



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.09.2017 Bulletin 2017/36

(51) Int Cl.:
H01H 25/00 (2006.01)

(21) Application number: **17157403.1**

(22) Date of filing: **22.02.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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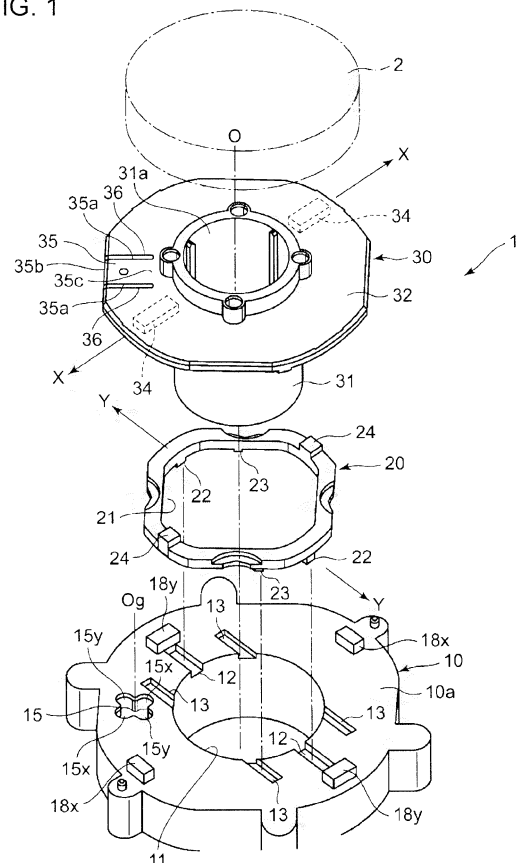
(30) Priority: **02.03.2016 JP 2016039940**

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(54) **OPERATION DEVICE**

(57) An operation device (1) includes a supporting member (10) having a cross-shaped guide recess (15), and a movably operated member (30) having a pin (38). The pin (38) moves in the guide recess (15). Hence, the guide recess (15) restricts the movably operated member (30) to be movable only in the X direction and in the Y direction. The movably operated member (30) includes a projection (35) extending obliquely with respect to the X direction and to the Y direction. The pin (38) is provided integrally with the projection (35). When a large force is applied from the guide recess (15) to the pin (38), the projection (35) deforms. Hence, the energy acting on the pin (38) is dispersed.

FIG. 1



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an operation device in which a movably operated member is supported by a supporting member in such a manner as to be movable in the X direction and in the Y direction thereon.

2. Description of the Related Art

[0002] An operation device in which an operated member is movable in directions that are orthogonal to each other is disclosed by Japanese Unexamined Patent Application Publication No. 2008-171680.

[0003] The operation device includes a sliding-motion-transmitting member provided on a base member. The sliding-motion-transmitting member is movable with the operated member. The sliding-motion-transmitting member has a cross-shaped guide hole. The base member has a sliding projection that is fitted in the guide hole. As the sliding projection slides in the guide hole, the operated member and the sliding-motion-transmitting member move in either of two directions defined by the cross-shaped guide hole.

[0004] The base member is provided with push switches that each detect the movement of the sliding-motion-transmitting member in a corresponding one of the two directions.

[0005] In the operation device according to Japanese Unexamined Patent Application Publication No. 2008-171680, however, the sliding projection is formed integrally with the base member, which is a substantially rigid body, in such a manner as to project therefrom. Hence, if a large pressing force acting in any direction other than the direction in which the operated member and the sliding-motion-transmitting member are slid is applied from the sliding-motion-transmitting member to the sliding projection, the probability of the occurrence of problems such as that the sliding projection may be broken becomes high.

SUMMARY OF THE INVENTION

[0006] The present invention is to solve the above problem and provides an operation device in which a force that may act on a pin provided for guiding a movably operated member in either of two directions is reduced.

[0007] According to an aspect of the present invention, there is provided an operation device including a supporting member, a movably operated member supported by the supporting member in such a manner as to be movable in both an X direction and a Y direction that are orthogonal to each other, and detecting members that detect the movement of the movably operated member in the X direction and in the Y direction, respectively. The

movably operated member has a projection. One of the projection and the supporting member has a guide recess extending in the X direction and in the Y direction while another of the projection and the supporting member has a pin that moves in the guide recess. The projection has a pair of sides each extending obliquely with respect to the X direction and to the Y direction. The pin is provided between the pair of sides.

[0008] In the operation device according to the above aspect of the invention, it is preferable that the pair of sides be parallel to each other.

[0009] Furthermore, in the operation device according to the above aspect of the invention, it is preferable that the sides each extend at 45 degrees with respect to the X direction and to the Y direction.

[0010] In the operation device according to the above aspect of the invention, it is preferable that the projection be elastically deformable in each of a case where a force acting in the X direction is applied to the pin and a case where a force acting in the Y direction is applied to the pin.

[0011] In the operation device according to the above aspect of the invention, it is preferable that the projection be made of synthetic resin, and that the pin be formed integrally with the projection.

[0012] According to the above aspect of the present invention, the movably operated member has the projection whose sides each extend obliquely with respect to the X direction and to the Y direction, and the projection has the pin or the cross-shaped guide recess. Hence, even if a large force acts on the projection with the sliding of the pin in the guide recess while the movably operated member is being moved in the X or Y direction, the force can be dispersed because the projection is elastically deformable slightly. Therefore, the occurrence of problems such as damage to the pin can be prevented more easily.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is an exploded perspective view of an operation device according to an embodiment of the present invention;

Fig. 2 is a plan view of a movably operated member and an operation handle that are included in the operation device;

Fig. 3 is an enlargement of a part of the plan view illustrated in Fig. 2; and

Fig. 4 is an enlargement of a section taken along line IV-IV illustrated in Fig. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] An operation device 1 illustrated in Figs. 1 and 2 is intended for on-vehicle electronic apparatuses, game apparatuses, home electronic apparatuses, and industrial electronic apparatuses.

[0015] As illustrated in Fig. 1, the operation device 1 includes a supporting member 10, an intermediate slide member 20, and a movably operated member 30. The movably operated member 30 is operated with an operation handle 2.

[0016] The supporting member 10 is a part of a base intended for various electronic apparatuses and is made of synthetic resin or is die-cast from a lightweight alloy. The supporting member 10 has a through hole 11 extending therethrough vertically in Fig. 1. The supporting member 10 has, in a front surface 10a thereof, a pair of central guide portions 12 extending in the Y direction and two pairs of side guide portions 13 provided on two respective sides of the pair of central guide portions 12. The central guide portions 12 and the side guide portions 13 are guide grooves (or guide rails). The pair of central guide portions 12 extend in the Y direction and are provided across the through hole 11 from each other. Each pair of side guide portions 13 extend in the Y direction and are provided across the through hole 11 from each other. The guide portions 12 and 13 are parallel to one another.

[0017] The intermediate slide member 20 is made of synthetic resin and has an opening 21 vertically extending through the center thereof. The intermediate slide member 20 has, on the lower surface thereof, a pair of central slide portions 22 and two pairs of side slide portions 23 provided on two respective sides of the central guide portions 12. The central slide portions 22 and the side slide portions 23 are sliding projections. The pair of central slide portions 22 are provided across the opening 21 from each other and at an interval in the Y direction. Each pair of side slide portions 23 are provided across the opening 21 from each other and at an interval in the Y direction.

[0018] When the intermediate slide member 20 is set on the front surface 10a of the supporting member 10, the central slide portions 22 are slidably fitted into the respective central guide portions 12 while the side slide portions 23 are slidably fitted into the respective side guide portions 13. The slide portions 22 and 23 are slidable in the respective guide portions 12 and 13. Therefore, the intermediate slide member 20 is supported in such a manner as to be movable in the Y direction along the front surface 10a of the supporting member 10. The intermediate slide member 20 is movable only in the Y direction and is not movable in the X direction.

[0019] The intermediate slide member 20 further has, on the upper surface thereof, intermediate guide portions 24. The intermediate guide portions 24 are guiding projections. The intermediate guide portions 24 are provided across the opening 21 from each other and at an interval in the X direction. The X direction and the Y direction are orthogonal to each other in a plane parallel to the front surface 10a of the supporting member 10.

[0020] The movably operated member 30 is made of synthetic resin and includes a cylindrical portion 31 projecting downward. The cylindrical portion 31 has a

through space 31a vertically extending therethrough. A flange portion 32 extending in an X-Y plane is provided continuously with the upper part of the cylindrical portion 31. As illustrated by broken lines in Fig. 1, the flange portion 32 has intermediate slide parts 34 provided in the lower surface thereof. The intermediate slide parts 34 are slide grooves that are open downward. The intermediate slide parts 34 are provided across the through space 31a from each other and on a virtual line passing through a center O of the movably operated member 30. The intermediate slide parts 34 each extend in the X direction.

[0021] The movably operated member 30 is set such that the cylindrical portion 31 thereof extends through the opening 21 of the intermediate slide member 20 and is fitted in the through hole 11 of the supporting member 10, with the lower surface of the flange portion 32 facing the intermediate slide member 20. In such a state, the intermediate guide portions 24 of the intermediate slide member 20 are fitted in the respective intermediate slide parts 34 provided in the lower surface of the flange portion 32, whereby the movably operated member 30 is supported in such a manner as to be movable in the X direction on the intermediate slide member 20. The movably operated member 30 is movable only in the X direction, not in the Y direction, with respect to the intermediate slide member 20.

[0022] When the intermediate slide member 20 and the movably operated member 30 are set on the supporting member 10, the movably operated member 30 becomes movable in an X-Y plane with the sliding of the intermediate slide member 20 in the Y direction and the sliding of the movably operated member 30 in the X direction on the intermediate slide member 20. That is, the diameter of the cylindrical portion 31 of the movably operated member 30 is smaller than the diameter of the through hole 11 provided in the supporting member 10 and smaller than the bore of the opening 21 provided in the intermediate slide member 20 so that the cylindrical portion 31 is movable in the X-Y plane. The supporting member 10 includes a stopper mechanism (not illustrated) in a lower part thereof. The stopper mechanism prevents the cylindrical portion 31 from coming off upward from the through hole 11.

[0023] As illustrated in Figs. 1 and 3, the supporting member 10 has a guide recess 15 in the front surface 10a thereof. The guide recess 15 includes X-guiding portions 15x and Y-guiding portions 15y that are continuous with one another. The X-guiding portions 15x extend toward two respective sides in the X direction from a guide center Og. The Y-guiding portions 15y extend toward two respective sides in the Y direction from the guide center Og.

[0024] As illustrated in Figs. 1 and 3, the flange portion 32 of the movably operated member 30 has a pair of cuts 36. A part of the flange portion 32 between the cuts 36 forms a projection 35. The projection 35 is a rectangular part defined by the cuts 36 and having a pair of sides 35a

and a free-end side 35b.

[0025] As illustrated in Figs. 1 and 2, the pair of sides 35a of the projection 35 extend linearly and parallel to each other. The cuts 36 provided in the flange portion 32 have the same length. Hence, the pair of sides 35a also have the same length. The sides 35a extend obliquely with respect to the X direction and to the Y direction. Preferably, the sides 35a are each at 45 degrees with respect to the X direction and to the Y direction. Fig. 2 illustrates a center line Oe of the projection 35 that is parallel to the sides 35a. The center line Oe equally divides the projection 35 into two in the width direction thereof. The center line Oe is at an angle θ of 45 degrees with respect to the X direction and to the Y direction.

[0026] The projection 35 is made of synthetic resin and has a substantially uniform thickness. The projection 35 is elastically deformable slightly in such a manner as to bend vertically about a base end 35c thereof. The projection 35 is also elastically twistable slightly. That is, the projection 35 is an elastically deformable part.

[0027] As illustrated in Figs. 3 and 4, the projection 35 of the movably operated member 30 has a pin 38 extending downward therefrom. The pin 38 is made of the synthetic resin forming the projection 35 and is continuous with the projection 35. When the movably operated member 30 is set on the supporting member 10, the pin 38 is slidably fitted into the guide recess 15.

[0028] As illustrated in Fig. 1, the supporting member 10 is provided on the front surface 10a thereof with a pair of X-direction detecting members 18x facing each other in the X direction, and a pair of Y-direction detecting members 18y facing each other in the Y direction. When the intermediate slide member 20 is moved in the Y direction, either of the Y-direction detecting members 18y is activated. When the movably operated member 30 is moved in the X direction, either of the X-direction detecting members 18x is activated. The X-direction detecting members 18x and the Y-direction detecting members 18y are push switches. Alternatively, the X-direction detecting members 18x and the Y-direction detecting members 18y may be magnetic detectors if magnets are provided to the intermediate slide member 20 and to the movably operated member 30.

[0029] The operation handle 2 is attached to the upper side of the movably operated member 30. The operation handle 2 and the movably operated member 30 move together in the X direction and in the Y direction. The operation handle 2 is supported by the movably operated member 30 in such a manner as to be depressable and rotatable thereon. The movably operated member 30 is provided in the through space 31a thereof with a depression-detecting member and a rotation-detecting member (not illustrated). When the operation handle 2 on the movably operated member 30 is depressed, the depression-detecting member is activated. When the operation handle 2 on the movably operated member 30 is rotated, the rotation-detecting member is activated.

[0030] A sliding operation performed with the operation

handle 2 will now be described.

[0031] Since the pin 38 included in the movably operated member 30 slides in the guide recess 15 provided in the supporting member 10, the operation handle 2 and the movably operated member 30 are movable only in the X direction and in the Y direction.

[0032] When the operation handle 2 is moved in the X direction, the pin 38 moves along either of the X-guiding portions 15x of the guide recess 15. Therefore, the movably operated member 30 moves in the X direction on the intermediate slide member 20, and a corresponding one of the pair of X-direction detecting members 18x is activated. When the operation handle 2 is moved in the Y direction, the pin 38 moves along either of the Y-guiding portions 15y of the guide recess 15. Therefore, the operation handle 2 and the intermediate slide member 20 move in the Y direction on the supporting member 10, and a corresponding one of the pair of Y-direction detecting members 18y is activated.

[0033] Thus, the guide recess 15 restricts the operation handle 2 and the movably operated member 30 to be movable only in the X direction and in the Y direction. However, if the pin 38 is not fitted in the guide recess 15, the movably operated member 30 is movable in any direction in the X-Y plane. Therefore, if a force acting in the Y direction is applied to the operation handle 2 while the pin 38 is moving in either of the X-guiding portions 15x of the guide recess 15, the pin 38 comes into contact with the inner wall of that X-guiding portion 15x, whereby a sliding load acts on the pin 38. In such a situation, if a large force is applied to the pin 38 provided between the pair of sides 35a of the projection 35, the projection 35 deforms in such a manner as to bend vertically about the base end 35c. Thus, the force applied to the pin 38 is dispersed as the energy that elastically deforms the projection 35.

[0034] Furthermore, if the pin 38 comes into contact with the sidewall of the X-guiding portion 15x and a large sliding load acts on the pin 38, referring now to Fig. 3, the projection 35 deforms in such a manner as to twist in a direction α about the X axis. Hence, the energy of the force applied to the pin 38 is dispersed.

[0035] If a force acting in the X direction is applied to the operation handle 2 while the pin 38 is moving in either of the Y-guiding portions 15y of the guide recess 15, a force is applied from the inner wall of that Y-guiding portion 15y to the pin 38. In such a situation also, since the projection 35 is deformable in such a manner as to bend vertically and to twist in a direction P about the Y axis as illustrated in Fig. 3, the energy of the force applied to the pin 38 is dispersed.

[0036] Since the force applied from the guide recess 15 to the pin 38 is converted into a force that elastically deforms the projection 35, the probability of the occurrence of problems such as breakage of the pin 38 is reduced. Hence, the pin 38 does not need to be made of metal. Therefore, the pin 38 and the movably operated member 30 can be integrated into a single body made

of a synthetic resin material. Consequently, the number of components is reduced. Correspondingly, the manufacturing cost is reduced.

[0037] To summarize, since the pair of sides 35a of the projection 35 included in the movably operated member 30 are each at an angle with respect to the X direction and to the Y direction, the force acting in the X direction and the force acting in the Y direction that are applied to the pin 38 can be converted into a force that elastically deforms the projection 35. The sides 35a do not need to be parallel to each other. That is, the width of the projection 35 may be gradually reduced or increased toward the free-end side 35b. Note that, in either case, the center line Oe that equally divides the projection 35 into two in the width direction is preferably at 45 degrees with respect to the X direction and to the Y direction.

[0038] Conversely to the above embodiment, the pin 38 may be provided to the supporting member 10 while the cross-shaped guide recess 15 may be provided in the projection 35. In such a configuration also, any force generated between the pin 38 and the inner wall of the guide recess 15 and acting on the pin 38 can be dispersed as the energy that elastically deforms the projection 35.

Claims

1. An operation device (1) comprising:

a supporting member (10);
 a movably operated member (30) supported by the supporting member (10) in such a manner as to be movable in both an X direction and a Y direction that are orthogonal to each other; and detecting members (18x, 18y) that detect the movement of the movably operated member (30) in the X direction and in the Y direction, respectively,
 wherein the movably operated member (30) has a projection (35),
 wherein one of the projection (35) and the supporting member (10) has a guide recess (15) extending in the X direction and in the Y direction while another of the projection (35) and the supporting member (10) has a pin (38) that moves in the guide recess (15),
 wherein the projection (35) has a pair of sides (35a) each extending obliquely with respect to the X direction and to the Y direction, and
 wherein the pin (38) is provided between the pair of sides (35a).

2. The operation device (1) according to Claim 1, wherein the pair of sides (35a) are parallel to each other.

3. The operation device (1) according to Claim 1 or 2, wherein the sides (35a) each extend at 45 degrees

with respect to the X direction and to the Y direction.

4. The operation device (1) according to any of Claims 1 to 3, wherein the projection (35) is elastically deformable in each of a case where a force acting in the X direction is applied to the pin (38) and a case where a force acting in the Y direction is applied to the pin (38).

5. The operation device (1) according to any of Claims 1 to 4, wherein the projection (35) is made of synthetic resin, and the pin (38) is formed integrally with the projection (35).

FIG. 1

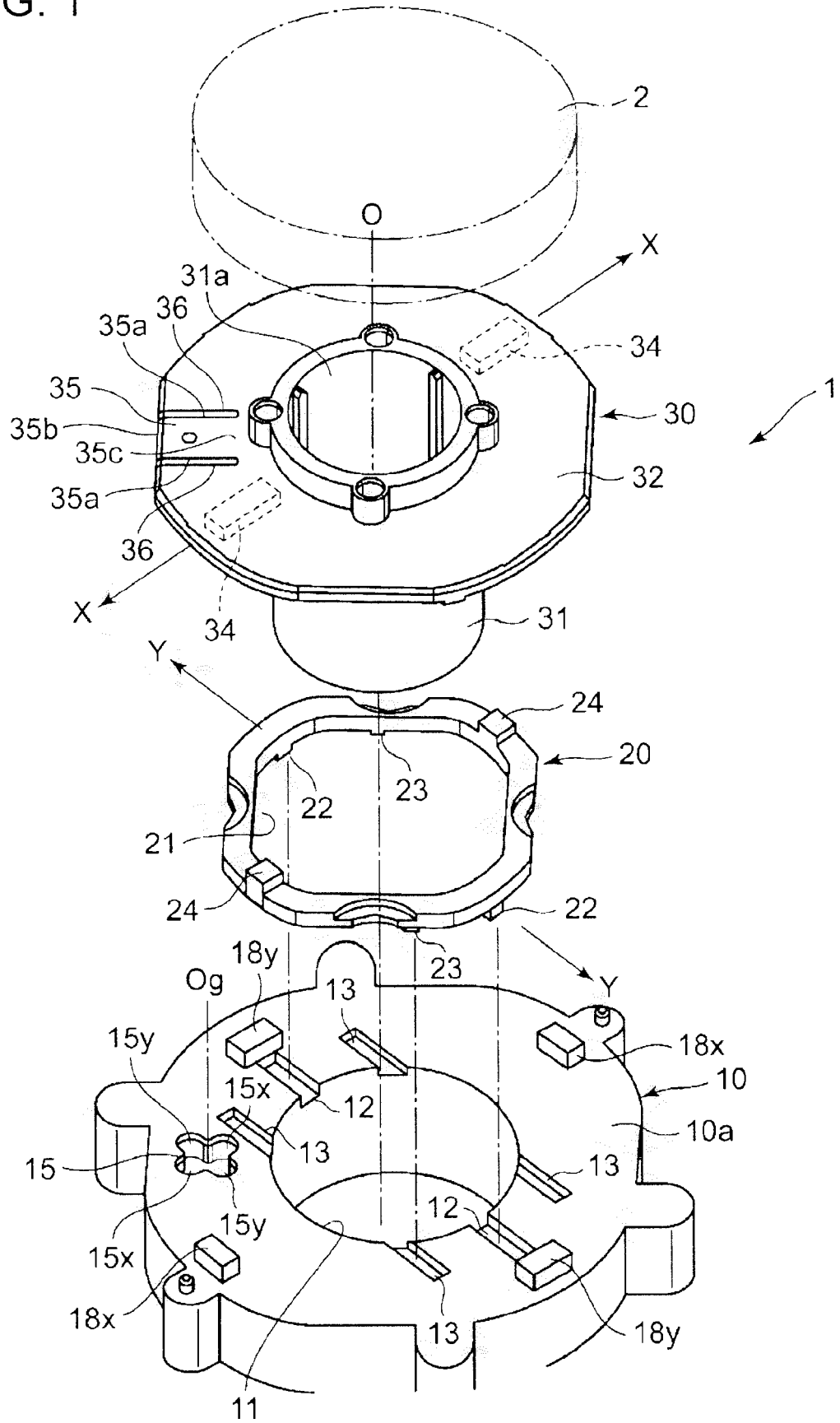


FIG. 2

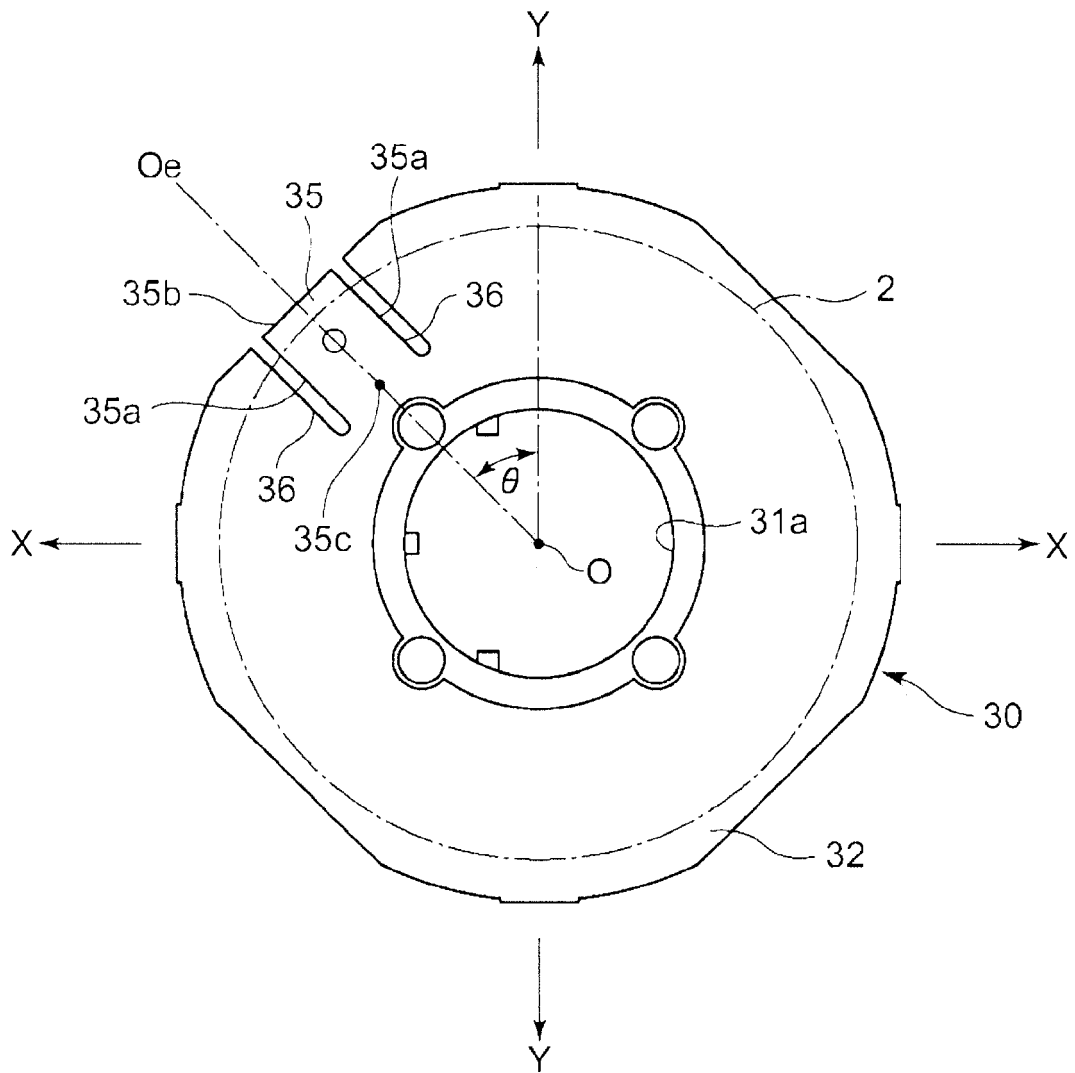


FIG. 3

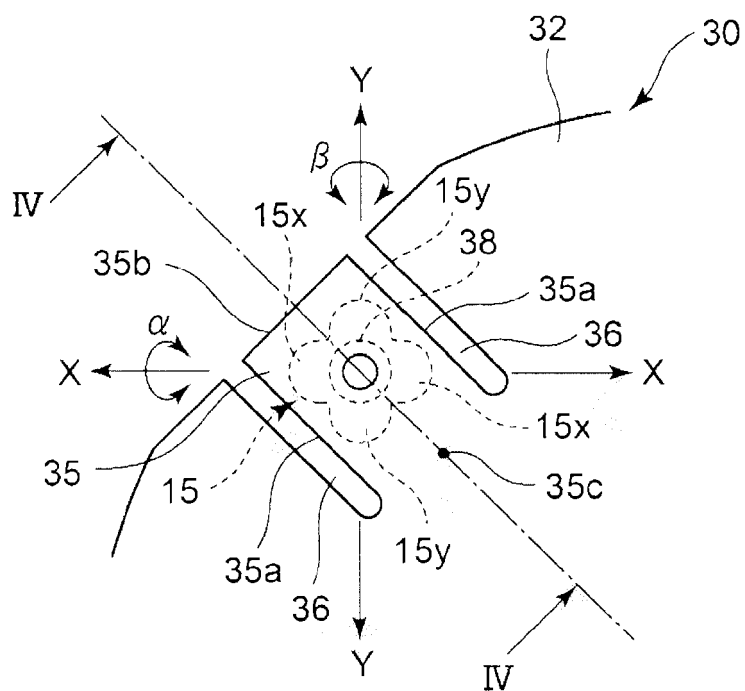
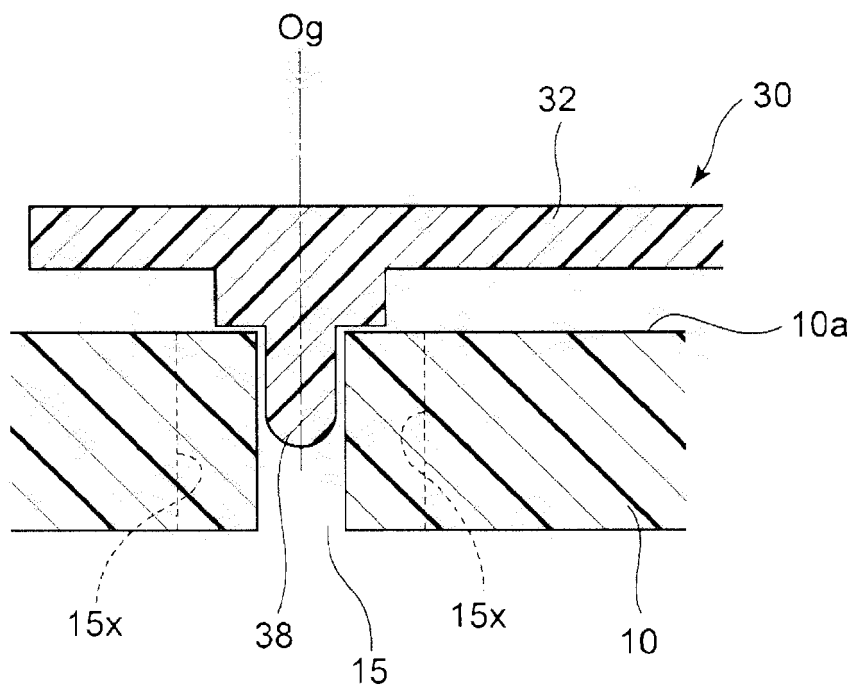


FIG. 4





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Application Number
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 July 2017	Examiner Ledoux, Serge
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