

(19)



(11)

EP 3 493 232 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:

04.05.2022 Bulletin 2022/18

(51) International Patent Classification (IPC):

H01H 9/04 ^(2006.01) **H01H 19/06** ^(2006.01)
H01H 19/00 ^(2006.01)

(21) Application number: **17834163.2**

(52) Cooperative Patent Classification (CPC):

H01H 19/06; H01H 19/001

(22) Date of filing: **20.07.2017**

(86) International application number:

PCT/JP2017/026361

(87) International publication number:

WO 2018/021155 (01.02.2018 Gazette 2018/05)

(54) **DRIP-PROOF STRUCTURE OF ELECTRONIC COMPONENT**

TROPFGESCHÜTZTE STRUKTUR EINES ELEKTRONISCHEN BAUTEILS

STRUCTURE ANTI-GOUTTE DE COMPOSANT ÉLECTRONIQUE

(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**

(30) Priority: **28.07.2016 JP 2016148630**

03.07.2017 JP 2017130113

(43) Date of publication of application:

05.06.2019 Bulletin 2019/23

(73) Proprietor: **Kabushiki Kaisha Tokai Rika Denki**

Seisakusho

Ohguchi-cho

Niwa-gun

Aichi 480-0195 (JP)

(72) Inventors:

• **AOKI, Hiroshi**

Niwa-gun

Aichi 480-0195 (JP)

• **TSUKAHARA, Yoshiharu**

Kawasaki-shi

Kanagawa 211-8530 (JP)

• **KUWABARA, Satoshi**

Kawasaki-shi

Kanagawa 211-8530 (JP)

• **HAYASHI, Naoki**

Kawasaki-shi

Kanagawa 211-8530 (JP)

(74) Representative: **Betten & Resch**

Patent- und Rechtsanwälte PartGmbB

Maximiliansplatz 14

80333 München (DE)

(56) References cited:

WO-A1-2015/087366

WO-A1-2015/087366

JP-A- 2011 134 573

JP-A- 2015 115 121

JP-A- 2016 091 806

US-A- 3 306 993

US-A- 3 809 830

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

Cross-Reference to Related Applications

[0001] The present application claims priorities of Japanese patent application Nos. 2016/148630 and 2017/130113.

Technical Field

[0002] The present invention relates to a drip-proof structure of an electronic component.

Background Art

[0003] A rotary electronic component is known in which a portion of an outer periphery of a rotary body of is exposed as an operating portion to the outside through an opening provided on an outer case, and an electrical function portion in a main case is driven by rotationally operating the operating portion with a finger etc. so as to cause a change in an output from the electrical function portion. In the rotary electronic component, a drip-proof structure of an electronic component is known in which a rubbery drip-proof sheet is installed so as to seal a gap between the opening and the rotary body to prevent a liquid from entering through the gap between the opening and the rotary body to contact with the electrical function portion (see, e.g., JP 2011/134573 A).

[0004] Another drip-proof structure of an electronic component is known in which an electrical function portion is covered with a waterproof case etc. to prevent liquid from contacting with the electrical function portion (see, e.g., JP 2010/9937 A).

Citation List

Patent Literatures

[0005]

JP 2011/134573 A
JP 2010/9937 A

[0006] US 3 809 830 A discloses a thumb selector switch structure which is particularly suitable for use in corrosive or dusty environments. The selector switch includes a printed circuit panel having an angularly encoded conductive pattern printed thereon. A rotatable contact carrying indicia wheel is rotatably mounted to the printed circuit panel so that the contacts carried by the indicia wheel selectively engage various portions of the angularly encoded printed circuit pattern, thereby producing digital output signals in response to the rotation of the contact carrying wheel. The contact carrying wheel is permanently hermetically sealed to the printed circuit board by means of a clear plastic casing. An actuator wheel is provided for rotating the indicia and contact car-

rying wheel. A suitable housing having a detent spring mounted therein is provided to enclose the above described structure.

[0007] WO 2015/087366 A1 discloses a component to effectively carry out waterproofing, while avoiding cramping an internal space to the extent it is possible to do so. The component is provided with: a light source ; a moveable part having a first window; a circuit board; and a housing in which is formed an opening through which the surface of the moving part protrudes. The housing, in combination with the moveable part, has dividing walls for dividing the internal space of the housing into a first space and a second space. The dividing walls support the moveable part, and the light source illuminates the first window through a portion of the dividing walls, which are formed by transmissive members.

Summary of Invention

20 Technical Problem

[0008] The drip-proof structure of an electronic component disclosed in JP 2011/134573 A may be poor in operability of the operating portion since the rubbery drip-proof sheet is in contact with the rotary body.

[0009] Also, concerning the drip-proof structure of the electronic component disclosed in JP 2010/9937 A, since it is necessary to separately provide the waterproof case etc., the number of components may increase and the size of the rotary electronic component itself may also increase.

[0010] It is an object of the invention to provide a drip-proof structure of an electronic component that is effective in drip-proofness and excellent in operability of the operating portion and allows downsizing of the component.

Solution to Problem

[0011] According to the present invention a drip-proof structure of an electronic component as defined by claim 1 is provided. The dependent claims define embodiments of the invention.

45 Advantageous Effects of Invention

[0012] According to the invention, a drip-proof structure of an electronic component can be provided that is effective in drip-proofness and excellent in operability of the operating portion and allows downsizing of the component.

Brief Description of Drawings

55 [0013]

FIG. 1 is a perspective view showing a rotary electronic component in an embodiment.

FIG. 2 is a cross sectional view showing the rotary electronic component taken along a line A-A in **FIG. 1**.

FIG. 3 is an exploded perspective view showing a main unit, a cover and drip-proof members.

FIG. 4 is an exploded perspective view showing the state in which the cover is detached from the rotary electronic component.

FIG. 5 is an exploded perspective view showing the main unit.

FIG. 6 is an exploded perspective view showing the main unit when viewed at an angle different from **FIG. 5**.

FIG. 7 is a perspective view showing the back of the cover.

FIG. 8 is a cross sectional view showing a liquid ingress path into the rotary electronic component.

Description of Embodiments

[0014] An embodiment of the invention will be described below in reference to the drawings. **FIG. 1** is a perspective view showing an electronic component (hereinafter, referred to as "rotary electronic component") 1 configured using an embodiment of the present invention, **FIG. 2** is a cross sectional view showing the rotary electronic component 1 (a cross section taken along the line A-A in **FIG. 1**), **FIG. 3** is an exploded perspective view showing a main unit 10, a cover 300 and drip-proof members (hereinafter, referred to as "packings") 250 that constitute the rotary electronic component 1, **FIG. 4** is a perspective view showing a process of attaching the packings 250 and the cover 300 to the main unit 10, **FIG. 5** is an exploded perspective view showing the main unit 10, and **FIG. 6** is an exploded perspective view showing the main unit 10 when viewed at another angle. As shown in these drawings, the rotary electronic component 1 is provided with the main unit 10 housing various parts, and the cover 300 covering a surface of the main unit 10 on the side where an rotary body (hereinafter, referred to as operating knob 100) protrudes. In the following description, "upper/upward" is a direction to view the cover 300 from the main unit 10, and "lower/downward" is a direction opposite thereto. In addition, "front/forward" is a direction to view the operating knob 100 from a first case 20 (described later), and "rear/rearward" is a direction to view a circuit board 160 (described later) from the first case 20.

[0015] As shown in **FIGS. 1** to **6**, the main unit 10 is configured that the operating knob 100 as a rotary body, with a sliding piece 130 attached thereto, is housed between the first case 20 and a second case 70, a terminal unit 140 is housed in the first case 20 on the opposite side, and the circuit board 160, a light guide 190 and a third case 220 are provided thereon. The rotary electronic component 1 is formed by attaching the packings 250 and the cover 300 to the main unit 10.

[0016] The first case 20 is a molded article formed by

molding a synthetic resin into a substantially rectangular box shape, and has a substantially cylindrical bearing 21 at the upper center, a first housing portion 23 as a recess provided on the operating knob 100 side of the bearing 21, and a second housing portion 25 as a recess provided on the circuit board 160 side. A pair of engagement portions 27, which are rectangular through-holes to be engaged with claw portions 79 of the second case 70 (described later), are provided on both right and left side surfaces of the first case 20 at positions on the first housing portion 23 side. Meanwhile, a pair of engagement portions 29, which are rectangular through-holes to be engaged with claw portions 223 of the third case 220 (described later), are formed on both the right and left side surfaces of the first case 20 at positions on the second housing portion 25 side. In addition, a pair of claw-shaped engaging portions 30, which engage in engagement portions 309 of the cover 300 (described later), are formed both the right and left side surfaces of the first case 20 at positions between the engagement portions 27 and 29. A terminal unit housing portion 31, which has a substantially rectangular shape and opens rearward, is formed under the bearing 21. An arc surface portion of the bearing 21 at the middle of the upper surface and the upper surface portions located on right and left sides of the arc surface portion and protruding toward the first housing portion 23 serve as drip-proof member-mounting surfaces (hereinafter, referred to as "packing mounting surfaces") 33 (33a to 33c), where the arc surface portion is defined as a bearing-side drip-proof member-mounting surface 33a, and linear portions on both sides thereof are defined as right- and left-side packing mounting surfaces 33b and 33c. In addition, a pair of right and left stopper engaging portions 35 (only one is shown in **FIG. 5**) are formed, which butt against a stopper 129 of the operating knob 100 (described later) and prevent the stopper 129 from moving upward therebeyond. In addition, although it is not shown in the drawings, a click engaging portion composed of raised and recessed portions along an arc direction (a direction of the arc along which a click ball 127 moves (described later)) is formed in the first housing portion 23 at a lower portion (at a position facing the click ball 127) of a surface on which the bearing 21 is provided.

[0017] The second case 70 is formed in a single piece by molding a synthetic resin and has a case main body 71 having a substantially rectangular plate shape and a circular plate-shaped knob supporting portion 73 which protrudes from the upper center of the case main body 71 toward the operating knob 100. The knob supporting portion 73 is configured that an outer peripheral portion protruding from a surface on the operating knob 100 side is a cylindrical protruding portion 74 constituting a part of the drip-proof portion, and a protruding portion 75 having a bottomed cylinder shape is provided at the center inside the protruding portion 74. A pair of engaging claws 77 protrude from both right and left side edges of the case main body 71 toward the operating knob 100. The

engaging claws **77** are flat plate-shaped members on which the claw portions **79** are provided near the end portions on both outer sides (only one claw portion **79** is shown in **FIGS. 5** and **6**). In addition, the upper surface of the case main body **71** serves as a non-bearing-side packing mounting surface **81** to be in contact with the packing **250** (described later).

[0018] The operating knob **100** is a molded article of a synthetic resin and is formed by comolding a transparent material and an opaque material. The operating knob **100** has a substantially circular-plate shape and is configured that the circular outer circumferential surface thereof serves as an operating portion **101**. A circular recessed portion **103** constituting a part of the drip-proof portion is provided on a surface of the operating knob **100** facing the second case **70**, and two cylindrical protruding portions **105** and **107** are concentrically provided and protrude in the recessed portion **103**. A circular recessed portion between the two protruding portions **105** and **107** is an insertion portion (recess) **109** into which the protruding portion **75** of the second case **70** is inserted. The protruding portion **74** of the knob supporting portion **73** of the second case **70** is also inserted into the recessed portion **103**. The drip-proof portion by a male-female interlocking connection between the protruding portion **74** and the recessed portion **103** is thereby formed. Meanwhile, the recessed portion in the middle of the protruding portion **107** has a bottom surface which is recessed in a substantially cone shape and serves as a light-reflecting surface **110**. A shaft portion **111** having a substantially circular-columnar shape protrudes from the center of a side surface (a surface facing the first case **20**) of a main body **100a** of the operating knob **100**. An upper surface of the shaft portion **111** serves as a sliding piece attachment portion **113**, and a truncated cone-shaped light-guiding protrusion **115** is further provided and protrudes from the center of the sliding piece attachment portion **113**. An end face of the light-guiding protrusion **115** serves as a light introducing surface **117**. Sliding piece attaching protrusions **119** formed of small pieces sticking out are formed on the sliding piece attachment portion **113**. A ring-shaped drip-proof recess **121** is formed around the shaft portion **111**. A click mechanism housing portion **123** formed of a bottomed circular hole is formed on the operating knob **100** at an outer peripheral portion of a surface facing the first case **20**. A coil spring **125** and the click ball **127** are housed in the click mechanism housing portion **123**. A portion around the click mechanism housing portion **123** bulges outward from the outer periphery of the operating knob **100** and the bulging portion serves as the stopper **129**. The operating knob **100** is formed by molding two types of resins **A1** and **A2** into a single piece, as shown in **FIG. 2**. The resin **A1** is a transparent resin and the resin **A2** is an opaque resin. The whole transparent resin **A1** constitutes a light guide and is molded so that the circular outer circumferential surface of the operating portion **101** is optically coupled to the light introducing surface **117** of the

light-guiding protrusion **115**.

[0019] The sliding piece **130** is formed of an elastic metal plate and is provided with a base portion **131** and arch-shaped arm portions **133** protruding from an outer surface of the base portion **131** and having a shape with U-turn at a root portion. A contact portion **135** which is curved and protrudes toward the circuit board **160** is formed at the center of each arm portion **133**. Attachment holes **137** formed of small holes are also provided on the base portion **131**.

[0020] The terminal unit **140** is formed by insert molding in which six metal-plate terminals **141** are molded in a substantially rectangular terminal case **143** consisting of a molding resin and a terminal holding case **145** having a substantially rectangular-prism shape. Each terminal **141** is arranged such that one end protrudes from a rear surface of the terminal case **143** so that the six ends are aligned in a row, and the other end protrudes from a side surface of the terminal case **143**, is bent downward, is fixed by the terminal holding case **145** and then protrudes from a lower surface of the terminal holding case **145** so that the six ends are aligned in a row.

[0021] The circuit board **160** is configured that a circular through-hole **163** is provided at an upper portion of an insulating substrate **161** formed of a substantially rectangular hard plate, a sliding contact pattern **165** to be in sliding contact with the contact portions **135** of the sliding piece **130** is formed on a front surface of the insulating substrate **161** around the circular through-hole **163**, six terminal insertion holes **167** formed of small holes for inserting one ends of the terminals **141** are formed horizontally in a row on the insulating substrate **161** in the vicinity of the lower edge, a light-emitting element **169** is attached to the rear surface of the insulating substrate **161** so as to be located below the through-hole **163**, and various other electronic parts **171** are attached to predetermined positions. A circuit pattern (not shown) is formed on the insulating substrate **161** to electrically connect between the sliding contact pattern **165**, the light-emitting element **169**, the various other electronic parts **171** and the terminals **141** inserted into the terminal insertion holes **167**. Various patterns such as switch pattern or resistor pattern can be used as the sliding contact pattern **165**.

[0022] The light guide **190** is formed in a single piece by molding a transparent synthetic resin into a substantially rectangular box shape having an opening on the front side. On the front side, the light guide **190** has a substrate housing portion **191** having a recessed shape, and a circular-columnar protruding portion **193** protrudes from an upper portion of the bottom surface of the substrate housing portion **191**. The substrate housing portion **191** is formed in a shape capable of housing and covering the entire circuit board **160**. The protruding portion **193** has a size capable of being inserted into the through-hole **163** of the circuit board **160** and is configured that an end face serves as a light-emitting surface **195**. The upper surface of the light guide **190** also serves as a light-

emitting surface 197.

[0023] The third case 220 is formed in an outer shape which is a substantially rectangular plate shape and substantially covers the rear surface of the first case 20. A pair of engaging claws 221 protrude from both right and left sides of the third case 220 toward the first case. The engaging claws 221 are flat plate-shaped members on which the claw portions 223 are provided near the end portions on both outer sides.

[0024] As shown in FIG. 3, the packings 250 are formed of an elastic body such as elastomer into a substantially rectangular ring-shape with a circular cross section and form a shape in which the front side and the right and left sides are linear and the rear side has a curved portion which is curved upward in an arc shape. Here, a portion having the arc-shaped curved portion is defined as a bearing-side packing 250a, portions on the right and left sides are defined as right- and left-side packings 250b and 250c, and a portion on the front side is defined as a non-bearing-side packing 250d. The right- and left-side packings 250b and 250c serve as coupling portions for coupling the bearing-side packing 250a to the non-bearing-side packing 250d and contribute to improvement in assemblability and wobble prevention, in addition to the sealing effect. The curved portion of the bearing-side packing 250a matches the outer shape of the bearing 21 of the first case 20.

[0025] FIG. 7 is a perspective view showing the cover 300 when viewed from the rear lower side. As shown in FIGS. 7 and also FIGS. 2 and 3, the cover 300 is a molded article of a synthetic resin and is formed in a substantially rectangular box shape having an opening on the lower side so that a case main body-housing portion 301 for covering and housing the upper portion of the main unit 10 is formed on the lower side of the cover 300. On an upper surface (outside surface) 303 of the cover 300, an exposure opening 305 for exposing a portion of the operating portion 101 of the operating knob 100 is formed at a position facing the operating knob 100 and an illumination portion 307 is formed at a position facing the light-emitting surface 197 of the light guide 190. The illumination portion 307 is formed by cutting a desired shape, such as letter/character or symbol, out of an opaque coating material applied to a surface of a transparent molded resin constituting the cover 300, but may be formed by other methods. The engagement portions 309, which are rectangular through-holes to be engaged with the engaging portions 30 of the first case 20, are respectively formed on both the right and left side surfaces of the cover 300. Drip-proof member-mounting surfaces (hereinafter, referred to as "packing mounting surfaces") 311 (311a to 311d) are formed on the back surface of the cover 300 so as to surround the exposure opening 305. The packing mounting surfaces 311 consist of a bearing-side packing mounting surface 311a in an arc shape convex toward the exposure opening 305, linear-shaped right- and left-side packing mounting surfaces 311b and 311c on both sides thereof (311c is not

shown), and a non-bearing-side packing mounting surface 311d having a linear shape and located on the opposite side to the bearing-side packing mounting surface 311a, which together form one substantially rectangular ring-shaped surface (the same shape as that formed by the packings 250). In other words, the bearing-side packing mounting surface 311a is formed at a position along the shape of an arc-shaped portion around the rim of the exposure opening 305, and the non-bearing-side packing mounting surface 311d is formed at a position away from the arc-shaped portion around the rim of the exposure opening 305.

[0026] Next, assembly of the rotary electronic component 1 will be described. Firstly, the main unit 10 is assembled. In detail, the base portion 131 of the sliding piece 130 is pre-placed on the sliding piece attachment portion 113 of the operating knob 100. At this time, the sliding piece 130 is attached by heat staking (or only press-fitting) the tips of the sliding piece attaching protrusions 119 of the sliding piece attachment portion 113 which are inserted into the attachment holes 137 of the sliding piece 130. Also, grease G for drip-proofing is applied to fill the drip-proof recess 121 of the operating knob 100. Meanwhile, the tip of each terminal 141 protruding from the rear of the terminal unit 140 is inserted into the corresponding terminal insertion hole 167 of the circuit board 160 and is fixed on the opposite side to the circuit pattern (not shown) on the circuit board by solder h (see FIG. 2).

[0027] Then, the operating knob 100, with the sliding piece 130 attached thereto and also the coil spring 125 and the click ball 127 housed in the click mechanism housing portion 123, is arranged to be housed in the first housing portion 23 of the first case 20 in such a manner that the shaft portion 111 of the operating knob 100 is inserted into the bearing 21 of the first case 20 is rotatably supported. In this state, the bearing 21 of the first case 20 is inserted in the drip-proof recess 121 of the operating knob 100 which is filled with the grease G, and this provides a drip-proof processing portion B1. Next, the second case 70 is attached to cover the front side surface of the operating knob 100. Once the claw portions 79 of the engaging claws 77 are engaged with the engagement portions 27 of the first case 20, the second case 70 and the first case 20 are attached to each other with the operating knob 100 sandwiched therebetween. The second case 70 is attached such that the knob supporting portion 73 covers the other side surface (the front side surface) of the operating knob 100, the protruding portion 75 is inserted into the insertion portion 109 of the operating knob 100, and the protruding portion 74 is inserted into the recessed portion 103.

[0028] Next, the circuit board 160 with the terminal unit 140 attached thereto and the light guide 190 are arranged to be housed in the second housing portion 25 of the first case 20, and the third case 220 is placed thereover. Then, the claw portions 223 of the third case 220 are respectively engaged with the engagement portions 29 of the

first case **20**. The main unit **10** shown in **FIG. 3** is thereby completed.

[0029] In this state, an opening **H1** is formed on the upper surface between the first case **20** and the second case **70**, and an opening **H2** is formed on the upper surface between the first case **20** and the third case **220** (see **FIG. 2**). A portion of the operating portion **101** of the operating knob **100** is exposed (protrudes) in the opening **H1**. Meanwhile, the light-emitting surface **197** of the light guide **190** is exposed in the opening **H2** so as to protrude externally (upward). Then, the contact portions **135** of the sliding piece **130** are in contact with the sliding contact pattern **165** of the circuit board **160**, as shown in **FIG. 2**. In addition, in this state, the terminal unit **140** is housed in the terminal unit housing portion **31**. Furthermore, the outer peripheral portion of the light guide **190** is in contact with a surface of the first case **20** facing the light guide **190** and encircles the circuit board **160**. Furthermore, the protruding portion **193** of the light guide **190** is inserted into the through-hole **163** of the circuit board **160** so that the tip of the light-emitting surface **195** located at the end thereof closely faces the light introducing surface **117** of the operating knob **100**.

[0030] Next, the packings **250** shown in **FIG. 3** are inserted into the case main body-housing portion **301** of the cover **300** and are placed in contact with the packing mounting surfaces **311** (**311a** to **311d**) of the cover **300**. Then, the cover **300** with the packings **250** installed thereon is attached to the main unit **10** from above. In other words, the upper portion of the main unit **10** is housed in the case main body-housing portion **301** of the cover **300**. Then, the engaging portions **30** of the main unit **10** are respectively engaged with engagement portions **309** of the cover **300**. Assembly of the rotary electronic component **1** is thereby completed. Note that, the above-mentioned assembly process is only an example and it is obvious that various other assembly processes may be used for assembly. For example, instead of attaching the packings **250** to the cover **300**, the packings **250** may be attached to the main unit **10** which is then covered with the cover **300**. In this case, ribs, etc., for preventing the packings **250** from coming out of alignment are preferably formed on at least some of the packing mounting surfaces **33** (**33a** to **33c**) and the non-bearing-side packing mounting surface **81** of the main unit **10**.

[0031] **FIG. 4** is an exploded perspective view showing the state in which only the cover **300** is detached from the assembled rotary electronic component **1**. As understood from **FIG. 4**, the packings **250** in the rotary electronic component **1** are in contact with the main unit **10** in the surrounding area of the hole the opening **H1** which is formed by combining the first and second cases **20** and **70**. In detail, among the packings **250**, the bearing-side packing **250a** is in contact with the bearing-side drip-proof member-mounting surface **33a** of the first case **20**, the right- and left-side packings **250b** and **250c** are in contact with the right and left-side packing mounting surfaces **33b** and **33c** of the first case **20**, and the non-bearing-

side packing **250d** is in contact with the non-bearing-side packing mounting surface **81** of the second case **70**.

[0032] Meanwhile, a portion of the operating portion **101** of the operating knob **100** is exposed through the exposure opening **305**, as shown in **FIGS. 1** and **2**. The light-emitting surface **197** of the light guide **190** is arranged at a position facing the lower surface (the back surface) of the illumination portion **307** of the cover **300**. Then, in the assembled state, the bearing-side packing **250a** is in contact with the bearing-side packing mounting surface **311a**, the right- and left-side packings **250b** and **250c** are in contact with the right- and left-side packing mounting surfaces **311b** and **311c**, and the non-bearing-side packing **250d** is in contact with the non-bearing-side packing mounting surface **311d**, hence, the packings **250** are sandwiched between the packing mounting surfaces **33** (**33a** to **33c**)/the non-bearing-side packing mounting surface **81** of the main unit **10** and the cover **300** and seals between the main unit **10** and the cover **300**.

[0033] In the rotary electronic component **1** assembled as described above, when the operating knob **100** is rotated, the contact portions **135** of the sliding piece **130** slide on the sliding contact pattern **165** of the circuit board **160** and this produces a difference in the detection output between the terminals **131**. When rotating the operating knob **100**, the grease **G** causes some resistance but a large torque is not required to rotate the operating knob **100** since the packings **250** are not in contact therewith at all, hence, operability is not impaired. The operating knob **100**, when rotated, does not rotate more than about half of a turn since the stopper **129** thereof (see **FIG. 6**) butts against the pair of right and left stopper engaging portions **35** (only one is shown in **FIG. 5**) provided in the first housing portion **23** of the first case **20**. In other words, the operating knob **100** moves in an arc motion.

[0034] When the light-emitting element **169** is turned on, light therefrom is introduced into and reflected by the light guide **190**, is then emitted from the light-emitting surface **197**, and illuminates the illumination portion **307** of the cover **300** from the back side thereof, as indicated by a dot-and-dash line. On the other hand, the light reflected inside the light guide **190** and emitted from the light-emitting surface **195** is introduced into the resin **A1** from the light introducing surface **117** of the operating knob **100**, is reflected therein and guided to the circular outer circumferential surface of the operating portion **101**, and illuminates the operating portion **101**.

[0035] In the meantime, the rotary electronic component **1** is installed on an operation panel **C** of an electronic device, as shown in **FIG. 8**. When installed, the upper surface **303** of the cover **300** is exposed, as the outside surface, to the outside of the operation panel **C**. Liquid may spill on the upper surface **303** exposed to the outside of the operation panel **C**. The spilled liquid enters inside the cover **300** through the exposure opening **305**. The entered liquid tries to advance from the surrounding area of the operating portion **101** of the operating knob **100** toward the circuit board **160** by passing through a gap

between the cover **300** and the first case **20** as indicated by an arrow **L1**, by passing through a gap between the cover **300** and the second case **70**, moving down along the outer surface of the second case **70** and going under its lower edge and around to the opposite side of the operating knob **100** as indicated by an arrow **L2**, or by passing through the opening **H1** of the main unit **10** as indicated by an arrow **L3**.

[0036] In the rotary electronic component 1, however, ingress of the liquid advancing toward the circuit board **160** by passing through a gap between the cover **300** and the first case **20** as indicated by the arrow **L1** is prevented by the bearing-side packing **250a**. Then, ingress of the liquid advancing toward the circuit board **160** by passing through a gap between the cover **300** and the second case **70**, moving down along the outer surface of the second case **70** and going under its lower edge of and around to the opposite side of the operating knob **100** as indicated by the arrow **L2** is prevented by the non-bearing-side packing **250d**. Meanwhile, the liquid entered through the opening **H1** of the main unit **10** as indicated by the arrow **L3** passes in the surrounding area of the operating knob **100** and is directly drained downward, but the liquid advancing toward the sliding piece **130** is blocked by the drip-proof processing portion **B1** and the ingress thereof is prevented. As such, drip-proof against the liquid entering through the exposure opening **305** of the cover **300** is effectively provided at each of these points.

[0037] As described above, the rotary electronic component 1 is configured that the operating knob **100** moving in a circular motion (including an arc motion and an oscillatory motion) about an axis **K** (see FIG. 2) is arranged on one side of the circuit board **160**, a detection means composed of the sliding piece **130** and the sliding contact pattern **165** and changing its output according to the motion of the operating knob **100** is provided between the operating knob **100** and the circuit board **160**, at least the operating knob **100** is housed in the first and second cases **20** and **70**, a portion of the operating portion **101** on the outer surface of the operating knob **100** is exposed through the opening **H1** provided on the first and second cases **20** and **70**, the cover **300** having the exposure opening **305** for exposing the portion of the operating portion **101** of the operating knob **100** is attached to cover the outer surface of the first and second cases **20** and **70** on which the opening **H1** is provided, and the packings **250** are sandwiched and held between a surrounding area of the opening **H1** of the first and second cases **20** and **70** and a surrounding area of the exposure opening **305** of the cover **300** and prevent ingress of liquid from the exposure opening **305** of the cover **300** through a gap between the first and second cases **20** and **70** and the cover **300**.

[0038] In addition, since the shaft portion **111** provided on the operating knob **100** so as to protrude from a side surface on the circuit board **160** side is rotatably inserted into the bearing **21** protruding from the first case **20** at a

position near the detection means and the drip-proof processing portion **B1** is provided at the end portion of the bearing **21** into which the shaft portion **111** is inserted, liquid which is not blocked by the packings **250** and enters the first and second cases **20** and **70** from the opening **H1** of the first and second cases **20** and **70** is prevented from entering by a portion of the bearing **21** inside the first and second cases **20** and **70**. Thus, it is possible to prevent ingress of liquid into the detection means and the circuit board **160** more effectively.

[0039] The bearing-side packing **250a**, which is the packing **250** arranged on the side where the surface of the operating knob **100** with the shaft portion **111** attached (the one side surface) is located, is arranged at a position along the operating portion **101** of the operating knob **100**. Thus, the bearing-side packing **250a**, which is arranged on the side where the circuit board **160** is located, prevents ingress of liquid at a position in the vicinity of the operating portion **101** of the operating knob **100** (immediately after the position of liquid ingress). On the other hand, the non-bearing-side packing **250d**, which is the packing **250** arranged on the side where the surface (the other side surface) of the operating knob **100** opposite to the surface with the shaft portion **111** attached is located, is arranged in the vicinity of the axis **K** of the operating knob **100**. Thus, the non-bearing-side packing **250d**, which is arranged on the side where the circuit board **160** is not located, provides drip-proof protection near the center of the side surface of the operating knob **100** which is distant from the operating portion **101** of the operating knob **100**. That is, the drip-proof effect at the portion near the circuit board **160** side is enhanced by providing drip-proof protection at a position in the vicinity of the exposure opening **305** of the cover **300**. On the other hand, in a region on the opposite side of the operating knob **100** which is distant from the circuit board **160**, the non-bearing-side packing **250d** is arranged at a position rearward (downward) of the operating portion **101** of the operating knob **100**, which allows a width dimension **S1** of a portion of the cover **300** in the vicinity of the exposure opening **305** (see FIG. 8) to be reduced. The portion of the cover **300** in the vicinity of the exposure opening **305** is a portion exposed on the operation panel **C** of the electronic device when the rotary electronic component 1 is mounted thereon. Since the width dimension **S1** of such portion can be reduce, it is possible to reduce the size or thickness, etc., of the operation panel **C** as well as of the electronic device provided with the operation panel **C**.

[0040] It is also configured such that the circular recessed portion **103** is provided on the operating knob **100** on a surface opposite to the surface with the shaft portion **111** attached, the cylindrical protruding portion **74** to be inserted into the recessed portion **103** is provided on a surface of the second case **70** facing the surface with recessed portion **103**, and the recessed portion **103** engages with the protruding portion **74**. Thus, even when liquid enters through the opening **H1** of the first and sec-

and cases **20** and **70**, the liquid is prevented from further advancing through a gap between the second case **70** and the surface of the operating knob **100** on the opposite side to the shaft portion **111**.

Reference Signs List

[0041]

1	ROTARY ELECTRONIC COMPONENT (ELECTRONIC COMPONENT)	10
20	FIRST CASE (CASE)	
21	BEARING	
70	SECOND CASE (CASE)	
100	OPERATING KNOB	15
101	OPERATING PORTION	
111	SHAFT PORTION	
130	SLIDING PIECE (DETECTION MEANS)	
160	CIRCUIT BOARD	
165	SLIDING CONTACT PATTERN (DETECTION MEANS)	20
250	PACKING (DRIP-PROOF MEMBER)	
250a	BEARING-SIDE PACKING (DRIP-PROOF MEMBER)	
250d	NON-BEARING-SIDE PACKING (DRIP-PROOF MEMBER)	25
300	COVER	
305	EXPOSURE OPENING	
K1	AXIS	
HI	OPENING	30
B1	DRIP-PROOF PROCESSING PORTION	

Claims

1. A drip-proof structure of an electronic component, comprising:

a rotary body (100) that comprises a main body comprising a circular outer circumferential surface as an operating portion (101) and a shaft portion (111) provided on one side surface of the main body;

a first case (20) that comprises a bearing (21) rotatably supporting the shaft portion of the rotary body (100);

a second case (70) that is provided integral with the first case (20) so as to have an opening therebetween, supports the other side surface of the main body of the rotary body (100), and houses, together with the first case (20), the rotary body (100) while exposing a portion of the circular outer circumferential surface of the rotary body (100) through the opening;

a sliding piece (130) that is provided on the rotary body (100) located inside the first and second cases and changes its position to follow rotation of the rotary body (100);

a circuit board (160) that comprises a sliding contact pattern (165) to be in sliding contact with the sliding piece (130) and outputs an output signal corresponding to the rotational position of the rotary body (100);

a cover (300) that comprises an exposure opening for exposing the portion of the circular outer circumferential surface of the rotary body (100) exposed through the opening and covers the first and second cases and the circuit board (160);

first and second drip-proof members (250a, 250d) arranged between the first case (20) and the cover (300) and between the second case and the cover (300), respectively, **characterized in that it further comprises** a drip-proof processing portion (B1) provided between the shaft portion of the rotary body (100) and the bearing (21),

wherein the drip-proof processing portion (B1) comprises an end portion of a cylindrical protruding portion serving as the bearing (21) and receiving the shaft portion of the rotary body (100) inserted therein, and a drip-proof recess formed on the shaft portion of the rotary body (100) so as to be concentrically with the shaft portion and receiving the end portion of the protruding portion inserted therein.

2. The drip-proof structure of an electronic component according to claim 1, wherein the first drip-proof member (250a) is arranged between a portion of the first case (20) constituting a surrounding area of the opening and a portion of the cover (300) constituting a surrounding area of the exposure opening (305), and wherein the second drip-proof member (250d) is arranged between a portion of the second case (70) constituting a surrounding area of the opening and a portion of the cover (300) constituting the surrounding area of the exposure opening (305).
3. The drip-proof structure of an electronic component according to claim 1 or 2, wherein the first and second drip-proof members (250a, 250d) extend in a direction orthogonal to an axial direction of the rotary body (100).
4. The drip-proof structure of an electronic component according to claim 1 or 2, wherein the first and second drip-proof members (250a, 250d) comprise coupling portions extending in an axial direction of the rotary body (100).
5. The drip-proof structure of an electronic component according to claim 4, wherein the first and second drip-proof members (250a, 250d) and the coupling portions are ring-shaped.

6. The drip-proof structure of an electronic component according to any one of claims 3 to 5, wherein an outer circumferential shape of the bearing (21) of the first case (20) is arc-shaped, and wherein the first drip-proof member comprises a curved portion that is located on the bearing side and is formed in an arc shape engaging with the outer shape of the bearing of the first case (20). 5
7. The drip-proof structure of an electronic component according to any one of claims 3 to 5, wherein the second drip-proof member is located on an opposite side of the rotary body (100) to the bearing. 10
8. The drip-proof structure of an electronic component according to claim 1, further comprising a drip-proof portion provided between the other side surface of the main body of the rotary body (100) and the second case (70), the drip-proof portion comprising a male-female interlocking connection. 15 20

Patentansprüche

1. Tropfsichere Struktur eines elektronischen Bauteils, umfassend: 25
 - einen Drehkörper (100), der einen Hauptkörper mit einer kreisförmigen äußeren Umfangsfläche als Betätigungsabschnitt (101) und einen an einer Seitenfläche des Hauptkörpers vorgesehenen Wellenabschnitt (111) umfasst; 30
 - ein erstes Gehäuse (20), das ein Lager (21) umfasst, das den Wellenabschnitt des Drehkörpers (100) drehbar lagert; 35
 - ein zweites Gehäuse (70), das einstückig mit dem ersten Gehäuse (20) vorgesehen ist, so dass es eine Öffnung dazwischen aufweist, die andere Seitenfläche des Hauptkörpers des Drehkörpers (100) stützt und zusammen mit dem ersten Gehäuse (20) den Drehkörper (100) aufnimmt, während ein Teil der kreisförmigen Außenumfangsfläche des Drehkörpers (100) durch die Öffnung freigelegt wird; 40
 - ein Gleitstück (130), das an dem Drehkörper (100) vorgesehen ist, der sich im Inneren des ersten und zweiten Gehäuses befindet, und seine Position ändert, um der Drehung des Drehkörpers (100) zu folgen; 45
 - eine Leiterplatte (160), die ein Gleitkontaktmuster (165) umfasst, um in gleitendem Kontakt mit dem Gleitstück (130) zu sein, und ein Ausgangssignal ausgibt, das der Drehposition des Drehkörpers (100) entspricht; 50
 - eine Abdeckung (300), die eine Freilegungsöffnung zum Freilegen des Abschnitts der kreisförmigen Außenumfangsfläche des Drehkörpers (100), der durch die Öffnung freigelegt ist, um-

fasst und das erste und zweite Gehäuse und die Leiterplatte (160) abdeckt;
 ein erstes und ein zweites tropfsicheres Element (250a, 250d), die zwischen dem ersten Gehäuse (20) und der Abdeckung (300) bzw. zwischen dem zweiten Gehäuse und der Abdeckung (300) angeordnet sind, **dadurch gekennzeichnet, dass** es ferner umfasst einen tropfsicheren Bearbeitungsabschnitt (B1), der zwischen dem Wellenabschnitt des Drehkörpers (100) und dem Lager (21) vorgesehen ist, wobei der tropfsichere Bearbeitungsabschnitt (B1) einen Endabschnitt eines zylindrischen vorstehenden Abschnitts, der als das Lager (21) dient und den Wellenabschnitt des Drehkörpers (100), der darin eingesetzt ist, aufnimmt, und eine tropfsichere Aussparung umfasst, die an dem Wellenabschnitt des Drehkörpers (100) so ausgebildet ist, dass sie konzentrisch mit dem Wellenabschnitt ist und den Endabschnitt des vorstehenden Abschnitts, der darin eingesetzt ist, aufnimmt.

2. Tropfsichere Struktur eines elektronischen Bauteils nach Anspruch 1, wobei das erste tropfsichere Element (250a) zwischen einem Abschnitt des ersten Gehäuses (20), der einen Umgebungsbereich der Öffnung bildet, und einem Abschnitt der Abdeckung (300), der einen Umgebungsbereich der Freilegungsöffnung (305) bildet, angeordnet ist, und wobei das zweite tropfsichere Element (250d) zwischen einem Abschnitt des zweiten Gehäuses (70), der einen Umgebungsbereich der Öffnung bildet, und einem Abschnitt der Abdeckung (300), der den Umgebungsbereich der Freilegungsöffnung (305) bildet, angeordnet ist.
3. Tropfsichere Struktur eines elektronischen Bauteils nach Anspruch 1 oder 2, wobei sich das erste und das zweite tropfsichere Element (250a, 250d) in einer Richtung orthogonal zu einer axialen Richtung des Drehkörpers (100) erstrecken.
4. Tropfsichere Struktur eines elektronischen Bauteils nach Anspruch 1 oder 2, wobei das erste und das zweite tropfsichere Element (250a, 250d) Koppelungsabschnitte umfassen, die sich in einer axialen Richtung des Drehkörpers (100) erstrecken.
5. Tropfsichere Struktur eines elektronischen Bauteils nach Anspruch 4, wobei das erste und das zweite tropfsichere Element (250a, 250d) und die Koppelungsabschnitte ringförmig sind.
6. Tropfsichere Struktur eines elektronischen Bauteils nach einem der Ansprüche 3 bis 5, wobei eine äußere Umfangsform des Lagers (21) des ersten Gehäuses (20) bogenförmig ist, und

wobei das erste tropfsichere Element einen gekrümmten Abschnitt umfasst, der sich auf der Lagerseite befindet und bogenförmig geformt ist und mit der Außenform des Lagers des ersten Gehäuses (20) in Eingriff steht.

7. Tropfsichere Struktur eines elektronischen Bauteils nach einem der Ansprüche 3 bis 5, wobei das zweite tropfsichere Element auf einer dem Lager gegenüberliegenden Seite des Drehkörpers (100) angeordnet ist.
8. Tropfsichere Struktur eines elektronischen Bauteils nach Anspruch 1, ferner umfassend einen tropfsicheren Abschnitt, der zwischen der anderen Seitenfläche des Hauptkörpers des Drehkörpers (100) und dem zweiten Gehäuse (70) vorgesehen ist, wobei der tropfsichere Abschnitt eine Steckverbindung umfasst.

Revendications

1. Une structure anti-goutte d'un composant électronique, comprenant :

un corps rotatif (100) qui comprend un corps principal comprenant une surface circonférentielle extérieure circulaire en tant que partie opérationnelle (101) et une partie d'arbre (111) prévue sur une surface latérale du corps principal ;
 un premier boîtier (20) qui comprend un palier (21) supportant de manière rotative la partie d'arbre du corps rotatif (100) ;
 un deuxième boîtier (70) qui est prévu solidaire du premier boîtier (20) de manière à avoir une ouverture entre eux, supporte l'autre surface latérale du corps principal du corps rotatif (100) et qui loge, avec le premier boîtier (20), le corps rotatif (100) tout en exposant une partie de la surface circonférentielle externe circulaire du corps rotatif (100) à travers l'ouverture ;
 une pièce coulissante (130) qui est prévue sur le corps rotatif (100) situé à l'intérieur des premier et deuxième boîtiers et qui change sa position de façon à suivre la rotation du corps rotatif (100) ;
 une carte à circuit imprimé (160) qui comprend un motif à contact glissant (165) destiné à être en contact glissant avec la pièce coulissante (130) et qui délivre un signal de sortie correspondant à la position de rotation du corps rotatif (100) ;
 un couvercle (300) qui comprend une ouverture d'exposition pour exposer la partie de la surface circonférentielle externe circulaire du corps rotatif (100) exposée à travers l'ouverture et qui recouvre les premier et deuxième boîtiers et la

carte à circuit (160) ;

des premier et deuxième éléments anti-gouttes (250a, 250d) agencés entre le premier boîtier (20) et le couvercle (300) et entre le deuxième boîtier et le couvercle (300), respectivement, **caractérisée en ce qu'elle** comprend en outre une partie (B1) de traitement anti-gouttes prévue entre la partie d'arbre du corps rotatif (100) et le palier (21), la partie (B1) de traitement anti-gouttes comprenant une partie d'extrémité d'une partie saillante cylindrique servant en tant que le palier (21) et recevant la partie d'arbre du corps rotatif (100) en elle, et un évidement anti-gouttes formé sur la partie d'arbre du corps rotatif (100) de manière à être concentrique avec la partie d'arbre et recevant la partie d'extrémité de la partie saillante insérée en lui.

2. La structure anti-goutte d'un composant électronique selon la revendication 1, dans laquelle le premier élément anti-goutte (250a) est agencé entre une partie du premier boîtier (20) constituant une zone environnante de l'ouverture et une partie du couvercle (300) constituant une zone environnante de l'ouverture d'exposition (305), et dans laquelle le deuxième élément anti-gouttes (250d) est agencé entre une partie du deuxième boîtier (70) constituant une zone environnante de l'ouverture et une partie du couvercle (300) constituant la zone environnante de l'ouverture d'exposition (305).
3. La structure anti-goutte d'un composant électronique selon la revendication 1 ou la revendication 2, dans laquelle les premier et deuxième éléments anti-goutte (250a, 250d) s'étendent dans une direction orthogonale à une direction axiale du corps rotatif (100).
4. La structure anti-gouttes d'un composant électronique selon la revendication 1 ou la revendication 2, dans laquelle les premier et deuxième éléments anti-gouttes (250a, 250d) comprennent des portions de liaison s'étendant dans une direction axiale du corps rotatif (100).
5. La structure anti-goutte d'un composant électronique selon la revendication 4, dans laquelle les premier et deuxième éléments anti-goutte (250a, 250d) et les parties de liaison sont en forme d'anneau.
6. La structure anti-gouttes d'un composant électronique selon l'une quelconque des revendications 3 à 5, dans laquelle une forme circonférentielle externe du palier (21) du premier boîtier (20) est en forme d'arc, et dans laquelle le premier élément anti-gouttes com-

prend une partie incurvée qui est située sur le côté palier et est formée selon une forme d'arc venant en engagement avec la forme extérieure du palier du premier boîtier (20).

5

7. La structure anti-goutte d'un composant électronique selon l'une quelconque des revendications 3 à 5, dans laquelle le deuxième élément anti-goutte est situé sur un côté du corps rotatif (100) opposé au palier.

10

8. La structure anti-goutte d'un composant électronique selon la revendication 1, comprenant en outre une partie anti-goutte prévue entre l'autre surface latérale du corps principal du corps rotatif (100) et le deuxième boîtier (70), la partie anti-goutte comprenant une liaison par emboîtement mâle-femelle.

15

20

25

30

35

40

45

50

55

FIG.1

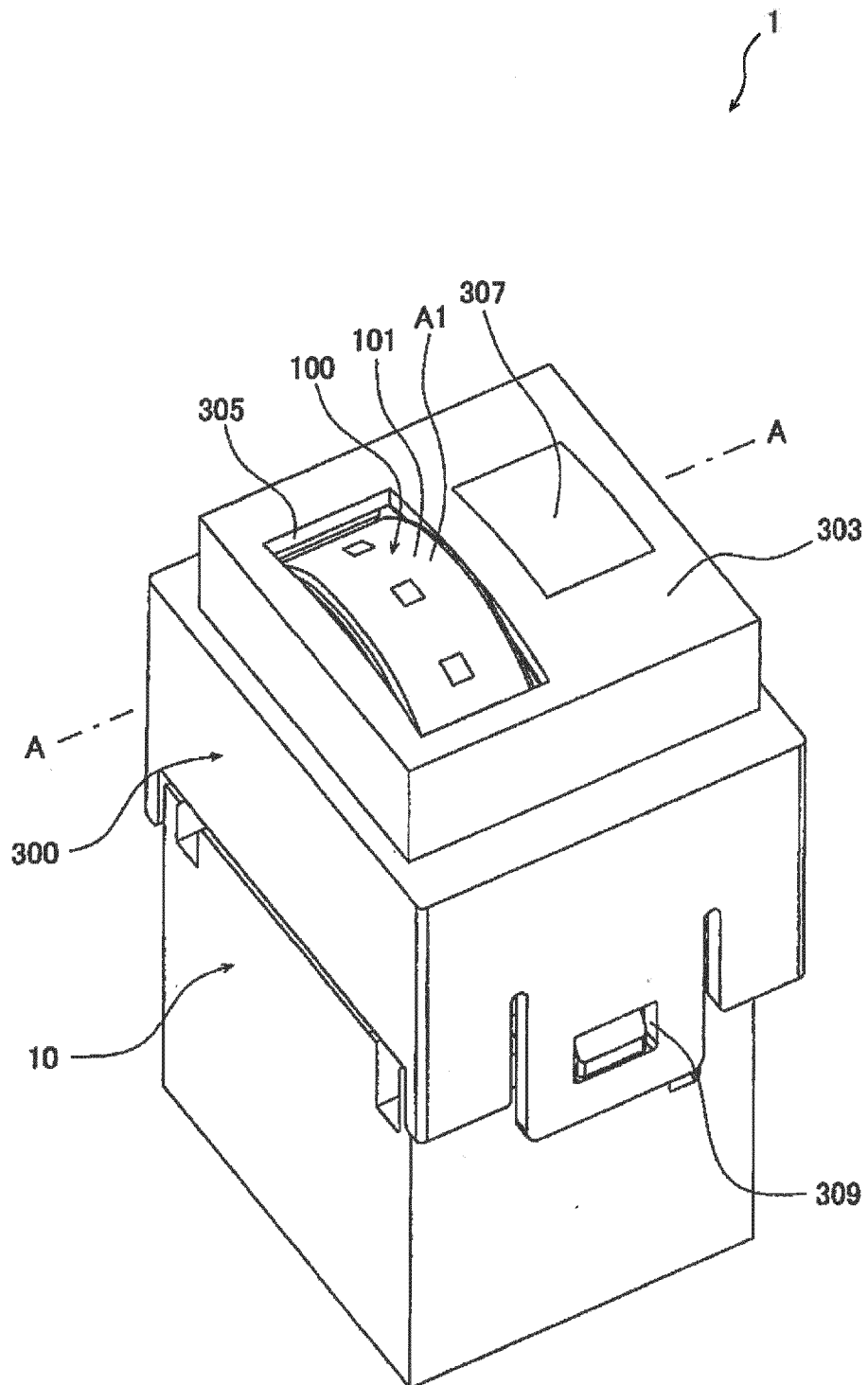


FIG.2

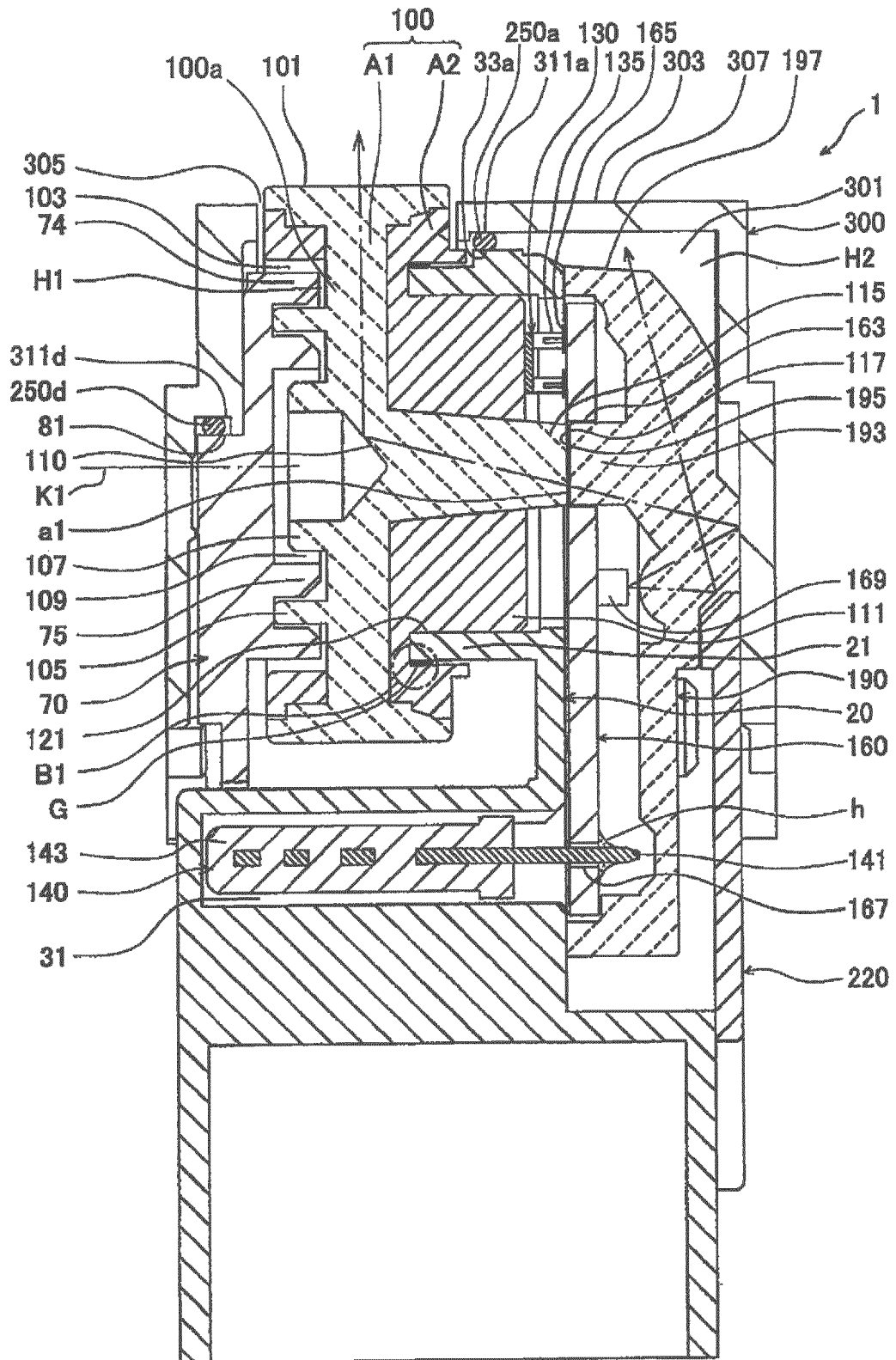


FIG. 3

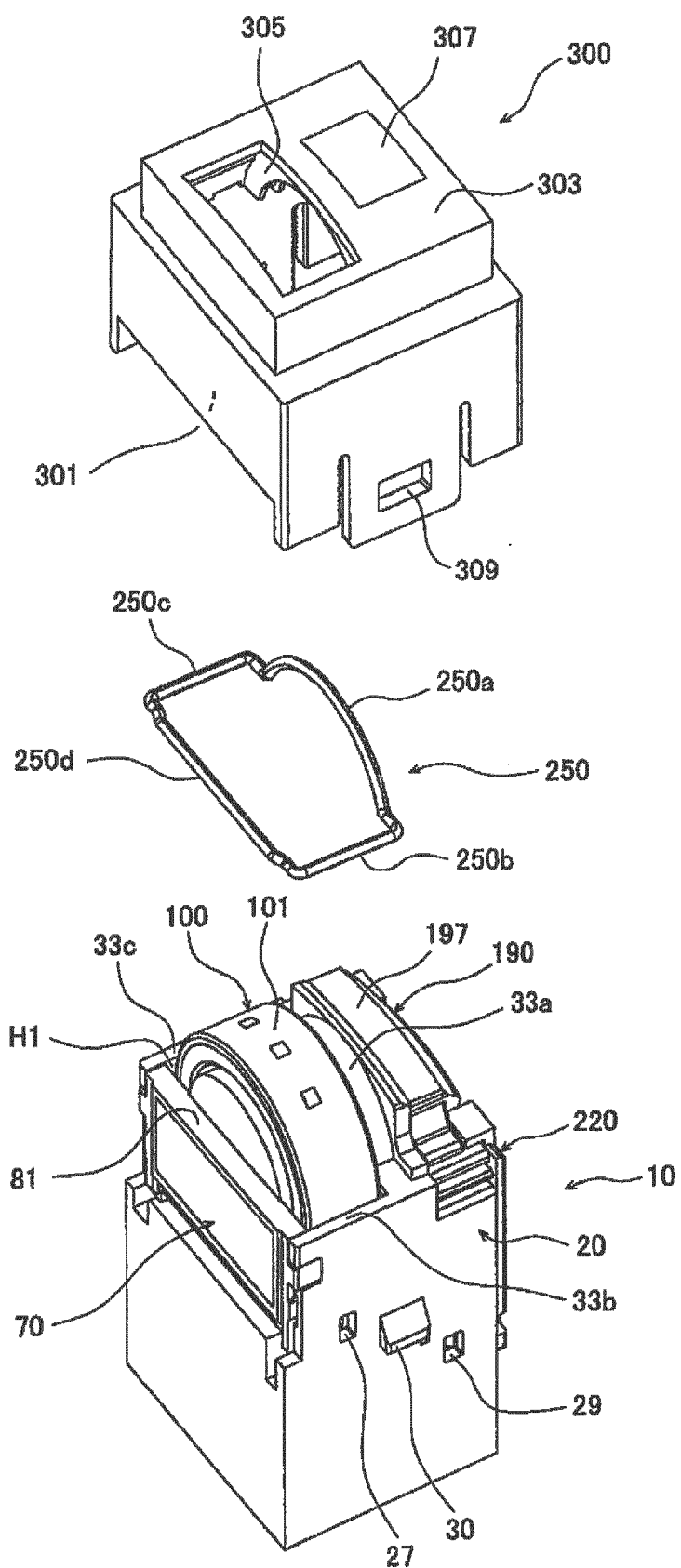
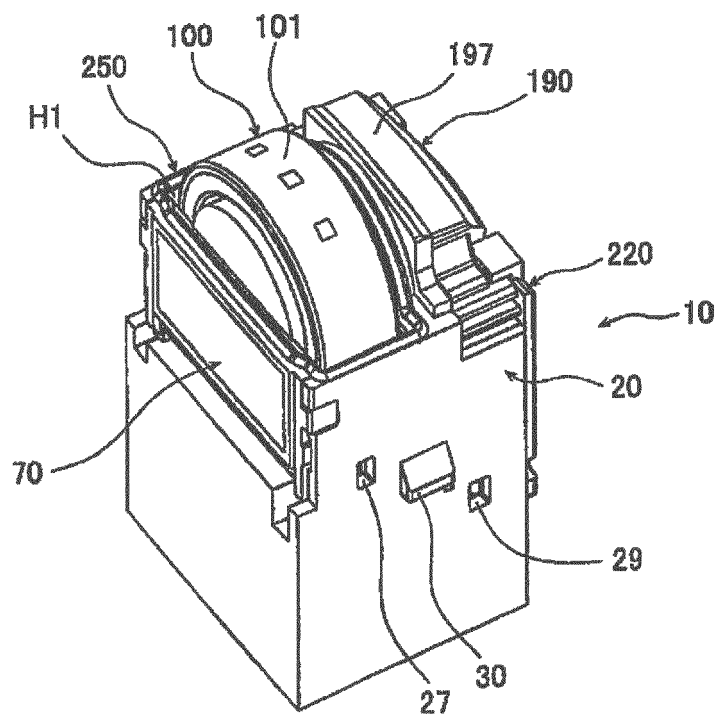
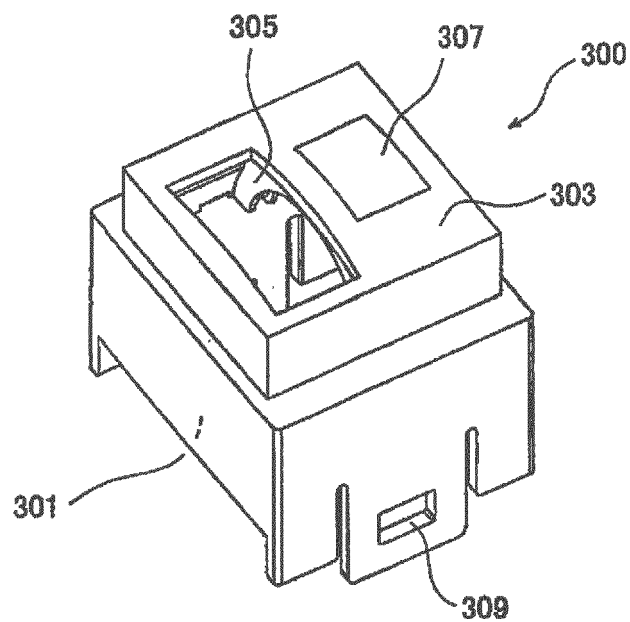
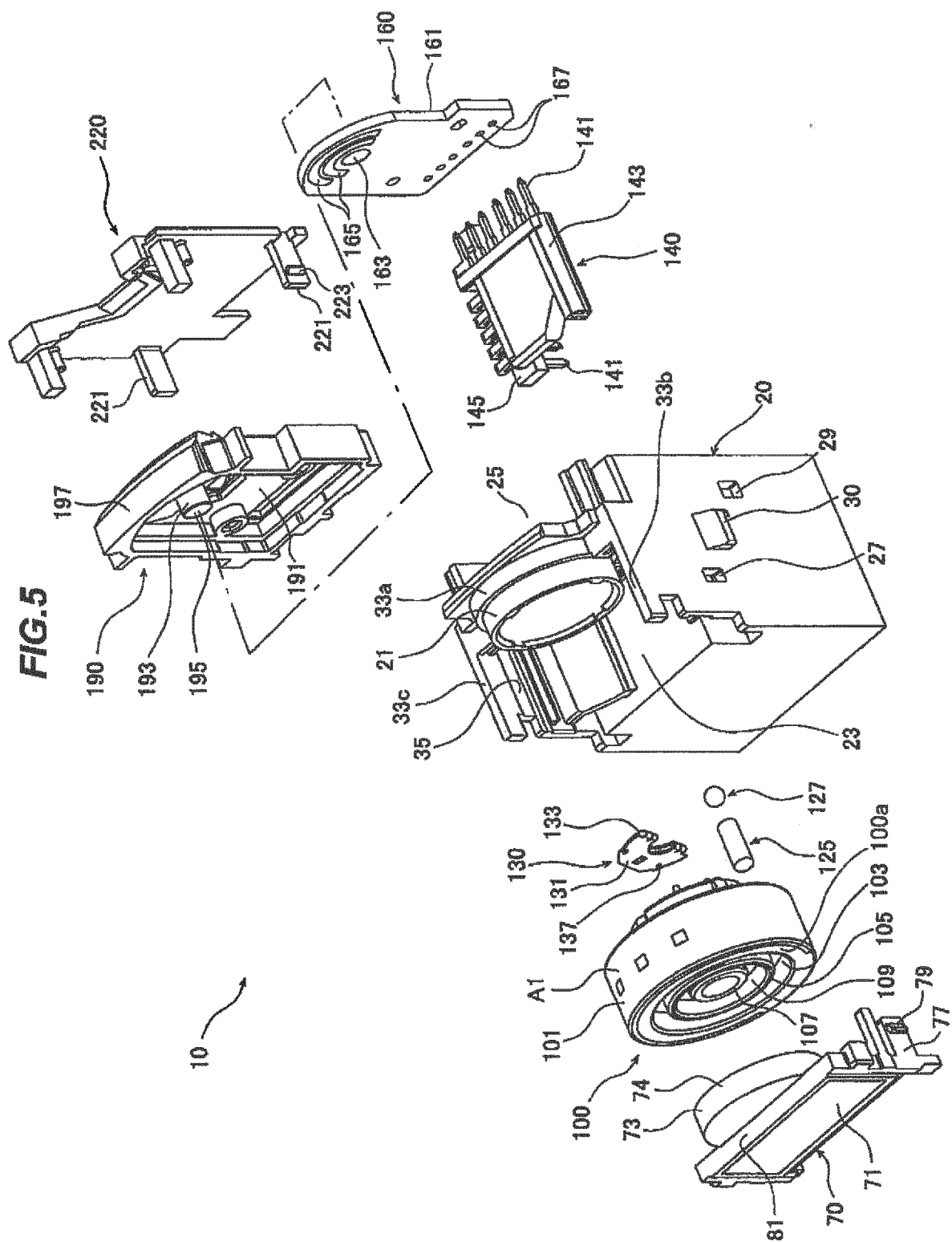


FIG.4





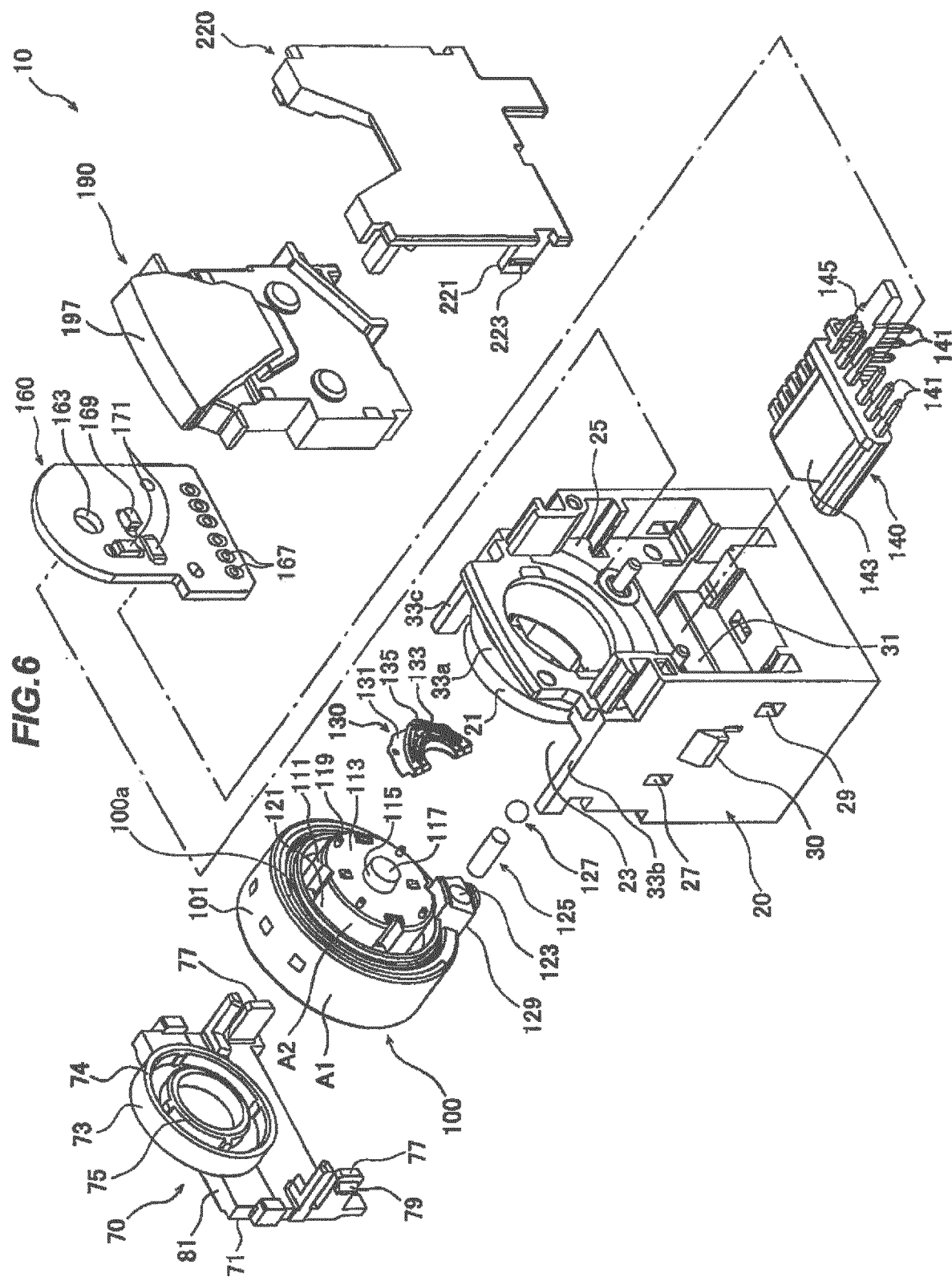


FIG.7

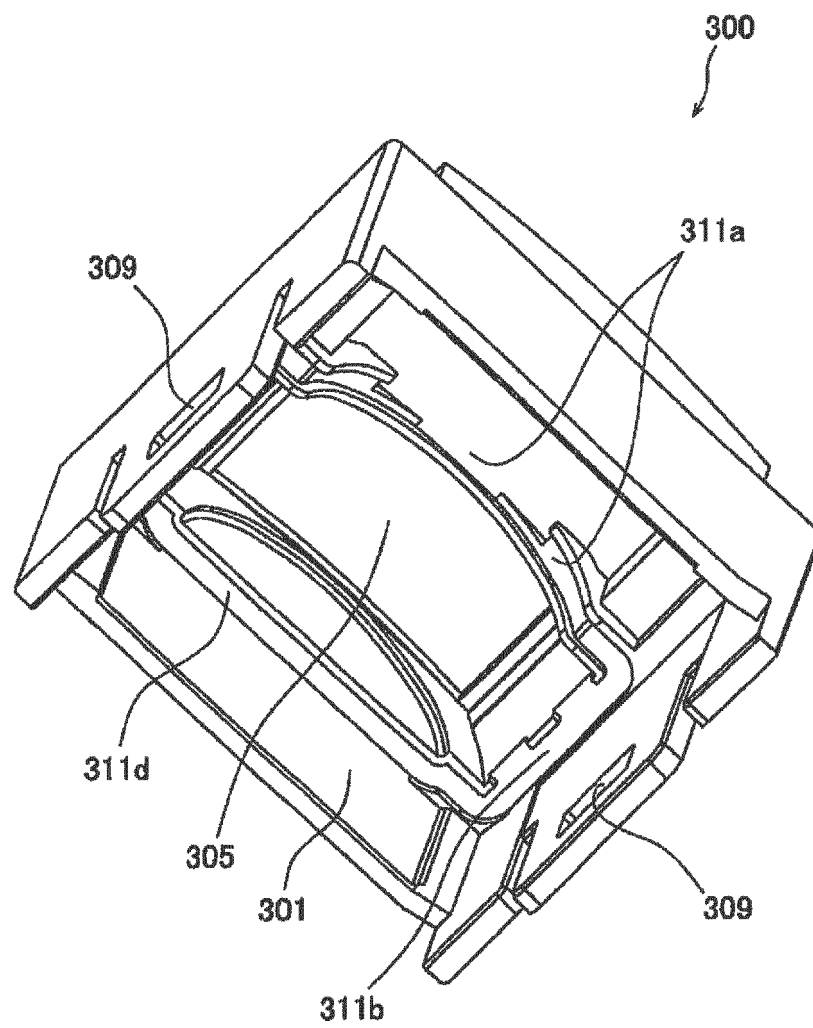
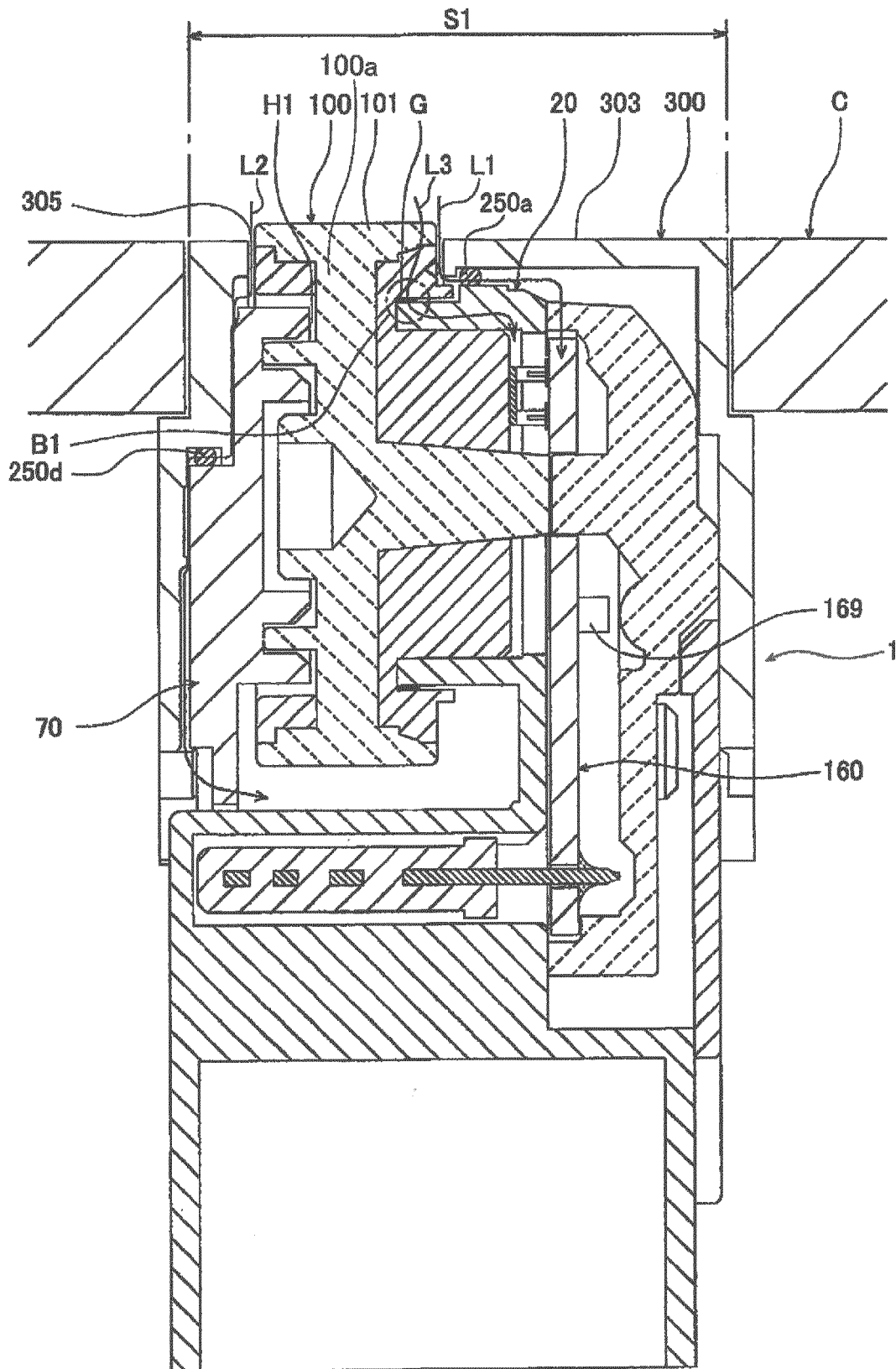


FIG.8



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2016148630 A [0001]
- JP 2017130113 A [0001]
- JP 2011134573 A [0003] [0005] [0008]
- JP 2010009937 A [0004] [0005] [0009]
- US 3809830 A [0006]
- WO 2015087366 A1 [0007]