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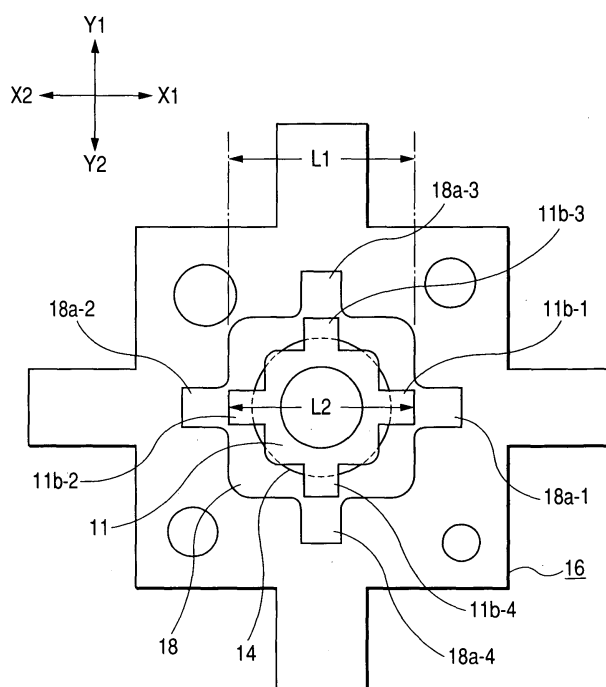
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(54) **Multidirectional input device**

(57) A multidirectional input device includes an operating body capable of rocking in first and second directions, which are perpendicular to each other; a guide member (16) having an opening (18) through which an engaging protrusion (11) provided at the operating body is inserted; and detecting units that detect the moving of the operating body in the first and second directions. In the multidirectional input device, the engaging protrusion

has four outer walls extending in the first and second directions respectively with a guided part (11b) interposed at the center thereof, and the opening has four inner walls extending in the first and second directions respectively with a guiding part (18a) interposed at the center thereof. The guided part is concavo-convexly engaged with the guiding part so that the engaging protrusion is guided in the first and second directions.

FIG. 11



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a multidirectional input device capable of moving an operating body in either of two directions, substantially perpendicular to each other, so as to input predetermined data, and particularly, to a guide mechanism for guiding the moving of the operating body.

2. Description of the Related Art

[0002] In the related art, a multidirectional input device, in which a guide mechanism guides an operating body to move in either of two directions perpendicular to each other and a plurality of detecting units such as push switches, photo-interrupters or the like detects the moving of the operating body, is well known (for example, see pp. 3 and 4, and Fig. 1 of JP-A-11-162299).

[0003] Figs. 13A and 13B are plan views showing the guide mechanism provided at the multidirectional input device in the related art. Fig. 13A shows a non-operating state of the operating body, and Fig. 13B shows an operating state the operating body.

[0004] The guide mechanism shown in Figs. 13A and 13B includes a guide member 101 having an opening 100 and an engaging protrusion 102 inserted through the opening 100, and the engaging protrusion 102 stands on the bottom surface of the operating body that is not shown in Figs. 13A and 13B. When an X - Y rectangular coordinate is set the center of the opening 100 as the origin, cutout parts 100a and 100b extending in the X1 - X2 direction (the first direction) and cutout parts 100c and 100d extending in the Y1 - Y2 direction (the second direction) are formed at the inner wall surfaces of the opening 100. The engaging protrusion 102 is held at the center (neutral position) of the opening 100 by an elastic returning unit that is not shown in Figs. 13A and 13B and can move within the opening 100 against the urging force of the elastic returning unit. The horizontal shape of the engaging protrusion 102 is a square, and four outer wall surfaces of the engaging protrusion 102 face the entrances of the cutout parts 100a to 100d respectively. Meanwhile, even though not shown in Figs. 13A and 13B, a cross-like slider having four branch parts is disposed in a circumference of the engaging protrusion 102, and the detecting units such as push switch, photo-interrupter or the like are oppositely disposed at the front end of each branch part of the slider, respectively.

[0005] In the multidirectional input device constructed as above, when the operating body is in a non-operating state, the engaging protrusion 102 is held at the center of the opening 100, and the outer wall surfaces of the engaging protrusion 102 face the entrances of the cutout parts 100a to 100d of the opening 100, respectively, as

shown in Fig. 13A. If the operating body slides in a certain direction, for example, the Y1 direction from the non-operating state, and the engaging protrusion 102 moves in the Y1 direction within the opening 100, since one outer wall surface of the engaging protrusion 102 comes into contact with the inner wall surface of the cutout part 100c located in the Y1 direction, the engaging protrusion 102 is prevented from moving further in the Y1 direction, as shown in Fig. 13B. It is the same as above-mentioned operation, even in a case that allows the operating body to slide in the Y2 or X1 - X2 direction. Accordingly, in any cases, the engaging protrusion 102 is prevented from moving in the direction more than a position, at which one outer wall surface of the engaging protrusion 102 comes into contact with the inner wall surface of one of the cutout parts 100a to 100d located in the same direction.

[0006] In addition, if the operating body slides in either X1 - X2 or Y1 - Y2 direction, since the slider, not shown, moves in the same direction in conjunction with the engaging protrusion 102, which is accompanied by the operating body, one of four detecting elements is selectively turned on, and thus the operating direction of the operating body can be identified on the basis of an ON signal. Furthermore, if the sliding-operating force with respect to the operating body is removed, the engaging protrusion 102 automatically returns to the neutral position by the urging force of the elastic returning unit, not shown, and, the respective outer wall surfaces of the engaging protrusion 102 face the entrances of the respective cutout parts 100a to 100d of the opening 100, as shown in Fig. 13A.

[0007] As described above, in the guide mechanism provided at the multidirectional input device in the related art, since the cutout parts 100a to 100d extending in the first and second directions are formed at the inner wall surfaces of the opening 100, through which the engaging protrusion 102 of the operating body is inserted, and the respective outer wall surfaces of the engaging protrusion 102 face the entrances of the respective cutout parts 100a to 100d at the neutral position, the engaging protrusion 102 is guided to the moving direction by means of the cutout parts 100a to 100d to determine the position of the engaging protrusion 102. However, there has been a problem in that, if it is sought to shorten the operating distance of the operating body moved while the operating body is operated and one of the detecting elements is turned on, since the depth of each of the cutout parts 100a to 100d needs to be short, the position of the engaging protrusion 102 cannot be regulated surely at the moving end position.

[0008] That is, if the operating body in a non-operating state slides in, for example, the Y1 direction, even though one outer wall surface of the engaging protrusion 102 intrudes into the cutout part 100c located in the Y1 direction so as to regulate the position, as shown in Fig. 13B, in this case, only one engaging part of the engaging protrusion 102 comes into contact with the cutout part 100c

of the opening 100, and the other parts do not come into contact with the opening 100. Therefore, if the operating distance of the operating body decrease and, accordingly, the depth of each cutout part 100a to 100d is shortened, it is highly likely that the engaging protrusion 102 deviates from the cutout part 100c at the moving end position of the Y1 direction, and thus the engaging protrusion 102 can move in the X1 - X2 direction despite the operating body is operated in the Y1 direction.

SUMMARY OF THE INVENTION

[0009] The present invention has been finalized in view of the drawbacks inherent in the multidirectional input device in the related art, and it is an object of the invention to provide a multidirectional input device capable of satisfactorily regulating a position at the moving end position even when the operating distance is shortened.

[0010] In order to achieve the above object, the multidirectional input device according to the invention includes an operating body capable of moving in first and second directions, which are perpendicular to each other; a guide member having an opening, through which an engaging protrusion provided at the operating body is inserted; and detecting units that detect the moving of the operating body in the first and second directions. In the multidirectional input device, the engaging protrusion has four outer walls parallel to the first and second directions respectively with a guided part interposed at the center thereof, and the opening has four inner walls parallel to the first and second directions respectively with a guiding part interposed at the center thereof. The guided part is concavo-convexly engaged with the guiding part so that the engaging protrusion is guided in the first and second directions.

[0011] In the multidirectional input device constructed as above, when the engaging protrusion is moved in the first direction by the operation of the operating body, the guided part located in the moving direction is concavo-convexly engaged with the guide part of the opening. Therefore, the position of the engaging protrusion is regulated at a moving end position of the first direction. However, in this case, since the other guided parts located in the second direction come into contact with an inner wall surface of the opening, the engaging protrusion is restricted by the opening at three outer walls other than the outer wall located at the rear end side of the moving direction. Conversely, when the engaging protrusion is moved in the second direction, the guided part located in the moving direction is concavo-convexly engaged with the guide part of the opening. Therefore, the position of the engaging protrusion is regulated at the moving end position of the second direction. However, in this case, since the other guided parts located in the first direction come into contact with the inner wall surface of the opening, the engaging protrusion is regulated by the opening at three outer walls other than the outer wall located at the rear end side of the moving direction. As a result,

when the operating body is operated in either first or second direction so as to reach the moving end position, the position of the operating body or the engaging protrusion can be regulated surely at the moving end position, and the engaging protrusion can be guided safely in a desired direction.

[0012] In the above construction, it is preferable that the maximum size of the engaging protrusion including the guided part and the outer walls along the first and second directions be set slightly shorter than the minimum size of the opening including the guide part and the inner wall surfaces along the first and second directions, since the engaging protrusion can be guided in a desired direction more stably within the opening.

[0013] In addition, in the above construction, even though the satisfactory effect can be obtained if one of the guide part and the guided part forms a protruding part and the other forms a recessed part, it is preferable that the guided part be composed of protruding parts extending in the first and second directions from the outer walls of the engaging protrusion and the guide part be composed of recessed parts extending in the first and second directions from the inner wall surfaces of the opening; therefore, the length between both protruding parts opposite to each other in first and second directions be set slightly shorter than the opposing length of both inner wall surfaces.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig. 1 is a perspective view of a control unit according to the embodiment;

Fig. 2 is a plan view of the control unit;

Fig. 3 is a cross-sectional view of the control unit taken along the line III - III in Fig. 2;

Fig. 4 is a cross-sectional view of the control unit taken along the line IV - IV in Fig. 2;

Fig. 5 is an exploded perspective view of a multidirectional input device provided in the control unit;

Fig. 6 is an exploded perspective view of a multidirectional input device provided in the control unit;

Fig. 7 is a cross-sectional view showing a main part of the multidirectional input device;

Fig. 8 is a plan view showing the main part of the multidirectional input device;

Fig. 9 is a perspective view showing the main part of the multidirectional input device;

Fig. 10 is an exploded perspective view showing the main part of the multidirectional input device;

Fig. 11 is a plan view showing an arrangement relationship of a guide member and an engaging protrusion provided in the multidirectional input device;

Fig. 12 is a view explaining the operation of the engaging protrusion; and

Figs. 13A and 13B are plan views showing a guide mechanism provided in the multidirectional input device.

vice in the related art.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0015] Hereinafter, an embodiment of the present invention will be described with reference to the drawings. Fig. 1 is a perspective view of a control unit according to the embodiment; Fig. 2 is a plan view of the control unit; Fig. 3 is a cross-sectional view of the control unit taken along the line III - III in Fig. 2; Fig. 4 is a cross-sectional view of the control unit taken along the line IV - IV in Fig. 2; Fig. 5 is an exploded perspective view of a multi-operational input device provided in the control unit; Fig. 6 is an exploded perspective view of a multidirectional input device provided in the control unit; Fig. 7 is a cross-sectional view of the multidirectional input device; Fig. 8 is a plan view showing a main part of the multidirectional input device; Fig. 9 is a perspective view showing the main part of the multidirectional input device; Fig. 10 is an exploded perspective view showing the main part of the multidirectional input device; Fig. 11 is a plan view showing an arrangement relationship of a guide member and an engaging protrusion provided in the multidirectional input device; and Fig. 12 includes views explaining the operation of the engaging protrusion.

[0016] The control unit according to the embodiment integrally controls in-vehicle electric devices such as air conditioner, sound system, navigation system or the like and includes a housing 1 attached to a center console or the like in a vehicle; and an operating body 2 projecting from the housing 1. The housing 1 is composed of a hollow case 3 having openings at the top and bottom; a top cover 4 that blocks the top opening of the case 3; a bottom cover 5 that blocks a bottom opening of the case 3; or the like, and all components are made of a synthetic resin.

[0017] An annular ring body 6 is disposed in the case 3, and a pair of spindles 6a and a pair of holes 6b are alternately formed along the ring body 6 at 90 degree angle intervals. The spindles 6a are inserted into spindle holes 3a formed at the upper side of the inner wall surfaces of the case 3, which face each other, and the ring body 6 is rotatably supported by the case 3 with the central axis thereof at a straight line passing the spindle holes 3a. A cylindrical holder 7 is inserted into the ring body 6, and a pair of step-attached protrusions 7a is formed at the outer circumferential surface of the holder 7. In addition, penetrating holes 7b are formed perpendicular to the central axis of the holder 7 and the both step-attached protrusions 7a in the holder 7, and a pin 8 is inserted into the penetrating holes 7b and the both spindle holes 6b of the ring body 6. The pin 8 is tightened with the ring body 6 by a locking ring 9, and the holder 7 is rotatably supported by the ring body 6 with the central axis at a straight line passing the both spindle holes 6b. That is, the holder 7 is supported by the case 3 through the ring body 6 and can rock in directions perpendicular to each other. In the following description, a rocking direction (X1 - X2 direction) of the holder 7, in which the both spindles

6a of the ring body 6 is a fulcrum, is defined as a first direction, and a rocking direction (Y1 - Y2 direction) of the holder 7, in which the pin 8 is the fulcrum, is defined as a second direction.

[0018] Since the holder 7 is a component of the operating body 2, a pair of protrusions 7d is provided upright on a top surface of the holder 7 with a screw hole 7c interposed therebetween, and a coupling body 10 is integrated with the bottom end of the holder 7 by using a fixing unit such as snap coupling or the like. In addition, in the embodiment, even though the coupling body 10 is used to accommodate a driving motor or the like in the holder 7, if a driving motor or the like does not need to be accommodated in the holder 7, the holder 7 and the coupling body 10 can be formed integrally. A cylindrical engaging protrusion 11 is provided at the center of the bottom surface of the coupling body 10, and an accommodating hole 11a is formed vertically in the engaging protrusion 11 (see Fig. 10). Four projecting parts 11b are provided at the outer walls of the engaging protrusion 11 as guided parts, and each projecting part 11b extends in either first or second direction from the center of each side of the square engaging protrusion 11. As shown in Fig. 7, a coil spring 12 and a driving rod 13 are inserted into the accommodating hole 11a of the engaging protrusion 11, and the front end (rear end) of the driving rod 13 is pressed on the inside bottom surface of a cam mechanism 14 by the elastic force of the spring coil 12. The cam mechanism 14 is a bowl-like recessed portion provided at the top surface of a synthetic resin-made supporting body 15, and a click protrusion 14a is concentrically formed on the center of the deepest portion of the cam mechanism 14. The supporting body 15 is pushed into and thus fixed at a recessed portion 5a formed on the center of the inside bottom surface of the bottom cover 5, and protrusions 15a and screw holes 15b are formed at four corners on the top surface of the supporting body 15.

[0019] A synthetic resin-made guide member 16 is mounted on the supporting body 15, and circular holes 16a are formed at four corners of the guide member 16. Two of the circular holes 16a act as positioning holes fitted with the protrusions 15a of the supporting body 15, and the guide member 16 is fixed on the supporting body 15 by screwing screws 17 into the screw holes 15b through the other circular holes 16a. An opening 18 is provided at the center of the guide member 16. As shown in Fig. 11, the engaging protrusion 11 protruding from the bottom surface of the coupling body 10 is located in the opening 18, and the front end of the driving rod 13 held by the engaging protrusion 11 is pressed on the cam mechanism 14 exposed at the center of the opening 18. Four cutout parts 18a are formed at the inner wall surfaces of the opening 18 as guide parts, and each cutout part 18a extends outward in either first or second direction from the center of each side of the square opening 18. The projecting parts 11b of the engaging protrusion 11 face the entrances of the cutout parts 18a respectively,

and, if the distance between the facing inner wall surfaces of the opening 18 is defined as L1 and the distance between the front ends of the facing projecting parts 11b is defined as L2, L2 is set slightly shorter than L1.

[0020] In addition, a pair of first guide protrusions 16b and a pair of second guide protrusions 16c are provided upright at the outside edge portions of the guide member 16, and the guide protrusions 16b and 16c are located on the lines extended from the cutout parts 18a. The first and second guide protrusions 16b and 16c are forked, and the height of the first protrusion 16b is set shorter than the height of the second protrusion 16c. A first slider 19 capable of sliding in the first direction (X1 - X2 direction) is supported by both first guide protrusions 16b, and a second slider 20 capable of sliding in the second direction (Y1 - Y2 direction) is supported by both second guide protrusions 16c. The first slider 19 includes a rectangular frame part 19a; a pair of arm parts 19b extending outward from the centers of the facing long sides of the frame part 19a; and lightproof parts 19c protruding perpendicular to the plate surface of the arm parts 19b from the front ends of both arm parts 19b, and a long hole 19d extending in the second direction is formed in the frame part 19a. The second slider 20 includes a rectangular frame part 20a; a pair of arm parts 20b extending outward from the centers of the facing long sides of the frame part 20a; and lightproof parts 20c protruding perpendicular to the plate surface of the arm parts 20b from the front ends of the both arm parts 20b, and a long hole 20d extending in the second direction is formed in the frame part 20a. Even though the first slider 19 and the second slider 20 are synthetic resin-made common parts of the same shape, when used, the first slider 19 and the second slider 20 are turned over and then integrated with the guide member 16; therefore the frame part 20a of the second slider 20 overlaps the frame part 19a of the first slider 19.

[0021] That is, as shown in Figs. 8 and 9, when the first slider 19 is disposed, the lightproof parts 19c are made to protrude upward from the plate surfaces of the arm parts 19b, and the first slider 19 is made slidably supported by the short first guide protrusions 16b of the guide member 16 by interposing the arm parts 19b into the corresponding first guide protrusions 16b. On the other hand, when the second slider 20 is disposed, the lightproof parts 20c are made to protrude downward from the plate surfaces of the arm parts 20b, and the second slider 20 is made slidably supported by the long second guide protrusions 16c of the guide member 16 by interposing the arm parts 20b into the corresponding second guide protrusions 16c. As described above, if the similarly-shaped first slider 19 and second slider 20 are turned over and then laminated, the lightproof parts 19c of the first slider 19 and the lightproof parts 20c of the second slider 20 are located on the same plane, and thus the long hole 19d formed in the frame part 19a of the first slider 19 and the long hole 20d formed in the frame part 20a of the second slider 20 are overlapped with each other at right angle. Since the engaging protrusion 11 is

inserted into the long holes 19d and 20d (see Fig. 8), when the first slider 19 receives an external force through the engaging protrusion 11 so as to move in the first direction (X1 - X2 direction), the second slider 20 can move within the long hole 20d only as much as the engaging protrusion 11 moves. On the other hand, when the second slider 20 receives an external force through the engaging protrusion 11 so as to move in the second direction (Y1 - Y2 direction), the first slider 19 can move within the long hole 19d only as much as the engaging protrusion 11 moves.

[0022] A print substrate 21 is fixed on the bottom cover 5, and the guide member 16 is exposed through an opening 21a provided at the center of the print substrate 21. Four photo-interrupters 22 are mounted on the print substrate 21, and the photo-interrupters 22 are disposed on X1 - X2 and Y1 - Y2. The photo-interrupter 22 is a light-detecting element, in which light-emitting element 22b and light-receiving element 22c are integrally disposed to face each other through a recessed portion 22a, and, as shown in Fig. 8, when the first slider 19 and the second slider 20 are located at the neutral position of the first and second directions, the lightproof units 19c and 20c remain at insensible areas at the entrances of the recessed portions 22a of the photo-interrupters 22.

[0023] As shown in Figs. 1 to 5, a circular opening 4a is provided at the center of the top cover 4, and a plurality of operating keys 23 is disposed in the circumference of the opening 4a. Corresponding to the operating keys 23, a plurality of push switches (not shown) are provided in the top cover 4, and the push switches are operated by pressing the operating keys 23. In addition, the annular decorated ring 24 is engaged with the opening 4a of the top cover 4 by a fixing unit such as snap coupling or the like, and the components of the operating body 2 such as base 25, lower knob 26, rotating ring 27, upper knob 28, pressing knob 29 or the like protrude through the decorated ring 24.

[0024] The base 25 is mounted on the holder 7, and a penetrating hole 25a and a pair of positioning holes 25b are formed on the base. The positioning holes 25b are fitted with the protrusions 7d of the holder 7. The lower knob 26 is mounted on the base 25, and a cylindrical spindle 26a and a pair of accommodating holes 26b are formed in the lower knob 26. A coil spring 30 and a driving rod 31 are inserted into each accommodating hole 26b, and the driving rod 31 is pressed on the bottom surface of a click plate 32 by the elastic force of the coil spring 30. Uneven portion 32a is formed along the circumference at the bottom surface of the click plate 32, and four engaging parts 32b are formed at the circumferential edge of the click plate 32 at 90 degree intervals. Each engaging part 32b is engaged with a cutout part 27a formed at the lower end of the inside circumference of the rotating ring 27, and a code plate 33 is fixed on the click plate 32 by using screws 34. A plurality of lightproof plates 33a and cutout parts 33b are alternately formed along the circumference on the top surface of the code

plate 33, and a circuit substrate 35 is disposed on the code plate 33.

[0025] A photo interrupter 36 is mounted on the bottom surface of the circuit substrate 35, and a pair of push switches 37 is mounted on the top surface of the circuit substrate 35. The photo interrupter 36 is also a light-detecting element, in which light-emitting element and light-receiving element (not shown) are integrally disposed to face each other through a recessed portion, and the lightproof plates 33a and the cutout parts 33b of the code plate 33 move in the recessed portion of the photo interrupter 36. In addition, the push switch 37 is a so-called tact switch having stems 37a, and the stems 37a are urged upward by the elastic force of built-in tact springs (not shown). A pair of holes 35b is provided on the circuit substrate 35 with the engaging hole 35a therebetween, and the engaging hole 35a is fitted with the upper end step of the spindle 26a of the lower knob 26.

[0026] The upper knob 28 is disposed on the circuit substrate 35, and a dent 28a is formed on the top surface of the upper knob 28. A penetrating hole 28b is formed at the center of the bottom surface in the dent 28a, and a setscrew 38 inserted in the penetrating hole is screwed into the screw hole 7c of the holder 7 through the spindle 26a of the lower knob 26 and the penetrating hole 25a of the base 25. As a result, the lower knob 26 is fixed on the holder 7 through the base 25, and the circuit substrate 35 and the upper knob 28 are fixed on the upper end of the spindle 26a of the lower knob 26; therefore, the rotating ring 27 is rotatably held between the lower knob 26 and the upper knob 28. In addition, since the click plate 32 and the code plate 33 are engaged with the inner wall surface of the rotating ring 27, the click plate 32 and the code plate 33 can be rotated integrally in conjunction with the rotating operation of the rotating ring 27. A pair of relief holes 28c and a pair of guide holes 28d are formed at the bottom surface in the dent 28a of the upper knob 28 with the penetrating hole 28b therebetween, and the push switches 37 mounted on the top surface of the circuit substrate 35 protrude toward the dent 28a through the relief holes 28c. Furthermore, guide pieces 28e extending downward from the outside edges of the guide holes 28d are formed at the upper knob 28, and the guide pieces 28e reach the lower knob 26 through the holes 35b of the circuit substrate 35.

[0027] A pressing knob 29 is elevatably disposed in the dent 28a of the upper knob 28, and a pair of protrusions 29a provided at the bottom surface of the pressing knob 29 is in contact with the stems 37a of the push switches 37; therefore, the pressing knob 29 is urged upward by the elastic force of the tact switches built in the push switches 37. In addition, only one of two push switches 37 contributes to contact point-converting operation, and the other acts as an elasticity-supplying unit that urges the pressing knob 29 upward with good balance. A plurality of hooks 29a is formed along the circumferential edge of the lower end of the pressing knob 29, and the hooks 29a are engaged with the outside cir-

cumferential edge of the dent 28a; therefore, the pressing knob 29 is not detached from the upper knob 28. In addition, a pair of guide rods 29b is provided at the pressing knob 29, and the guide rods 29b reach the inside of the guide pieces 28e through the guide holes 28d of the upper knob 28.

[0028] Next, the operations of the multidirectional input device and the multi-operational input device, both of which are provided in the control unit constructed as above, will be described.

[0029] First, the operation of the multidirectional input device will be described. Figs. 1, 3 and 4 show a non-operating state, in which an external force is not supplied to the operating body 2; therefore, the components of the operating body 2 such as holder 7, base 25, lower knob 26, rotating ring 27, upper knob 28 or the like stand vertically (in the Z1 - Z2 direction in Fig. 1). In the non-operating state, the lower end of the driving rod 13 is pressed on the center (deepest part) of the bottom surface of the cam groove 14 by the elastic force of the coil spring 12, and, as shown in Fig. 1, the engaging protrusion 11 holding the driving rod 13 is located in the center of the opening 18 of the guide member 16. In addition, as shown in Fig. 8, since the engaging protrusion 11 is located at the center of the longitudinal directions of the long holes 19d and 20d, the first and second sliders 19 and 20 are located in the neutral position of the first and second directions, and the lightproof parts 19c and 20c remain at the insensible areas at the entrances of the recessions 22a of the photo interrupters 22. As a result, the light path between the light-emitting element 22b and the light-receiving element 22c of the photo interrupter 22 is not blocked, and thus all photo interrupters 22 output high-level signals.

[0030] When an operator rocks the operating body 2 in either first or second direction from the above non-operating state, since the holder 7 rocks in the above direction with the supporting points at either spindles 6a or pin 8 of the ring body 6, the lower end of the driving rod 13 held by the engaging protrusion 11 rocks outward from the center at the bottom surface of the cam groove 14, and a click sense generated when the driving rod 13 exceeds the click protrusion 14a is fed back to the operator through the operating body 2. In this case, the engaging protrusion 11 is moved outward in either first or second direction from the center of the opening 18, and then the engaging protrusion 11 is prevented from moving further when one projecting part 11b located in the moving direction intrudes into and engages with the facing cutout part 18a.

[0031] That is, when the projecting parts 11b and the cutout parts 18a, which face each other in the first and second directions, are denoted as follows for convenience: 11b - 1 for the projecting part and 18a-1 for the cutout part in the X1 direction; 11b - 2 for the projecting part and 18a-2 for the cutout part in the X2 direction; 11b - 3 for the projecting part and 18a-3 for the cutout part in the Y1 direction; 11b - 4 for the projecting part and 18a-

4 for the cutout part in the Y2 direction, as shown in Fig. 11, in a non-operating state, the projecting parts 11b - 1, 2, 3, 4 face the entrances of the cutout parts 18a - 1, 2, 3, 4. If the engaging protrusion 11 is moved in, for example, the X1 direction from the neutral position, as shown in Fig. 12(a), the front ends of the projecting parts 11b - 3 and 11b - 4 are guided to the facing inner wall surfaces of the opening 18; the projecting part 11b - 1 intrudes into the cutout part 18a - 1; and the engaging protrusion 11 is prevented from moving in the X1 direction more than a position where the outer wall of the engaging protrusion 11 located in the X1 direction comes into contact with the inner wall surface of the opening 18. As a result, at the moving end positions, four outer walls of the engaging protrusion 11 are restricted within the opening 18 by three parts, that is, the projecting parts 11b - 1, 11b - 3, 11b - 4, more specifically, total four surfaces such as both side surfaces of the projecting part 11b - 1, the front end surface of the projecting part 11b - 3, the front end surface of the projecting part 11b - 4; therefore, the operating body 2 moved in the X1 direction cannot be moved in either Y1 or Y2 direction by mistakes. Likewise, if the engaging protrusion 11 is moved in, for example, the Y1 direction, as shown in Fig. 12(b), the front ends of the projecting parts 11b - 1 and 11b - 2 slide toward the facing inner wall surfaces of the opening 18, and the projecting part 11b - 3 intrudes into the cutout part 18a - 3; therefore, the engaging protrusion 11 is prevented from moving in the Y1 direction more than a location where the outer wall of the engaging protrusion 11 located in the Y1 direction comes into contact with the inner wall surface of the opening 18. In this case, at the moving end positions, four outer walls of the engaging protrusion 11 are restricted within the opening 18 by three parts, that is, the projecting parts 11b - 1, 11b - 2, 11b - 3, more specifically, total four surfaces such as the front end surface of the projecting part 11b - 1, the front end surface of the projecting part 11b - 2, both side surfaces of the projecting part 11b - 3; therefore, the operating body 2 moved in the Y1 direction cannot be moved in either X1 or X2 direction by mistakes.

[0032] In addition, if the engaging protrusion 11 is moved in either first or second direction within the opening 18 in conjunction with the sliding operation of the operating body 2, either first or second slider 19 or 20 slides toward the guide member 16, and then the photo interrupters 22 are turned on selectively. For example, when the engaging protrusion 11 is moved in the X1 direction from the neutral position shown in Fig. 8, since the engaging protrusion 11 can move within the long hole 20d extending in the first direction (X1 - X2 direction), the second slider 20 does not receive an external force (a driving force in the moving direction) through the engaging protrusion 11 so as to remain in the neutral position. However, the first slider 19 receives an external force through the engaging protrusion 11 so as to move in the X1 direction. In this case, the arm part 19b is guided to the first guide protrusion 16b of the guide member 16,

and the first slider 19 is moved in the X1 direction; therefore, the lightproof part 19c is moved into the recessed portion 22a of the photo interrupter 22 located in the X1 direction. Furthermore, when the engaging protrusion 11 reaches the moving end position of the X1 direction, since the light path between the light-emitting element 22b and the light-receiving element 22c of the photo interrupter 22 is blocked by the lightproof part 19c, the photo interrupter 22 outputs a low-level signal. In this case, since the second slider 20 does not receive an external force through the engaging protrusion 11 so as to remain in the neutral position, the signals outputted from the other three photo interrupters located in the Y1 - Y2 direction and the X2 direction are maintained at high-level. The same operation can be found when the engaging protrusion 11 is moved in the X2 direction from the neutral position, and, in this case, the first slider 19 receives an external force through the engaging protrusion 11 so as to move in the X2 direction; therefore, the photo interrupter 22 located in the X2 direction outputs a low-level signal, and the signals outputted from the other three photo interrupters 22 remain at high-level.

[0033] On the other hand, if the engaging protrusion 11 is moved in the Y1 direction from the neutral position shown in Fig. 8, since the engaging protrusion 11 can move within the long hole 19d extending in the second direction (Y1 - Y2 direction), the first slider 19 does not receive an external force through the engaging protrusion 11 so as to remain in the neutral position. However, the second slider 20 receives an external force through the engaging protrusion 11 so as to move in the Y1 direction. In this case, the arm part 20b is guided to the second guide protrusion 16c of the guide member 16, and the second slider 20 is moved in the Y1 direction; therefore, the lightproof part 20c is moved into the recessed portion 22a of the photo interrupter 22 located in the Y1 direction. In addition, when the engaging protrusion 11 reaches the moving end position of the Y1 direction, since the light path between the light-emitting element 22b and the light-receiving element 22c of the photo interrupter 22 is blocked by the lightproof part 20c, the photo interrupter 22 outputs a low-level signal. In this case, since the first slider 19 does not receive an external force through the engaging protrusion 11 so as to remain in the neutral position, the signals outputted from the other three photo interrupters located in the X1 - X2 direction and the Y2 direction are maintained at high-level. The same operation can be found when the engaging protrusion 11 is moved in the Y2 direction from the neutral position, and, in this case, the second slider 20 receives an external force through the engaging protrusion 11 so as to move in the Y2 direction; therefore, the photo interrupter 22 located in the Y2 direction outputs a low-level signal, and the signals outputted from the other three photo interrupters 22 remain at high-level.

[0034] If the operating body 2 is operated to selectively rock in one of the first and second directions, which are perpendicular to each other, since only the signal output-

ted from the photo interrupter 22 located in the operating direction is changed from high-level to low-level, it is possible to identify the operating direction of the operating body 2 on the basis of the signals outputted from the four photo interrupters 22. Meanwhile, when the rock-operating force on the operating body 2 is removed, the lower end of the driving rod 13 receives the elastic force of the coil spring 12 so as to return to the center of the bottom surface of the cam groove 14; therefore, the entire operating body 2 including the holder 7 stands upright, and the engaging protrusion 11 or the first and second sliders 19 and 20 returns to the neutral position automatically.

[0035] Next, the operation of the multi-operational input device will be described with reference to Figs. 3 to 5. As shown in Figs. 3 and 4, the components of the operating body 2 such as the base 25, the lower knob 26, the rotating ring 27, the upper knob 28, the pressing knob 29 and the like protrude from the top cover 4 of the housing 1, and, if an operator rotates the rotating ring 27 clockwise or counterclockwise, the click plate 32 and the code plate 33 are integrally rotated in conjunction with the rotating ring 27. In addition, since the rotating of the click plate 32 makes the upper ends of the driving rods 31, which are elastically urged by the coil springs 30, disengaged from the uneven portion 32, a click sense generated at this time is fed back to the operator through the operating body 2. Furthermore, since the rotating of the code plate 33 makes the lightproof plates 33a and the cutout parts 33b turn and pass the recessed portion of the photo interrupter 36 mounted on the bottom surface of the circuit plate 35, the photo interrupter 36 outputs pulse signals corresponding to the rotating of the code plate 33. As described above, if the rotating ring 27 is rotating-operated, since the photo interrupter 35 outputs signals corresponding to the rotating direction and amount of the rotating ring 27, it is possible to obtain the information on the rotating of the rotating ring 27 on the basis of the signals.

[0036] On the other hand, if the operator presses the pressing knob 29 downward (Z2 direction in Fig. 1), since the stems 37a of the push switches 37 mounted on the top surface of the circuit plate 35 are pushed down by the protrusions 29a of the pressing knob 29, the contact points of the push switches 37 are converted to ON from OFF. In addition, if such pressing force is removed, the pressing knob 29 returns to the original position by the elastic force of the tact spring built in the push switches 37, and the contact points of the push switches 37 are also converted to OFF from ON. In this case, since the guide rods 29b provided at the bottom surface of the pressing knob 29 are guided to the guide pieces 28e of the upper knob 28 and elevated, the pressing knob 29 can be pressing-operated smoothly with no rattle.

[0037] As described above, the multi-operational input device according to the embodiment includes the operating body 2 capable of rocking in one of the first and second directions, which are perpendicular to each other; the guide member 16 having the opening 18, through

which the engaging protrusion 11 provided at the operating body 2 is inserted; and four photo interrupters 22, which are detecting units that detect the moving of the operating body 2 in the first and second directions. In the multi-operational input device, the engaging protrusion 11 has four outer walls extending in the first and second directions respectively with the recessed part (guided part) interposed at the center thereof; the opening 18 has four inner wall surfaces extending in the first and second directions with the cutout part (guide part) 18a at the center thereof respectively; and the engaging protrusion 11 is guided in the first and second directions by the engaging of a set of the projecting part 11b and the cutout part 18a. When the engaging protrusion 11 is moved in the first direction by the rocking-operation of the operating body 2, one projecting part 11b located in the moving direction is concavo-convexly engaged with the cutout part 18a of the opening 18; therefore, the position of the engaging protrusion 11 is regulated at the moving end position of the first direction. However, in this case, since the other two projecting parts 11b located in the second direction are in contact with the inner wall surface of the opening 18, the engaging protrusion 11 is supported by the opening 18 at three outer walls other than the outer wall located at the rear end side of the moving direction. Conversely, when the engaging protrusion 11 is moved in the second direction, one projecting part 11b located in the moving direction is concavo-convexly engaged with the cutout part 18a of the opening 18; therefore, the position of the engaging protrusion 11 is regulated at the moving end position of the first direction. However, in this case, since the other two projecting parts 11b located in the first direction are in contact with the inner wall surface of the opening 18, the engaging protrusion 11 is supported by the opening 18 at three outer walls other than the outer wall located at the rear end side of the moving direction. As a result, when the operating body 2 is operated in either first or second direction so as to move the engaging protrusion 11 to the moving end position, the position of the operating body 2 or the engaging protrusion 11 can be regulated surely at the moving end position, and, since the other two projecting parts 11b located in the direction perpendicular to the moving direction come into contact with the inner wall surfaces of the opening 18, the engaging protrusion 11 can be guided more stably in a desired direction.

[0038] Meanwhile, even though the embodiment describes an input device, in which the operating body 2 can be rocking-operated in the first and second directions that are perpendicular to each other, and the engaging protrusion 11 is moved in the first and second directions by the rocking-operation of the operating body 2, an input device, in which the operating body 2 can be sliding-operated in the first and second directions, can obtain the same effect.

[0039] In addition, even though the embodiment takes a light-detecting mode, in which four photo interrupters 22 detect the moving of the first and second sliders 19

and 20 selectively operated by the engaging protrusion 11, as a detecting unit that detects the moving of the operating body 2 in the first and second directions, it is possible to use the other detecting units such as push switch, magnetic detecting element or the like.

[0040] In the multidirectional input device according to the invention, when the operating body is operated and thus the engaging protrusion is moved in either first or second direction, the guided part located in the moving direction is concavo-convexly engaged with the guide part of the opening; therefore, the position of the engaging protrusion is regulated at the moving end position. In this case, since the other guided parts located in perpendicular directions to the moving direction also come into contact with the inner wall surfaces of the opening, the engaging protrusion is supported by the opening at three outer walls other than the outer wall located at the rear end side of the moving direction; therefore, the position of the operating body or the engaging protrusion can be regulated surely at the moving end position.

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1 or 2, **characterized in that** the guided part (11b) is composed of protruding parts (11b) extending in the first and second directions from the outer walls of the engaging protrusion; the guide part (18a) is composed of recessed parts (18a) extending in the first and second directions from the inner wall surfaces of the opening; and the length between both protruding parts opposite to each other in the first and second directions is set slightly shorter than an opposing distance of both inner wall surfaces.

Claims

1. A multidirectional input device comprising:

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an operating body (2) capable of moving in first and second directions, which are perpendicular to each other;

a guide member (16) having a perforated opening (18) through which an engaging protrusion (11) provided at the operating body (2) is inserted; and

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detecting units (22) that detect the moving of the operating body (2) in the first and second directions,

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characterized in that the engaging protrusion (11) has four outer walls parallel to the first and second directions, respectively, with a guided part (11 b) interposed at the center thereof;

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the opening (18) has four inner walls parallel to the first and second directions respectively with a guiding part (18a) interposed at the center thereof; and the guided part (11b) is concavo-convexly engaged with the guiding part (18a) so that the engaging protrusion (11) is guided in the first and second directions.

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2. The multidirectional input device according to claim 1, **characterized in that** a maximum size of the engaging protrusion (11) including the guided part (11b) and the outer walls along the first and second directions is set slightly shorter than a minimum size of the opening including the guide part and the inner wall surfaces along the first and second directions.

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3. The multidirectional input device according to claim

FIG. 1

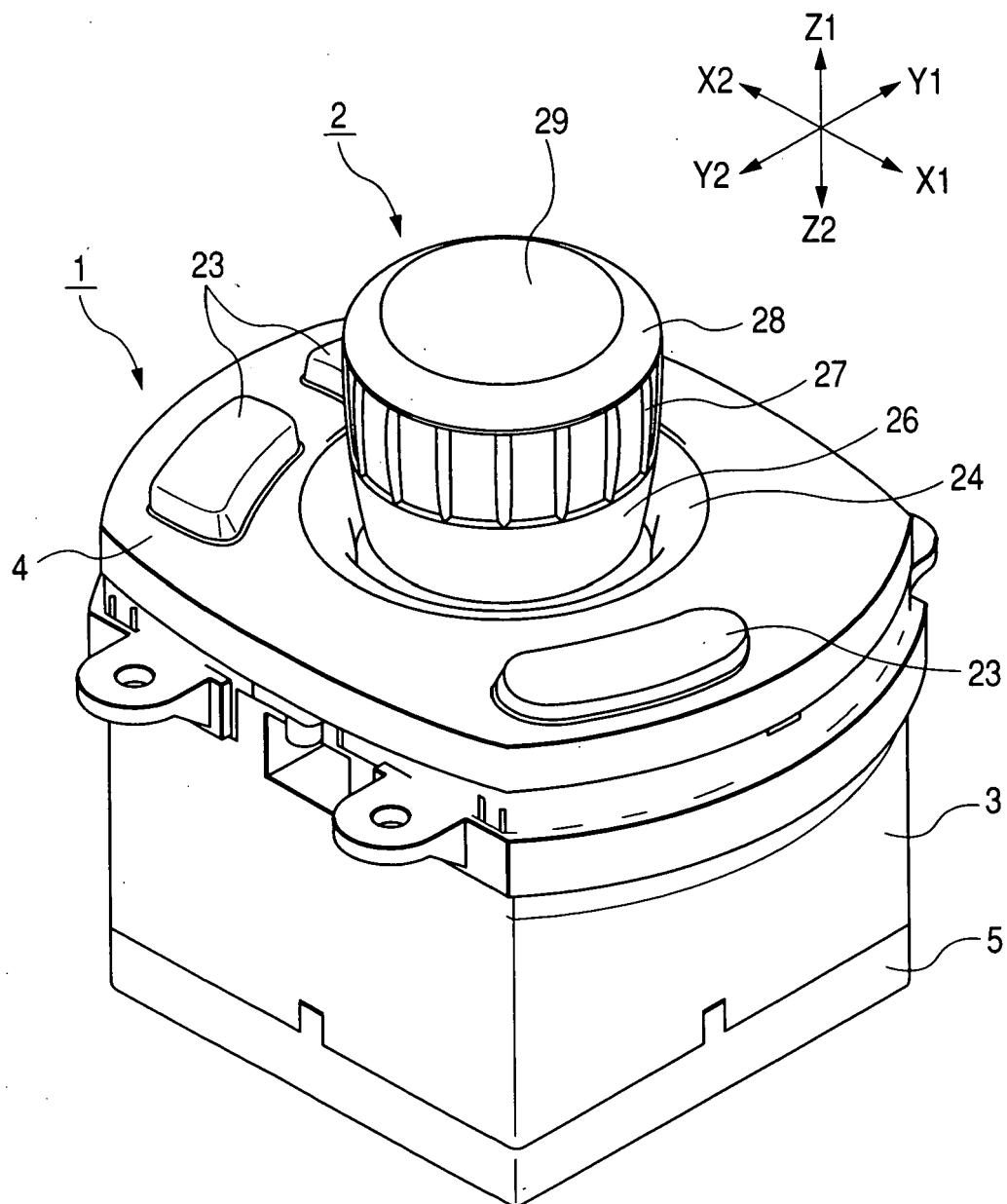


FIG. 2

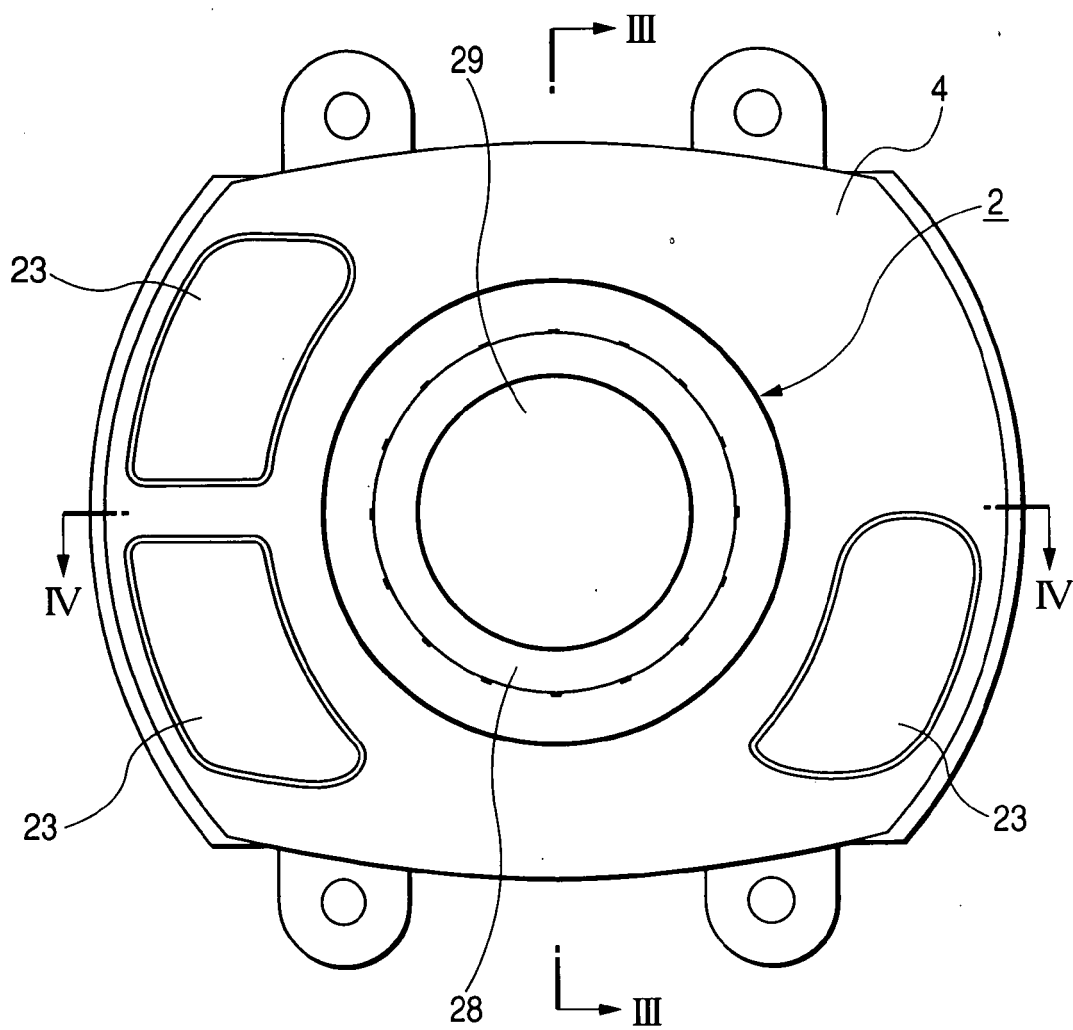


FIG. 3

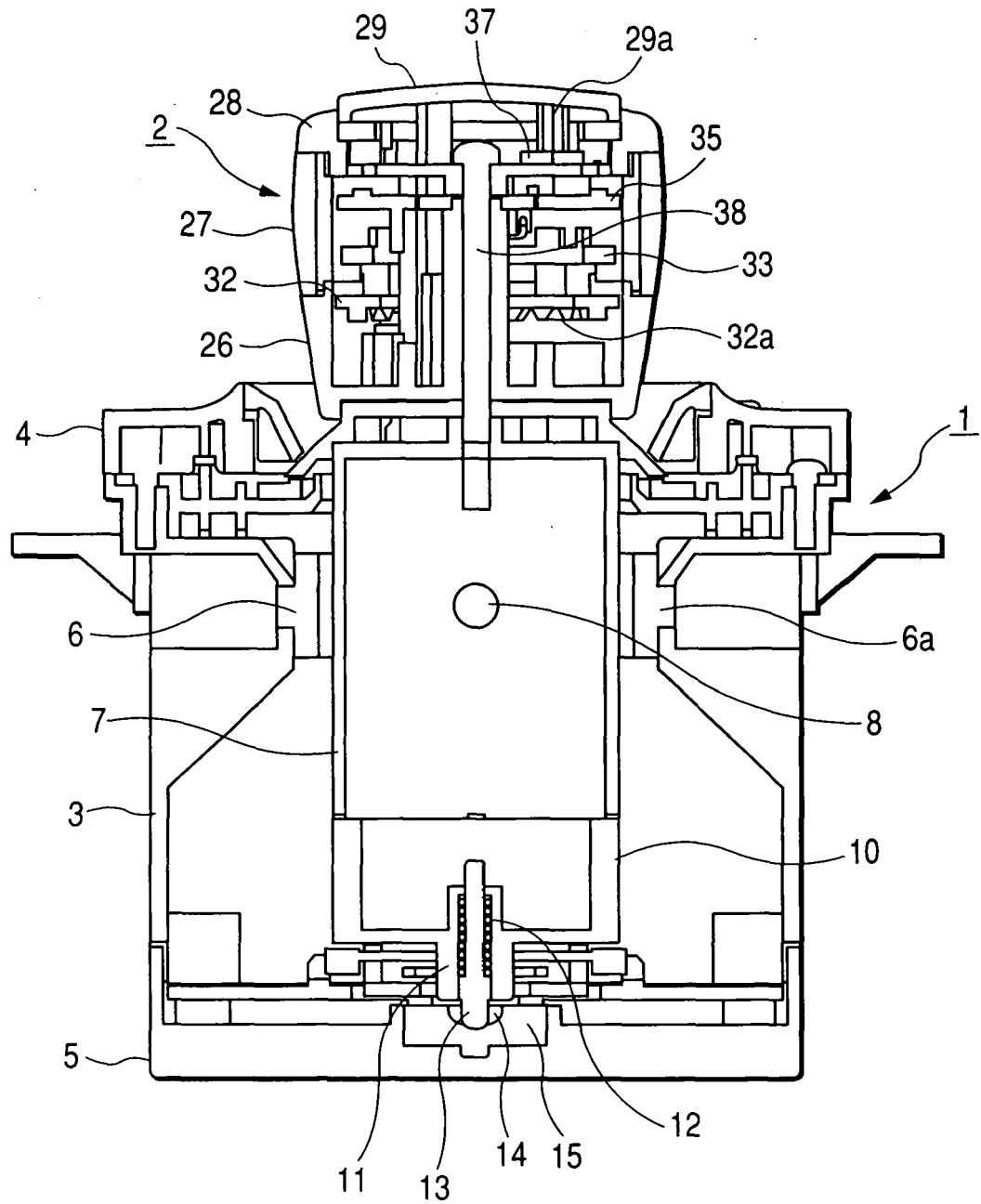


FIG. 4

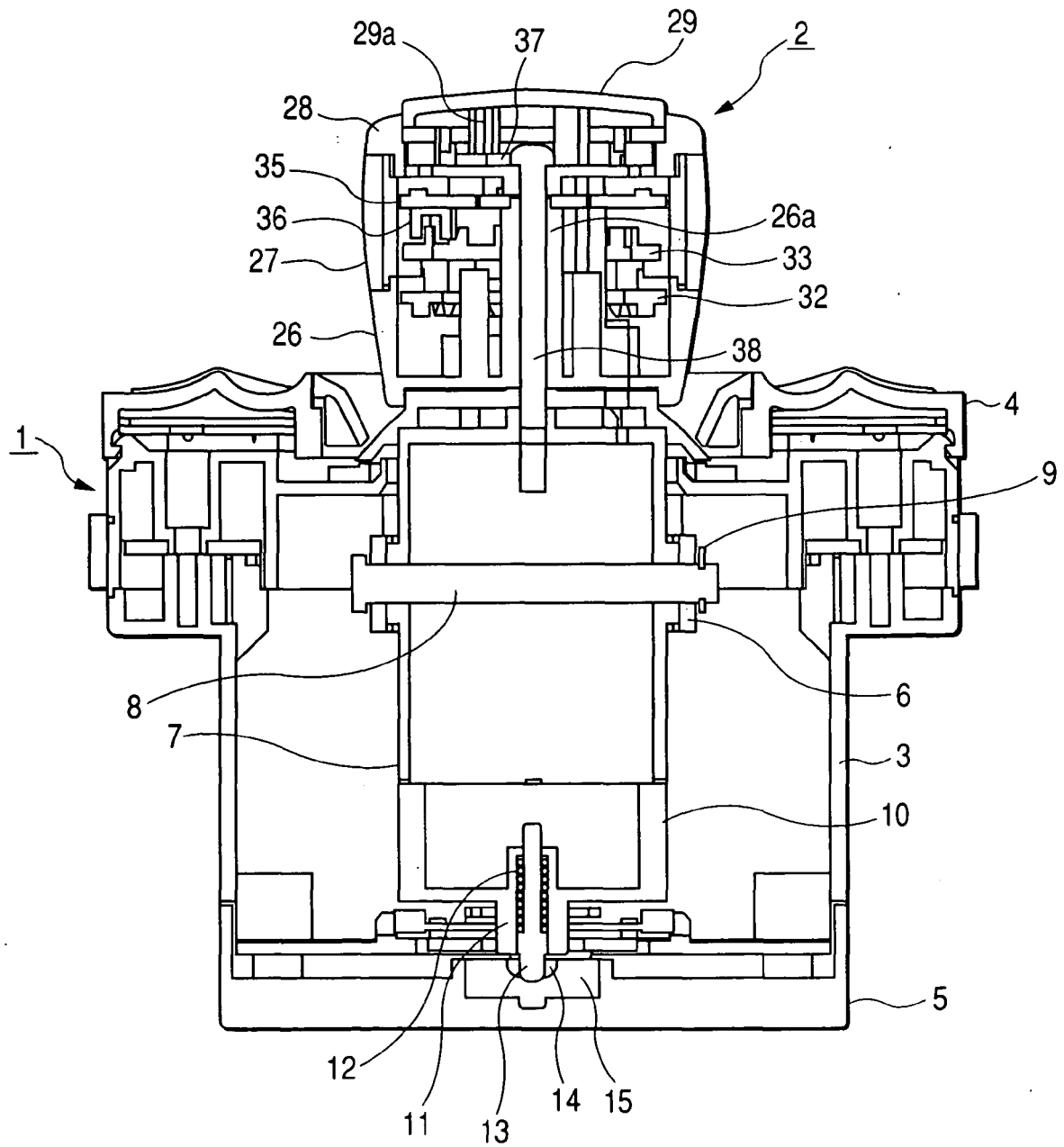


FIG. 5

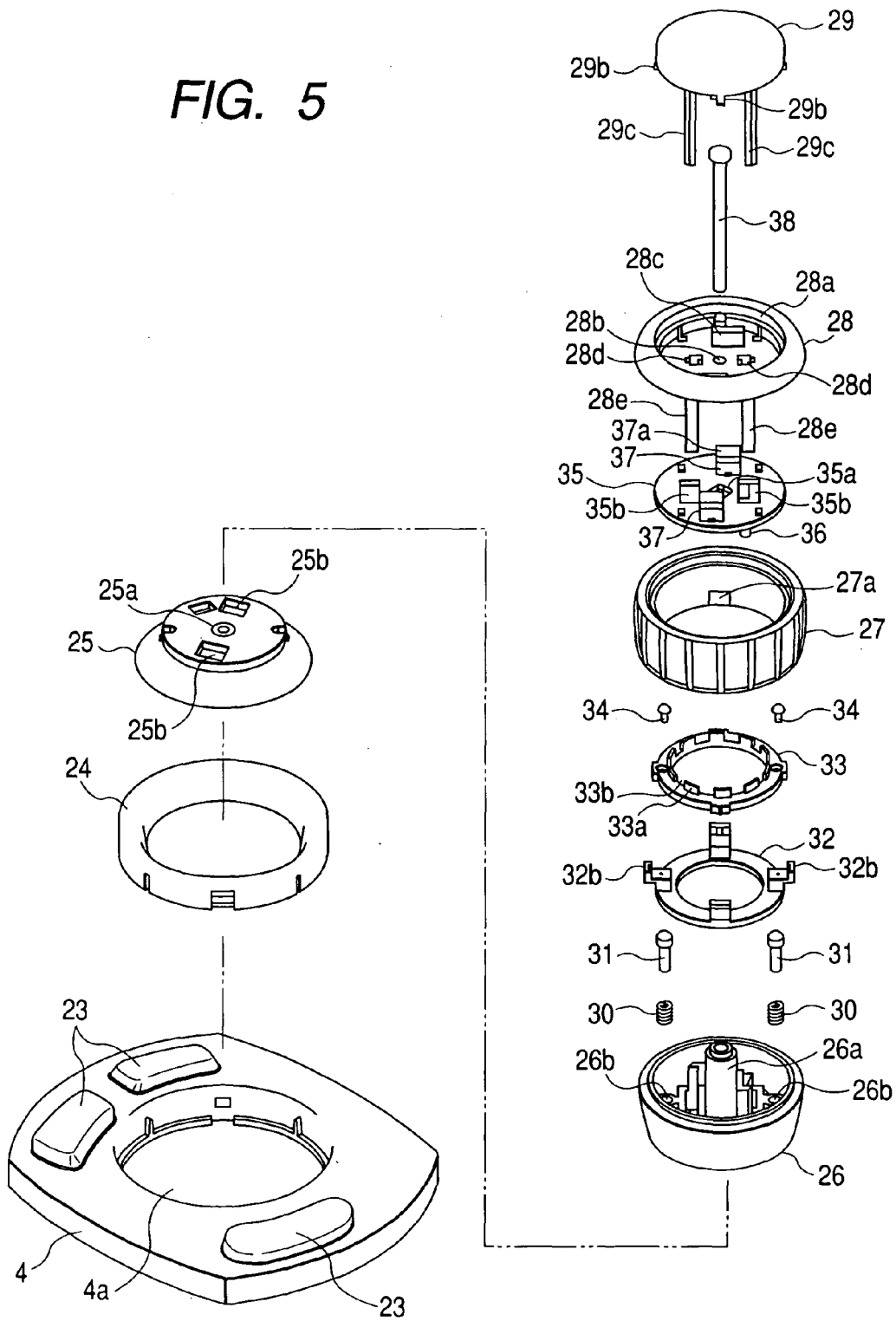


FIG. 6

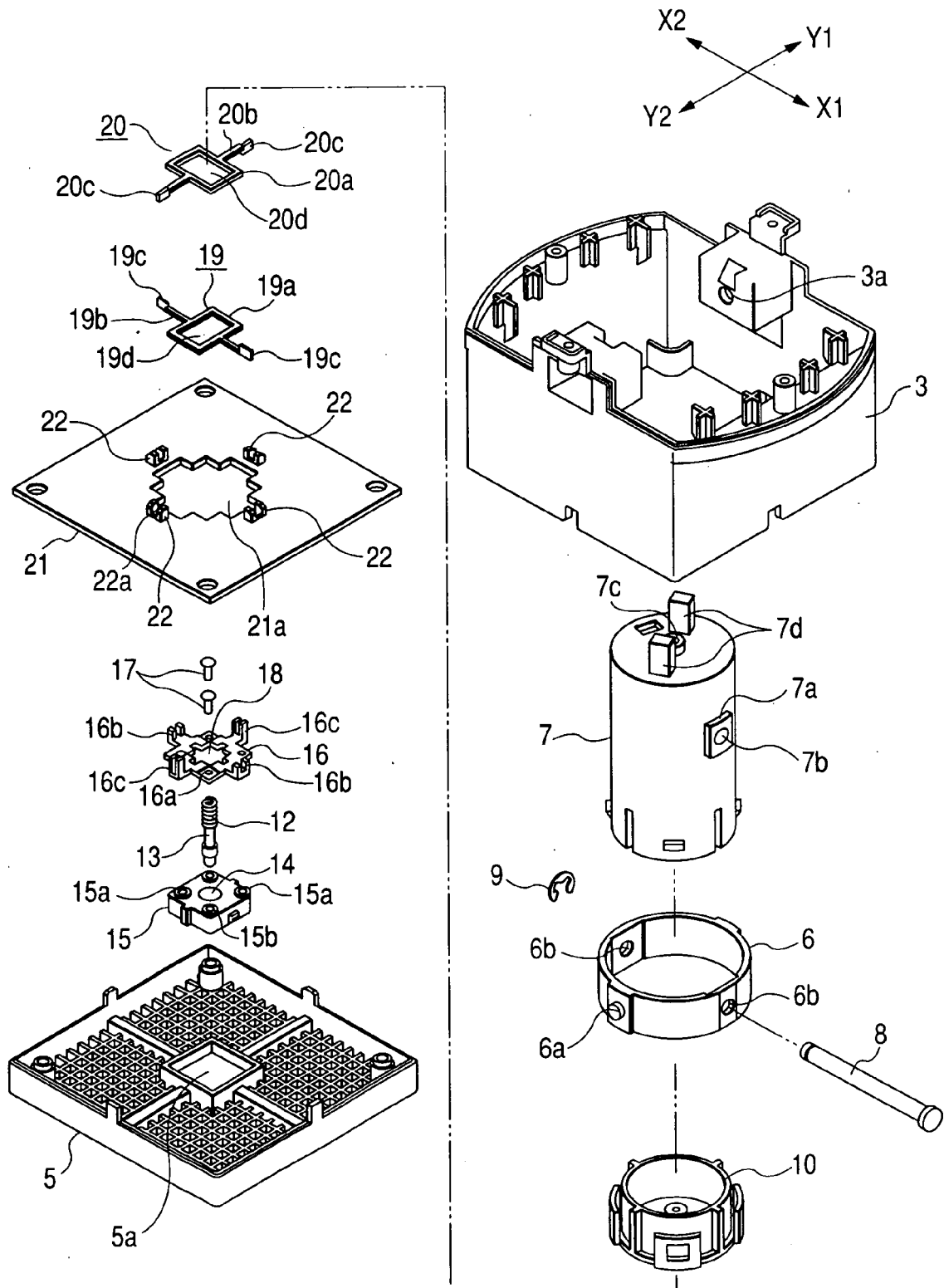


FIG. 8

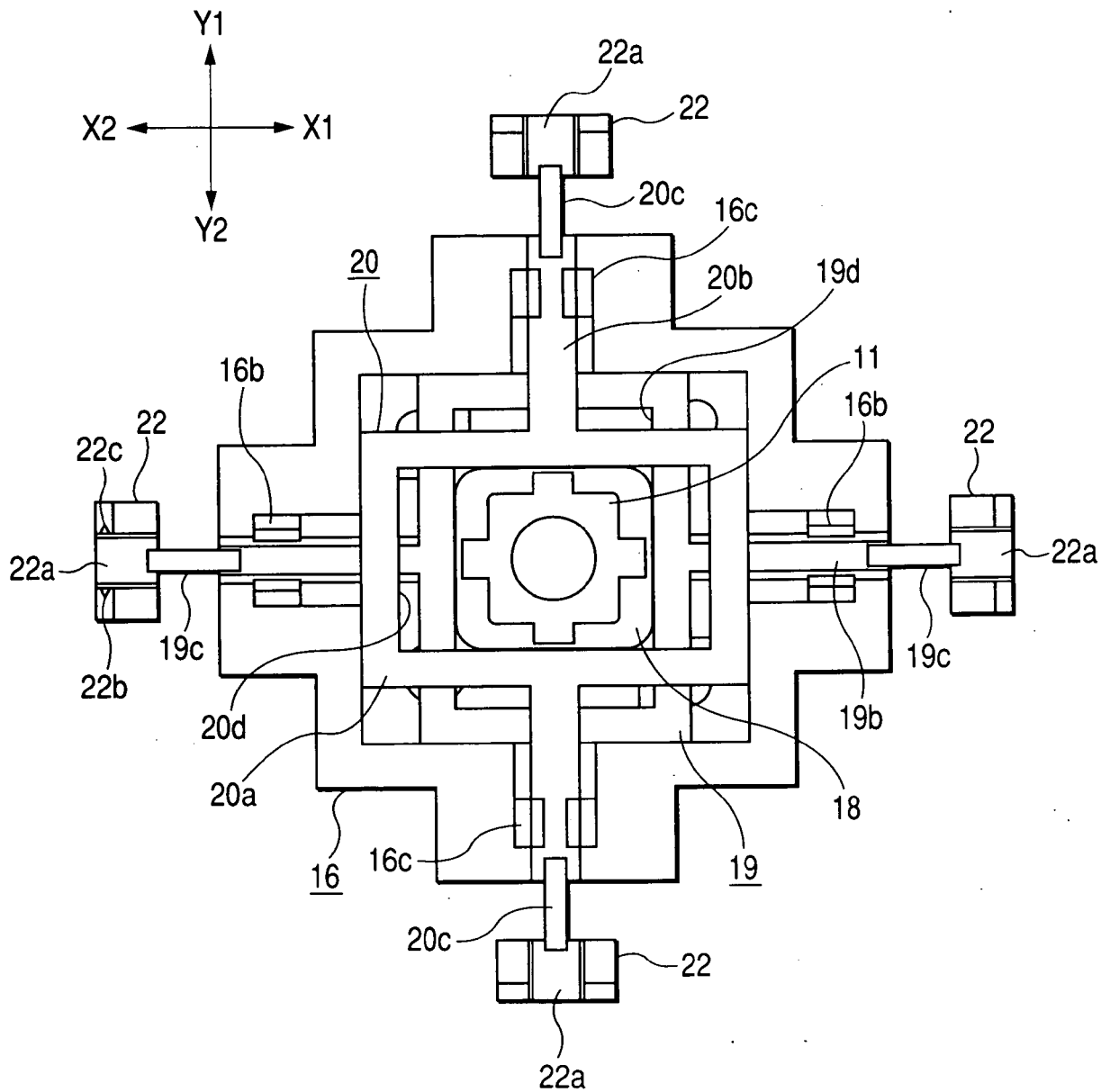


FIG. 9

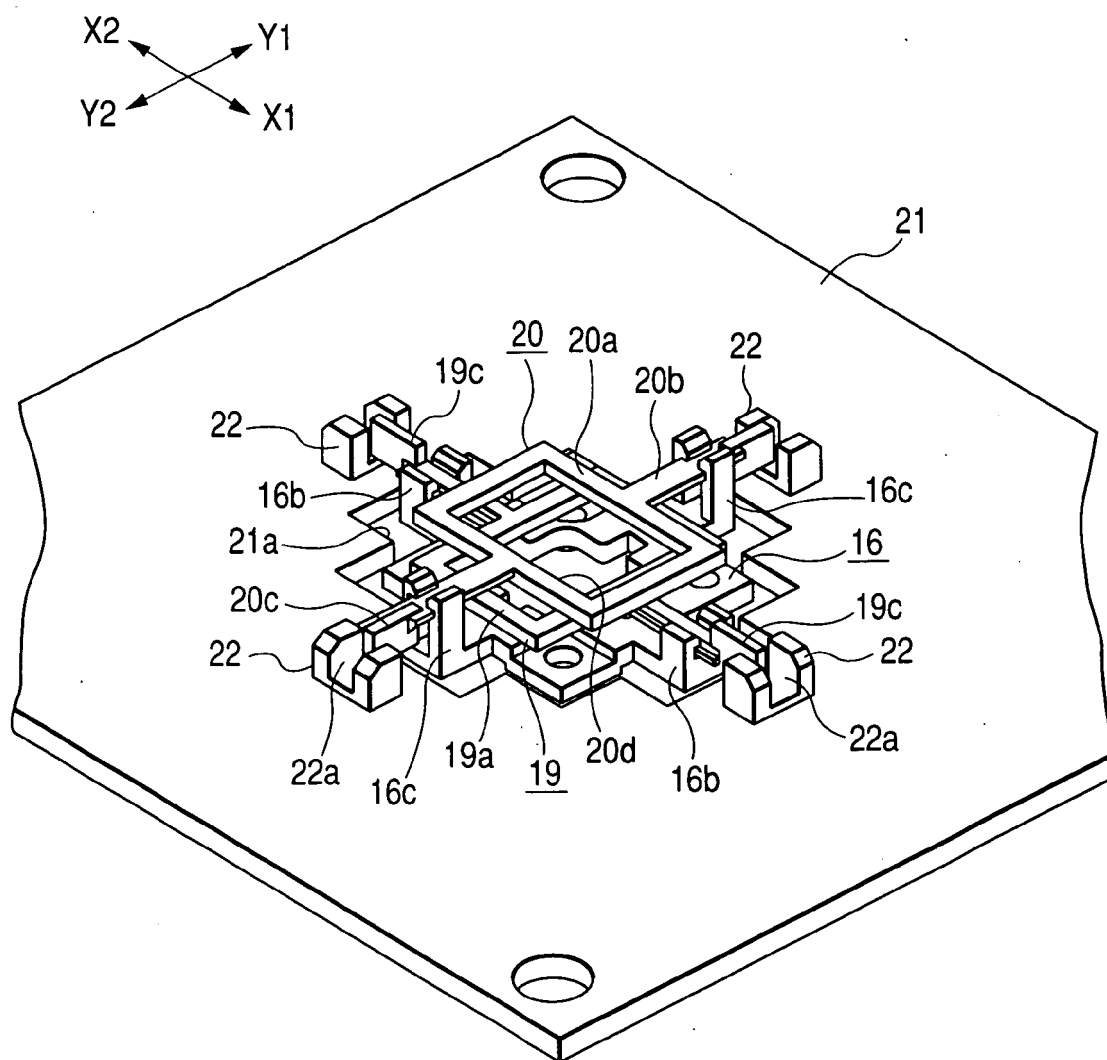


FIG. 10

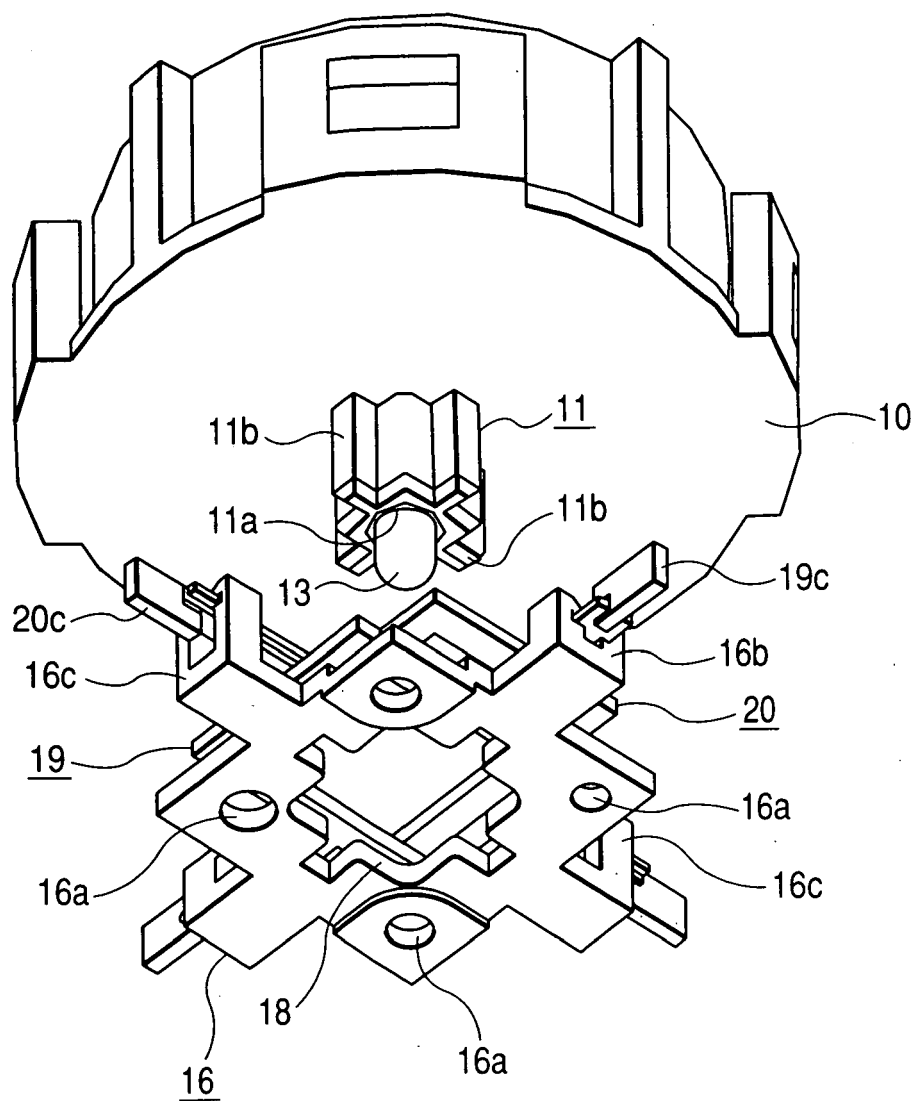


FIG. 11

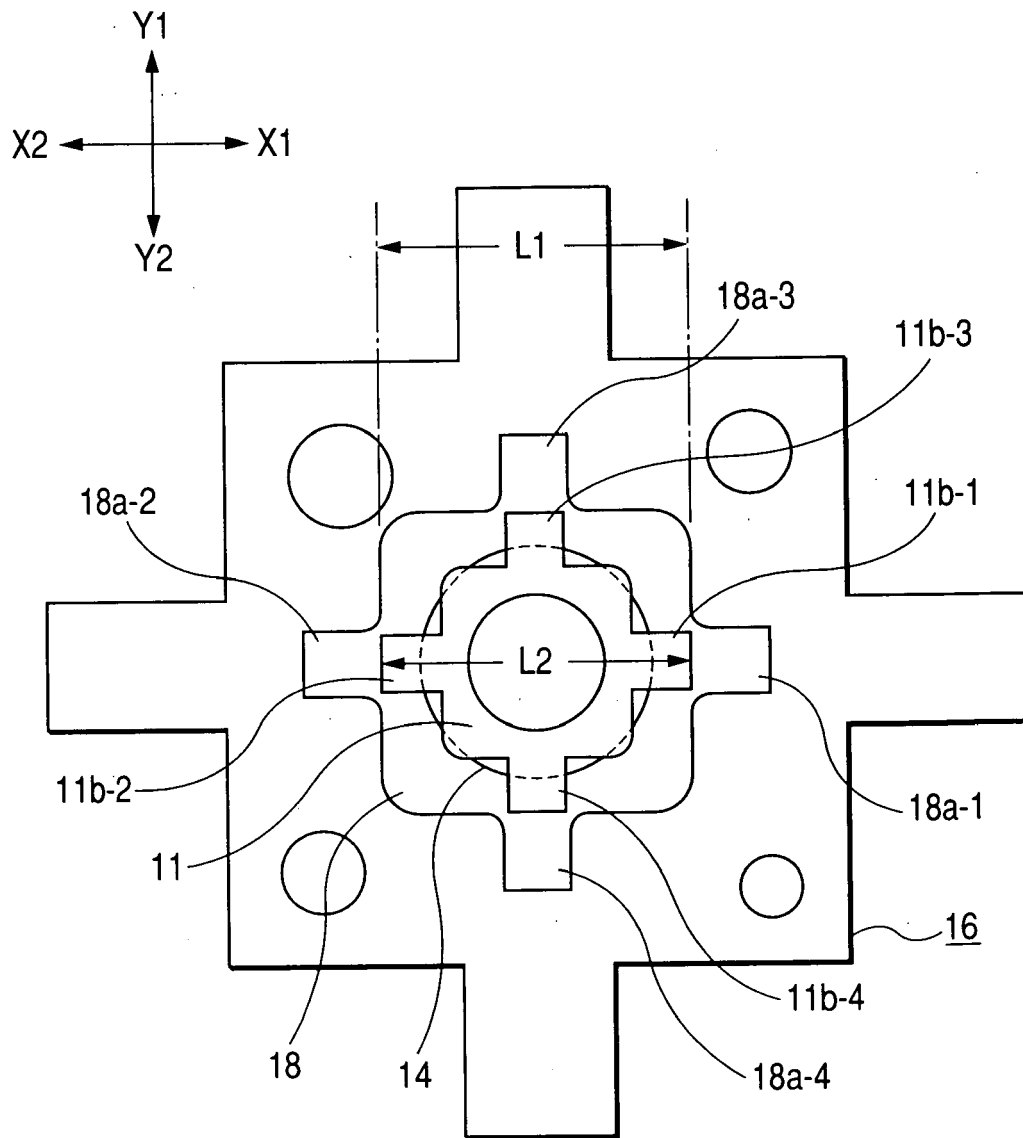


FIG. 12A

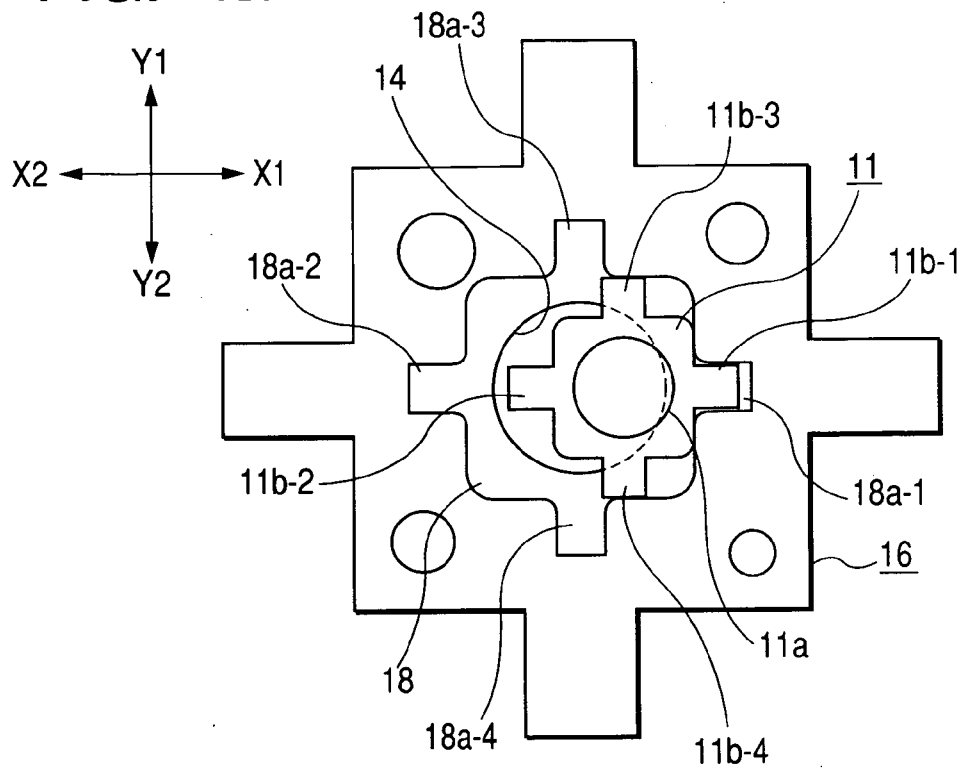


FIG. 12B

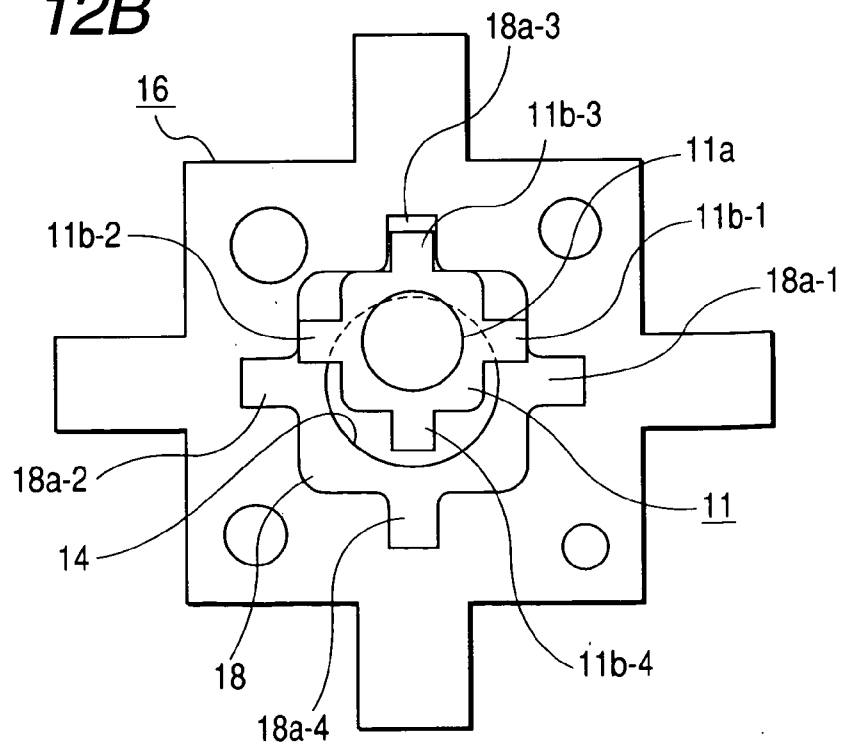
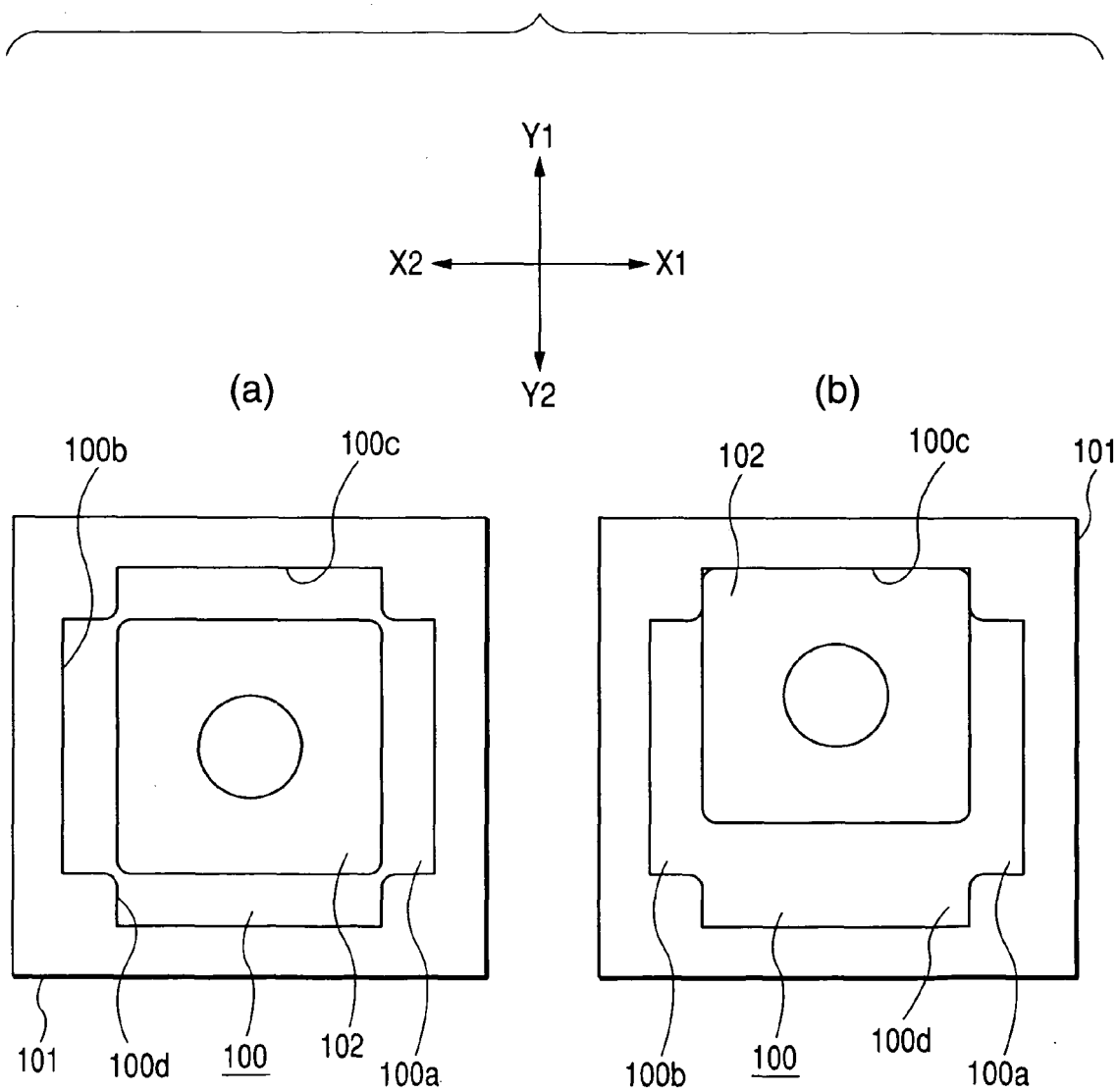


FIG. 13
PRIOR ART





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 198 26 527 A1 (ROBERT BOSCH GMBH) 23 December 1999 (1999-12-23) * abstract; figure 4 *	1-3	INV. H01H25/04 G05G9/047
A	US 6 618 036 B1 (TANAKA ATSUSHI) 9 September 2003 (2003-09-09) * column 3, lines 37-46; figures 1,2 *	1-3	
A	US 6 635 832 B1 (OSTER CHRISTOPH ET AL) 21 October 2003 (2003-10-21) * abstract; figure 1 *	1	
A	US 6 084 189 A (MENCHE ET AL) 4 July 2000 (2000-07-04) * abstract; figure 1 *	1	
A	DE 201 12 469 U1 (LEOPOLD KOSTAL GMBH & CO KG) 18 October 2001 (2001-10-18) * abstract; figure 1 *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			H01H G05G
Place of search		Date of completion of the search	Examiner
Munich		6 July 2006	Simonini, S
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ON EUROPEAN PATENT APPLICATION NO.**

EP 06 00 4628

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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06-07-2006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19826527	A1	23-12-1999	WO 9966521 A2 23-12-1999 EP 1036395 A2 20-09-2000 JP 2003516603 T 13-05-2003
US 6618036	B1	09-09-2003	JP 2001175347 A 29-06-2001
US 6635832	B1	21-10-2003	BR 9906069 A 05-09-2000 DE 19844336 C1 30-09-1999
US 6084189	A	04-07-2000	BR 9903794 A 22-08-2000 DE 19844335 C1 30-09-1999
DE 20112469	U1	18-10-2001	NONE

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 11162299 A [0002]