(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 575 072 A1

# (12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
**14.09.2005 Bulletin 2005/37**

(51) Int Cl.[7]: **H01H 19/02**

(21) Application number: **05004921.2**

(22) Date of filing: **07.03.2005**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
**AL BA HR LV MK YU**

(30) Priority: **08.03.2004 JP 2004064224**

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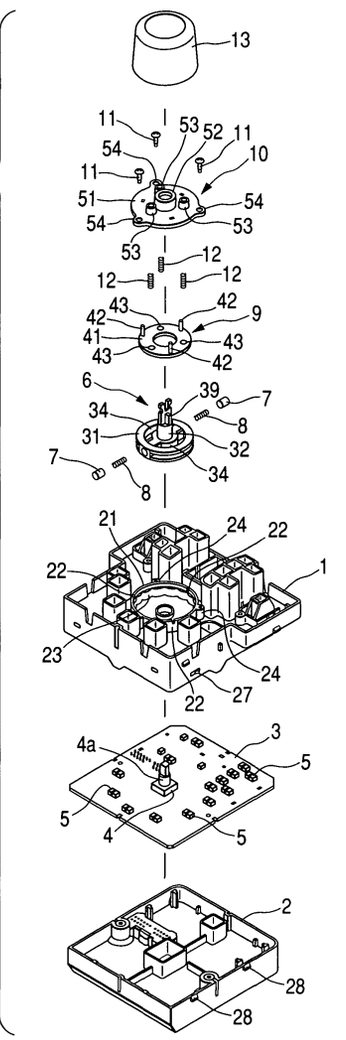
## (54) Rotation operating device

(57) A rotation operating device includes a base, a rotating body supported on the base, a lid member which has a through hole for controlling the center of rotation of the rotating body and is fixed to the base, and engaging portions constructed with combinations of concave grooves which are formed between the base and the lid member and projections which can be fitted into the concave grooves. The engaging portions are radially provided at substantially equal angles in three directions around the center of rotation of the rotating body.

FIG. 1




EP 1 575 072 A1

## Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

**[0001]** The present invention relates to a rotation operating device for operating a rotation operating-type electrical part, such as a rotary switch or a rotary volume, and more particularly to a means for improving the operation feeling of a rotating body and the operability of a rotation operating-type electrical part.

2. Description of the Related Art

**[0002]** Conventionally, there is known an rotation operating-type electrical part which is rotatably provided in a housing and has a rotating body rotating together with a rotating shaft, a fixed plate which is provided in the casing while opposing the rotating body, and an elastic member which applying a friction force between the rotating body and the fixed plate. The rotational operating-type electrical part adjusts the torque generated in the rotating shaft by the friction force between the rotating body and the fixed plate (for example, see Japanese Unexamined Patent Application Publication No. 06-017202).

**[0003]** However, an electrical part in which an operation feeling applying means such as the rotating body, the fixed plate, the elastic member, and so on in the housing as in such a rotational operating-type electrical part is incorporated, has the constraints in size and shape. Also, there is a problem in that it is difficult to realize optimal operation feeling for the applications.

**[0004]** Accordingly, the present inventors, rather than using such a rotational operating-type electrical part, have implemented a general-purpose rotational operating-type electrical part that is not equipped with an operation feeling applying means. Also, the present inventor is developing a rotational operating-type electrical part which provides an operation feeling applying means at the outside thereof to obtain optimal operation feeling for the applications (for example, a vehicle-mounted installing device which is mounted on a luxury model car).

**[0005]** Meanwhile, as a rotation operating device into which an operation feeling applying means is incorporated, as shown in FIG. 15, a device has been suggested, which includes a base 101, a rotating body 102 rotatably supported on the base 101, a lid member 103 fixed to the base 101 and having bearing through-holes 103a for controlling the center of rotation of the rotating body 102, an operation feeling applying means 104 composed of a cam 104a circumferentially provided on the base 101 and an elastic contact member 104b attached to the rotating body 102 and having its end elastically contacting the cam 104a, and screws 105 for fastening the lid member 103 to the base 101.

**[0006]** In order to align a rotating shaft of the rotating body 102 with a rotating shaft set in the base 101 in the rotation operating device having such a construction, the bearing through-hole 103a which is formed in the lid member 103 needs to be aligned exactly with the center of the circumferential surface of the cam 104a. As a means for achieving this purpose, as shown in FIG. 16, a method has been suggested, in which engaging portions 106 constructed with combinations of four concave grooves 106a between the base 101 and the lid member 103 and four projections 106b to be fitted into the concave grooves 106a are formed, and the positioning of the lid member 103 with respect to the base 101 in an X-X direction and a Y-Y direction is performed by fitting the projections 106b into the concave grooves 106a. In order to align the center of the through-hole 103a exactly with the center of the circumferential surface of the cam 104a, the inner width and circumferential arrangement pitch of the concave grooves 106a and the outer width and circumferential arrangement pitch of the projections 106b need to be given with high accuracy.

**[0007]** However, since the base 101 and the lid member 103 are formed with a molded material made of synthetic resin, there is a limit in improving the dimension accuracy, so that errors often occur in the outer width and circumferential arrangement pitch of the projections 106b with respect to the inner width and the circumferential arrangement pitch of the concave grooves 106a. Also, when the errors occur in the circumferential arrangement pitch of the projections 106b with respect to the circumferential arrangement pitch of the concave grooves 106a, in the rotation operating device having a construction as shown in FIG. 16, three pairs of the concave grooves 106a and the projections 106b cannot control a position deviation in relation to the meshing between the other pair of the concave groove 106a and the projection 106b, so that the arrangement position of the through-hole 103a causes the position deviation as much as 1/2 error W in the X-X direction or Y-Y direction, as shown in FIG. 17.

**[0008]** In this way, when a position deviation of 1/2 error W occur in the arrangement position of the through-hole 103a, the rotating shaft of rotating body 102 becomes eccentric or inclined and the positional relationship between the base 101 and the rotational operating-type part becomes deviated from the designed position, so that defects such as the deterioration in the operation feeling and the occurrence of undesirable sound are generated.

**[0009]** The present invention has been made to solve such defects in the related art. It is therefore an object of the present invention to provide a rotation operating device capable of preventing a center deviation of a bearing through-hole even in the presence of a manufacturing error in the width of projections or in the arrangement pitch of the engaging portions provided for positioning a lid member having the bearing through-hole.

## SUMMARY OF THE INVENTION

**[0010]** In order to solve the problems, the present invention provides a rotation operating device comprising a base, a rotating body supported on the base, a lid member which has a through-hole for controlling the center of rotation of the rotating body and is fixed to the base, and engaging portions constructed with combinations of concave grooves formed between the base and the lid member and projections to be fitted into the concave grooves, in which the engaging portion is radially provided in three directions around the center of rotation of the rotating body.

**[0011]** As such, when the engaging portions are radially provided in three directions around the center of rotation of the rotating body, even if error occurs in the pitch at which the concave grooves 22 or the positioning projections 57 are formed, as shown in FIG. 14, the position deviation of the lid member 10 in the X-X direction and the Y-Y direction is controlled by the meshing between the two pairs of the concave grooves 22 and the positioning projections 57 when the other positioning projection is fitted into the other concave groove 22, so that the center deviation (position deviation) of the bearing through-hole can be prevented.

**[0012]** Further, in the rotation operating device of the present invention having the above-mentioned construction, an operation feeling applying means which is constructed with a combination of a cam and a plunger biased to and elastically contacting the cam may be provided between the base and the rotating body.

**[0013]** As such, when the operation feeling applying means, which is constructed with a combination of the cam and the elastic contact member elastically contacting the cam is provided between the base and the rotating body, the size of the operation feeling applying means can be set without any restriction, compared to an operation feeling applying means which is incorporated inside a rotational operating-type electrical part. Therefore, it is easy to output the desired operation feeling randomly, and it is possible to improve the operability of the rotational operating-type electrical part.

**[0014]** Further, in the rotation operating device of the present invention having the above-mentioned construction, three screw holes are equally formed in a circumferential direction of the base, and three screw through-holes are equally formed in a circumferential direction of the lid member.

**[0015]** As such, when three screw holes are equally formed in a circumferential direction of the base, and three screw through-holes are equally formed in a circumferential direction of the lid member, the screw holes and the screw through-holes can be allowed to coincide with each other at all times even though any one of the three concave grooves or three projections formed in the circumferential direction of the lid member is fitted into any one of the three projections or three concave grooves formed in the circumferential direction of the base. Therefore, fastening the lid member to the base can be performed easily, which can make it easy to assemble the rotation operating device.

**[0016]** In the rotation operating device of the present invention, since the engaging portion is radially provided in three directions around the center of rotation of the rotating body, the position deviation of the lid member in the X-X direction and the Y-Y direction is controlled by the meshing between two pairs of the concave grooves and the positioning projections when the other projection is fitted into the other concave groove, even though an error occurs in the pitch at which the concave grooves and the projections are formed, which makes it possible to control the center deviation (the position deviation) of the through-hole. Thus, the eccentricity and the inclination of the rotating shaft of the rotating body are prevented, and the positional relationship between the base and the rotational operating-type electrical part is close to that of the designed ideal position, so that the deterioration of operation feeling and the occurrence of undesirable sound can be prevented.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0017]**

FIG. 1 is an exploded perspective view of a rotating operating device according to an embodiment;
FIG. 2 is a cross-sectional view of an assembled rotation operating device according to the embodiment;
FIG. 3 is a plan view of a base according to the embodiment;
FIG. 4 is a front view of a rotating body according to the embodiment;
FIG. 5 is a sectional view taken along the line A-A in FIG. 4;
FIG. 6 is a plan view of the rotating body according to the embodiment;
FIG. 7 is a bottom view of the rotating body according to the embodiment;
FIG. 8 is a front view of a frictional resistance applying member according to the embodiment;
FIG. 9 is a plan view of the frictional resistance applying member according to the embodiment;
FIG. 10 is a bottom view of the frictional resistance applying member according to the embodiment;
FIG. 11 is a plan view of a lid member according to the embodiment;
FIG. 12 is a sectional view taken along the line B-B in FIG. 11;
FIG. 13 is a bottom view of the lid member according to the embodiment;
FIG. 14 is a schematic view illustrating effects of the rotation operating device according to the embodiment;
FIG. 15 is an exploded perspective view of a rotation operating device according to a conventional

example;

FIG. 16 is a schematic view illustrating a positioning means of a lid member in the rotation operating device according to the conventional example; and

FIG. 17 is a schematic view illustrating defects of the rotation operating device according to the conventional example.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

**[0018]** Hereinafter, preferred embodiments of the rotation operating device relating to the present invention will now be described with reference to FIGS. 1 to 14. FIG. 1 is an exploded perspective view of an rotation operating device according to an embodiment, FIG. 2 is a cross-sectional view of an assembled rotation operating device according to the embodiment, FIG. 3 is a plan view of a base according to the embodiment, FIG. 4 is a front view of a rotating body according to the embodiment, FIG. 5 is a sectional view taken along the line A-A in FIG. 4, FIG. 6 is a plan view of the rotating body according to the embodiment, FIG. 7 is a bottom view of the rotating body according to the embodiment, FIG. 8 is a front view of a frictional resistance applying member according to the embodiment, FIG. 9 is a plan view of the frictional resistance applying member according to the embodiment, FIG. 10 is a bottom view of the frictional resistance applying member according to the embodiment, FIG. 11 is a plan view of a lid member according to the embodiment, FIG. 12 is a sectional view taken along the line B-B in FIG. 11, FIG. 13 is a bottom view of the lid member according to the embodiment, and FIG. 14 is a schematic view illustrating effects of the rotation operating device according to the embodiment.

**[0019]** As shown in FIG. 1 and FIG. 2, a rotation operating device of the present embodiment is mainly composed of a base 1, a lower case 2 joined to a lower portion of the base 1, a wiring board 3 provided in a space which is defined by joining the base 1 to the lower case 2, a rotational operating-type electrical part 4 and other electrical parts 5 which are mounted on the wiring board 3, a rotating body 6 which is rotatably supported on the base 1 to rotationally drive a rotating shaft 4a of the rotational operating-type electrical part 4, plungers 7 which are attached to the rotating body 6 and impart a click feeling in operating the rotating body 6, first elastic members 8 which always bias the plungers 7 outwardly, a frictional resistance applying member 9 which applying a frictional resistance required for rotation of the rotating body 6, a lid member 10 which is fastened to the base 1, screws 11 for fastening the lid member 10 to the base 1, second elastic members 12 which are stretched between the frictional resistance applying member 9 and the lid member 10 to impart a pressing force to the frictional resistance applying member 9, and a knob 13 which is attached to the rotating body 6.

**[0020]** Among the respective members, the base 1, the lower case 2, the rotating body 6, the driving rod 7, the frictional resistance applying member 9, the lid member 10 and the knob 13 are formed with a molded material made of synthetic resin.

**[0021]** As shown in FIGS 1 to 3, the base 1 is formed in a box shape with no bottom surface and has a tubular portion 21 on the top surface of its center portion. Three concave grooves 22 for positioning of the lid member 10 are formed at a pitch of 120 degrees (at substantially equal angles) on the top surface of the tubular portion 21. Also, a cam 23 for imparting click feeling is formed in the inner surface of the tubular portion 21, which is formed by equally arranging a plurality (16 pieces in an example shown in FIG. 2) of cam robes 23a and cam grooves 23b having a circular shape in plan view. Further, three cylindrical bosses 24 are formed at a pitch of 120 degrees between the respective concave grooves 22 at an outer circumferential portion of the tubular portion 21, at the center of which screw holes 25 for fastening the lid member 10 are formed. Further, a rotating body holding projection 26 for rotatably holding the rotating body 6 is formed concentrically with the tubular portion 21, at an inner circumferential portion of the tubular portion 21. Furthermore, engagement holes 27 for snapping the lower case 2 are formed at the lower periphery of the base 1.

**[0022]** The lower case 2 is formed in a shape of a lid adhered to the bottom surface of the base 1, and engagement claws 28 for engaging the lower case 2 to the base 1 are formed in portions corresponding to the engagement holes 27 formed in the base 1. The lower case 2 is snapped to the base 1 by engaging the engagement claws 28 formed in the lower case 2 to the corresponding engagement holes 27 formed in the base 1.

**[0023]** In the wiring board 3, a required wiring pattern (not shown) is formed and the rotational operating-type electrical part 4 and other electrical parts 5 are mounted in a required arrangement. The wiring board 3 is attached to the base 1 with screws (not shown), etc. As the rotational operating-type electrical part 4, any rotational operating-type electrical part, such as a rotary switch or rotary volume, can be used.

**[0024]** As shown FIG. 1, FIG. 2, FIG. 4, and FIG. 7, the rotating body 6 is composed of a disc-shaped flange 31 which can be accommodated in the tubular portion 21 formed in the base 1 and a shank 32 which stands upright from the center portion of the flange 31. In a circumferential surface of the flange 31, two accommodating holes 33 for the driving rods 7 and the first elastic members 8 are formed opposite to each other with respect to the center of the shank 32. The first elastic member 8 and the driving rod 7 are accommodated within each accommodating hole 33 in this order, to always bias the driving rod 7 outwardly by an elastic force of the first elastic member 8.

**[0025]** On the top surface of the flange 31, arcuate concave grooves 34 are formed opposite to each other around the outer circumference of the shank 32, and ring-shaped inner circumferential portion 35a, outer cir-

cumferential portion 35b, and connecting portions 35c which connect the inner circumferential portion 35a to the outer circumferential portion 35b, excluding portions in which the concave grooves 34 are formed, make a contact portion of the frictional resistance applying member 9. Further, on the bottom surface of the flange 31, an inner circumferential rib 36a, and an outer circumferential rib 36b, and a radial rib 36c connecting the inner circumferential rib 36a to the outer circumferential rib 36b are formed around the outer circumference of the shank 32. A ring-shaped concave groove 37 for inserting the rotating body holding projection 26 formed in the base 1 is formed between the shank 32 and the inner circumferential rib 36a.

**[0026]** On the other hand, a concave portion 38 for inserting the rotating shaft 4a of the rotational operating-type electrical part 4 is formed on the bottom surface of the shank 32, and a D-shaped connecting hole 38a for connecting the rotating shaft 4a of the rotational operating-type electrical part 4 so that the rotating shaft 4a cannot idle is formed in the concave portion 38. Also, a cross-shaped rib 39 for connecting the knob 13 so that the knob 13 cannot idle is formed at an upper end of the shank 32.

**[0027]** As shown in FIG. 8 to FIG. 10, the frictional resistance applying member 9 is composed of a donut-shaped friction plate 41 and three latching members 42 which stand upright at a pitch of 120 degrees (at substantially equal angles) from the top surface of the friction plate 41. On the top surface of the friction plate 41, three dents 43 for inserting a lower end of the second elastic member 12 are formed at a pitch of 120 degrees between the latching members 42, and on the bottom surface of the friction plate 41, an inner circumferential rib 44a and an outer circumferential rib 44b, which abut on the planar inner circumferential portion 35a and the planar outer circumferential portion 35b formed on the top surface of the flange 31, are formed in a ring shape together with a radial rib 44c connecting the inner circumferential rib 44a to the outer circumferential rib 44b. Also, latching claws 45 for connecting the frictional resistance applying member 9 to the lid member 10 are formed on an outer surface of an upper end of the latching members 42.

**[0028]** As shown FIGS. 11 to 13, the lid member 10 is composed of a disc-like main body 51, a rotating body holding portion 52 which is swelled upward from the center portion of the main body 51, three spring inserting portions 53 which are swelled at a pitch of 120 degrees (at substantially equal angles) upward from the outer circumferential portion of the rotating body holding portion 52 in the main body 51, three bosses 54 which project at a pitch of 120 degrees outwardly from the outermost circumferential portion of the main body 51, screw through-holes 55 which are formed at the center portion of the bosses 54, three frictional resistance applying member mounting holes 56 which are formed at a pitch of 120 degrees between spring inserting portions 53 in the main body 51, and three positioning projections 57 which project downward at a pitch of 120 degrees between the bosses 54 on the bottom surface of the outermost circumferential portion of the main body 51.

**[0029]** At the center portion of the rotating body holding portion 52, a through-hole 61 for allowing the shank 32 of the rotating body 6 to pass therethrough is formed. The through-hole 61 is a hole for controlling the installing position of the shank 32 with respect to the base 1, so that a required dimension, in which an excessive gap does not occur between the through-hole 61 and the shank 32, is secured, without inhibiting the shank 32 from rotating.

**[0030]** The spring inserting portions 53 are formed in a position opposing the three dents 43 formed in the top surface of the friction plate 41, and the screw through-holes 55 are formed at positions opposing the screw holes 25 formed in the base 1. Also, the frictional resistance applying member mounting holes 56 are formed at positions opposing the three latching members 42 which stand upright from the top surface of the friction plate 41, and the positioning projections 57 are formed at positions opposing the concave grooves 22 formed in the tubular portion 21 of the base 1.

**[0031]** The second elastic members 12 are stretched between three dents 43, which are formed on the top surface of the friction plate 41, and the inserting portions 53, to apply a required pressing force to the frictional resistance applying member 9.

**[0032]** The knob 13 is a part for allowing a user to operate the rotational operating-type electrical part 4 and is formed with a size and a shape enough to be rotatably operated by the user's fingers.

**[0033]** Hereinafter, a method of assembling the rotation operating device according to the present embodiment will now be described.

**[0034]** First, the first elastic member 8 and driving rod 7 are accommodated in this order within each of the accommodating holes 33 which are formed in the flange 31 of the rotating body 6, and then the rotating body 6, the driving rod 7, and the first elastic member 8 are assembled.

**[0035]** Next, the flange 31 of the rotating body 6, which is integrally assembled with the driving rod 7 and the first elastic member 8, is inserted into the tubular portion 21 formed in the base 1, and the tubular rotating body holding projection 26 formed at the inner circumferential portion of the tubular portion 21 is inserted into the ring-shaped concave groove 37 formed on the lower surface of the rotating body 6. As a result, the rotating body 6 is stably held in the base 1, and two ends of the driving rods 7 respectively abut on the cam 23 formed in the inner surface of the tabular portion 21.

**[0036]** To keep pace with the above-mentioned process, the friction resistance applying member 9, the lid member 10, and the second elastic members 12 are assembled together. When these respective members are assembled, first, the second elastic members 12 are in-

stalled in the three dents 43 formed in the top surface of the friction plate 41, and then the respective portions of the second elastic members 12 are inserted into the spring inserting portions 53 formed in the lid member 10. Next, in a state in which three latching members 42 which stand upright from the top surface of the friction plate 41 are respectively inserted into the three frictional resistance applying member mounting holes 56 which are formed in the main body 51 of the lid member 10, the lid member 10 is pushed down toward the friction plate 41 of the frictional resistance applying member 9, against an elastic force of the second elastic members 12. In this moment, the latching members 42 are elastically deformed inward by the pressing force of the lid member 10, which makes it possible to insert the latching claws 45 into the frictional resistance applying member mounting holes 56. When the latching claws 45 reach the positions higher than the top surface of the lid member 10, the latching claws 45 moves outward by the elastic force of the latching members 42. Accordingly, when the pressing force applied to the lid member 10 is released in the above state, the lid member 10 ascends by the elastic force of the second elastic member 12, to allow the latching claws 45 to engage the top surface of the lid member 10. As a result, assembling the frictional resistance applying member 9, the lid member 10, and the second elastic member 12 is finished.

**[0037]** Next, the shank 32 of the rotating body 6 passes through the through-hole 61 which is formed in the lid member 10, and the friction plate 41 of the frictional resistance applying member 9 concentrically overlaps the top surface of the flange 31 of the rotating body 6. In this moment, the positioning projections 57 formed on the bottom surface of the lid member 10 is automatically fitted into the concave grooves 22 formed in the tubular portion 21 of the base 1, so that the center of through-hole 61 automatically coincides with the center of tubular portion 21. Furthermore, centering the rotating body 6 with respect to the cam 23 is automatically performed, and the positions of the screw holes 25 formed in the base 1 with respect to the screw through-holes 55 formed in the lid member 10 are automatically adjusted. Therefore, the screws 11 passing through the screw through-holes 55 from the upside are screwed to the screw holes 25, and the lid member 10 is fastened to the tubular portion 21 of the base 1.

**[0038]** Next, the knob 13 is attached to the upper end of the shank 32 which projects upward from the top surface of the lid member 10. Also, the rotating shaft 4a of the rotational operating-type electrical part is inserted into the concave portion 38 formed in the bottom surface of the rotating body 6, the rotating shaft 4a and the shank 32 of the rotating body 6 are coaxially connected to each other, and then the wiring board 3 is fixed to the base 1. Finally, the engagement claws 28 formed in the lower case 2 engages the engagement holes 27 formed in the base 1, so that the lower case 2 is snapped to the base 1.

**[0039]** The rotation operating device according to the present embodiment has following effects.

(1) As shown in FIG. 14, the engaging portions constructed with the concave grooves 22 and the positioning projections 57 are radially provided at substantially equal angles in three directions around the center of rotation of the rotating body 6. Even if an error occurs in a pitch at which the concave grooves 22 and the positioning projections 57 are formed, a position deviation in the X-X direction and the Y-Y direction of the lid member 10 is controlled by the meshing between two pairs of the concave grooves 22 and the positioning projections 57 when the other concave groove 22 is fitted into the other positioning projection, so that a (position deviation) of the through-hole 61 can be prevented. Accordingly, the eccentricity and the inclination of the rotating shaft of the rotating body are prevented, and the positional relationship between the base and the rotational operating-type electrical part is close to that of the designed ideal position, so that the deterioration of operation feeling and the occurrence of undesirable sound can be prevented.

(2) Since the operation feeling applying means, which is constructed with a combination of the cam 23 and the elastic contact members (the driving rod 7 and the first elastic member 8) elastically contacting the cam 23 between the base 1 and the rotating body 6, is provided, the size of operation feeling applying means can be set without any restriction, compared to operation feeling applying means which is assembled inside the rotational operating-type electrical part 4. Therefore, it is possible to output the desired operation feeling randomly and to improve the operability of the rotational operating-type electrical part.

(3) Since the three screw holes 25 are equally formed in the circumferential direction of the base 1 and the three screw through-holes 55 are equally formed in the circumferential direction of the lid member 10, the screw holes 25 and the screw through-holes 55 can be allowed to coincide with each other at all times even though any one of the three projections 22 formed in the circumferential direction of the base 1 is fitted into any one of the three positioning projections 57 formed in the circumferential direction of the lid member 10. Therefore, fastening the lid member 10 to the base 1 can be performed easily, which can make it easy to assemble the rotation operating device.

## Claims

**1.** A rotation operating device comprising:

a base (1);
a rotating body (6) supported on the base (1);

a lid member (10) which has a through hole (61) for controlling the center of rotation of the rotating body (6) and is fixed to the base (1); and
engaging portions (22, 57) constructed with combinations of concave grooves (22) which are formed between the base (1) and the lid member (10) and projections (57) to be fitted into the concave grooves (22),

wherein the engaging portions (22, 57) are radially provided at substantially equal angles in three directions around the center of rotation of the rotating body (6).

**2.** The rotation operating device according to claim 1, wherein operation feeling applying means is provided between the base (1) and the rotating body (6), which is constructed with a combination of a cam (23) and a plunger (7) biased to the cam (23).

**3.** The rotation operating device according to claim 1 or 2, wherein three screw holes (25) are equally formed in a circumferential direction of the base (1) and three screw through-holes (55) are equally formed in a circumferential direction of the lid member (10).

FIG. 1

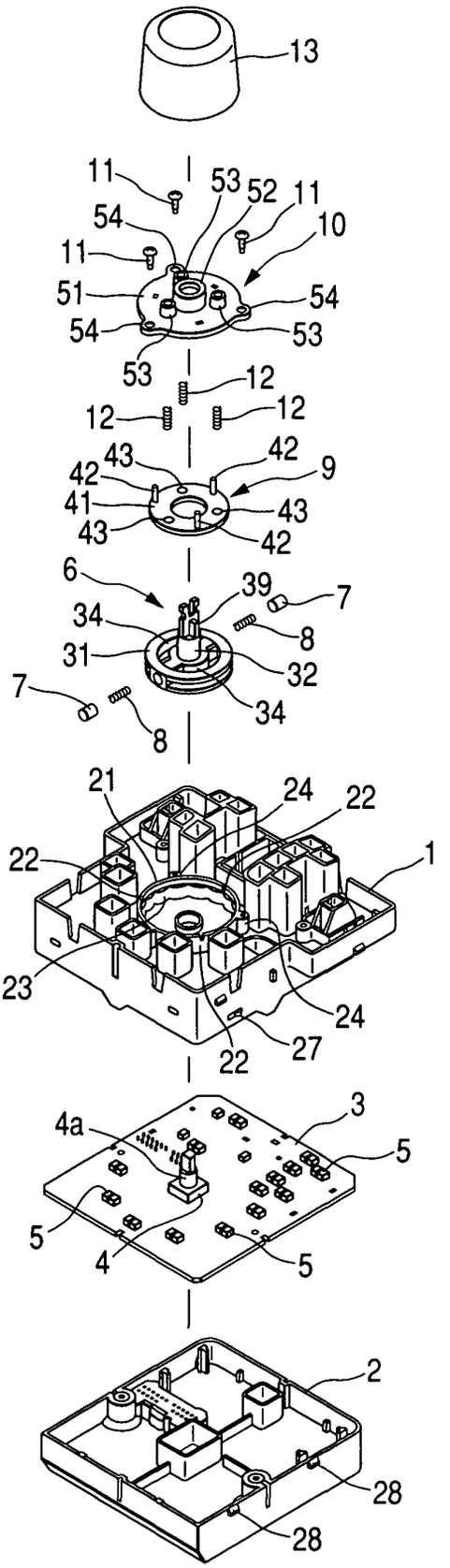

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FIG. 2

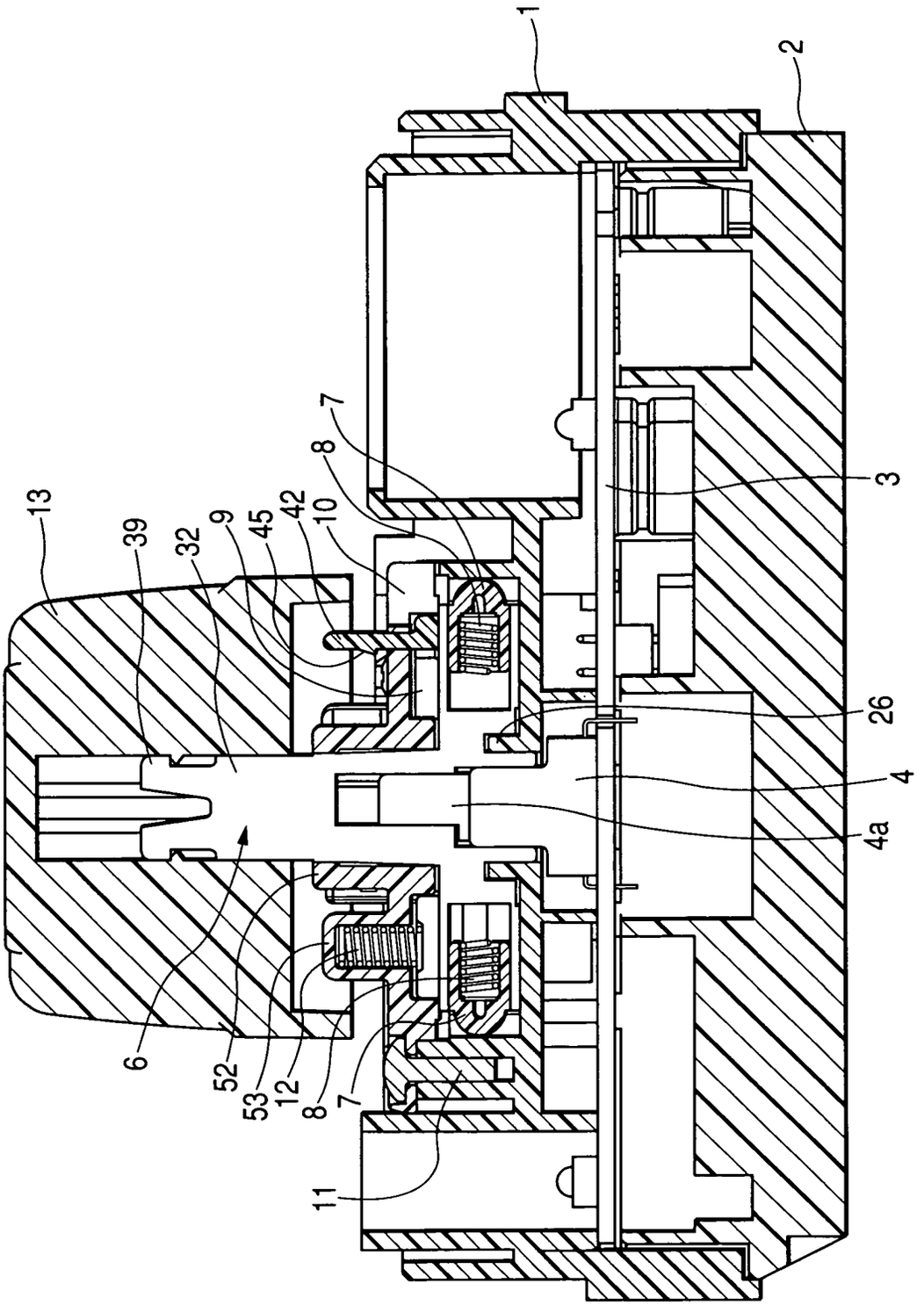

FIG. 3

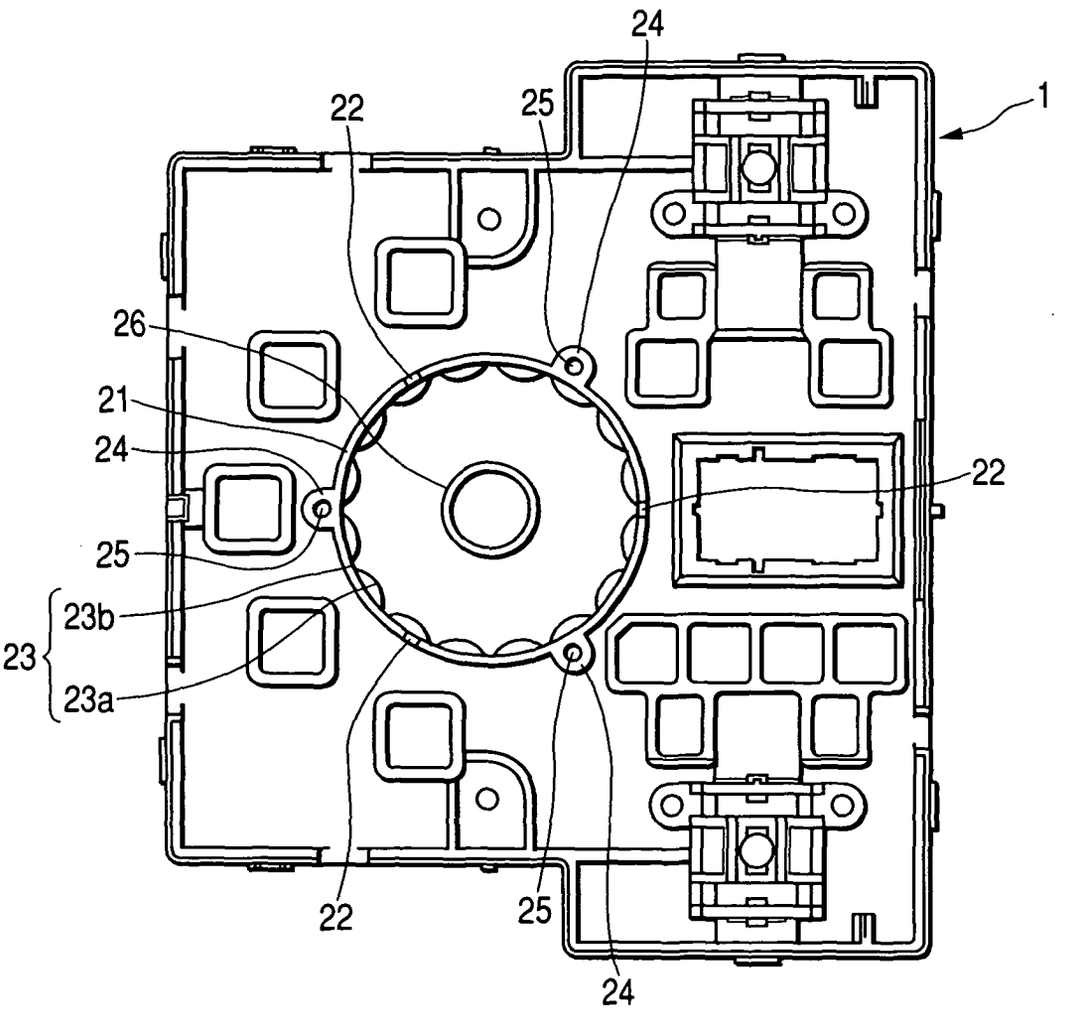

FIG. 4

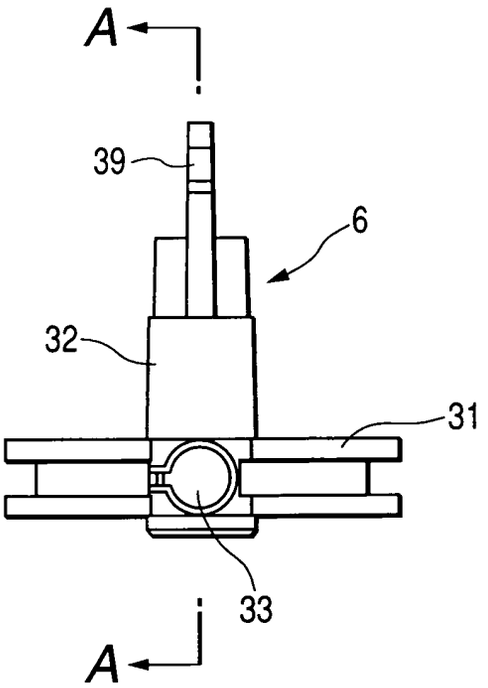


FIG. 5

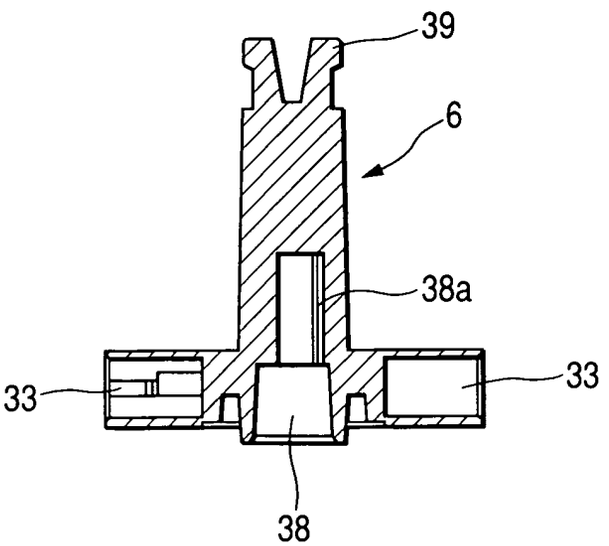

FIG. 6

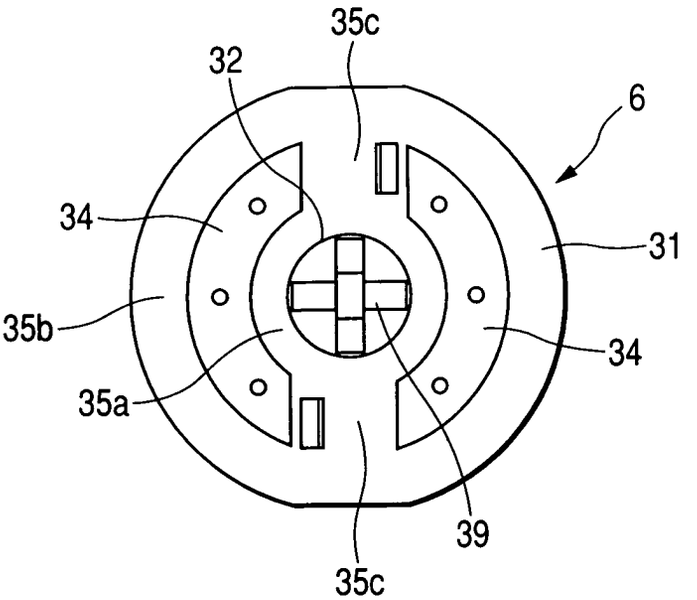


FIG. 7

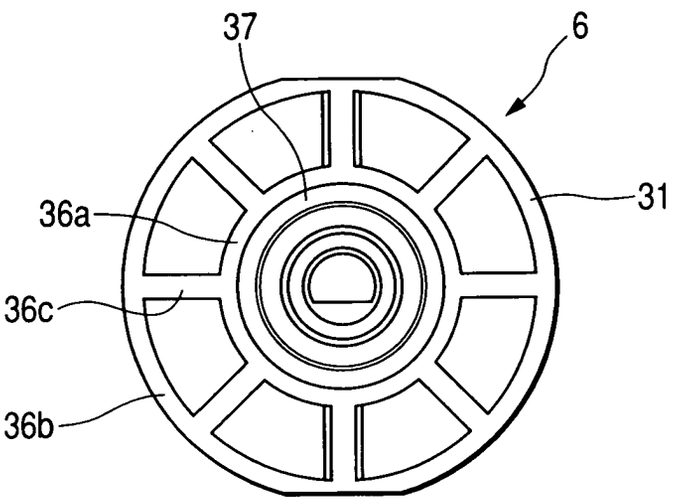

FIG. 8

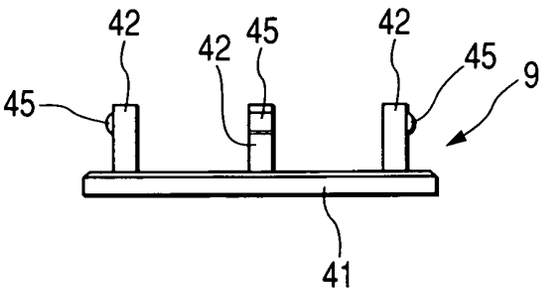


FIG. 9

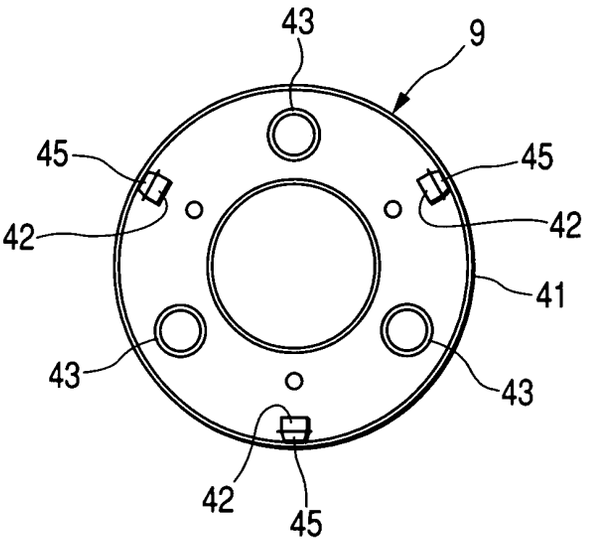


FIG. 10

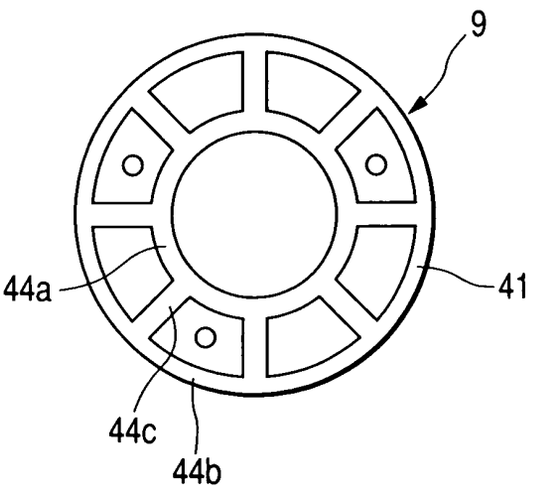

FIG. 11

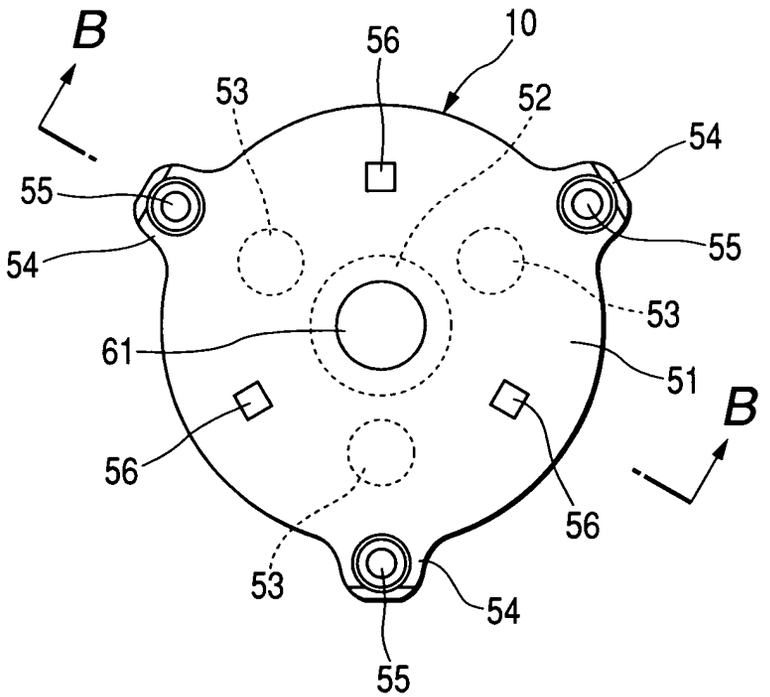
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FIG. 12

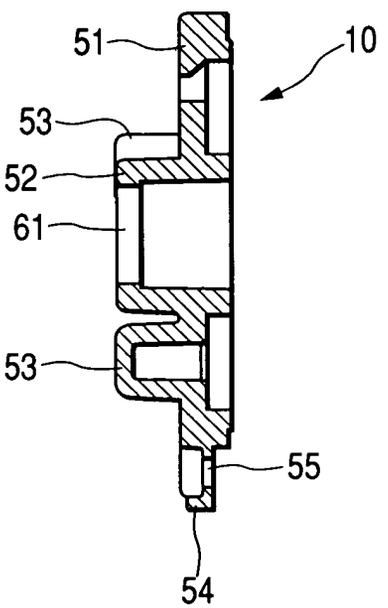
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FIG. 13

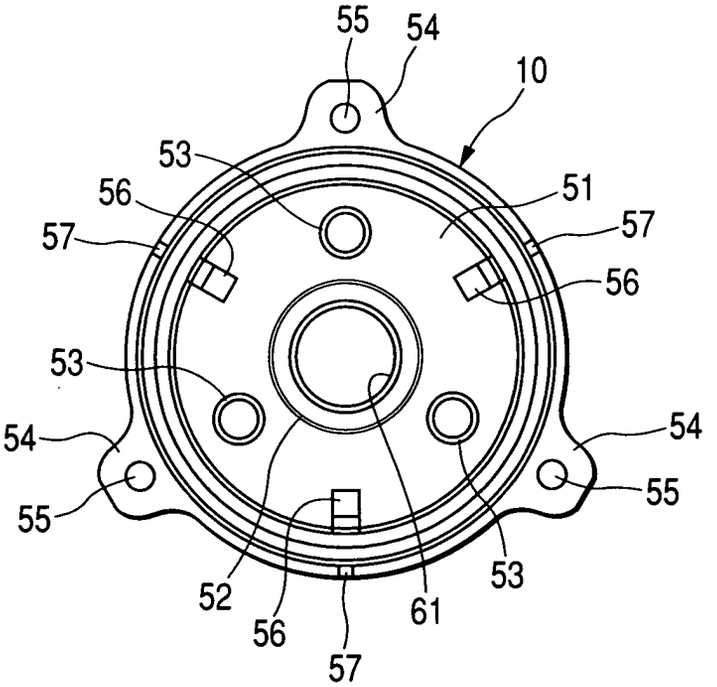
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FIG. 14

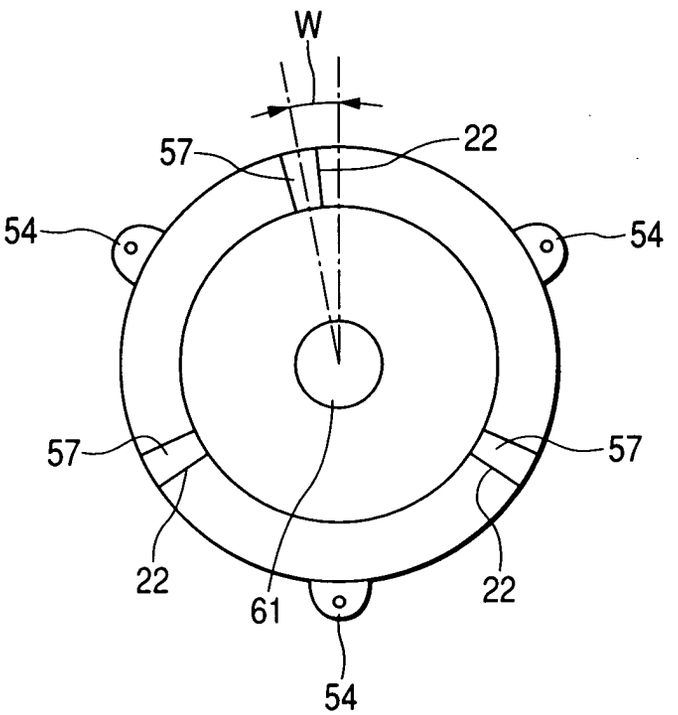
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FIG. 15
PRIOR ART

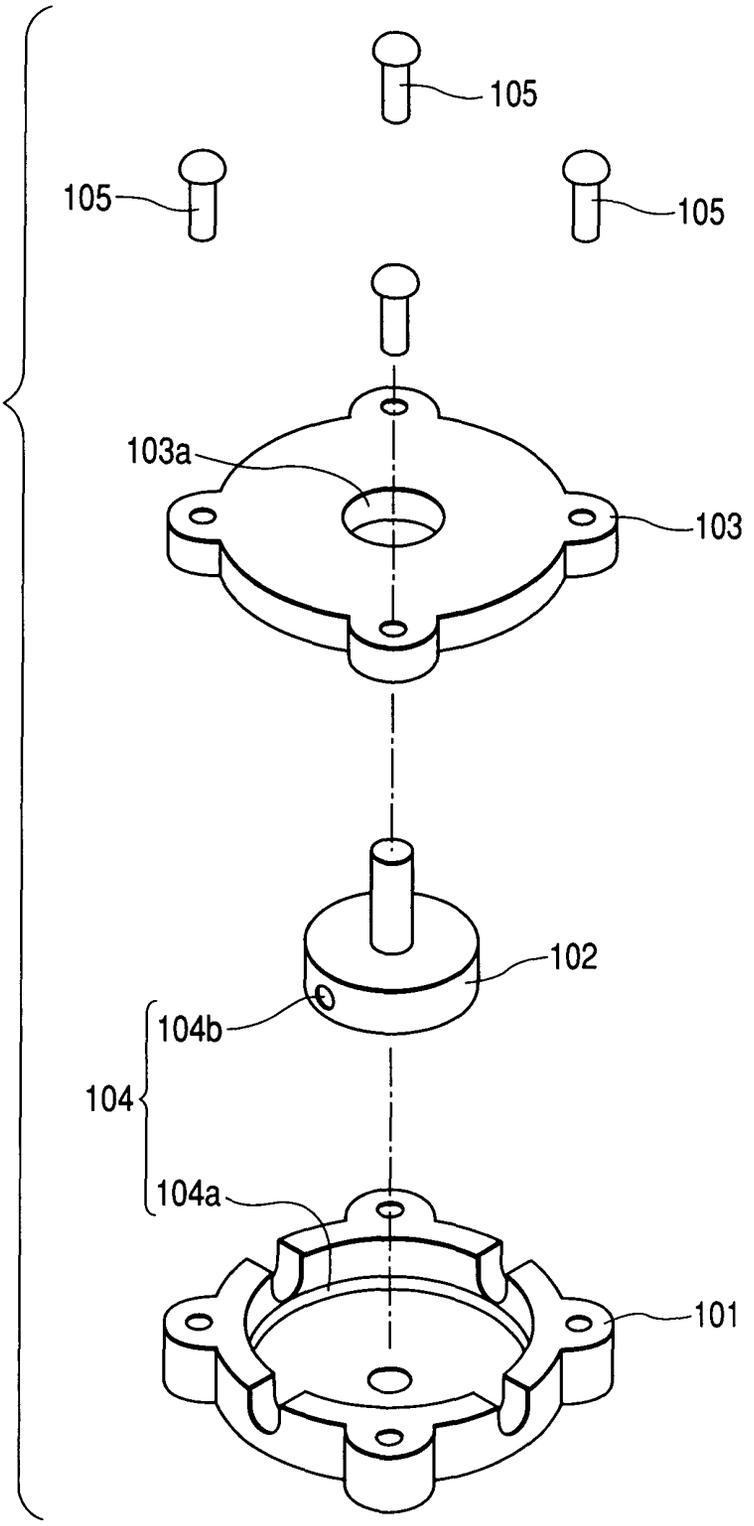


FIG. 16
PRIOR ART

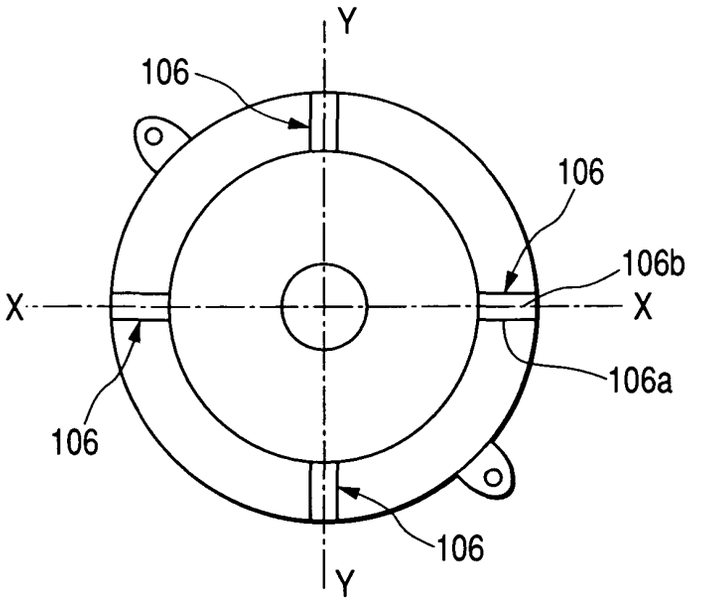
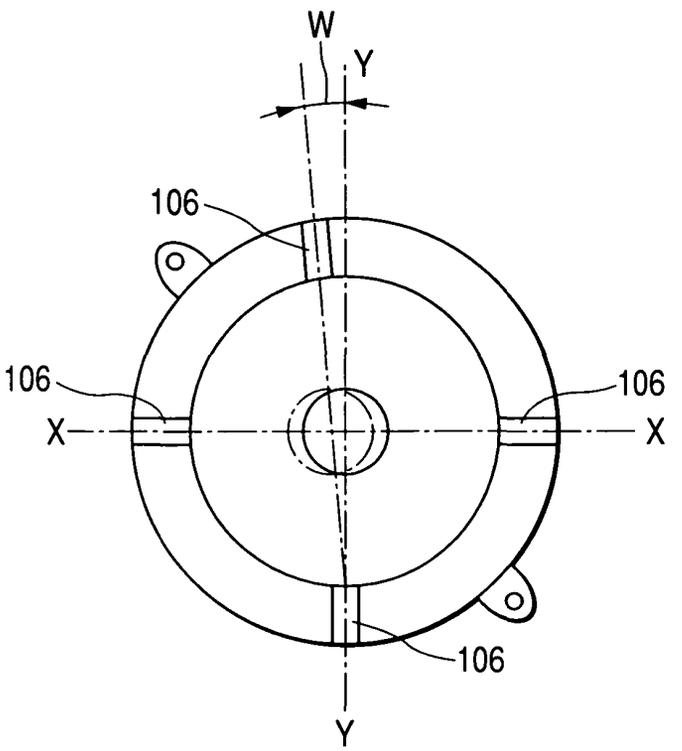



FIG. 17
PRIOR ART



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# EUROPEAN SEARCH REPORT

Application Number
EP 05 00 4921

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
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| Y | GB 2 108 321 A (* INTERNATIONAL STANDARD ELECTRIC CORPORATION) 11 May 1983 (1983-05-11) * page 1, line 121 - line 129; figures 2,3 * | 1 | |
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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 10 June 2005 | Janssens De Vroom, P |

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