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

(11) EP 2 672 493 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.12.2013 Bulletin 2013/50

(21) Application number: **13170991.7**

(22) Date of filing: **07.06.2013**

(51) Int Cl.:
H01G 5/00 *(2006.01)* ***H01C 10/00*** *(2006.01)*
H01H 35/00 *(2006.01)* ***H01R 13/66*** *(2006.01)*

(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

(30) Priority: **07.06.2012 JP 2012130142**

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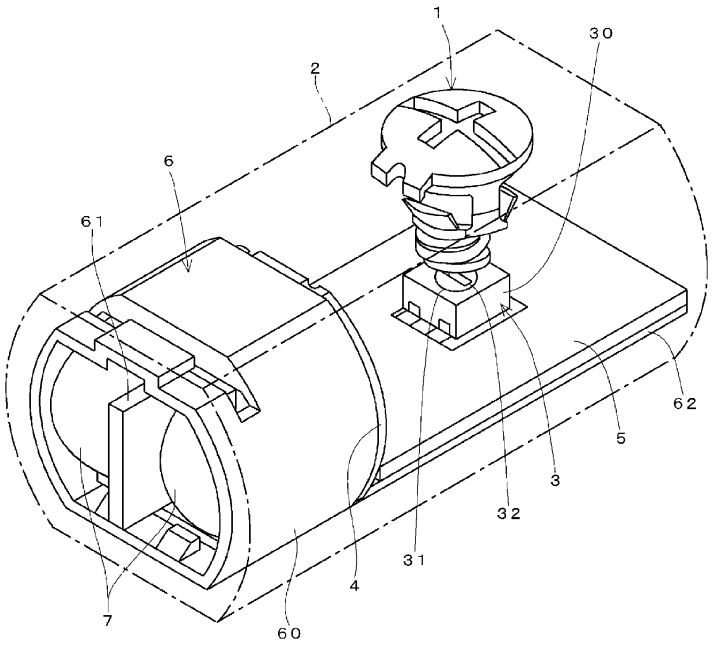
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(54) Rotation operation part and electronic device

(57) The present invention provides a rotation operation part which is capable of absorbing shaft misalignment by a sufficient deformation force even when the shaft misalignment from a rotation type electronic part is generated in any direction. A rotation operation part formed by integrally molding an operation portion having a screw hole, a base portion, and a shaft portion which connects both the portions from elastic resin is manufactured, and the base portion is fixed to a rotation type electronic part. The shaft portion includes a spiral spring wound around a rotation shaft thereof, and shaft misalignment from the rotation type electronic part is absorbed by deformation of the spiral spring.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. TECHNICAL FIELD

[0001] The present invention relates to a rotation operation part to be attached to a turning portion in order to rotate the turning portion of a rotation type electronic part, and an electronic device provided with these parts.

2. RELATED ART

[0002] The rotation type electronic part is a part whose setting state is changed by a rotation angle of a turning portion provided in a part main body. A specific example thereof includes a variable resistor, a variable capacitor, and a rotary switch and the like. In an electronic device inside which this type of parts are assembled, the turning portion is rotated by a method of attaching a rotation operation part to the turning portion and applying a rotation force to this rotation operation part.

[0003] With the reference sign 200 denoting a rotation type electronic part and the reference sign 500 denoting a rotation operation part, Fig. 7 illustrates a conventional configuration example of an electronic device to which these parts 200, 500 are introduced.

In the figure, the reference sign 300 denotes a case body of the electronic device, and a circuit substrate 400 is arranged inside thereof. The rotation type electronic part 200 is fixed at a preliminarily fixed place of the circuit substrate 400 and electrically connected to a circuit pattern of the substrate 400. At a place of the case body 300 on the upper side of the rotation type electronic part 200, an attachment hole 301 for supporting the rotation operation part 500 is formed.

[0004] A hole portion (not illustrated) is formed in the center of an upper surface of a main body portion 201 of the rotation type electronic part 200, and a turning portion 202 having a recessed portion 203 on an upper surface thereof is fitted into the hole portion.

The rotation operation part 500 is formed by placing an operation portion 502 having a screw hole 501 being continuous to a shaft portion 503 in series. An attachment piece 504 having a shape which corresponds to the recessed portion 203 of the turning portion 202 is provided in a leading end of the shaft portion 503.

[0005] By inserting the attachment piece 504 and the shaft portion 503 into the case body 300 via the attachment hole 301 and fitting the attachment piece 504 into the recessed portion 203 of the turning portion 202, the rotation operation part 500 is fixed to the turning portion 202 in a state where the operation portion 502 is exposed onto a surface of the case body 300. It should be noted that a downward step portion is formed in an inner circumferential edge of the attachment hole 301, and an O ring 310 is arranged in the step portion. A circumferential edge portion on a bottom surface of the operation portion 502 is supported by an upper surface of the case body 300, and a portion on the further inner side is supported by the O ring 310.

[0006] When a screw driver (not illustrated) is inserted into the screw hole 501 of the operation portion 502 of the rotation operation part 500 attached by the above method and the screw driver is rotated, a rotation force thereof is transmitted to the turning portion 202 of the rotation type electronic part 200 from the operation portion 502 via the shaft portion 503 and the attachment piece 504, so that the turning portion 202 and the rotation operation part 500 are integrally rotated. In such a way, setting of the rotation type electronic part 200 inside the case body 300 can be performed by a rotation operation outside the case body 300.

[0007] Japanese Unexamined Patent Publication No. 1993-67505 discloses a method which is similar to the method illustrated in Fig. 7 regarding attachment of a rotation operation part.

Further, Japanese Unexamined Patent Publication No. 1994-85474 describes that in an electronic device in which a rotation type electronic part (volume for adjusting sensitivity) is assembled, a support of the rotation type electronic part is provided inside a lid member coupled to an opening of a main body case, a rotation operation part is attached to the rotation type electronic part supported by this support, and a circuit substrate is coupled to the support, so that the rotation type electronic part and the substrate are electrically connected.

[0008] According to the description of Japanese Unexamined Patent Publication No. 1993-67505, it is thought that the rotation type electronic part on the substrate and the rotation operation part inserted into the main body portion can be easily coupled. However, actually, due to influences of misalignment between the main body portion and the substrate, misalignment of a wiring pattern formed on the substrate, misalignment between the substrate and the rotation type electronic part, and the like, there is a possibility that misalignment is generated between a rotation shaft of the rotation type electronic part and a rotation shaft of the rotation operation part.

Hereinafter, this misalignment of the rotation shafts between the parts will be referred to as the "shaft misalignment".

[0009] When the rotation type electronic part and the rotation operation part are coupled to each other while ignoring this shaft misalignment, a coupling part and the shaft portion are unreasonably pulled or pressed, so that torque is increased. Therefore, even when the rotation operation is performed, the turning portion is sometimes not easily rotated. When the unreasonable rotation operation is continued in that state, there is a fear that the rotation type electronic part or the rotation operation part is broken.

[0010] In the invention described in Japanese Unexamined Patent Publication No. 1994-85474, in order to solve the above problem, the rotation type electronic part

is positioned and fixed by the support and then electric connection to the substrate and coupling to the rotation operation part are performed via the support. However, with such a method, the number of parts and man-hour are increased, so that cost becomes high. There is also a fear that size of a main body of the electronic device is increased.

[0011] Fig. 8 is an example of a rotation operation part 500A improved for a purpose of solving the above problems.

Regarding the example of Fig. 8, the same configurations as the example of Fig. 7 will be denoted by the same reference signs as Fig. 7, so that the description will be omitted and only changed points will be described. The shaft portion 503 of the rotation operation part 500A of this example is formed by a short shaft portion 505 and a spring portion 506 formed by coupling a plurality of plate springs to each other in a rectangular shape.

This configuration is based on a thought that even when shaft misalignment is generated from the rotation type electronic part 200, the spring portion 506 is deformed, so that the misalignment is absorbed. However, by examination of the inventors, it became clear that although the rectangular spring portion 506 formed by coupling the plate springs is deformed in the directions along diagonal lines of the rectangle (in the up and down direction and the left and right direction in the figure), the spring portion 506 is not really deformed in the direction which passes through the rectangle (in the thickness direction of the plate springs). The shaft misalignment can be generated in an arbitrary direction. Thus, with the spring portion 506 whose deformation force is varied depending on the direction, it is difficult to absorb the shaft misalignment sufficiently.

SUMMARY

[0012] The present invention has been devised to solve the problems described above, and a first object thereof is to provide a rotation operation part which is capable of absorbing shaft misalignment by a sufficient deformation force even when the shaft misalignment from a rotation type electronic part is generated in any direction.

Further, a second object of the present invention is to provide a small electronic device which is capable of easily performing a rotation operation for a setting change at reasonable price by introducing this rotation operation part.

[0013] In accordance with one aspect of the present invention, a rotation operation part is formed by coupling a base portion to be fixed to a turning portion of a rotation type electronic part and an operation portion having a screw hole via a shaft portion, wherein the shaft portion includes a spiral spring wound around a rotation shaft thereof, and the shaft portion, the operation portion, and the base portion are integrally molded from elastic resin.

[0014] The rotation operation part provided with the above characteristics is arranged in a main body portion of an electronic device in which a substrate provided with the rotation type electronic part is accommodated in a state where the base portion is fixed to the turning portion of the electronic part, and the operation portion is exposed onto a surface of the main body portion. When a rotation force is applied to the operation portion, the entire rotation operation part is rotated together with the turning portion of the rotation type electronic part.

[0015] The entire rotation operation part described above is manufactured from elastic resin, and the shaft portion includes the spiral spring. Thus, even when shaft misalignment from the rotation type electronic part is generated in any direction, the spiral spring is deformed in accordance with the direction of the shaft misalignment and a misalignment amount, so that the misalignment can be absorbed in the shaft portion. Therefore, while preventing an unreasonable force applied to a coupling part between the parts and the shaft portion, the operation portion can be stably supported by a surface of a casing and the base portion can be firmly fixed to the turning portion of the rotation type electronic part.

Since the entire part including the spiral spring is integrally molded from elastic resin, strength of the entire part can be enhanced and manufacture can be easily performed.

[0016] In one mode of the above rotation operation part, the shaft portion includes a pair of spiral springs whose winding directions are opposite to each other, and a coupling portion sandwiched by the spiral springs so as to connect both the spiral springs. For example, in a case where the right-winding spiral spring is arranged on the operation portion side, the other spiral spring coupled to the spring via the coupling portion is left-winding.

[0017] With the above configuration, when the base portion of the rotation operation part is fixed to the turning portion of the rotation type electronic part and even when the spiral springs of the shaft portion are slightly contracted and rotation forces are generated along the winding directions thereof, the rotation forces in the springs are offset in the coupling portion, so that the rotation forces can be prevented from propagating to the turning portion of the rotation type electronic part. Therefore, a situation that the turning portion is rotated from an initial state and an adjustable range by the rotation operation is decreased can be prevented.

[0018] In the above mode, when the coupling portion is a columnar body whose longitudinal direction is the axial direction of the shaft portion, and the pair of spiral springs is formed so as to have equivalent length across the coupling portion, a configuration of the shaft portion including the spiral springs and the columnar body is simplified. Thus, the rotation operation part is easily molded. Since a deformation force of the coupling portion is enhanced, responsiveness to the shaft misalignment is improved.

[0019] With the rotation operation part according to the present invention, even when the shaft misalignment

from the rotation type electronic part is generated in any direction, the shaft misalignment can be absorbed in the shaft portion by deformation of the spiral spring.
Therefore, torque to the rotation operation is weakened, so that the turning portion of the rotation type electronic part can be easily rotated. Thus, breakage of the parts can be prevented.

[0020] In accordance with another aspect of the present invention, an electronic device in which a substrate provided with a rotation type electronic part is accommodated inside a main body portion, and a rotation operation part formed by coupling an operation portion having a screw hole and a base portion via a shaft portion is arranged in a state where the base portion is fixed to a turning portion of the electronic part and the operation portion is exposed at a surface of the main body portion, wherein in the rotation operation part, the shaft portion includes a spiral spring wound around a rotation axis thereof, and the shaft portion, the operation portion, and the base portion are integrally molded with elastic resin. With an electronic device to which the above rotation operation part is introduced, the number of parts and man-hour can be reduced and a device main body can be downsized. Therefore, a small electronic device which is capable of easily performing an operation for a setting change can be provided at reasonable price.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

Fig. 1 is a perspective view illustrating an internal configuration of a photoelectric sensor to which the present invention is applied;
Fig. 2 is a perspective view in which a rotation operation part of a basic form is seen from the obliquely lower side;
Figs. 3A and 3B are a side view and a perspective view of the rotation operation part of the basic form;
Figs.4A and 4B are a top view illustrating an operation portion of the rotation operation part of the basic form together with a peripheral case member, and a vertically sectional view of the operation portion, a support shaft, and the peripheral case member;
Figs. 5A and 5B are a side view and a perspective view of a rotation operation part according to a second embodiment;
Figs. 6A and 6B are a side view and a perspective view of a rotation operation part according to a third embodiment;
Fig. 7 is a schematic sectional view illustrating a conventional example of an electronic device to which a rotation type electronic part and a rotation operation part are introduced; and
Fig. 8 is a schematic sectional view illustrating another conventional example of an electronic device to which a rotation type electronic part and a rotation operation part are introduced.

DETAILED DESCRIPTION

[0022] Fig. 1 illustrates an internal configuration of a photoelectric sensor serving as one example of an electronic device to which the present invention is applied.
The photoelectric sensor of the present embodiment is a reflecting type sensor in which a light projecting unit and a light receiving unit are integrated, and a holder 6 which supports an optical system and a substrate is assembled inside a longitudinal case body 2 whose front and rear parts are opened. The open part in a front end of the case body 2 is closed by a translucent cover lens (not illustrated), and the open part in a rear end is closed by a lid body (not illustrated) having a connector.

[0023] The holder 6 is a resin-molded item in which a substrate support 62 is integrated on the rear side of a lens holder 60. A space inside the lens holder 60 is divided into two parts by a wall portion 61. One of the parts serves as a light guide path for light projection and the other part serves as a light guide path for light reception. A light projecting or light receiving lens 7 is installed in a front end portion of each of the light guide paths.

[0024] A light shielding plate (not illustrated) having a light projecting window and a light receiving window is provided in a rear end portion of the lens holder 60, and behind the light shielding plate, a substrate 4 which supports a light projecting element and a light receiving element is installed. The light projecting element and the light projecting window correspond to the light guide path for light projection, and the light receiving element and the light receiving window correspond to the light guide path for light reception.

[0025] The substrate support 62 extends along a bottom surface of the case body 2, and a circuit substrate 5 is installed on the substrate support. In the circuit substrate 5, a circuit pattern relating to light projecting processing and light receiving processing is formed and a variable resistor 3 is provided as a rotation type electronic part. Although parts which are other than the variable resistor 3 are provided in the circuit substrate 5, the parts are omitted in Fig. 1.

[0026] The variable resistor 3 of the present embodiment is a part in which a turning portion 31 is fitted into a hole portion of a cubic main body portion 30 having the hole portion (not illustrated) in the center. A groove shape recessed portion 32 is formed on an upper surface of the turning portion 31.
In the present embodiment, by utilizing a mechanism that resistance is changed by a rotation angle of the turning portion 31, the variable resistor 3 is electrically connected to a light projecting or light receiving processing circuit, so that a light projecting amount or gain of a light receiving signal can be manually adjusted. For this adjustment operation, a rotation operation part 1 to be described later is fixed to the turning portion 31.

[0027] The rotation operation part 1 used in the present embodiment is a molded item with elastic resin as a material. Fig. 2 is a perspective view illustrating a state where

this rotation operation part 1 is seen from the obliquely lower side. Fig. 3A illustrates a state where the rotation operation part 1 attached to the variable resistor 3 is seen from one side in a front view, and Fig. 3B illustrates a state where a view point is changed to the left oblique front side of Fig. 3A and the rotation operation part 1 is seen.

It should be noted that in Figs. 3A and 3B, the direction along one side of the main body portion 30 of the variable resistor 3 is the width direction, an axis along the width direction is a X axis, an axis along the depth direction is a Y axis, and an axis along the height direction is a Z axis. The same is applied to examples of Figs. 5A to 6B to be described later.

[0028] The rotation operation part 1 of the present embodiment is a resin-molded item in which a disc shape base portion 11 and a disc shape operation portion 12 which is larger than the base portion 11 are coupled via a shaft portion 10.

A projected thread 110 which is engageable with the recessed portion 32 of the turning portion 31 is provided on a bottom surface of the base portion 11. A screw hole 120 is formed on an upper surface of the operation portion 12, and a projection 121 which is bifurcated via a substantially semi-circular cutout portion 123 is provided at one point of an edge. A downward hook 122 is formed in a leading end portion of this projection 121. The screw hole 120 is formed in a plus shape and has depth of reaching an upper end position of the shaft portion 10.

[0029] The shaft portion 10 is formed by coupling a support shaft 101 which is continuous to the operation portion 12 and a short shaft 102 which is continuous to the base portion 11 in series across a spiral spring 100. The support shaft 101 is formed in such a shape that a cylindrical body having a slightly larger diameter than the base portion 11 is dented at two points in a facing relationship on a circumferential surface from an intermediate position to a bottom portion and protruding pieces 104, 104 which protrude obliquely upward are provided on the lower side of dents 103, 103. The short shaft 102 is a substantially cylindrical body whose upper end surface is obliquely inclined and a lower end surface thereof is bonded to a center portion of the base portion 11.

[0030] The spiral spring 100 is integrally molded from elastic resin together with other parts and wound around a rotation shaft of the shaft portion 10 for substantially two spires at a wider pitch. Width of the spring is set to be wide in such a manner that the inside of the winding surrounds the rotation shaft in the vicinity thereof and the outside of the winding substantially corresponds to the support shaft 101 and an outer edge portion of the base portion 11. An upper end of the spiral spring 100 is coupled to the center of the support shaft 101 via a short coupling shaft 105. Although not clear in Figs. 2 to 3B, a lower end of the spiral spring 100 and an upper end surface of the short shaft 102 are continuous in series so as to form one surface.

[0031] Fig. 4A serving as a top view which illustrates the upper surface of the operation portion 12 of the rotation operation part 1 together with a peripheral case member (part of the case body), and Fig. 4B serving as a vertically sectional view of a range including the operation portion 12, the support shaft 101, and the peripheral case member are illustrated correspondingly on the upper and lower sides.

[0032] An attachment hole 20 which passes through a thickness part is formed in a point of the case body 2 of the present embodiment on the upper side of the variable resistor 3. A downward step portion 21 is formed on an inner circumferential edge of the attachment hole 20, and a guide groove 22 is formed on the further outer side of the step portion. Depth of the step portion 21 is matched with thickness of a circumferential edge of the operation portion 12, a distance from a center portion of the attachment hole 20 to the guide groove 22 is matched with a distance from a center portion of the operation portion 12 to the projection 121, and depth of the guide groove 22 is matched with length of the hook 122. Further, an inward step portion 23 is also provided in an inner bottom portion of the attachment hole 20.

[0033] It should be noted that although the step portions 21, 23 are provided along the entire circumference of the attachment hole 20, a formation range of the guide groove 22 is limited in accordance with a turnable range of the turning portion 31 of the variable resistor 3. On an upper surface of the case body 2, a mark 25 of "+" is put in the vicinity of one end portion of the guide groove 22 and a mark 26 of "-" is put in the vicinity of the other end portion. These marks 25, 26 indicate the directions of adjustment. Linear step marks 24 along the radical direction of the attachment hole 20 are put at five points in the guide groove 22. The cutout portion 123 of the bifurcated projection 121 of the operation portion 12 functions as a display window for the step mark 24 in the case where a position of the projection 121 is matched with the step mark 24.

[0034] For attaching the rotation operation part 1 illustrated in Figs. 2 to 4B, the base portion 11 and the shaft portion 10 are inserted into the case body 2 via the attachment hole 20 and pressed until the projected thread 110 of the base portion 11 is fitted into the recessed portion 32 of the turning portion 31 of the variable resistor 3. At the time of this attachment, an O ring 8 is installed in an upper end portion on a circumferential surface of the support shaft 101. The protruding pieces 104, 104 in the bottom portion of the support shaft 101 are deformed at the time of insertion and pass through the attachment hole 20. However, after attachment, the protruding pieces are positioned on the lower side of the step portion 23 so as to function as retainers.

[0035] The rotation operation part 1 after attachment is supported on the case body 2 in a state where a circumferential edge portion of a bottom surface of the operation portion 12 is abutted with the step portion 21, a part on the further inner side is brought into contact with the O ring 8, and the hook 122 of the projection 121 is

engaged with the guide groove 22 as illustrated in Fig. 4B. When a rotation force is applied to the operation portion 12, the hook 122 is guided along the guide groove 22. Thus, in a range that the hook 122 can be moved by this guide groove 22, the rotation operation part 1 can be rotated together with the turning portion 31.

[0036] Length of the shaft portion 10 of the above rotation operation part 1 is set to be slightly shorter than a distance from the bottom portion of the attachment hole 20 to the turning portion 31 of the variable resistor 3. Therefore, when the attachment of the rotation operation part 1 is completed, the spiral spring 100 is in a slightly contracted state. By a bias force of this spiral spring 100 and the O ring 8 and engagement of the hook 122 of the projection 121 with the guide groove 22, a posture of the operation portion 12 with respect to the case body 2 can be stabilized.

[0037] The spiral spring 100 wound around for almost two spires while matching an outer edge with the support shaft 101 and the base portion 11 has a sufficient deformation force in any direction in a XY plane. Thus, even when the shaft misalignment from the variable resistor 3 on the lower side is generated in any direction, the spiral spring 100 can be deformed in accordance with the direction of the shaft misalignment and a misalignment amount. In addition, the support shaft 101 and the short shaft 102 on the upper and lower sides of the spiral spring 100 also have elasticity. Thus, even when the shafts are slightly pulled or pressed by deformation of the spiral spring 100, the shafts can be deformed to endure in accordance with the force. Therefore, the shaft misalignment of the variable resistor 3 can be absorbed in the shaft portion 10, so that an unreasonable pulling force or pressing force following the shaft misalignment can be prevented from being applied to a coupling part between the turning portion 31 of the variable resistor 3 and the base portion 11 of the rotation operation part 1, and the shaft portion 10. Since the winding pitch of the spiral spring 100 is set to be wide, a deformation force in the height direction (Z axis direction) is ensured, so as to respond to variation of the distance from the variable resistor 3.

[0038] Therefore, when a screw driver (not illustrated) is inserted into the screw hole 120 of the operation portion 12 of the rotation operation part 1 after attachment and a rotation force is applied, the rotation force is transmitted to the base portion 11 and the turning portion 31 from the operation portion 12 via the shaft portion 10, so that the turning portion 31 can be smoothly rotated.

Thereby, an adjustment task can be easily performed and breakage of the parts 1, 3 can be prevented. Since there is no need for providing a separate part for preventing the shaft misalignment, attachment can be performed in a stabilized state without increasing cost and manhour. The sensor can also be downsized.

[0039] Hereinafter, while taking the rotation operation part 1 illustrated above in Figs. 2 to 4B as a basic form, Figs. 5A to 6B illustrate rotation operation parts 1P, 1Q according to modified examples.

In Figs. 5A to 6B, as well as Figs. 3A and 3B, a side view (A) and a perspective view (B) of the rotation operation parts 1P, 1Q are illustrated in line on the left and right sides, and the same reference signs as those illustrated in Figs. 2 to 4B are given to the same or corresponding configurations as or to the basic form.

[0040] In the rotation operation part 1 of the basic form, in order to stabilize the posture of the operation portion 12, attachment is performed while adding a pressing force so as to slightly contract the spiral spring 100. At that time, there is a possibility that rotation along the winding direction of the spiral spring 100 is generated and the rotation propagates to the turning portion 31 of the variable resistor 3, so that the turning portion 31 is rotated. Then, the turning portion 31 of the variable resistor 3 is slightly rotated from an initial stage. Thus, an adjustable range by the rotation operation is decreased.

[0041] In consideration with the above problem, a shaft portion 10 of the rotation operation part 1P according to a second embodiment of Figs. 5A and 5B includes a spring member in which a pair of spiral springs 100a, 100b whose winding directions are opposite to each other is connected in series via a coupling portion 100c. In the figures, the upper spiral spring 100a is set to be right-winding, and the lower spiral spring 100b is set to be left-winding. Any of the spiral springs 100a, 100b has length of substantially one spire, the inside of the winding surrounds a rotation shaft of the shaft portion 10 in the vicinity thereof, and the outside of the winding corresponds to a support shaft 101 and an outer edge portion of a base portion 11. The spiral springs 100a and 100b are formed in a shape which is close to line symmetry via the coupling portion 100c.

[0042] Upper and lower end surfaces of the coupling portion 100c are formed to be inclined surfaces which are respectively continuous to the spiral springs 100a, 100b in series. Length of the coupling portion 100c and coupling positions to the springs 100a, 100b are adjusted in such a manner that a slight gap is generated between the springs 100a, 100b so as not to bring the springs 100a, 100b into contact with each other.

[0043] It should be noted that in the rotation operation part 1P of this second embodiment, dents 103 and protruding pieces 104 of the support shaft 101 are provided at positions displaced from the basic form by about 90 degrees. The inclination direction of an upper surface of a short shaft 102 is changed in such a manner that the upper surface is continuous to the winding of the left-winding spiral spring 100b.

[0044] With the above configuration, when the spiral springs 100a, 100b are contracted by a pressing force at the time of attachment, a rightward rotation force is generated in the upper spiral spring 100a whereas a leftward rotation force is generated in the lower spiral spring 100b. Length of the springs 100a, 100b is the substantially same. Thus, both the rotation forces can be offset in the coupling portion 100c between both the springs.

Thereby, the turning portion 31 of the variable resistor 3 is prevented from being rotated, so that the adjustable range can be fully utilized.

[0045] In the rotation operation part 1Q of a third embodiment illustrated in Figs. 6A and 6B, as well as the rotation operation part 1P, a coupling body in which a pair of spiral springs 100a, 100b whose winding directions are opposite to each other is coupled in series via a coupling portion 100d is introduced to a shaft portion 10. The coupling portion 100d of the present embodiment is formed in a substantially cylindrical shape, the longitudinal direction thereof is matched with the axial direction of the shaft portion 10, and upper and lower end surfaces are inclined so as to be respectively continuous to the spiral springs 100a, 100b in series.

[0046] As well as the second embodiment, the spiral springs 100a, 100b have length of substantially one spire and are set in a shape which is close to line symmetry via the coupling portion 100d. Although a support shaft 101 is the same as the basic form, the spiral spring 100a and the support shaft 101 are coupled via a coupling shaft 106 which is slightly thicker than the coupling shaft 105 of Figs. 3A and 3B. The spiral spring 100b and a base portion 11 are also coupled via a coupling shaft 107 which has the substantially same shape as the coupling shaft 106.

[0047] In the rotation operation part 1Q of the third embodiment, rotation forces generated at the time of contracting the spiral springs 100a, 100b can also be offset in the coupling portion 100d. Thus, the turning portion 31 of the variable resistor 3 is prevented from being rotated, so that the adjustable range can be fully utilized.

Further, in this rotation operation part 1Q, a sufficient gap is ensured between the spiral springs 100a, 100b and a shape of the coupling portion 100d is simplified. Thus, molding is easily performed. Since the coupling portion 100d is a columnar body, a deformation force of the coupling portion 100d is enhanced. Thus, regarding shaft misalignment, the coupling portion 100d can be deformed together with the spiral springs 100a, 100b, so that responsiveness to the shaft misalignment can be enhanced.

[0048] The rotation operation part 1 of the basic form and the rotation operation parts 1P, 1Q of the modified examples illustrated above are not limited to the variable resistor 3 but can also be applied to other rotation type electronic parts such as a variable capacitor and a rotary switch. The electronic device to which these parts are introduced is not limited to the photoelectric sensor but the same configurations can be introduced to other types of sensors or electronic devices other than the sensors.

Claims

1. A rotation operation part formed by coupling a base portion to be fixed to a turning portion of a rotation type electronic part and an operation portion having a screw hole via a shaft portion, wherein
the shaft portion includes a spiral spring wound around a rotation axis thereof, and
the shaft portion, the operation portion, and the base portion are integrally molded with elastic resin.

2. The rotation operation part according to claim 1, wherein the shaft portion includes a pair of spiral springs whose winding directions are opposite to each other, and a coupling portion sandwiched by the spiral springs so as to connect both the spiral springs.

3. The rotation operation part according to claim 2, wherein the coupling portion is a columnar body whose longitudinal direction is the axial direction of the shaft portion, and the pair of spiral springs is formed so as to have equivalent length across the columnar body.

4. An electronic device comprising a rotation operation part according to any one of claims 1 - 3, wherein
a substrate is provided with the rotation type electronic part, the substrate being accommodated inside a main body portion, and
the rotation operation part is formed by coupling an operation portion having the screw hole and the base portion via the shaft portion, the rotation operation part being arranged in a state where the base portion is fixed to a turning portion of the electronic part and the operation portion is exposed at a surface of the main body portion.

FIG. 1

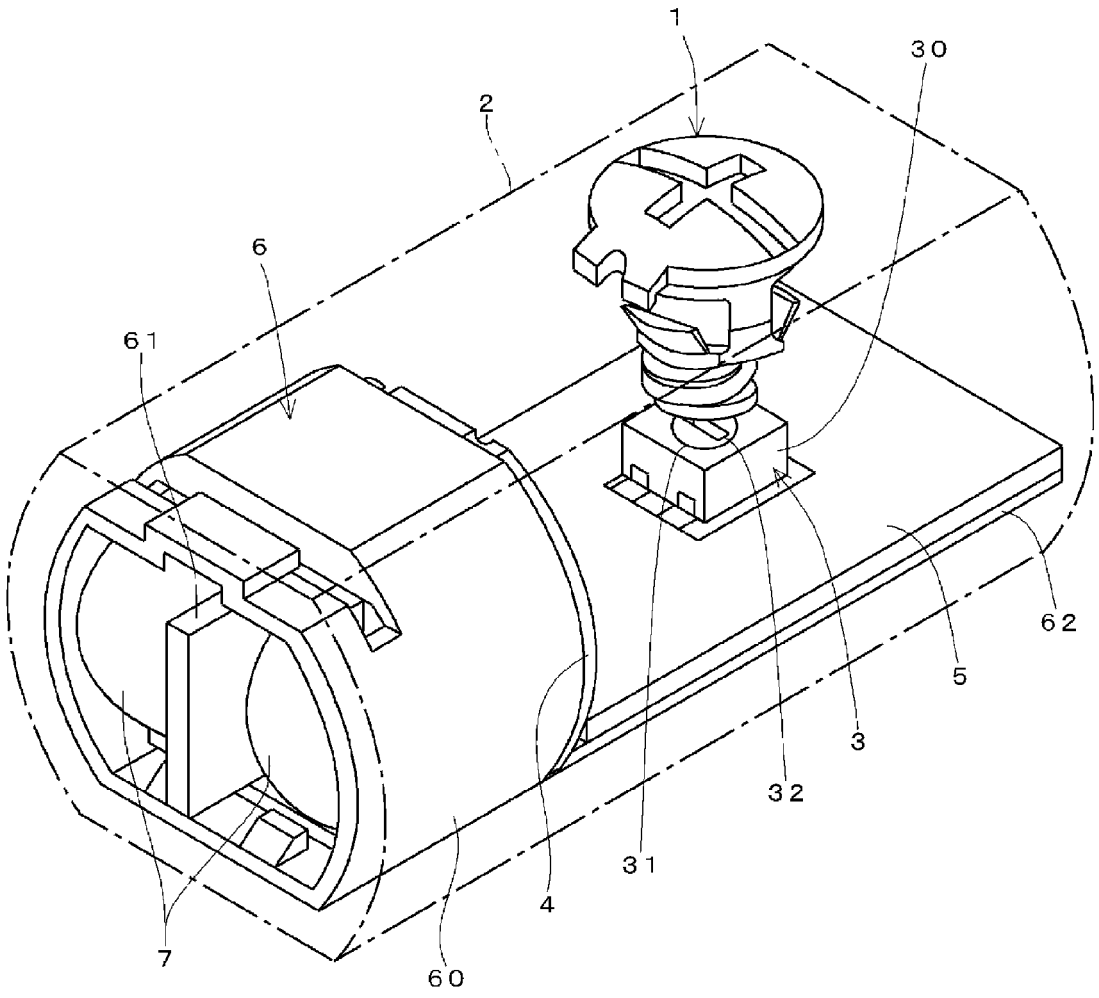


FIG. 2

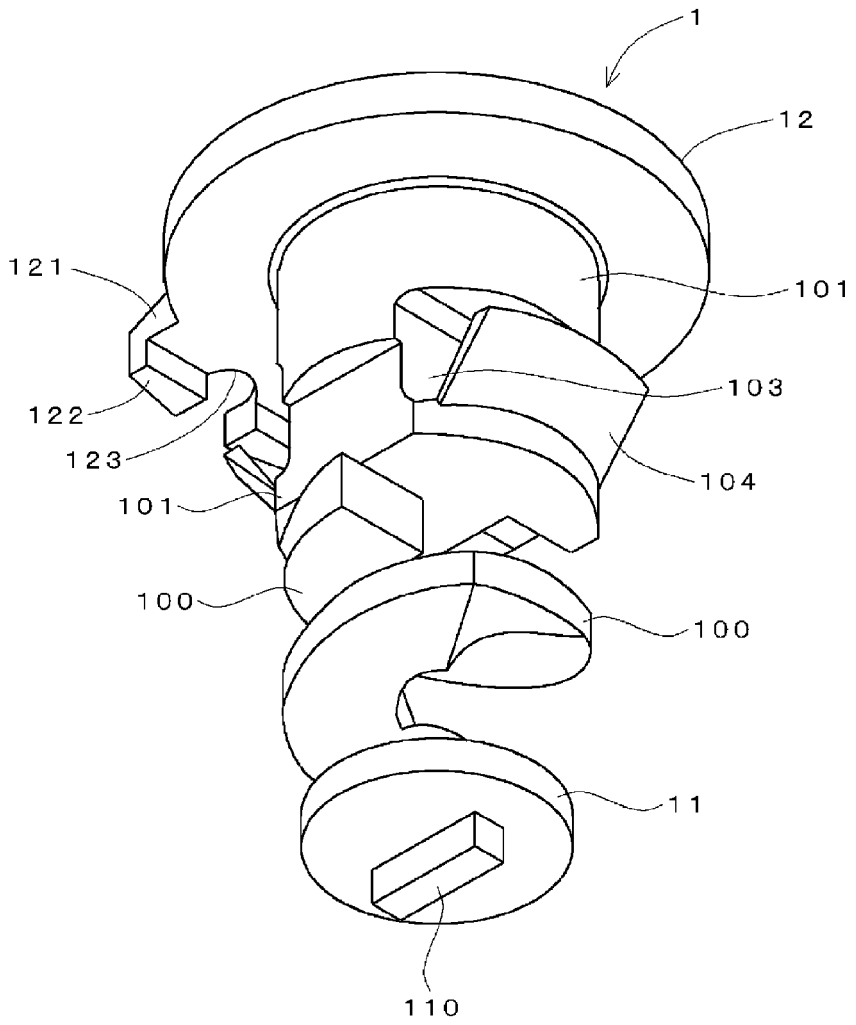


FIG. 3A

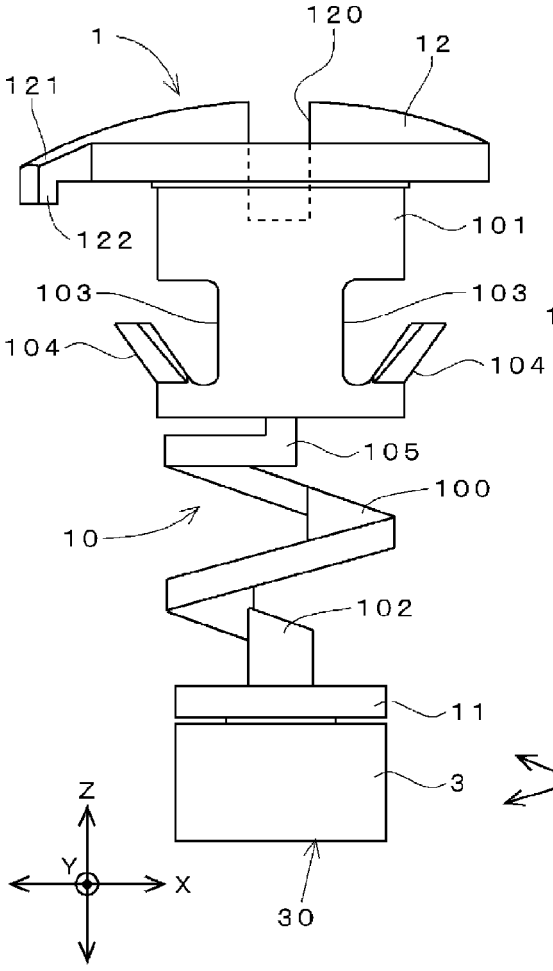

1
120
12
121
122
101
103
103
104
104
105
100
10
102
11
3
30
Z
Y
X

FIG. 3B

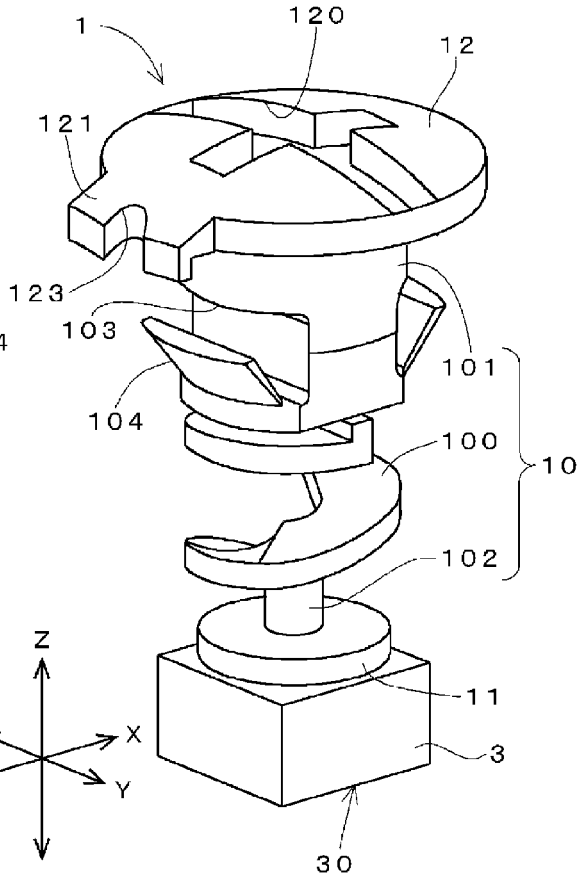

1
120
12
121
123
103
101
104
100
10
102
11
3
30
Z
X
Y

FIG. 4A

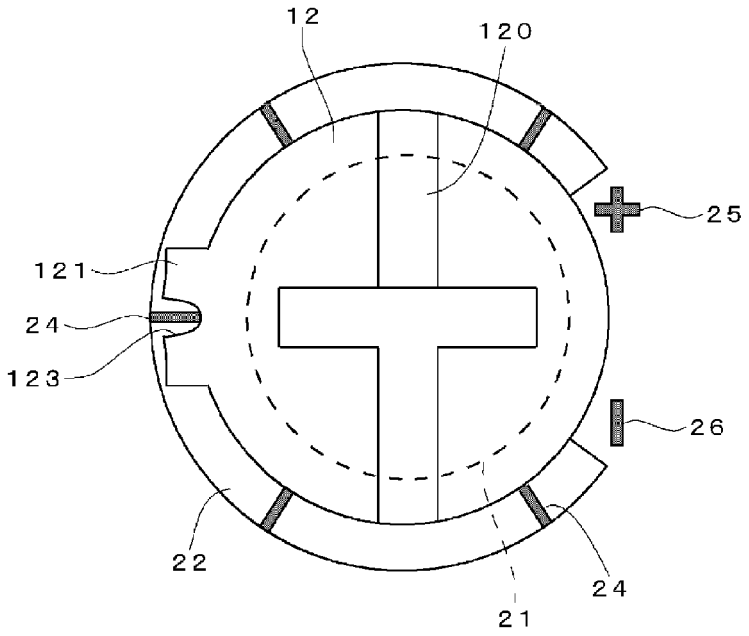

12
120
25
121
24
123
26
22
24
21

FIG. 4B

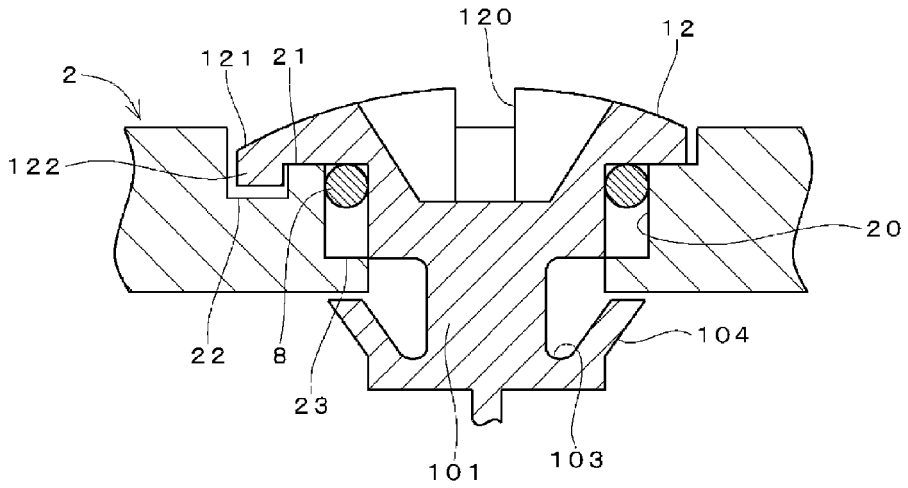

120
12
121
21
2
122
20
22
8
104
23
101
103

FIG. 5A

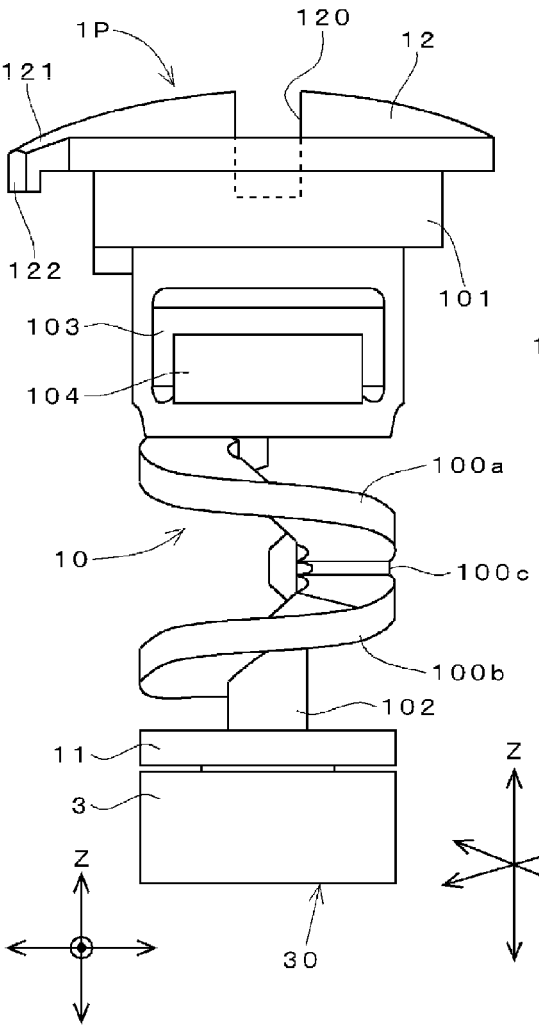

1P
120
12
121
122
101
103
104
100a
10
100c
100b
102
11
3
Z
30

FIG. 5B

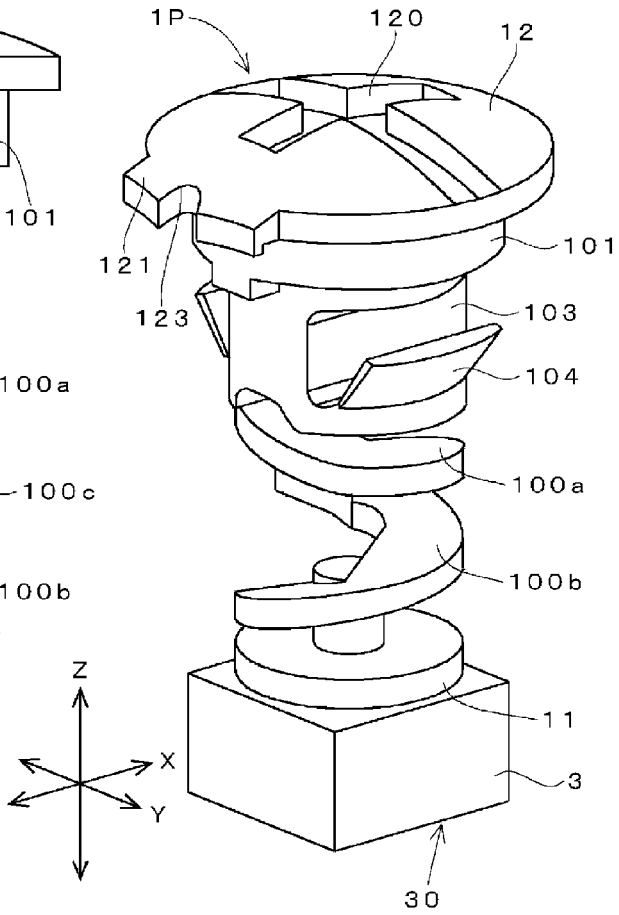

1P
120
12
101
121
123
103
104
100a
100b
11
3
Z
X
Y
30

FIG. 6A

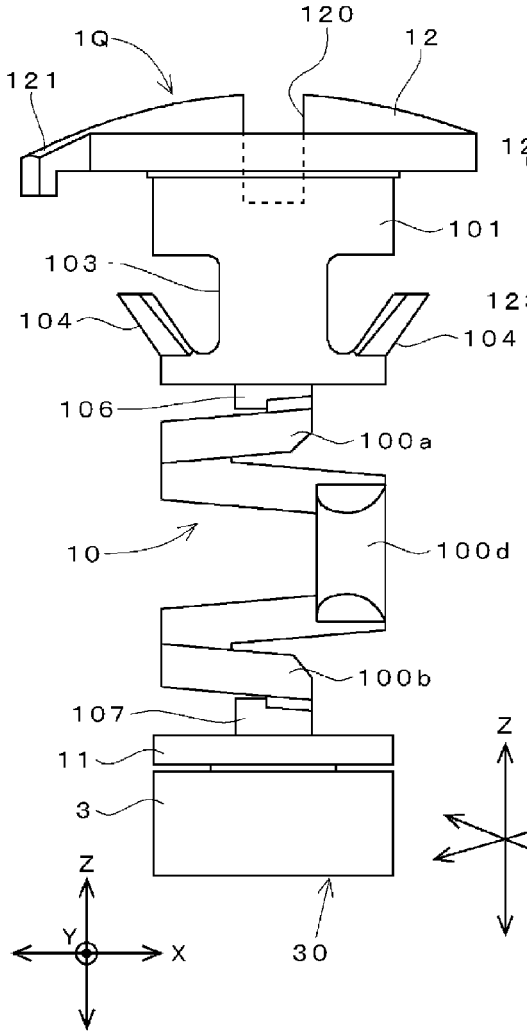

1Q
120
12
121
101
103
104
104
106
100a
10
100d
100b
107
11
3
30
Z
Y
X

FIG. 6B

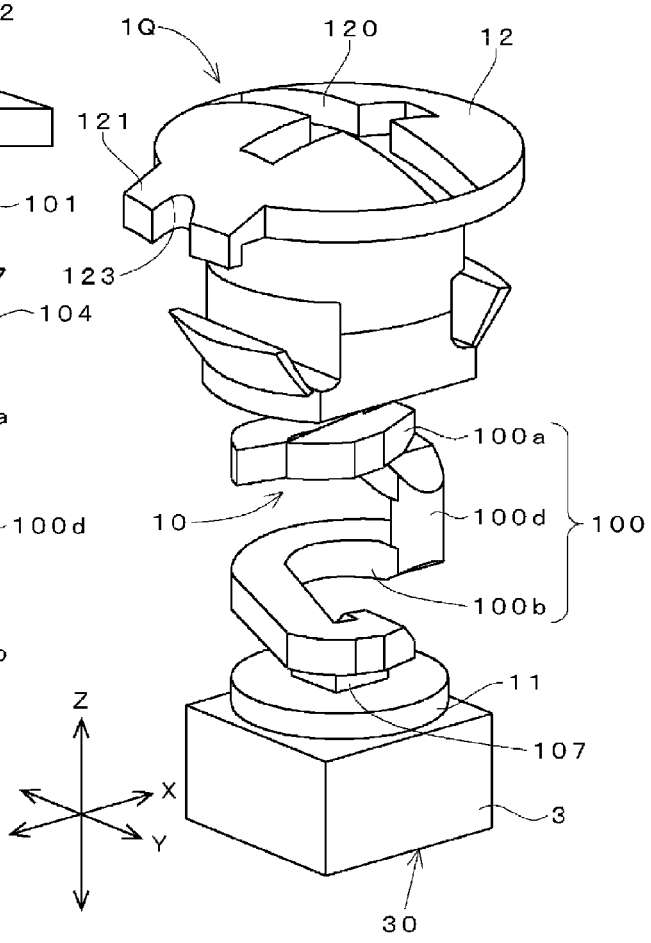

1Q
120
12
121
123
100a
10
100d
100
100b
11
107
3
30
Z
X
Y

FIG. 7

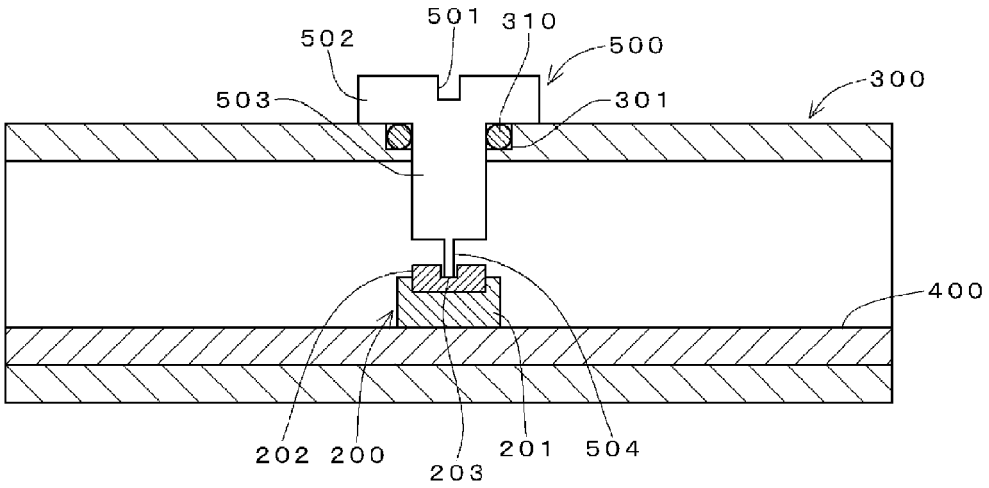
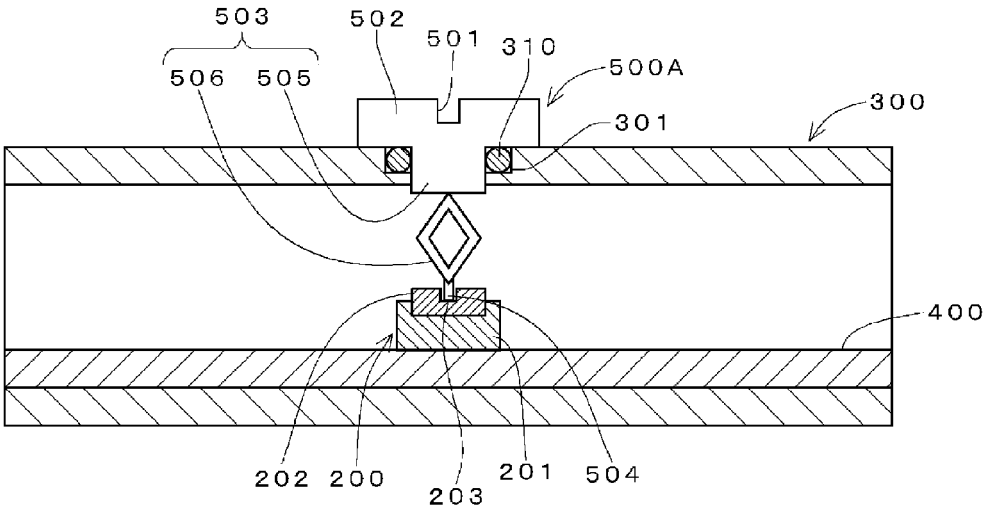

501
310
502
500
503
300
301
400
202
200
203
201
504

FIG. 8


503
502
501
310
506
505
500A
300
301
400
202
200
203
201
504

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- JP 6085474 A **[0007] [0010]**