push-pull switch device 10.

[0071] The holding holes 52a may be bottomed holes that do not penetrate the connecting plate portions 52. Holding holes forming part of the connecting mechanism may be provided in the movable portion 20, and pins forming part of the connecting mechanism may be provided on the operation portion 50.

[0072] The shaft holes 23a of the movable portion 20 may be bottomed holes that do not penetrate the central plate portions 23. Shaft holes may be provided in the supporting plate portions 33 of the supporting member 30, and shaft portions to be fitted in the shaft holes may be provided on the central plate portions 23 of the movable portion 20.

Second Embodiment

[0073] Fig. 5 to Fig. 7 are sectional views of a push-pull switch device 110 according to this embodiment as viewed along the front-back direction (as viewed from the +X side to the -X side). Fig. 5 shows the push-pull switch device 110 in the neutral state. Fig. 6 shows the push-pull switch device 110 in the first state. Fig. 7 shows

the push-pull switch device 110 in the second state.

[0074] The push-pull switch device 110 includes, as shown in Fig. 5, an operation portion 150, a guide member 130, a movable portion 120, a board 70, a first switch 161, and a second switch 162.

[0075] In the operation portion 150, connecting plate portions 152 are provided with pins 153 protruding in the front-back direction. The pins 153 are, for example, cylindrical in shape. In other respects, the configuration of the operation portion 150 is the same as the configuration of the operation portion 50 of the first embodiment.

[0076] The guide member 130 has a plate-like shape extending in a plane (XY plane) perpendicular to the vertical direction. The guide member 130 is disposed above the board 70. A through-hole 130a penetrating the guide member 130 in the vertical direction is formed in the guide member 130. The operation portion 150 extends through the inside of the through-hole 130a in the vertical direction.

[0077] The movable portion 120 is disposed between the guide member 130 and the board 70 in the vertical direction. The movable portion 120 is a member having a trapezoidal cross-sectional shape (YZ cross-sectional shape). In the left-right direction, the length of the lower side of the cross-sectional shape of the movable portion 120 is less than the length of the upper side of the cross-sectional shape of the movable portion 120. The upper surface 120a of the movable portion 120 is in contact with the lower surface of the guide member 130. The lower surface 120b of the movable portion 120 is in contact with the upper surface 70a of the board 70. The movable portion 120 is disposed slidably in the left-right direction relative to the lower surface of the guide member 130 and the upper surface 70a of the board 70.

[0078] A first contact surface 121 that is the left side (-Y side) surface of the movable portion 120 is an inclined surface that inclines downwardly to the right side (+Y side). A second contact surface 122 that is the right side (+Y side) surface of the movable portion 120 is an inclined surface that inclines downwardly to the left side (-Y side).

[0079] A holding hole 123 that penetrates the movable portion 120 in the front-back direction is formed in the movable portion 120. The holding hole 123 extends in a direction inclined to the vertical direction. In Fig. 5, the holding hole 123 inclines downwardly to the right side (+Y side). A pin 153 is inserted into the holding hole 123.

[0080] The holding hole 123 and the pin 153 form a connecting mechanism 180. In this embodiment, the connecting mechanism 180 is disposed between the first switch 161 and the second switch 162 in the left-right direction.

[0081] The first switch 161 and the second switch 162 are attached to the upper surface 70a of the board 70. The first switch 161 and the second switch 162 are switches that are activated by being pushed from above. The first switch 161 and the second switch 162 are each, for example, a switch in which a moving contact is provided in a cover made of rubber.

[0082] Next, the operation of the push-pull switch device 110 will be described. The movable portion 120 performs a first moving operation with the upward movement (the movement in one sense in the first direction) of the operation portion 150, and performs a second operation different from the first moving operation with the downward movement (the movement in the other sense in the first direction) of the operation portion 150. In this embodiment, the first moving operation and the second moving operation are moving operations in which the movable portion 120 moves linearly along the left-right direction. The first switch 161 is activated by the first moving operation, and the second switch 162 is activated by the second moving operation.

[0083] In this embodiment, the first moving operation is an operation in which, as shown in Fig. 6, the movable portion 120 moves to the left (in the -Y sense). The operation portion 150 is pushed downward, and the pin 153 thereby pushes the inner surface of the holding hole 123 downward. The pin 153 thereby moves relative to the holding hole 123 to the lower right. Since the movement in the left-right direction of the operation portion 150 is restricted, the relative movement between the pin 153 and the holding hole 123 causes the movable portion 120 to move in the left-right direction (to the left). When the first moving operation is performed, the first switch 161 is pushed downward by the first contact surface 121, and the first switch 161 is activated. The push-pull switch device 110 is thereby brought into the first state.

[0084] In this embodiment, the second moving operation is an operation in which, as shown in Fig. 7, the movable portion 120 moves to the right (in the +Y sense). The operation portion 150 is pulled upward, and the pin 153 thereby pushes the inner surface of the holding hole 123 upward. The pin 153 thereby moves relative to the holding hole 123 to the upper left, and the movable portion 120 moves to the right. When the second moving operation is performed, the second switch 162 is pushed downward by the second contact surface 122, and the second switch 162 is activated. The push-pull switch device 110 is thereby brought into the second state.

[0085] In this embodiment, the operating states of the switches can be switched by the linear moving operation of the movable portion 120. Therefore, by making the moving direction of the movable portion 120 parallel to the upper surface 70a of the board 70 on which the switches are disposed, the whole push-pull switch device 110 can be reduced in size in the vertical direction.

[0086] In the above-described embodiments, the first switch and the second switch are not particularly limited. The first switch and the second switch may each be, for example, a push switch having a metal reversal spring. Sensors such as magnetic sensors and light sensors may be used as the first switch and the second switch. In this case, for example, sensors serving as the switches may be activated when the movement of the movable portion is detected by the sensors.

[0087] Apparatuses on which the push-pull switch de-

vices of the above-described embodiments are mounted are not particularly limited. For example, the push-pull switch devices of the embodiments are mounted on an apparatus provided in a vehicle.

[0088] The above-described configurations may be appropriately combined to the extent that they do not conflict with one another.

10 Claims

1. A push-pull switch device (10, 110) comprising:

an operation portion (50, 150);
a movable portion (20, 120) that moves with the movement in a first direction of the operation portion (50, 150);
a first switch (61, 161) and a second switch (62, 162) that are activated by the movement of the movable portion (20, 120); and
a board (70) to one surface of which the first switch (61, 161) and the second switch (62, 162) are attached,
wherein the movable portion (20, 120) performs a first moving operation with the movement of the operation portion (50, 150) in one sense in the first direction, and performs a second moving operation different from the first moving operation with the movement of the operation portion (50, 150) in the other sense in the first direction, wherein the first moving operation differs from the movement of the operation portion (50, 150) in one sense in the first direction, wherein the second moving operation differs from the movement of the operation portion (50, 150) in the other sense in the first direction, wherein the first switch (61, 161) is activated by the first moving operation of the movable portion (20, 120), and wherein the second switch (62, 162) is activated by the second moving operation of the movable portion (20, 120).

2. The push-pull switch device (10) according to Claim 1, wherein the first moving operation and the second moving operation are rotational operations in which the movable portion (20) rotates about a predetermined axis (J).

3. The push-pull switch device (10) according to Claim 2, wherein the predetermined axis (J) is parallel to a second direction perpendicular to the first direction, and is located between the first switch (61) and the second switch (62) in a third direction perpendicular to both the first direction and the second direction.

4. The push-pull switch device (10) according to Claim 3,

wherein the movable portion (20) is rotatably connected to the operation portion (50) by a connecting mechanism (80), and

wherein the connecting mechanism (80) is disposed on the second switch (62) side of the predetermined axis (J) in the third direction. 5

5. The push-pull switch device (10) according to Claim 4, wherein the distance in the third direction between the connecting mechanism (80) and the predetermined axis (J) is greater than the distance in the third direction between a part of the movable portion (20) that is in contact with the first switch (61) and the predetermined axis (J). 10 15
6. The push-pull switch device (10) according to Claim 4 or 5, wherein the connecting mechanism (80) is formed by a holding hole (52a) provided in one of the operation portion (50) and the movable portion (20), and a pin (24) provided on the other of the operation portion (50) and the movable portion (20) and inserted into the holding hole (52a). 20 25
7. The push-pull switch device (110) according to Claim 1, wherein the first moving operation and the second moving operation are moving operations in which the movable portion (120) moves linearly. 30

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FIG. 1

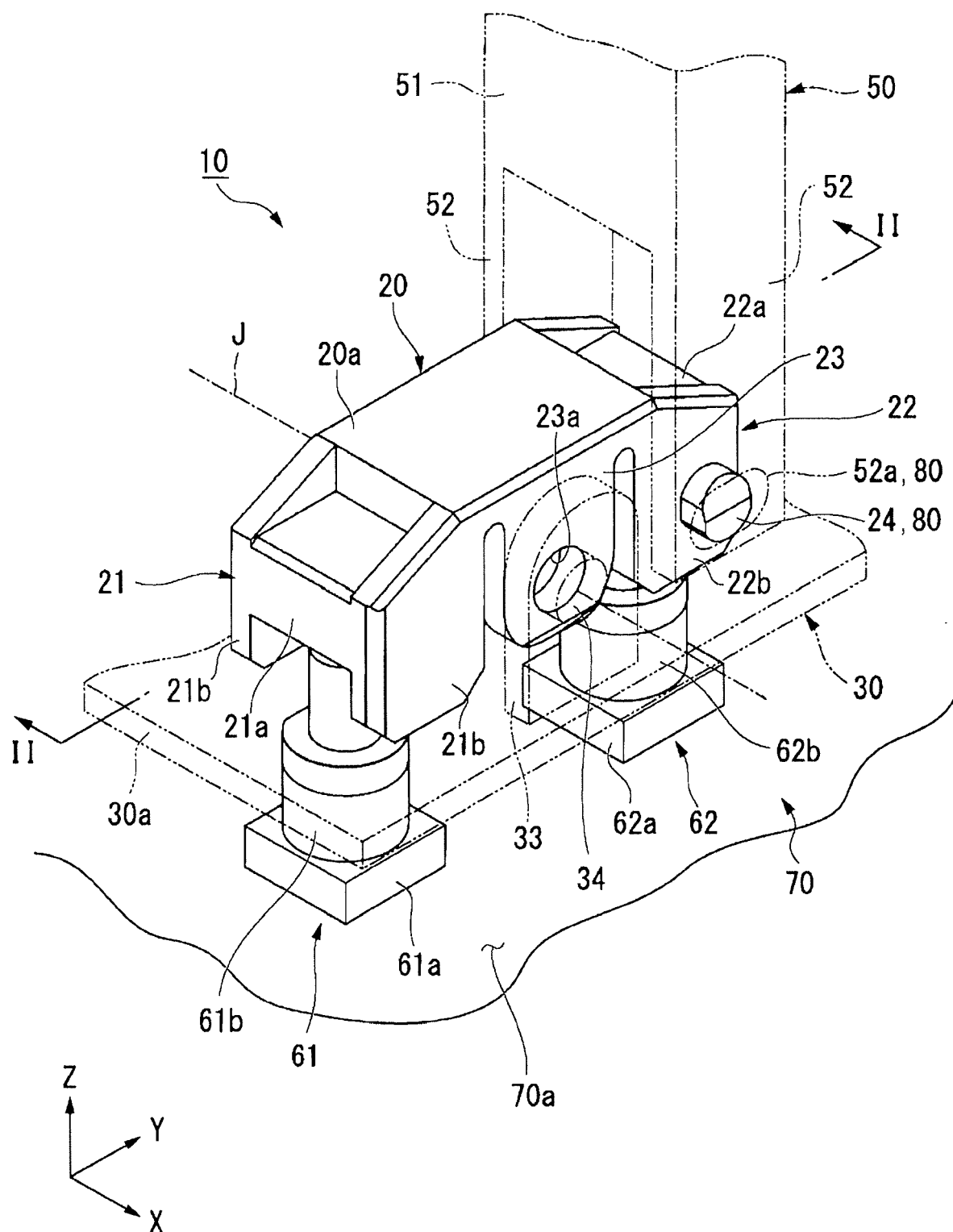


FIG. 2

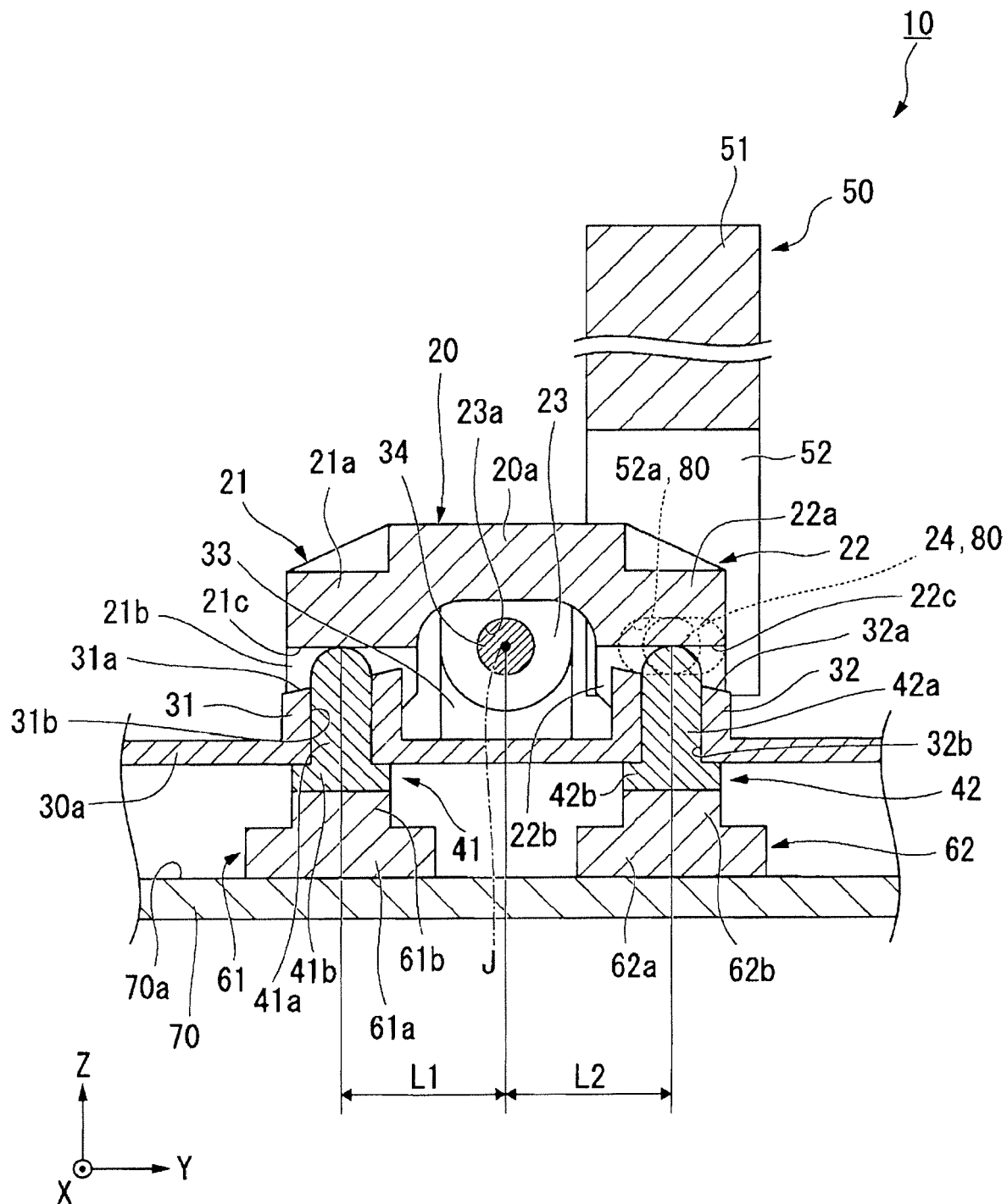


FIG. 3

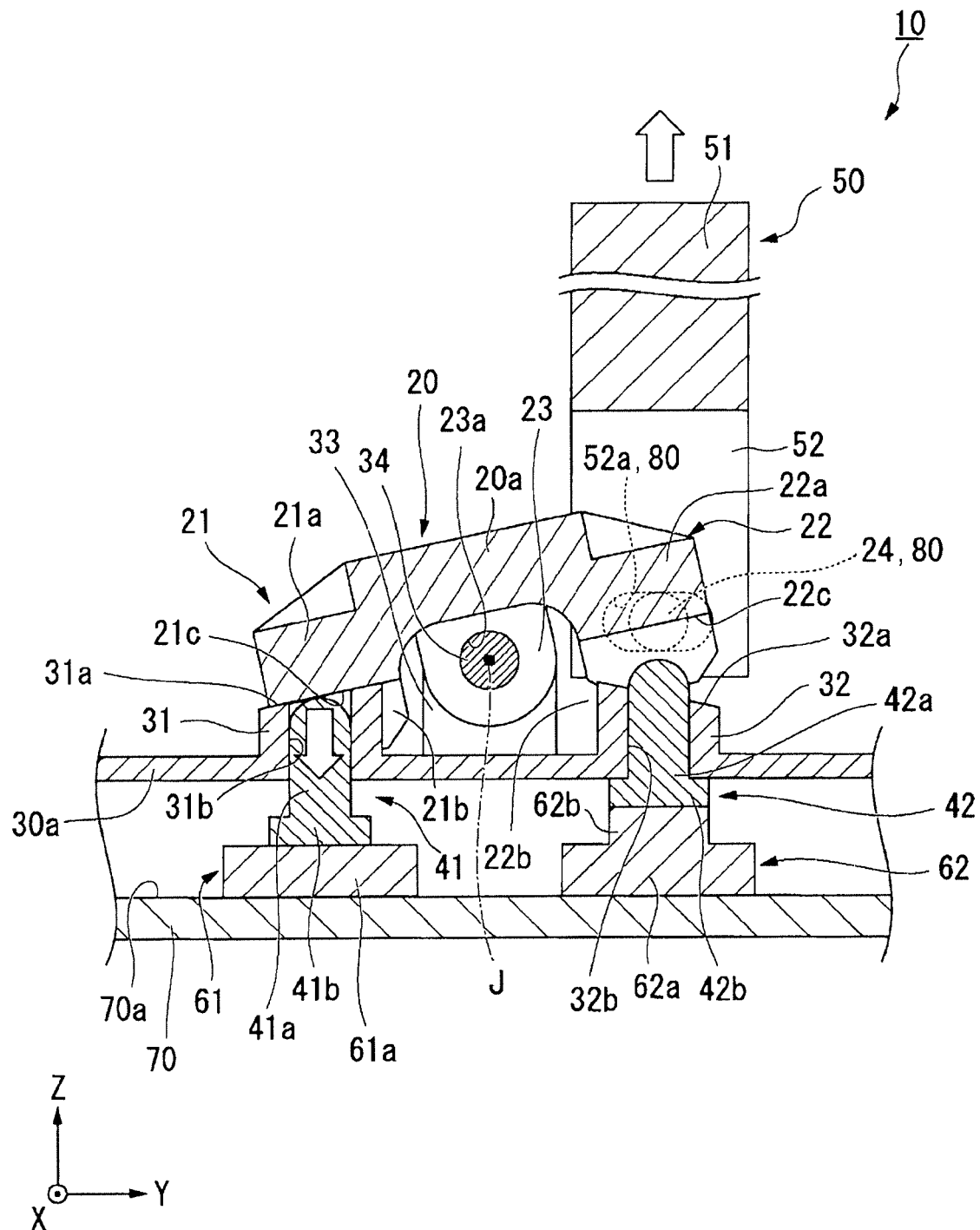


FIG. 4

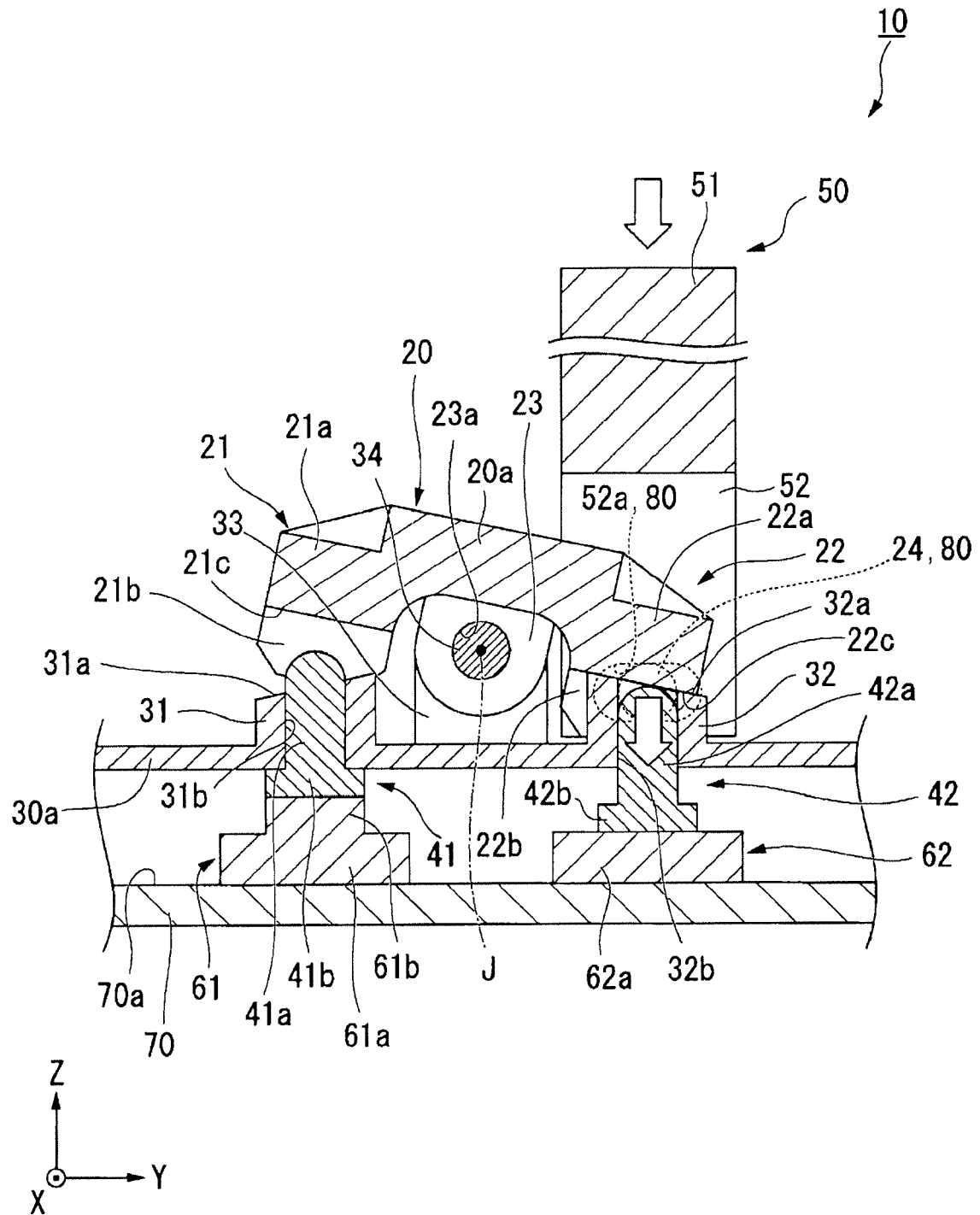


FIG. 5

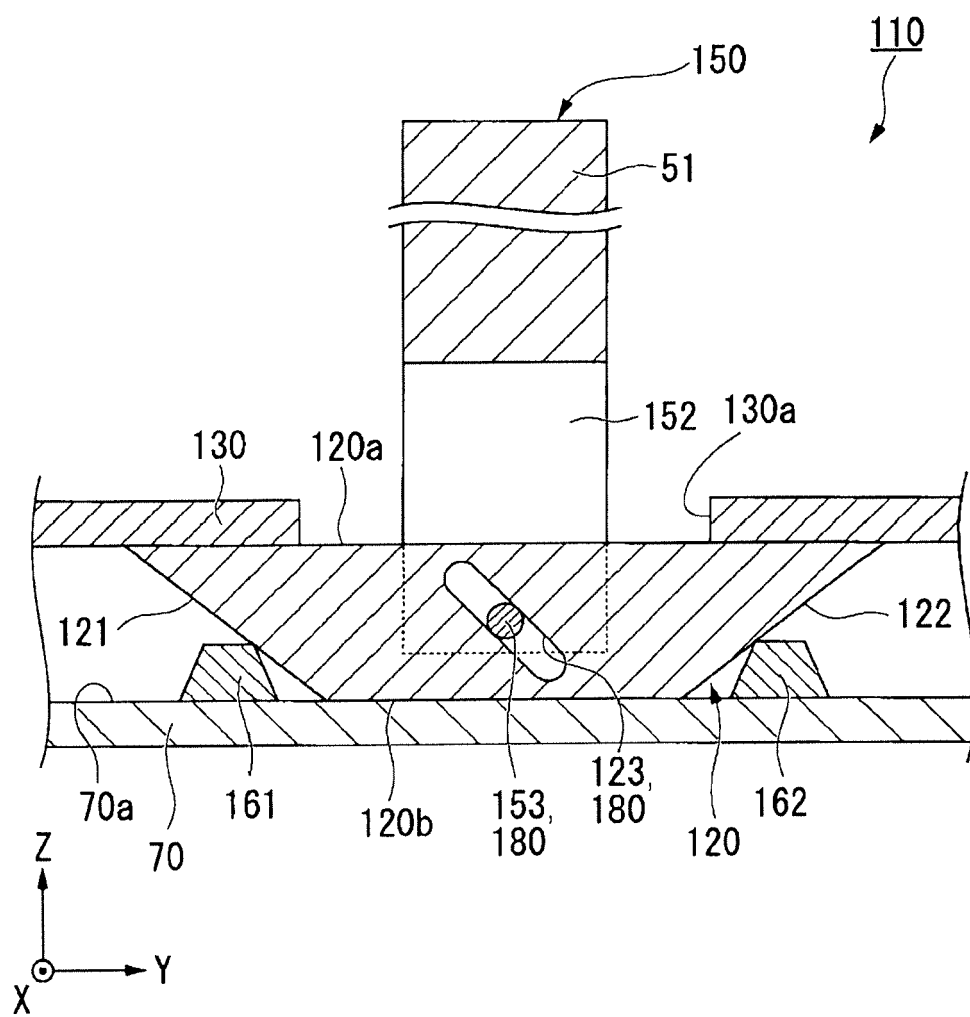


FIG. 6

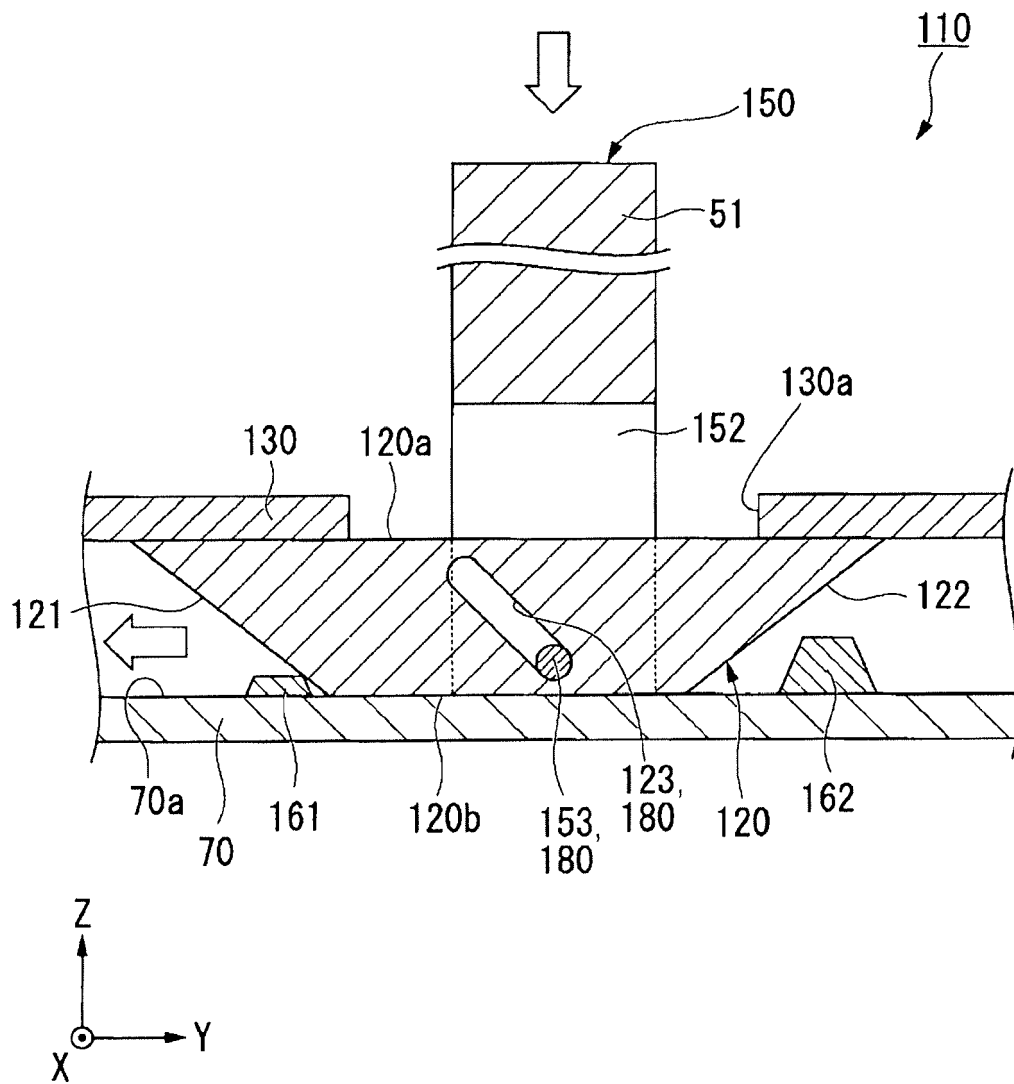
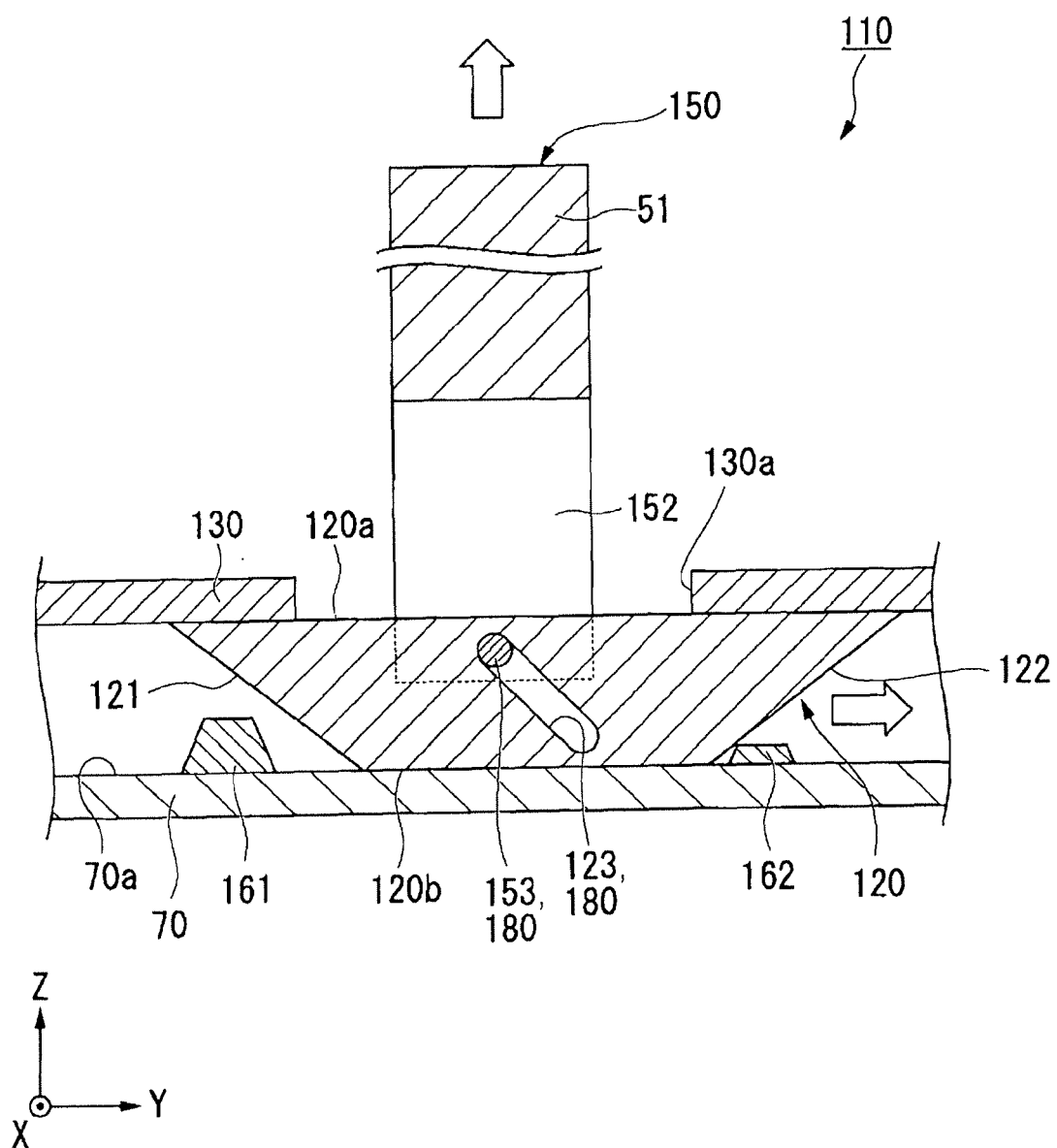


FIG. 7





EUROPEAN SEARCH REPORT

 Application Number
 EP 17 16 4913

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