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(71) Applicant: **Alps Electric Co., Ltd.**
Tokyo 145-8501 (JP)

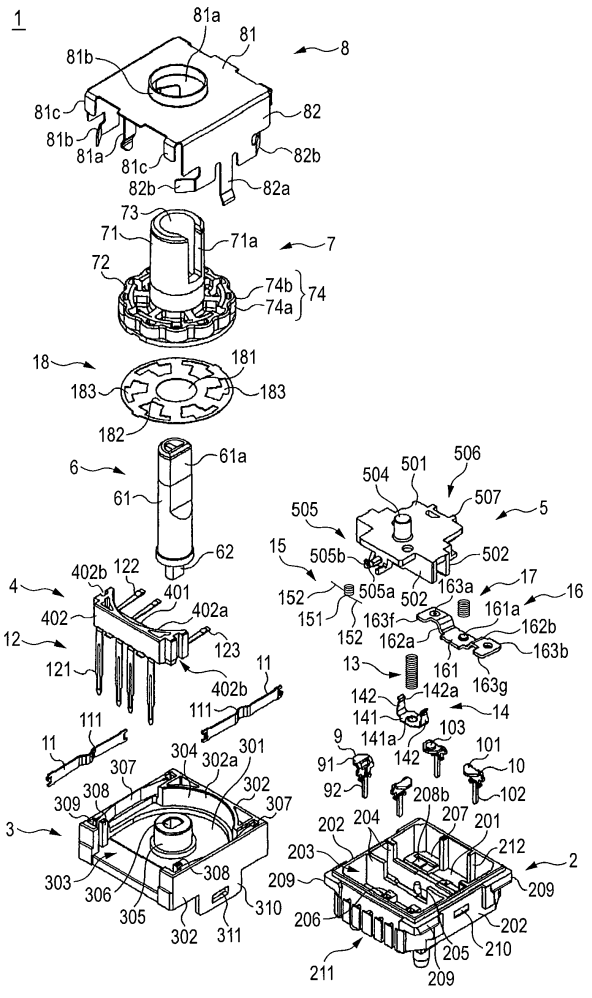
(72) Inventors:
- **Tanaka, Takaki**
  Tokyo, Tokyo 145-8501 (JP)
- **Mikawa, Masaaki**
  Tokyo, Tokyo 145-8501 (JP)

(74) Representative: **Klunker . Schmitt-Nilson . Hirsch**
Patentanwälte
Destouchesstrasse 68
80796 München (DE)

(54) Composite Operation Type Electric Component

(57) A composite operation type electric component (1) includes a rotation operation member (7) which protrudes from a housing having a storage portion and has a rotatable cylindrical portion (71), a pressing operation member (6) which is movably inserted into a through hole (73) in the cylindrical portion (71) of the rotation operation member (7) in an axis direction, rotation detection means for detecting a rotation operation of the rotation operation member (7), and a push switch which is operated in response to vertical movement of the pressing operation member (6). A partition wall (301) is provided to partition the storage portion in the housing into a storage portion (304) and a storage portion (203). The rotation detection means is arranged in the storage portion (304), and the push switch is arranged in the storage portion (203). An engagement shaft portion (62) of the pressing operation member (6) is movably inserted into a through hole (306) of a cylindrical portion (305) provided in the partition wall (301) in the axial direction.

FIG. 1



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Description

[0001] This application claims benefit of Japanese Patent Application No. 2011-055053 filed on March 14, 2011, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a composite operation type electric component, and in particular, to a composite operation type electric component which is receivable pressing operation and rotation operation from an operator.

2. Description of the Related Art

[0003] In the related art, a microwave oven or a car audio system is mounted with a composite operation type electric component which is receivable pressing operation and rotation operation from an operator. As this composite operation type electric component, a composite operation type electric component is known in which a rotary switch is arranged on the outer circumference of a push switch, thereby reducing the height of the entire component (for example, see Japanese Unexamined Patent Application Publication No. 2001-43778).

[0004] However, in the composite operation type electric component described in Japanese Unexamined Patent Application Publication No. 2001-43778, since the rotary switch is arranged on the outer circumference of the push switch, it is difficult to cope with a request for reduction in the dimension of the component in plan view. In particular, when the push switch is applied to a power switch, since a contact structure in the power switch is generally of large size, it is difficult to reduce the dimension of the component in plan view.

[0005] In order to cope with a request for reduction in the dimension of the component in plan view, a structure in which the rotary switch is arranged above the push switch in an overlapping manner is considered. When the rotary switch is arranged above the push switch in an overlapping manner, the amount of stroke during a pressing operation in the push switch increases, and thus it is necessary to appropriately move up and down a pressing operation member which is subjected to a pressing operation. When the pressing operation member does not appropriately move up and down, this results in a variation in the switching timing between the on and off states of the push switch.

[0006] When the rotary switch is arranged above the push switch in an overlapping manner, the detection precision of rotation detection means of the rotary switch may be deteriorated due to heat or the like generated during switching between the on and off states of the push switch serving as a power switch. For example, heat generated during switching between the on and off states of the push switch may deform the housing which holds the rotation detection means, and then change the positional relation between the constituent components of the rotation detection means. A change in the positional relation between the constituent components causes deterioration in the detection precision of the rotation detection means. In particular, when the push switch is applied to a power switch, a large amount of current generally flows in the power switch and has a significant influence on the detection precision of the rotation detection means of the rotary switch, thus it is necessary to take into consideration this influence.

SUMMARY OF THE INVENTION

[0007] The present invention provides a composite operation type electric component capable of suppressing the occurrence of a variation in the switching timing between the on and off states of the push switch and deterioration in the detection precision of rotation detection means while realizing the reduction in the dimension of the component in plan view.

[0008] A composite operation type electric component according to an embodiment of the invention includes a housing having a storage portion, a rotation operation member which protrudes upward from the housing and has a rotatable first cylindrical portion, a pressing operation member which is movably inserted into a through hole formed in the first cylindrical portion of the rotation operation member in an axis direction, rotation detection means for detecting rotation operation of the rotation operation member, and a push switch which is operated in response to movement in the axis direction of the pressing operation member. A partition wall is provided in the housing to partition the storage portion into a first storage portion and a second storage portion below the first storage portion. A second cylindrical portion has a hole portion having passed therethrough in the axis direction and is provided in a central portion of the partition wall to protrude toward the first storage portion. The through hole of the rotation operation member is rotatably inserted into an outer circumferential portion of the second cylindrical portion. A tip portion of the pressing operation member is movably inserted into the hole portion in the axis direction. The rotation detection means is arranged in the first storage portion. The push switch which is operated by the tip portion of the pressing operation member is arranged in the second storage portion.

[0009] With this configuration, the rotation detection means is arranged in the first storage portion, and the push switch is arranged in the second storage portion. Thus, the rotation detection means and the push switch can be arranged vertically through the partition wall of the housing, thereby realizing reduction in dimension of the component in plan view. The pressing operation member is inserted into the through hole of the first cylindrical portion, and the tip portion thereof is inserted into the hole portion of the second cylindrical portion.

Thus, the pressing operation member can be guided in the up-down direction (axis direction) by both the through hole and the hole portion, thereby appropriately vertically moving the pressing operation member and suppressing the occurrence of a variation in the switching timing between the on and off states of the push switch. The rotation detection means and the push switch are partitioned by the partition wall. Thus, even if the push switch is applied to a power switch, it is possible to prevent the influence of heat or the like generated during switching between the on and off states of the push switch from affecting the rotation detection means, thereby suppressing deterioration in the detection precision of the rotation detection means.

[0010] In the composite operation type electric component, the push switch may have a vertically movable moving member which is stored in the second storage portion, driven by the pressing operation member, and biased upward, a fixed contact which is provided in the second storage portion, and a movable contact which comes into contact with and separates from the fixed contact, and is held by the moving member. In this case, the fixed contact and the movable contact are arranged within the scope of the second storage portion provided below the partition wall, thereby reliably switching between the on and off states of the push switch within the second storage portion. Therefore, it is possible to apply the push switch to a power switch which can endure a large amount of current.

[0011] In the composite operation type electric component, the moving member may include a base portion which holds the movable contact and a projection which is provided to protrude upward from the base portion, and the projection may be inserted into the hole portion of the partition wall to be vertically movable opposite the tip portion of the pressing operation member. In this case, it is possible to guide the projection by the hole portion of the second cylindrical portion, thereby reducing a slip with movement of the moving member and effectively suppressing a variation in the switching timing of the push switch.

[0012] In the composite operation type electric component, a coil spring is provided to bias the moving member upward at a position opposite the projection with the base portion interposed therebetween. In this case, since the coil spring is provided at the position opposite the projection to bias the moving member and the pressing operation member upward, it makes difficult for the moving member to vertically move in the inclined state, thereby improving the precision of the switching timing of the push switch. Since the coil spring is used for the return of the moving member, it is possible to increase the displacement of the moving member, thereby allowing a large gap between the fixed contact and the movable contact in an initial state (off state). Thus, even if the push switch is applied to a power switch, it is possible to secure insulation performance in the off state.

[0013] In the composite operation type electric component, the moving member may include a storage concave portion which stores a portion of the coil spring and a pair of engagement portions which are formed in the lateral portions of the storage concave portion to be opposite each other, and a pair of elastic pieces may be provided to be engaged with and disengaged from the engagement portions in response to vertical movement of the moving member with the storage concave portion interposed therebetween. In this case, it is possible to engage and disengage a pair of elastic pieces with and from the engagement portions in response to vertical movement of the moving member, thereby imposing a click sensation during pressing operation using the coil spring for return. The elastic pieces sandwich the engagement portions arranged inside the opposing lateral portions with the coil spring interposed therebetween, thereby preventing force from being applied to incline the moving member.

[0014] In the composite operation type electric component, the push switch may be arranged on one side of the base portion with respect to the central portion of the base portion, and a detection switch may be arranged on the other side of the base portion to detect pressing operation against the pressing operation member. In this case, the push switch is arranged on one side of the base portion, and the detection switch is arranged on the other side, thereby switching between the on and off states of the push switch and the detection switch with a proper balance in response to vertical movement of the moving member.

[0015] In the composite operation type electric component, the housing may include a lower case in which the fixed contact is provided and an upper case which has the partition wall and is superimposed to cover the lower case, the rotation detection means may have a cord pattern which is provided in the lower portion of the rotation operation member and a wiper which is in sliding contact with the cord pattern, and the wiper may be arranged on the upper side from the partition wall in a state of being buried in a holding member made of synthetic resin arranged in a notch portion provided in a sidewall of the upper case. In this case, the housing has the lower case and the upper case, thereby improving working efficiency when constituent components are stored in the housing. Since the wiper which constitutes the rotation detection means is arranged on the upper side from the partition wall in a state of being buried in the holding member arranged in a portion of the upper case, it is possible to prevent the influence of heat or the like generated during switching between the on and off states of the push switch, thereby effectively suppressing deterioration in the detection precision of the rotation detection means.

[0016] In the composite operation type electric component, the upper case and the lower case may be formed of synthetic resin having flame resistance higher than the holding member. In this case, the push switch can be stored in the upper case and the lower case formed of synthetic resin having high flame resistance,

thereby preventing heat or arc discharge generated during switching between the on and off states of the push switch from affecting the constituent components outside the housing and securing safety.

[0017] In the composite operation type electric component, a tip of the wiper may extend from the holding member and may be bent downward to form an external terminal, and the external terminal may be held by a terminal holding portion provided at a sidewall of the lower case. In this case, the external terminal extending from the holding member is held by the terminal holding portion provided at the sidewall of the lower case, thereby stabilizing the position of the external terminal and facilitating a mounting work on a printed board.

[0018] In the composite operation type electric component, a plurality of corrugated portions may be provided in the outer circumferential portion of the rotation operation member, and in the upper case, a pair of click plate springs which have projections to be engaged with and disengaged from the corrugated portions may be provided to be opposite each other. In this case, in the upper case, a pair of click plate springs having projections to be engaged with and disengaged from the corrugated portions of the rotation operation member, thereby imposing a click sensation with rotation of the rotation operation member. A pair of click plate springs are provided in the upper case, thereby allowing the projections to be engaged with and disengaged from the corrugated portions of the rotation operation member with a proper balance and suppressing the inclination of the rotation operation member. Since the upper case is superimposed to cover the lower case, it is possible to make abrasion powder generated when a click sensation is imposed difficult to enter the lower case, and to prevent defective contact of the push switch due to abrasion powder.

[0019] According to the embodiment of the invention, it is possible to suppress the occurrence of a variation in the switching timing between the on and off states of the push switch and deterioration in the detection precision of the rotation detection means while realizing reduction in the dimension of the component in plan view.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1 is an exploded perspective view of a composite operation type electric component of this embodiment.

Fig. 2 is an exploded perspective view of the composite operation type electric component of the embodiment.

Fig. 3 is a perspective view when the composite operation type electric component of the embodiment is assembled.

Fig. 4 is a perspective view of a state where a cover member and constituent components on the lower side from a lower case are removed from Fig. 3.

Fig. 5 is an explanatory view of the relation between a sliding member and a cord member provided in the composite operation type electric component of the embodiment.

Fig. 6 is a perspective view of a state where constituent components on the upper side from an upper case are removed from Fig. 3.

Fig. 7 is a bottom view of a moving member in the composite operation type electric component of the embodiment.

Fig. 8 is a side view of the moving member shown in Fig. 7 when viewed from below.

Fig. 9 is a side view of the moving member shown in Fig. 7 when viewed from left.

Fig. 10 is a side view of the moving member shown in Fig. 7 when viewed from right.

Fig. 11 is a sectional view of an initial state of the composite operation type electric component of the embodiment.

Fig. 12 is a sectional view of the initial state of the composite operation type electric component of the embodiment.

Fig. 13 is a sectional view of the initial state of the composite operation type electric component of the embodiment.

Fig. 14 is a sectional view of the composite operation type electric component of the embodiment during a pressing operation.

Fig. 15 is a sectional view of the composite operation type electric component of the embodiment during a pressing operation.

Fig. 16 is a sectional view of the composite operation type electric component of the embodiment during a pressing operation.

Fig. 17 is a diagram showing a configuration example of a power switch circuit of a washing machine using the composite operation type electric component of the embodiment.

Fig. 18 is an explanatory view of an operation state of a power switch circuit of a washing machine using the composite operation type electric component of the embodiment.

Fig. 19 is an explanatory view of an operation state of a power switch circuit of a washing machine using the composite operation type electric component of the embodiment.

Fig. 20 is an explanatory view of an operation state of a power switch circuit of a washing machine using the composite operation type electric component of the embodiment.

Fig. 21 is an explanatory view of an operation state of a power switch circuit of a washing machine using the composite operation type electric component of the embodiment.

Fig. 22 is an explanatory view of an operation state of a power switch circuit of a washing machine using the composite operation type electric component of the embodiment.

Fig. 23 is an explanatory view of an operation state of a power switch circuit of a washing machine using the composite operation type electric component of the embodiment.

Fig. 24 is an explanatory view of an operation state of a power switch circuit of a washing machine using the composite operation type electric component of the embodiment.

Fig. 25 is an explanatory view of an operation state of a power switch circuit of a washing machine using the composite operation type electric component of the embodiment.

Fig. 26 is an explanatory view of an operation state of a power switch circuit of a washing machine using the composite operation type electric component of the embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] Hereinafter, an embodiment of the invention will be described in detail with reference to the accompanying drawings. A composite operation type electric component (hereinafter, simply referred to as "electric component") according to an embodiment of the invention is configured to receive a plurality of operations including rotation operation and pressing operation from an operator. For example, the electric component of this embodiment is mounted in a washing machine, a microwave oven, or the like, and is used for a switching operation between the on and off of the power supply, a selection operation of various menus, and the like. The apparatuses and purposes to which the electric component of this embodiment is applied are not limited to those described above and may be appropriately changed.

[0022] Figs. 1 and 2 are exploded perspective views showing the overall configuration of an electric component 1 according to an embodiment of the invention. In the following description, for convenience of description, the lower left side shown in Fig. 1 is called "the front side of the electric component 1", and the upper right side shown in Fig. 1 is called "the rear side of the electric component 1". For convenience of description, the upper side shown in Fig. 1 is called "the upper side of the electric component 1", and the lower side shown in Fig. 1 is called "the lower side of the electric component 1".

[0023] As shown in Fig. 1, the electric component 1 of this embodiment includes a lower case 2 and an upper case 3 which form the housing of the electric component 1, a holding member 4 which is attached to the front side of the upper case 3, a moving member 5 which is stored in the lower case 2, a pressing operation member 6 and a rotation operation member 7 which are partially stored in the upper case 3, and a cover member 8 which is configured to cover the lower case 2 and the upper case 3 storing constituent components.

[0024] The lower case 2 is molded of, for example, an insulating resin material. Specifically, the lower case 2 is formed of a flame-resistant resin material, such as nylon or polybutylene terephthalate (PBT). The lower case 2 has an upward open shape, and includes a rectangular bottom portion 201 and sidewall portions 202 provided to extend upward from the edge portions of the bottom portion 201. In the lower case 2, a storage portion 203 is provided in a space defined by the bottom portion 201 and the sidewall portions 202. The storage portion 203 forms a second storage portion.

[0025] At the center of the storage portion 203, a pair of wall portions 204 are provided to extend in the left-right direction. A pair of wall portions 204 function as a guide portion which guides vertical movement of the moving member 5 in the lower case 2. A shaft portion 205 is provided upright at the center of the bottom portion 201 arranged in a pair of wall portions 204. In the bottom portion 201 arranged on the front side of the wall portions 204, a pair of insertion holes 206 to which a pair of fixed contacts 9 are attached are formed. In the bottom portion 201 arranged on the rear side of the wall portion 204, a pair of insertion holes 207 to which a pair of fixed contacts 10 are attached are formed. In the bottom portion 201 on the front side of each insertion hole 207, a rectangular projection 208 is provided. The upper surface of the projection 208a arranged on the right side is arranged to be higher than the upper surface of the projection 208b arranged on the left side (see Fig. 12).

[0026] At the upper ends of the four corner portions of the lower case 2, engagement pieces 209 are provided to protrude outward. At the centers of the outer surfaces of a pair of opposing sidewall portions 202, snap engagement pieces 210 are provided to slightly protrude outward. In the sidewall portion 202 arranged on the front side, a plurality of terminal holding portions 211 are provided to hold external terminal portions 121 of a sliding member 12 described below. A plurality of terminal holding portions 211 are arranged in the left-right direction of the lower case 2 and configured to hold the external terminal portions 121 which are inserted from above. In the inner surface of the sidewall portion 202 arranged on the rear side, a pair of guide portions 212 are provided to slightly protrude forward. These guide portions 212 are provided over the entire sidewall portion 202 in the up-down direction.

[0027] Similarly to the lower case 2, the upper case 3 is formed of, for example, an insulating resin material, in particular, a flame-resistance resin material, such as nylon or PBT. The upper case 3 has an upward open shape, and includes a rectangular bottom portion 301 and sidewall portions 302 provided to extend upward from the edge portions of the bottom portion 301. At the inner wall of the sidewall portion 302 arranged on the rear side, an arc-shaped inner wall surface 302a is provided. At the center of the sidewall portion 302 arranged on the front side, a notch portion 303 is formed. In the upper case 3, a storage portion 304 is provided in a space defined by the bottom portion 301 and the sidewall portions 302. The bottom portion 301 forms a partition wall which partitions the storage portion in the housing. The storage

portion 304 forms a first storage portion.

[0028] At the center of the bottom portion 301, a cylindrical portion 305 is provided to protrude upward (the storage portion 304 side). The cylindrical portion 305 forms a second cylindrical portion and is provided to substantially protrude to the same height as the sidewall portion 302. In the cylindrical portion 305, a through hole 306 is formed to pass through the upper case 3 in the up-down direction. The through hole 306 is provided in a noncircular shape, and specifically, is substantially provided in a D shape. Inside a pair of opposing sidewall portions 302, storage portions 307 which store click plate springs (hereinafter, simply referred to as "plate springs") 11 are provided. The spring storage portions 307 hold the end portions of the plate springs 11, and store the plate springs 11 such that the central portions of the plate springs 11 are exposable toward the storage portion 304.

[0029] At the corner portions near the notch portion 303, a pair of pillar portions 308 are provided upright. Each pillar portion 308 forms a portion of the corresponding spring storage portion 307. On the front side of the pillar portion 308, a concave portion 309 is provided between the pillar portion 308 and the sidewall portion 302 on the front side. At the centers of a pair of sidewall portions 302 in which the spring storage portions 307 are provided, extended portions 310 are provided to extend downward. At the center near the lower end portion of each extended portion 310, an opening 311 is provided.

[0030] The holding member 4 is formed of, for example, an insulating resin material, in particular, a resin material having flame resistance lower than the lower case 2 or the upper case 3. The holding member 4 has a bottom portion 401 substantially having a rectangular shape and a sidewall portion 402 provided to extend upward from the edge portion, excluding the rear end portion of the bottom portion 401. At the inner wall of the sidewall portion 402 arranged on the front side, an arc-shaped inner wall surface 402a is provided. At the outer wall of the sidewall portion 402 arranged, engagement portions 402b are provided to be engaged with the pillar portions 308 of the upper case 3.

[0031] In the holding member 4, a plurality of sliding members 12 are insert-molded by punching and bending a conductive metal material. Each sliding member 12 substantially has an L shape in side view, and includes an external terminal portion 121 extending in the up-down direction and a wiper portion 122 extending rearward from the upper end portion of the external terminal portion 121. Each sliding member 12 is buried in the bottom portion 401 of the holding member 4 near a connection portion (that is, the front end portion of the wiper portion 122) of the wiper portion 122 to the external terminal portion 121.

[0032] In the upper surface near the rear end portion of each wiper portion 122, a projection 123 is provided to slightly protrude upward. Each wiper portion 122 is configured to slide on a cord member 18 described below using the projection 123. In this embodiment, the sliding member 12 has four external terminal portions 121 and three wiper portions 122. Of the four external terminal portions 121, the inner two external terminal portions 121 are connected to the wiper portion 122 arranged at the center of the three wiper portions 122.

[0033] The moving member 5 is formed of, for example, an insulating resin material, in particular, a flame-resistance resin material, such as nylon or polybutylene terephthalate (PBT). The moving member 5 has a base portion 501 which substantially has a plate shape. In the lower surface of the base portion 501, a pair of wall portions 502 are provided near the central portion to extend downward. A pair of wall portions 502 extend in the left-right direction of the electric component 1 and are provided to be opposite each other. At the center of a pair of wall portions 502, a connection portion 503 is provided to connect a pair of wall portions 502. The connection portion 503 substantially has a rectangular parallelepiped shape which extends in the up-down direction of the moving member 5. At the center of the connection portion 503, a storage concave portion 503a is provided to be opened downward. In each lateral surface of the connection portion 503, an engagement portion 503b is provided to slightly protrude in the left-right direction. In the lower surface of the moving member 5, a pair of wall portions 502 are arranged to be opposite in a state where there is a given space lateral to the connection portion 503.

[0034] In the storage concave portion 503a, a coil spring 13 is stored. A plate spring 14 which substantially has a U shape is arranged below the coil spring 13 in front view (rear view). The plate spring 14 has a bottom portion 141 having a planar shape and a pair of elastic pieces 142 provided to extend upward from the lateral end portions of the bottom portion 141. At the center of the bottom portion 141, a circular opening 141a is formed. The interval between a pair of elastic pieces 142 is slightly narrower than the opposing lateral surface portions of the connection portion 503 of the moving member 5. Near the upper end portions of a pair of elastic pieces 142, projections 142a are provided to protrude inward.

[0035] At the center of the upper surface of the base portion 501, a projection 504 is provided to protrude upward. The projection 504 substantially has a columnar shape. In the lower surface of the front end portion of the base portion 501, a spring holding portion 505 which holds a torsion spring 15 is provided. The spring holding portion 505 has a shaft portion 505a provided to protrude forward and a pair of locking pieces 505b provided laterally to the shaft portion 505a.

[0036] The torsion spring 15 is formed of a conductive metal wire, and has a wound portion 151 and a pair of arm portions 152 extending laterally from the lower end portion of the wound portion 151. The torsion spring 15 functions as a movable contact which forms a portion of a detection switch described below.

[0037] In the lower surface of the rear end portion of the base portion 501, a plate holding portion 506 which holds a metal plate 16 is provided. The plate holding por-

tion 506 has a support wall portion 506a provided to extend downward from the rear end portion of the base portion 501, a shaft portion 506b provided to protrude from the lower surface of the base portion 501 inside the support wall portion 506a, and a pair of locking pieces 506c provided on the rear side slightly from the rear wall portion 502. In the lower end portion of the support wall portion 506a, a locking piece 506d is provided to protrude inward. In the end portion of the rear surface of the support wall portion 506a, a rib-like portion 507 is provided to protrude slightly rearward. The rib-like portion 507 is provided over the entire support wall portion 506a in the up-down direction.

[0038] The metal plate 16 is formed of a conductive metal plate material, and substantially has an elongated shape in top view. The metal plate 16 has a bottom portion 161 having a planar shape, a first planar portion 163a provided in one lateral end portion of the bottom portion 161 through a first connection portion 162a, and a second planar portion 163b provided in the other lateral end portion of the bottom portion 161 through a second connection portion 162b. The metal plate 16 functions as a movable contact which forms a portion of a power switch described below.

[0039] In the upper surface of the bottom portion 161, a projection 161a is provided to lock the lower end portion of the coil spring 17. The first connection portion 162a and the second connection portion 162b are provided to extend obliquely upward from the lateral end portions of the bottom portion 161. The first connection portion 162a is designed to be slightly longer than the second connection portion 162b. The first planar portion 163a and the second planar portion 163b are arranged on a plane substantially in parallel with the bottom portion 161. From the difference in the dimension between the first connection portion 162a and the second connection portion 162b, the first planar portion 163a is arranged on the upper side slightly from the second planar portion 163b. In the lower surfaces of the first planar portion 163a and the second planar portion 163b, disc-shaped projections 163c and 163d are provided. A circular silver chip 163e is fixed onto the lower surface of the projection 163c provided in the first planar portion 163a. In the front end portions of the first planar portion 163a and the second planar portion 163b, projection pieces 163f and 163g are provided to slightly protrude forward.

[0040] The pressing operation member 6 is formed of an insulating resin material, and has an operation shaft portion 61 substantially having a columnar shape and an engagement shaft portion 62 provided to extend downward from the lower end portion of the operation shaft portion 61. In a portion near the upper end portion of the operation shaft portion 61, a notch-like portion 61a is provided. Near the upper end portion of the operation shaft portion 61 has a D-shape section in top view. The section of the engagement shaft portion 62 has a noncircular shape, and specifically, substantially has a D shape. The shape of the outer circumference of the engagement shaft portion 62 is substantially identical to the shape of the inner circumference of the through hole 306 provided in the cylindrical portion 305 of the upper case 3.

[0041] The rotation operation member 7 is molded of an insulating resin material. The rotation operation member 7 has a cylindrical portion 71 substantially having a cylindrical shape and a disc-like portion 72 provided on the outer circumference of the lower end portion of the cylindrical portion 71. The cylindrical portion 71 forms a first cylindrical portion, and a through hole 73 is provided at the center of the cylindrical portion 71. In the outer circumferential surface of the cylindrical portion 71, a slit 71a is provided to extend in the up-down direction. The disc-like portion 72 is provided to extend in the radial direction from the outer circumference of the lower end portion of the cylindrical portion 71 by the same dimension. In the lateral surface portion on the outer circumference of the disc-like portion 72, a corrugated portion 74 is provided. In the corrugated portion 74, concave portions 74a and convex portions 74b are provided successively.

[0042] In the lower surface of the disc-like portion 72, a cord member 18 is insert-molded by punching a conductive metal plate material. The cord member 18 substantially a circular shape. At the center of the cord member 18, a circular opening 181 is formed, and a ring-like portion 182 is provided outside the opening 181. Outside the ring-like portion 182, a plurality of openings 183 (in this embodiment, 6 openings) are formed. A connection portion 184 is formed between the openings 183 to extend in the radial direction. The opening 181 is designed at a position and dimension corresponding to the through hole 73 of the rotation operation member 7. A plurality of openings 183 are arranged in parallel in the circumferential direction of the cord member 18. In the insert-molded state, a plurality of projections 75 provided in the lower surface of the disc-like portion 72 are stored in the openings 183. The projections 75 exposed from the openings 183 and the connection portions 184 form a cord pattern.

[0043] The cover member 8 is formed by punching and bending a metal plate material. The cover member 8 has an upper surface portion 81 has a planar shape and a pair of lateral surface portions 82 provided to extend downward from the lateral ends of the upper portion 81. At the center of the upper surface portion 81, a circular opening 81a is provided. In the vicinity of the opening 81a, a support wall portion 81b is provided to slightly protrude upward. At both ends of the front end portion and the rear end portion of the upper surface portion 81, pairs of positioning pieces 81c are provided. The positioning pieces 81c are provided to protrude downward from the upper surface portion 81.

[0044] At the center of the lower end portion of each lateral surface portion 82, an attachment piece 82a is provided to extend downward. The attachment pieces 82a are portions for attaching the assembled electric component 1 to the portions to be attached of an apparatus, in which the electric component 1 is mounted. On

the front side and the lower side of each attachment piece 82a, a pair of fixing pieces 82b which are slightly bent inward are provided. These fixing pieces 82b are portions for fixing the cover member 8 to the lower case 2 on which the upper case 3 is superimposed.

[0045] A pair of fixed contacts 9 are formed by punching and bending a conductive metal plate material. Each fixed contact 9 forms a portion of a detection switch described below, and has a planar portion 91 having a planar shape and an external terminal portion 92 provided to extend downward from the planar portion 91. Each fixed contact 9 is fixed to the lower case 2 when the external terminal portion 92 is inserted into the insertion hole 206. The external terminal portion 92 of each fixed contact 9 is configured to protrude from the lower surface of the lower case 2 in a state of being fixed to the lower case 2.

[0046] A pair of fixed contacts 10 are formed by punching and bending a conductive metal plate material. Each fixed contact 10 forms a portion of a power switch described below, and has a planar portion 101 having a planar shape and an external terminal portion 102 provided to extend downward from the planar portion 101. A circular silver chip 103 is fixed onto the upper surface of the planar portion 101 of one fixed contact 10. Each fixed contact 10 is fixed to the lower case 2 when the external terminal portion 102 is inserted into the insertion hole 207. The external terminal portion 102 of each fixed contact 10 is configured to protrude from the lower surface of the lower case 2 in a state of being fixed to the lower case 2.

[0047] A pair of plate springs 11 are formed by punching and bending an elastic metal plate material. Each plate spring 11 is formed of an elongated body which extends in the forth-back direction of the electric component 1. At the center of the plate spring 11, a projection 111 is provided to protrude inward. The projections 111 are engaged with and disengaged from the corrugated portion 74 of the disc-like portion 72 of the rotation operation member 7 to impose a click sensation.

[0048] Fig. 3 is a perspective view when the electric component 1 of this embodiment is assembled. As shown in Fig. 3, if the electric component 1 is assembled, the cover member 8 in a state where the constituent components, such as the moving member 5, the pressing operation member 6, and the rotation operation member 7, are stored in the housing (the lower case 2 and the upper case 3). The cover member 8 is fixed to the lower case 2 by engaging the fixing pieces 82b with the engagement pieces 209 in a state where the lateral surface portions 82 are opposite the sidewall portions 302 of the upper case 3, and the positioning pieces 81c are opposite the front surface and the rear surface of the upper case 3.

[0049] The holding member 4 is arranged in the notch portion 303 provided in the front surface of the upper case 3. The external terminal portions 121 of the sliding member 12 insert-molded in the holding member 4 are arranged to extend downward along the front surface of the electric component 1. The external terminal portions 121 are held in a state of being inserted into the terminal holding portions 211 of the lower case 2.

[0050] The cylindrical portion 71 of the rotation operation member 7 protrudes upward from the opening 81a formed in the cover member 8. The cylindrical portion 71 of the rotation operation member 7 is configured such that the outer circumferential portion thereof is supported by the support wall portion 81b provided in the cover member 8. The operation shaft portion 61 of the pressing operation member 6 is inserted into the through hole 73 provided in the cylindrical portion 71. The operation shaft portion 61 is configured such that the upper end portion thereof protrudes from the cylindrical portion 71. In this assembled state, the electric component 1 is configured to receive a pressing operation of the pressing operation member 6 and a rotation operation of the rotation operation member 7 from the operator.

[0051] Hereinafter, the internal structure of the electric component 1 of this embodiment will be described. Fig. 4 is a perspective view of a state where the cover member 8 and the constituent components on the lower side from the lower case 2 are removed from Fig. 3. As shown in Fig. 4, the disc-like portion 72 of the rotation operation member 7 is stored in the storage portion 304 of the upper case 3. The plate springs 11 are stored in the spring storage portions 307 of the upper case 3. The plate springs 11 are stored in the spring storage portions 307 in a state where the projections 111 protrude toward the storage portion 304. The corrugated portion 74 of the disc-like portion 72 is configured such that the projections 111 of the plate springs 11 can be engaged and disengaged in a state of being stored in the storage portion 304. If the disc-like portion 72 rotates in response to rotation operation from the operator, the projections 111 of the plate springs 11 are engaged and disengaged in response to rotation.

[0052] The holding member 4 is arranged in the notch portion 303 of the upper case 3 in a state where the engagement portions 402b provided in the opposing sidewall portions 402 are engaged with the pillar portions 308. In this case, the sidewall portion 402 arranged on the front side of the holding member 4 is arranged to be flush with the sidewall portion 302 on the front side of the upper case 3. In the sliding member 12 buried in the bottom portion 401 of the holding member 4, the wiper portions 122 are arranged to be slidable on the lower surface of the cord member 18 insert-molded in the lower surface of the disc-like portion 72.

[0053] Fig. 5 is an explanatory view of the relation between the sliding member 12 and the cord member 18 in the electric component 1 of this embodiment. Fig. 5 is a bottom view of a state the upper case 3 is removed from Fig. 4. In the following description, for convenience of description, the wiper portion 122 arranged on the left side shown in Fig. 5 is called "a wiper portion 122a", and the wiper portion 122 arranged on the right side shown in Fig. 5 is called "a wiper portion 122b", and the wiper

portion 122 arranged between the wiper portion 122a and the wiper portion 122b is called "a wiper portion 122c".

[0054] As shown in Fig. 5, the wiper portions 122 (122a to 122c) are arranged to be opposite the cord member 18 buried in the lower surface of the disc-like portion 72. In the state of Fig. 5, the wiper portion 122a is arranged at a position corresponding to the opening 183 formed in the cord member 18, and the wiper portion 122b is arranged at a position corresponding to the connection portion 184 formed in the cord member 18. The wiper portion 122c is arranged at a portion corresponding to the ring-like portion 182.

[0055] The opening 183 of the cord member 18 has an inner opening 183a and an outer opening 183b formed successively on the outer circumference side of the inner opening 183a. The outer opening 183b is arranged at a position shifted in the radial direction (specifically, the clockwise direction) from the inner opening 183a. The wiper portion 122a is arranged at a position on the circumference corresponding to the outer opening 183b of the opening 183, and the wiper portion 122b is arranged at a position on the circumference corresponding to the inner opening 183a.

[0056] In this embodiment, the wiper portion 122c is used as a common contact terminal portion, and the wiper portions 122a and 122b are used as a switching terminal portion. As described above, if the wiper portions 122a to 122c are arranged, it is possible to temporally shift the timing at which the wiper portion 122a and the wiper portion 122c are in an electrical conduction state and the timing at which the wiper portion 122b and the wiper portion 122c are in an electrical conduction state. The electric component 1 is configured to detect the switching state and the number of times of switching of the electrical conduction state in the wiper portions 122a to 122c, thereby detecting the rotation direction and the rotation angle of the rotation operation member 7. That is, the cord pattern provided in the lower surface of the disc-like portion 72 of the rotation operation member 7 and the wiper portions 122 of the sliding member 12 form rotation detection means for detecting the rotation of the rotation operation member 7.

[0057] Fig. 6 is a perspective view of a state where the constituent components on the upper side from the upper case 3 are removed from Fig. 3. As shown in Fig. 6, the moving member 5 is stored in the storage portion 203 of the lower case 2. The moving member 5 is stored in the lower case 2 in a state where a pair of wall portions 502 are arranged in the space (hereinafter, referred to as "central space") between a pair of wall portions 204 of the lower case 2. In an initial state where pressing operation is not received from the operator, the upper surface of the base portion 501 of the moving member 5 is arranged at the substantially same height as the upper end portion of the sidewall portion 202 of the lower case 2.

[0058] In the central space, the coil spring 13 and the plate spring 14 are stored. The plate spring 14 is arranged in a state where the shaft portion 205 is inserted into the opening 141a formed in the bottom portion 141. The coil spring 13 is attached to the shaft portion 205 protruding from the opening 141a. The upper end portion of the coil spring 13 attached to the shaft portion 205 is stored in a storage concave portion 503a provided in the connection portion 503 of the moving member 5. The center of the projection 504 provided in the top surface of the base portion 501 is arranged to coincide with the center of the shaft portion 205. The coil spring 13 attached to the shaft portion 205 is arranged at a position opposite the projection 504 with the base portion 501 interposed therebetween.

[0059] The spring holding portion 505 of the moving member 5 in the state of being stored in the storage portion 203 is arranged in a space (hereinafter, referred to as "front space") between the front sidewall portion 202 and the front wall portion 204. The plate holding portion 506 of the moving member 5 is arranged in a space (hereinafter, referred to as "rear space") between the rear sidewall portion 202 and the rear wall portion 204. In this case, a pair of rib-like portions 507 provided in the support wall portion 506a forming the plate holding portion 506 are arranged inside a pair of guide portions 212 of the rear sidewall portion 202.

[0060] In the front space, the fixed contacts 9 are attached to the insertion holes 206 of the bottom portion 201 in a state where the planar portions 91 are exposed. In the initial state, a pair of arm portions 152 of the torsion spring 15 held in the spring holding portion 505 are arranged to be opposite the planar portions 91 of the fixed contacts 9. In the electric component 1 of this embodiment, the torsion spring 15 and a pair of fixed contacts 9 form a detection switch which detects a pressing operation of the pressing operation member 6.

[0061] In the rear space, the fixed contacts 10 are attached to the insertion holes 207 of the bottom portion 201 in a state where the planar portions 101 are exposed. In the initial state, the projections 163c and 163d of the metal plate 16 held in the plate holding portion 506 are arranged to be opposite the planar portions 101 of the fixed contacts 10 at a given interval. In the electric component 1 of this embodiment, the moving member 5, the metal plate 16 held by the moving member 5, and a pair of fixed contacts 10 form a push switch. In particular, the push switch is used as a power switch.

[0062] The configuration of the moving member 5 in a state where the torsion spring 15 and the metal plate 16 are held will be described with reference to Figs. 7 to 10. Fig. 7 is a bottom view of the moving member 5 in the electric component 1 of this embodiment. Fig. 8 is a side view of the moving member 5 shown in Fig. 7 when viewed from below. Fig. 9 is a side view of the moving member 5 shown in Fig. 7 when viewed from left. Fig. 10 is a side view of the moving member 5 shown in Fig. 7 when viewed from right. Figs. 7 to 10 all show the moving member 5 in a state where the torsion spring 15 and the metal plate 16 are held. Figs. 7 to 10 show the moving

member 5 in the initial state.

[0063] As shown in Fig. 7, in the moving member 5, a pair of wall portions 502 are arranged at the center of the base portion 501 at a given distance. The connection portion 503 is provided at the center of a pair of wall portions 502. At the center of the connection portion 503, the circular storage concave portion 503a is provided toward the depth side of the paper shown in Fig. 7. The engagement portions 503b are provided in the outer wall surface lateral to the connection portion 503. These engagement portions 503b are provided to slightly protrude laterally in the lower portion of the outer wall surface of the connection portion 503 (see Figs. 9 and 10). The projection 504 are provided at a position at the back of the storage concave portion 503a shown in Fig. 7 (see Figs. 9 and 10).

[0064] The spring holding portion 505 is provided in the base portion 501 arranged on the front side of the front (in Fig. 7, upper) wall portion 502 of the electric component 1. As shown in Figs. 9 and 10, the spring holding portion 505 is provided to provide forward from the front end portion on the lower side of the base portion 501. In the spring holding portion 505, the torsion spring 15 is held in a state where the wound portion 151 is inserted into the shaft portion 505a and a pair of arm portions 152 are locked by the locking pieces 505b. The front ends of a pair of arm portions 152 locked by the locking pieces 505b are in a state of protruding laterally from the locking pieces 505b. The portions protruding laterally from the locking pieces 505b can be in contact with the planar portions 91 of the fixed contacts 9.

[0065] The plate holding portion 506 is provided in the base portion 501 arranged on the rear side of the rear (in Fig. 7, lower) wall portion 502 of the electric component 1. As shown in Figs. 9 and 10, the plate holding portion 506 is provided on the lower side of the base portion 501. In the plate holding portion 506, the metal plate 16 is configured such that the rear end portion of the bottom portion 161 is supported by the locking piece 506d from the lower side, and the front end portion of the projection piece 163g provided in the second planar portion 163b is supported by the locking piece 506c. As described above, since the first planar portion 163a is arranged at a position higher than the second planar portion 163b, the projection piece 163f provided in the first planar portion 163a is not in contact with the locking piece 506c (see Fig. 9). The locking piece 506c corresponding to the projection piece 163f is used to prevent dropout of the metal plate 16 from the plate holding portion 506.

[0066] As shown in Figs. 9 and 10, the coil spring 17 is attached to the shaft portion 506b of the plate holding portion 506. The coil spring 17 is arranged between the upper surface of the bottom portion 161 of the metal plate 16 and the lower surface of the base portion 501, and biases the metal plate 16 downward. That is, in the initial state, pretension is applied to the metal plate 16 by a biasing force of the coil spring 17. In a state of being biased by the coil spring 17, as shown in Figs. 8 to 10, the metal plate 16 is held in the plate holding portion 506 in a state where the front lateral end portion is inclined upward. The positions of the lower end portions of the projections 163c (including the silver chip 163e) and 163d provided in the lower surfaces of the first planar portion 163a and the second planar portion 163b are substantially arranged at the same height.

[0067] Figs. 11 to 13 are sectional views of the electric component 1 of this embodiment. Fig. 11 shows a section which passes through the center of the operation shaft portion 61 of the pressing operation member 6 and the center of the projection 111 of the plate spring 11. Fig. 12 shows a section parallel to the section shown in Fig. 11, specifically, a section which passes through the center of the shaft portion 506b of the moving member 5. Fig. 13 shows a section parallel to the section shown in Fig. 11, specifically, a section which passes through the tip portion of the shaft portion 505a of the moving member 5. Figs. 11 to 13 all show the electric component 1 in the initial state.

[0068] As shown in Fig. 11, the moving member 5 is stored in the storage portion 203 of the lower case 2 in a state where the projection 504 protrudes upward. The rotation operation member 7 is configured such that the disc-like portion 72 is stored in the storage portion 304 of the upper case 3 in a state where the cylindrical portion 71 protrudes upward. The cover member 8 is covered from above the upper case 3 in which the rotation operation member 7 is stored. The rotation operation member 7 is stored in the upper case 3 to be rotatable in a state where the outer circumferential surface of the cylindrical portion 71 is supported by the support wall portion 81b formed in the top surface 81 of the cover member 8.

[0069] In the storage portion 203 of the lower case 2, the plate spring 14 is arranged in a state where the shaft portion 205 is inserted into the opening 141a. The coil spring 13 is attached to the shaft portion 205 protruding from the opening 141a. The shaft portion 205 to which the coil spring 13 is attached is stored in the storage concave portion 503a of the moving member 5. The coil spring 13 is arranged between the upper surface of the bottom portion 141 of the plate spring 14 and the ceiling surface of the storage concave portion 503a, and biases the moving member 5 upward. A pair of elastic pieces 142 of the plate spring 14 are arranged such that the projections 142a sandwich the outer wall surface of the connection portion 503. In this case, the projections 142a of the elastic piece 142 sandwich a lower portion of the connection portion 503 from the engagement portion 503b.

[0070] The projection 504 of the moving member 5 is stored in the through hole 306 provided in the cylindrical portion 305 of the upper case 3 from below. The cylindrical portion 305 is stored in the through hole 73 of the rotation operation member 7 from below. In this case, the rotation operation member 7 is in a state where the through hole 73 of the cylindrical portion 71 is guided rotatably to the outer circumferential portion of the cylin-

drical portion 305. The pressing operation member 6 is inserted into the through hole 73 to be vertically movable along the axis direction. The engagement shaft portion 62 of the pressing operation member 6 is inserted into the through hole 306 of the cylindrical portion 305 from above. The lower end portion of the engagement shaft portion 62 is placed on the upper surface of the projection 504 of the moving member 5.

[0071] As shown in Fig. 12, the metal plate 16 held in the plate holding portion 506 of the moving member 5 is configured such that the projections 163c and 163d provided in the lower surface thereof are arranged at the positions apart from the planar portions 101 of a pair of fixed contacts 10 attached to the bottom portion 201 of the lower case 2. The fixed contact 10 (hereinafter, referred to as "a fixed contact 10a") arranged on the right side shown in Fig. 12 is attached in a state of being placed on the projection 208a of the bottom portion 201. The fixed contact 10 (hereinafter, referred to as "a fixed contact 10b") arranged on the left side shown in Fig. 12 is attached in a state of being placed on the projection 208b of the bottom portion 201. The upper surface of the planar portion 101 of the fixed contact 10a is arranged at a position higher than the upper surface of the silver chip 103 provided on the planar portion 101 of the fixed contact 10b.

[0072] As shown in Fig. 13, the torsion spring 15 held in the spring holding portion 505 of the moving member 5 is configured such that a pair of arm portions 152 are arranged at the positions apart from the planar portions 91 of a pair of fixed contacts 9 attached to the bottom portion 201 of the lower case 2. A pair of arm portions 152 of the torsion spring 15 substantially extend in parallel from near the lower end portion of the wound portion 151 toward the lateral sides. In a pair of arm portions 152, portions arranged to be opposite the planar portion 91 of the fixed contact 9 are substantially arranged at the same height.

[0073] Hereinafter, the operation of the electric component 1 of this embodiment having the above-described configuration will be described. First, an operation when a rotation operation of the rotation operation member 7 is received from the operator will be described with reference to Figs. 5 and 11. If the rotation operation is received, as shown in Fig. 11, the rotation operation member 7 rotates in a state of being guided by the outer circumferential surface of the cylindrical portion 305 of the upper case 3 and being guided by the inner circumferential surface of the support wall portion 81b of the cover member 8. If the rotation operation member 7 rotates, the projections 111 of the plate springs 11 stored in the spring storage portions 307 of the upper case 3 are engaged with and disengaged from the corrugated portion 74 provided in the disc-like portion 72. The engagement and disengagement of the projections 111 with and from the corrugated portion 74 imposes a click sensation. In this case, since a pair of plate springs 11 are provided in the upper case 3, it is possible to engage and disengage the projections 111 with and from the corrugated portion 74 of the rotation operation member 7 with a proper balance, and to suppress inclination of the rotation operation member 6. Since the upper case 3 is superimposed to cover the lower case 2, it is possible to make abrasion powder generated when a click sensation is imposed difficult to enter the lower case 2, and to prevent defective contact of the push switch due to abrasion powder.

[0074] With the rotation of the rotation operation member 7, the cord member 18 fixed to the lower surface of the disc-like portion 72 also rotates. With the rotation of the cord member 18, the slide contact positions between the projections 122a of the wiper portions 122 of a plurality of sliding members 12 and the cord member 18 relatively change. In this case, the wiper portions 122a and 122b shown in Fig. 5 slide on the cord member 184 between the projections 75 of the rotation operation member 7 exposed through the openings 183 and the openings 183, and the wiper portion 122c shown in Fig. 5 slides on the ring-like portion 182. As described above, since each opening 183 has the inner opening 183a and the outer opening 183b arranged to be shifted in the radial direction, the electrical conduction state between the wiper portion 122a and the wiper portion 122c and the electrical conduction state between the wiper portion 122b and the wiper portion 122c are switched at different timings. In the electric component 1, the switching state and the number of times of switching in the wiper portions 122a to 122c are detected, thereby detecting the rotation direction and the rotation angle of the rotation operation member 7.

[0075] Next, an operation when a pressing operation of the pressing operation member 6 is received from the operator will be described with reference to Figs. 14 to 16. Figs. 14 to 16 are sectional views when a pressing operation is received in the electric component 1 of this embodiment. The sections shown in Figs. 14 to 16 are common to the sections shown in Figs. 11 to 13. Figs. 14 to 16 all show the electric component 1 in a state where the pressing operation member 6 is pressed to a lower limit position.

[0076] If a pressing operation of the pressing operation member 6 is received from the initial state shown in Fig. 11, the pressing operation member 6 is guided to the inner circumferential surface of the through hole 73 of the cylindrical portion 71 of the rotation operation member 7 and the inner circumferential surface of the through hole 306 of the cylindrical portion 306 of the upper case 3, and moves downward. That is, if the pressing operation member 6 is pressed, the pressing operation member 6 moves downward in the axis direction along the rotation axis of the rotation operation member 7. If the pressing operation member 6 moves downward, the lower end portion of the engagement shaft portion 62 presses the projection 504 of the moving member 5 (see Fig. 14). The moving member 5 moves downward against the biasing force of the coil spring 13 in response to downward movement of the pressing operation member 6. In this

case, the moving member 5 is configured such that the projection 504 is guided to the inner circumferential surface of the through hole 306 of the cylindrical portion 305, is guided by a pair of wall portions 204 and a pair of guide portions 212 of the lower case 2, and moves downward. In this way, the projection 504 is guided by the through hole 306 of the cylindrical portion 305, thereby reducing a slip with movement of the moving member 5.

[0077] If the moving member 5 moves downward, the projections 142a provided in the elastic pieces 142 of the plate spring 14 slide on the outer circumferential surface of the connection portion 503. As shown in Fig. 14, if the moving member 5 moves to a lower limit position, the projections 142a of a pair of elastic pieces 142 crosses over the engagement portions 503b of the connection portion 503. A click sensation is imposed with movement of a pair of elastic pieces 142 when crossing over the engagement portions 503b.

[0078] The metal plate 16 held in the plate holding portion 506 moves downward in response to movement of the moving member 5. If the moving member 5 moves to the lower limit position, as shown in Fig. 15, the projection 163c provided in the lower surface of the first planar portion 163a and the projection 163d provided in the lower surface of the second planar portion 163b come into contact with the upper surfaces of the planar portions 101 of the fixed contacts 10. Accordingly, the fixed contacts 10a and 10b are in an electrical conduction state through the metal plate 16. As a result, the push switch is switched to the on state.

[0079] While the moving member 5 is moving to the lower limit position, first, the projection 163d provided in the lower surface of the second planar portion 163b comes into contact with the upper surface of the planar portion 101 of the fixed contact 10a. Thereafter, the silver chip 163e on the projection 163c provided in the lower surface of the first planar portion 163a comes into contact with the upper surface of the silver chip 103 on the planar portion 101 of the fixed contact 10b. The projections 163c and 163d coming into contact with the fixed contacts 10 at different timings is realized by the difference in height between the upper surfaces of the projections 208a and 208b provided in the lower surface of the lower case 2 and the difference in dimension between the first connection portion 162a and the second connection portion 162b of the metal plate 16. That is, the position of the upper surface of the projection 208b is set to be higher than the position of the upper surface of the projection 208a, and the length of the first connection portion 162a is set to be longer than the length of the second connection portion 162b, thereby securing the projections 163c and 163d coming into contact with the fixed contacts 10 at different timings.

[0080] The silver chips 163e and 103 are provided in the projection 163c and the fixed contact 10b which come into contact with each other late. This is to cope with arc discharge which is generated during switching to the electrical conduction state between the fixed contacts 10a and 10b. The projection 163c and the fixed contact 10b come into contact with each other later than the projection 163d and the fixed contact 10a. This is to switch the electrical conduction state between the fixed contacts 10a and 10b by the silver chips 163e and 103 having a resistance value lower than the metal plate 16.

[0081] The torsion spring 15 held in the spring holding portion 505 moves downward in response to movement of the moving member 5. If the moving member 5 moves to the lower limit position, as shown in Fig. 16, a pair of arm portions 152 come into contact with the upper surfaces of the planar portions 91 of the fixed contacts 9. Accordingly, a pair of fixed contacts 9 are in an electrical conduction state through the torsion spring 15. A pair of arm portions 152 come into contact with the planar portions 91 of a pair of fixed contacts 9 at the substantially same timing in response to downward movement of the moving member 5.

[0082] If the pressing operation is released, the pressing operation member 6 moves upward through the moving member 5 depending on the biasing force of the coil spring 13. Accordingly, the electric component 1 returns to the initial state shown in Fig. 11. If the moving member 5 returns upward, the projections 142a provided in the elastic pieces 142 of the plate spring 14 slide on the outer circumferential surface of the connection portion 503, and cross over the engagement portions 503b of the connection portion 503. A click sensation is imposed in response to movement of a pair of elastic pieces 142 when crossing over the engagement portions 503b. In this case, the elastic pieces 142 sandwich the opposing engagement portions 503b of the connection portion 503 with the coil spring 13 interposed therebetween, thereby preventing a force from being applied to incline the moving member 5.

[0083] As described above, in the electric component 1 of this embodiment, since the rotation detection means is provided in the storage portion 304 of the upper case 3, and the push switch is provided in the storage portion 203 of the lower case 2, it is possible to arrange the rotation detection means and the push switch vertically through the bottom portion 301 of the upper case 3 functioning as a partition wall, thereby realizing reduction in the dimension of the component in plan view. Since the pressing operation member 6 is inserted into the through hole 73 of the rotation operation member 7, and the tip portion (the engagement shaft portion 62) thereof is inserted into the through hole 306 of the cylindrical portion 305, it is possible to guide the pressing operation member 7 in the up-and down direction by both the through hole 73 and the through hole 306, thereby appropriately moving the pressing operation member 6 vertically and suppressing the occurrence of a variation in the switching timing between the on and off states of the push switch. Since the rotation detection means and the push switch are partitioned by the bottom portion of the upper case 3 functioning as a partition wall, it is possible to prevent the influence of heat or the like generated during switch-

ing between the on and off states of the push switch from affecting the rotation detection means, thereby suppressing deterioration in the detection precision of the rotation detection means.

[0084] In particular, in the electric component 1 of this embodiment, the push switch has the vertically movable moving member 5 which is stored in the storage portion 203, driven by the pressing operation member 6, and biased upward, a pair of fixed contacts 10 which are provided in the storage portion 203, and the metal plate 16 as a movable contact which is engaged with and disengaged from the fixed contacts 10. Accordingly, since the fixed contacts 10 and the movable contacts are arranged within the scope of the storage portion 203 of the lower case 2, thereby arranging a contact structure capable of enduring a large amount of current and applying the push switch to a power switch.

[0085] In the electric component 1 of this embodiment, the base portion 501 and the projection 504 provided to protrude upward from the base portion 501 are provided in the moving member 5, and the projection 504 is inserted into the through hole 306 of the cylindrical portion 305 to be opposite the tip portion of the engagement shaft portion 62 of the pressing operation member 6. Accordingly, it is possible to guide the projection 504 by the through hole 306 of the cylindrical portion 305, thereby reducing a slip with movement of the moving member 5 and effectively suppressing a variation in the switching timing of the push switch.

[0086] In particular, in the electric component 1 of this embodiment, since the coil spring 13 which biases the moving member 5 upward is arranged at a position opposite the projection 504 with the base portion 501 interposed therebetween, it is possible to make the moving member 5 difficult to vertically move in the inclined state, and to improve the precision of the switching timing of the push switch. Since the coil spring 13 is used to return the moving member 5 to the initial state, it is possible to increase the displacement of the moving member 5, thereby allowing a large gap between the fixed contacts 10 and the metal plate 16 in the initial state (off state) and securing insulation performance in the off state.

[0087] In the electric component 1 of this embodiment, since the push switch (power switch) is arranged on the rear side of the base portion 501 of the moving member 5, and the detection switch is arranged on the front side of the base portion 501, it is possible to switch the on and off states of the push switch (power switch) and the detection switch with a proper balance in response to vertical movement of the moving member 5.

[0088] In the electric component 1 of this embodiment, since the housing has the lower case 2 in which the fixed contacts 9 and 10 are provided and the upper case 3 which is superimposed to cover the lower case 2, it is possible to improve working efficiency when the constituent components are stored in the housing. Since the wiper portions 122 which form the rotation detection means is provided on the upper side from the bottom portion 301 of the upper case 3 in a state of being buried in the holding member 4 arranged in the notch portion 303 of the upper case 3, it is possible to prevent the influence of heat or the like generated during switching between the on and off states of the push switch from affecting the wiper portions 122, thereby effectively suppressing deterioration in the detection precision of the rotation detection means.

[0089] In particular, in the electric component 1 of this embodiment, the lower case 2 and the upper case 3 are formed of synthetic resin having flame resistance higher than the holding member 4. Accordingly, since the push switch can be stored in the lower case 2 and the upper case 3 formed of synthetic resin having high flame resistance, it is possible to prevent the influence of heat or arc discharge generated during switching between the on and off states of the push switch from affecting the constituent components outside the housing (the lower case 2 and the upper case 3), and to secure safety.

[0090] A use form of the electric component 1 of this embodiment will be described. In the following description, a case where the electric component 1 of this embodiment is used in a washing machine will be described. The electric component 1 of this embodiment is applied to, for example, a power switch circuit in a washing machine. Fig. 17 is a diagram showing a configuration example of a power switch circuit 1000 of a washing machine using the electric component 1 of this embodiment. In the power switch circuit 1000 shown in Fig. 17, the electric component 1 of this embodiment is in the initial state.

[0091] As shown in Fig. 17, the power switch circuit 1000 in the washing machine includes a control circuit 1001 which performs overall control of the washing machine. An AC power supply 1002 is connected to the control circuit 1001. A power switch unit 1003a is connected between the control circuit 1001 and the AC power supply 1002, and a relay 1004 is connected in parallel to the power switch unit 1003a.

[0092] The power switch unit 1003a includes the push switch which has the above-described metal plate 16 and a pair of fixed contacts 10. One fixed contact 10 forms a contact a1, and the other fixed contact 10 forms a contact a2. In the power switch unit 1003a, the electrical conduction state between the contact a1 and the contact a2 is switched in response to a pressing operation of the above-described pressing operation member 6. If the power switch unit 1003a is in the on state, the contact a1 and the contact a2 are switched to the electrical conduction state, and power is supplied to the control circuit 1001.

[0093] The relay 1004 switches the electrical conduction state between a contact b1 and a contact b2 under the control of the control circuit 1001. A signal from the control circuit 1001 is supplied to the relay 1004 through a signal line SL1 indicated by a broken line. If the relay 1004 is in the on state, the contact b1 and the contact b2 are switched to the electrical conduction state, and the

power supply state to the power control circuit 1001 is maintained.

[0094] A detection switch unit 1003b is connected to the control circuit 1001. The detection switch unit 1003b includes the detection switch which has the above-described torsion spring 15 and a pair of fixed contacts 9. One fixed contact 9 forms a contact c1, and the other fixed contact 9 forms a contact c2. In the detection switch unit 1003b, the electrical conduction state between the contact c1 and the contact c2 is switched in response to a pressing operation of the pressing operation member 6. If the detection switch unit 1003b is in the on state, the contact c1 and the contact c2 are switched to the electrical conduction state, and an on signal is output to the control circuit 1001 through a signal line SL2 indicated by a broken line.

[0095] A load 1005 in the washing machine is connected to the AC power supply 1002. A relay 1006 is connected between one end of the AC power supply 1002 and the load 1005. The relay 1006 switches the electrical conduction state between the contact d1 and the contact d2 under the control of the control circuit 1001. A signal from the control circuit 1001 is supplied to the relay 1006 through a signal line SL3 indicated by a broken line. If the relay 1006 is in the on state, the contact d1 and the contact d2 are switched to the electrical conduction state, and power is supplied to the load 1005. Examples of the load 1005 in the washing machine include a motor which drives a washing tub, a motor which radiates heat to a pile of laundry in the washing tub, and the like.

[0096] In the power switch circuit 1000 in the initial state, as shown in Fig. 17, the contact a1 and the contact a2 are in the electrical non-conduction state by the power switch unit 1003a, and the contact c1 and the contact c2 are in the electrical non-conduction state by the detection switch unit 1003b. Accordingly, power is not supplied to the control circuit 1001. The contact b1 and the contact b2 are in the electrical non-conduction state by the relay 1004, and the contact d1 and the contact d2 are in the electrical non-conduction state by the relay 1006. Accordingly, power is not supplied to the load 1005.

[0097] Hereinafter, the operation of the power switch circuit shown in Fig. 17 will be described. Figs. 18 to 26 are explanatory views of an operation state of the power switch circuit 1000 in the washing machine using the electric component 1 of this embodiment.

[0098] From the initial state shown in Fig. 17, if a pressing operation is received by the pressing operation member 6 of the electric component 1, and the metal plate 16 comes into contact with a pair of fixed contacts 10, as shown in Fig. 18, in the power switch unit 1003a, the contacts a1 and a2 are switched to the electrical conduction state. Accordingly, power supply to the control circuit 1001 starts.

[0099] In this case, simultaneously with the power switch unit 1003a, in the detection switch unit 1003b, the contacts c1 and c2 are switched to the electrical conduction state. Accordingly, a signal (on signal) indicating that the detection switch unit 1003b is in the on state is output to the control circuit 1001 through the signal line SL2. The control circuit 1001 neglects an on signal detected in a state where the load 1005 is not in operation.

[0100] If power is supplied, the control circuit 1001 outputs a signal (on signal) for switching the relay 1004 to the on state to the relay 1004 through the signal line SL1. Accordingly, the relay 1004 is in the on state, and as shown in Fig. 19, the contacts b1 and b2 are switched to the electrical conduction state. As a result, in addition to a power supply path which passes through the power switch unit 1003a, a power supply path which passes through the relay 1004 is formed.

[0101] After the relay 1004 is in the on state, if the pressing operation member 6 is released from the pressing operation, the metal plate 16 returns to the initial state, and as shown in Fig. 20, the contacts a1 and a2 are switched to the electrical non-conduction state. In this case, since the contacts b1 and b2 are maintained in the electrical conduction state, power supply to the control circuit 1001 is continued through the power supply path which passes through the relay 1004.

[0102] If an instruction to start washing or the like from the operator of the washing machine is received, the control circuit 1001 outputs the on signal to the relay 1006 through the signal line SL3. Accordingly, the relay 1006 is in the on state, and as shown in Fig. 21, the contacts d1 and d2 are switched to the electrical conduction state. As a result, power supply to the load 1005 starts. With the power supply, the load 1005 operates.

[0103] If the operation of the load 1005 ends, the control circuit 1001 outputs a signal (off signal) for switching the relay 1006 to the off state to the relay 1006 through the signal line SL3. Accordingly, the relay 1006 is in the off state, and as shown in Fig. 22, the contacts d1 and d2 are switched to the electrical non-conduction state. As a result, power supply to the load 1005 is stopped.

[0104] Thereafter, the control circuit 1001 outputs the off signal to the relay 1004 through the signal line SL1. Accordingly, the relay 1004 is in the off state, and as shown in Fig. 23, the contacts b1 and b2 are switched to the electrical non-conduction state. As a result, power supply to the control circuit 1001 is stopped. That is, the power switch circuit 1000 is configured such that power supply to the control circuit 1001 is automatically stopped after the operation of the power load 1005 is stopped (auto off function).

[0105] The power switch circuit 1000 is configured such that power supply to the control circuit 1001 can be stopped in accordance with an instruction from the operator in a state where the load 1005 is in operation. Hereinafter, a manual off function will be described. As shown in Fig. 21, in a state where the load 1005 is in operation, if a pressing operation is received by the pressing operation member 6 of the electric component 1, and the torsion spring 15 comes into contact with a pair of fixed contacts 9, as shown in Fig. 24, in the detection switch unit 1003b, the contacts c1 and c2 are switched

to the electrical conduction state. Accordingly, the on signal is output from the detection switch unit 1003b to the control circuit 1001 through the signal line SL2.

[0106] In this case, simultaneously with the detection switch unit 1003b, in the power switch unit 1003a, the contacts a1 and a2 are switched to the electrical conduction state. However, since power is supplied through the relay 1004, there is no case where the power supply state to the control circuit 1001 is changed.

[0107] If the on signal is detected in a state where the load 1005 is in operation, the control circuit 1001 outputs the on signal to the relay 1006 through the signal line SL3. Accordingly, the relay 1006 is in the off state, and as shown in Fig. 25, the contacts d1 and d2 are switched to the electrical non-conduction state. As a result, power supply to the load 1005 is stopped. Accordingly, the operation of the load 1005 is stopped. Fig. 25 shows a state where the pressing operation of the pressing operation member 6 of the electric component 1 is released.

[0108] Thereafter, the control circuit 1001 outputs the off signal to the relay 1004 through the signal line SL1. Accordingly, the relay 1004 is in the off state, and as shown in Fig. 26, the contacts b1 and b2 are switched to the electrical non-conduction state. As a result, power supply to the control circuit 1001 is stopped. That is, the power switch circuit 1000 is configured such that power supply to the control circuit 1001 is manually stopped in a state where the load 1005 is in operation (manual off function).

[0109] If the electric component 1 of this embodiment is used in the power switch circuit 1000, it becomes possible to automatically stop power supply after the operation of the load 1005 and to provide a washing machine capable of reducing standby power. Although the power switch circuit 1000 of the washing machine has been described as a specific example, the power switch circuit 1000 to which the electric component 1 is applied is not limited to the washing machine, and may be applied to the power switch circuit 1000 of an arbitrary apparatus. For example, when the electric component 1 is used in a microwave oven, a selection operation of various menus of the microwave oven may be performed by a rotation operation of the rotation operation member 7, and a menu selected by the rotation operation may be determined through switching of the electrical conduction state of the detection switch by a pressing operation of the pressing operation member 6.

[0110] The invention is not limited to the foregoing embodiment, and various changes may be made. In the foregoing embodiment, the size, shape, and the like in the accompanying drawings are not limited to those shown in the drawings, and may be appropriately changed within the scope capable of exhibiting the effect of the invention. The invention may be appropriately changed and carried out without departing from the scope of the invention.

[0111] For example, in the foregoing embodiment, a case where the upper end surface of the projection 504 of the moving member 5 has a planar shape has been described. However, the configuration of the projection 504 is not limited thereto, and may be appropriately changed. For example, the upper end surface of the projection 504 may have a spherical shape. In this case, since the pressing operation from the pressing operation member 6 can be received at the center of the projection 504, it is possible to make the moving member 5 more difficult to vertically move in the inclined state.

[0112] For example, although in the foregoing embodiment, a case where a push switch is a power switch has been described, the invention is not limited thereto, and a push switch may be appropriately changed to other switches, such as a detection switch.

[0113] It should be understood by those skilled in the art that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other factors insofar as they are within the scope of the appended claims of the equivalents thereof.

Claims

1. A composite operation type electric component (1) comprising:

a housing having a storage portion;
a rotation operation member (7) which protrudes upward from the housing and has a rotatable first cylindrical portion (71);
a pressing operation member (6) which is movably inserted into a through hole (73) formed in the first cylindrical portion (71) of the rotation operation member (7) in an axis direction;
rotation detection means for detecting rotation operation of the rotation operation member (7); and
a push switch which is operated in response to movement in the axis direction of the pressing operation member (6),

characterized in that a partition wall (301) is provided in the housing to partition the storage portion into a first storage portion (304) and a second storage portion (203) below the first storage portion (304),
a second cylindrical portion (305) has a hole portion (306) having passed therethrough in the axis direction and is provided in a central portion of the partition wall (301) to protrude toward the first storage portion (304),
the through hole (73) of the rotation operation member (7) is rotatably inserted into an outer circumferential portion of the second cylindrical portion (305),
a tip portion of the pressing operation member (6) is movably inserted into the hole portion (306) in the axis direction,
the rotation detection means is arranged in the first storage portion (304), and

the push switch which is operated by the tip portion of the pressing operation member (6) is arranged in the second storage portion (203).

2. The composite operation type electric component (1) according to claim 1,
characterized in that the push switch has a vertically movable moving member (5) which is stored in the second storage portion (203), driven by the pressing operation member (6), and biased upward, a fixed contact (10) which is provided in the second storage portion (203), and a movable contact (16) which comes into contact with and separates from the fixed contact (10), and is held by the moving member (5).

3. The composite operation type electric component (1) according to claim 2,
characterized in that the moving member (5) includes a base portion (501) which holds the movable contact (16) and a projection (504) which is provided to protrude upward from the base portion (501), and the projection (504) is inserted into the hole portion (306) of the partition wall (301) to be vertically movable opposite the tip portion of the pressing operation member (6).

4. The composite operation type electric component (1) according to claim 3,
characterized in that a coil spring (13) is provided to bias the moving member (5) upward at a position opposite the projection (504) with the base portion (501) interposed therebetween.

5. The composite operation type electric component (1) according to claim 4,
characterized in that the moving member (5) includes a storage concave portion (503a) which stores a portion of the coil spring (13) and a pair of engagement portions (503b) which are formed in the lateral portions of the storage concave portion (503a) to be opposite each other, and
a pair of elastic pieces (142) are provided to be engaged with and disengaged from the engagement portions (503b) in response to vertical movement of the moving member (5) with the storage concave portion (503a) interposed therebetween.

6. The composite operation type electric component (1) according to any one of claims 3 to 5,
characterized in that the push switch is arranged on one side of the base portion (501) with respect to the central portion of the base portion (501), and
a detection switch is arranged on the other side of the base portion (501) to detect pressing operation against the pressing operation member (6).

7. The composite operation type electric component (1) according to any one of claims 2 to 6,
characterized in that the housing includes a lower case (2) in which the fixed contact (10) is provided and an upper case (3) which has the partition wall (301) and is superimposed to cover the lower case (2),
the rotation detection means has a cord pattern (18) which is provided in the lower portion of the rotation operation member (7) and a wiper (122) which is in sliding contact with the cord pattern (18), and
the wiper (122) is arranged on the upper side from the partition wall (301) in a state of being buried in a holding member (4) made of synthetic resin arranged in a notch portion (303) provided in a sidewall (302) of the upper case (3).

8. The composite operation type electric component (1) according to claim 7,
characterized in that the upper case (3) and the lower case (2) are formed of synthetic resin having flame resistance higher than the holding member (4).

9. The composite operation type electric component (1) according to claim 8,
characterized in that a tip of the wiper (122) extends from the holding member (4) and is bent downward to form an external terminal (121), and
the external terminal (121) is held by a terminal holding portion (211) provided at a sidewall (202) of the lower case (2).

10. The composite operation type electric component (1) according to any one of claims 7 to 9,
characterized in that a plurality of corrugated portions (74) are provided in the outer circumferential portion of the rotation operation member (7), and
in the upper case (3), a pair of click plate springs (11) which have projections (111) to be engaged with and disengaged from the corrugated portions (74) are provided to be opposite each other.

FIG. 1

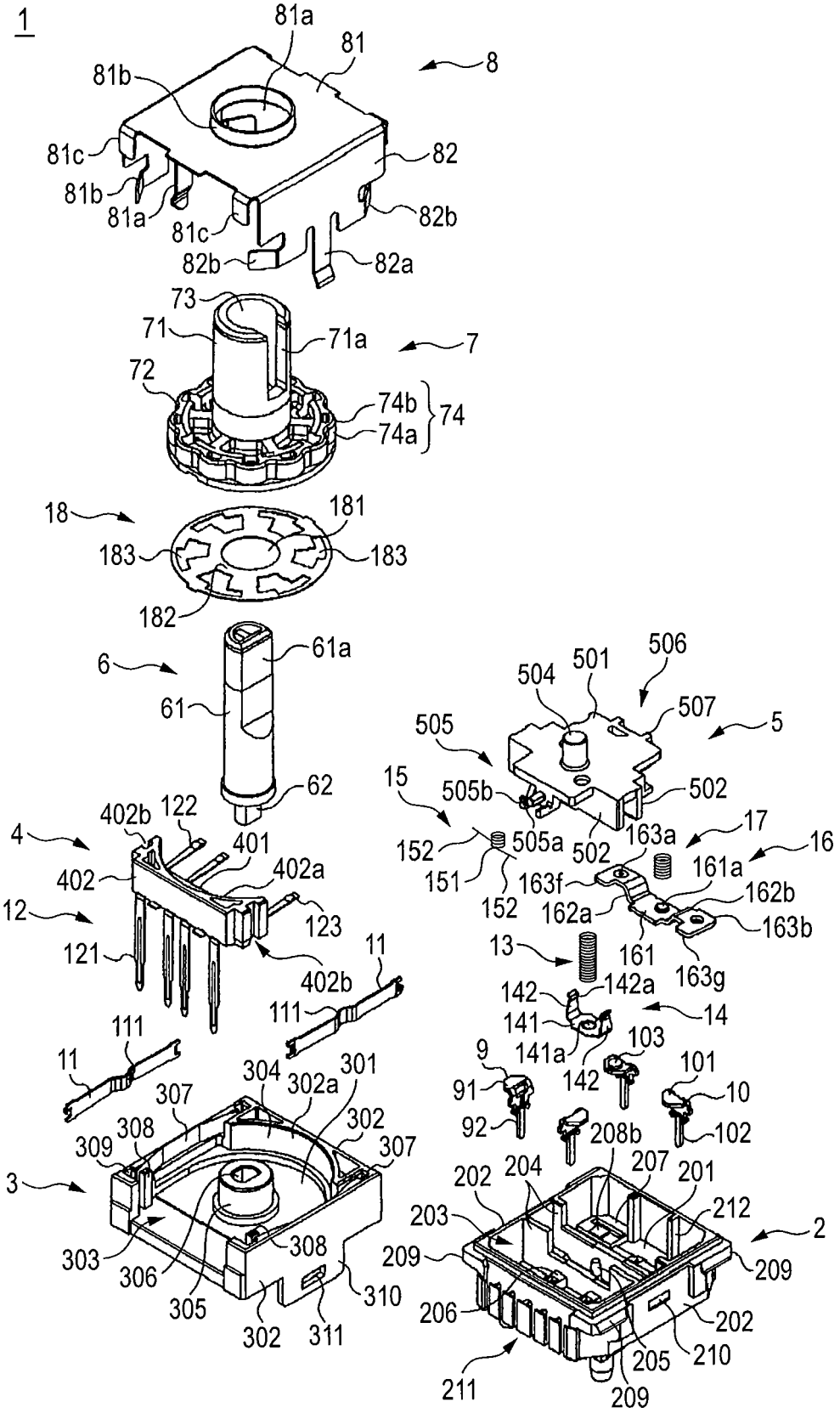
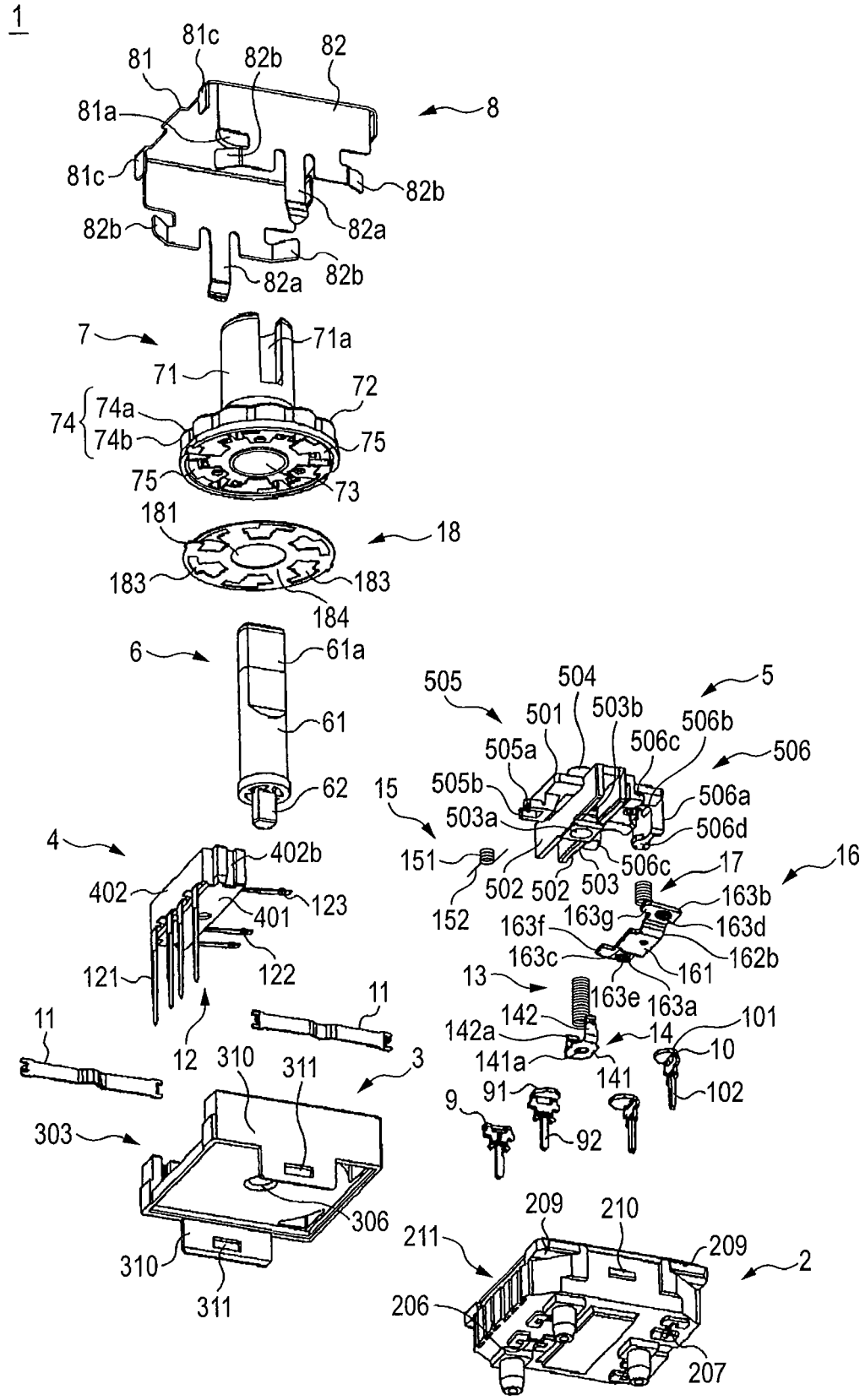

1
81a
81
8
81b
81c
82
81b
81a
81c
82b
82b
82a
73
71
71a
7
72
74b
74
74a
18
181
183
183
182
6
61a
61
62
4
402b
122
401
402
402a
12
123
121
11
402b
111
111
11
307
304
302a
301
309
308
302
307
3
303
306
308
305
302
311
310
506
504
501
507
5
505
15
505b
502
152
505a
502
163a
17
16
151
152
163f
161a
162b
162a
163b
13
161
163g
142
142a
141
14
141a
103
9
142
101
91
10
92
208b
102
202
204
207
201
212
203
2
209
209
206
202
205
210
211
209

FIG. 2


1
81c
81
82b
82
81a
8
81c
82b
82b
82a
82a
82b
7
71a
71
72
74
74a
74b
75
75
73
181
18
183
183
184
6
61a
61
62
505
504
5
501
503b
506b
505a
506c
506
505b
506a
15
503a
506d
151
506c
17
16
502
502
503
163b
152
163f
163g
163d
163c
162b
161
13
163e
163a
142
101
142a
14
10
141a
141
91
102
9
92
4
402b
402
123
401
121
122
12
11
11
310
311
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303
306
310
311
209
210
211
209
2
206
207

FIG. 3

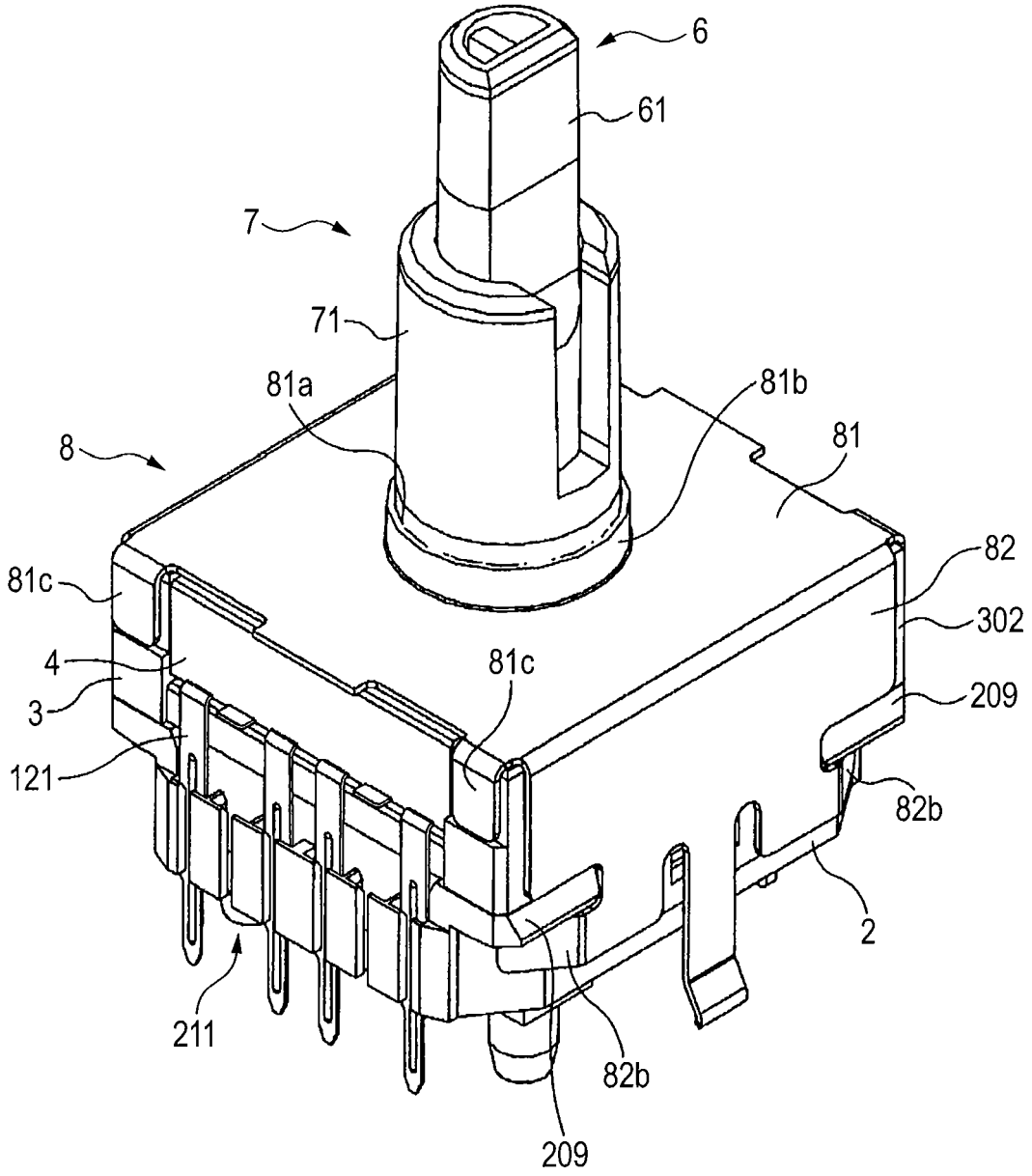


FIG. 4

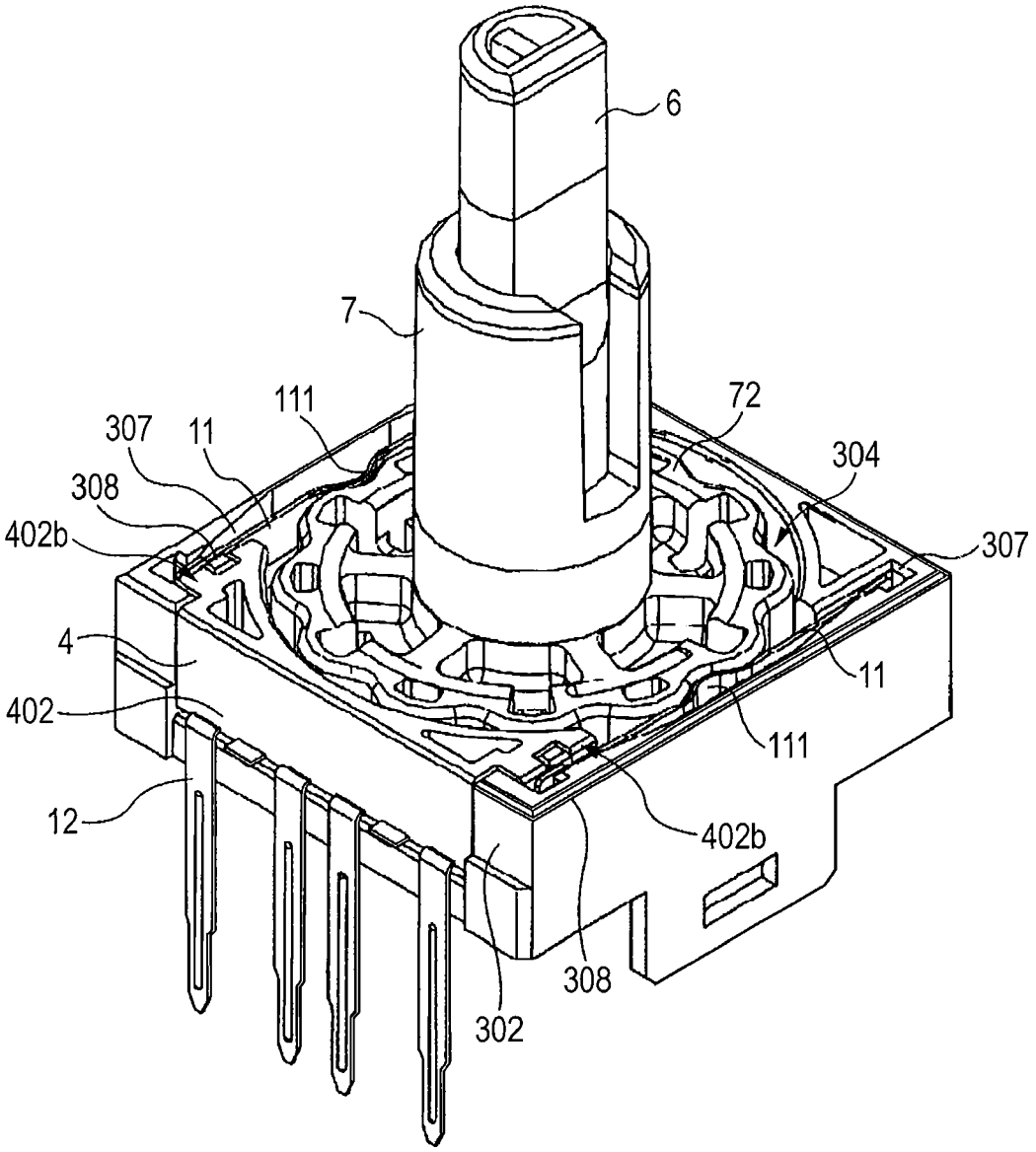


FIG. 5

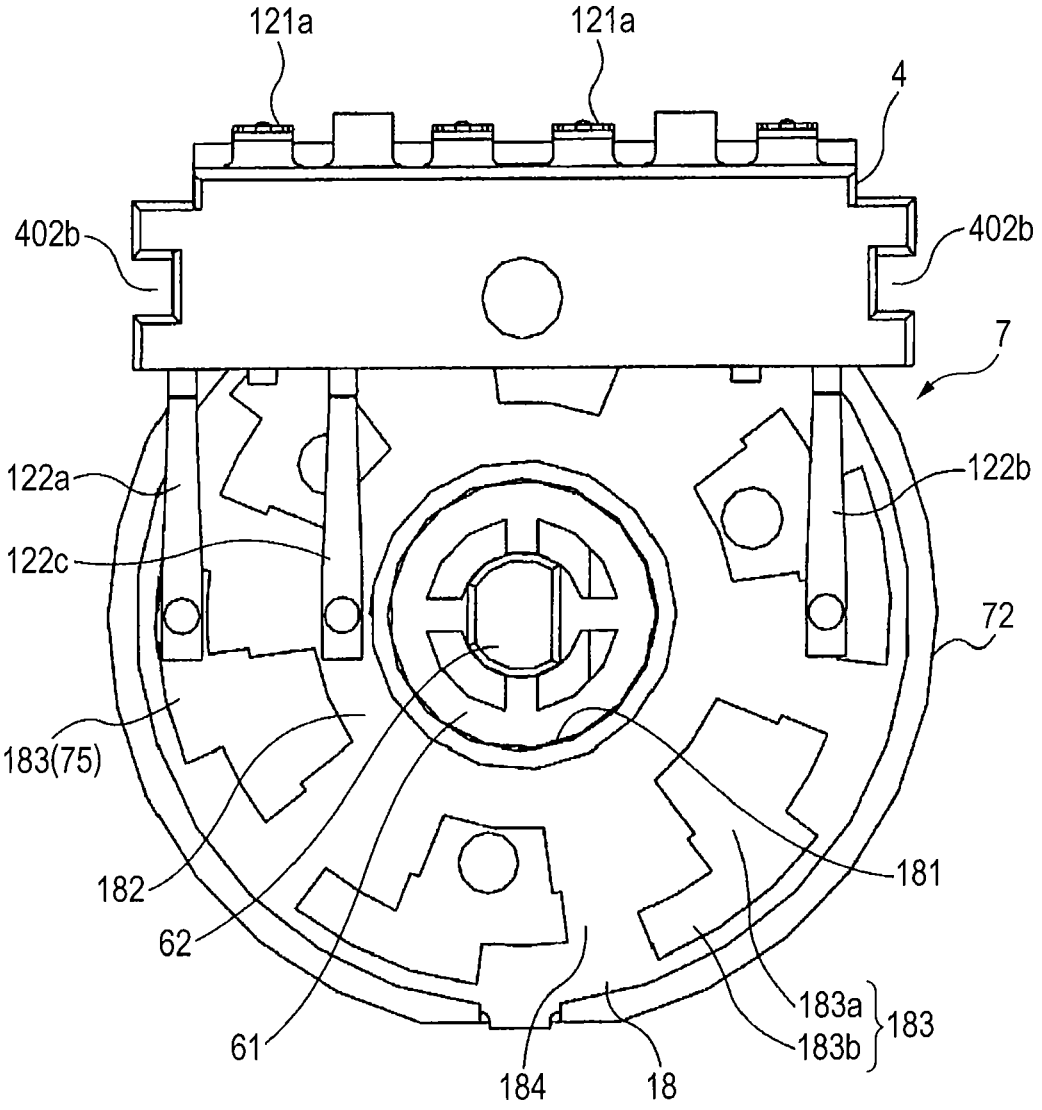

121a
121a
4
402b
402b
7
122a
122b
122c
72
183(75)
182
181
62
61
183a
183b
183
184
18

FIG. 6

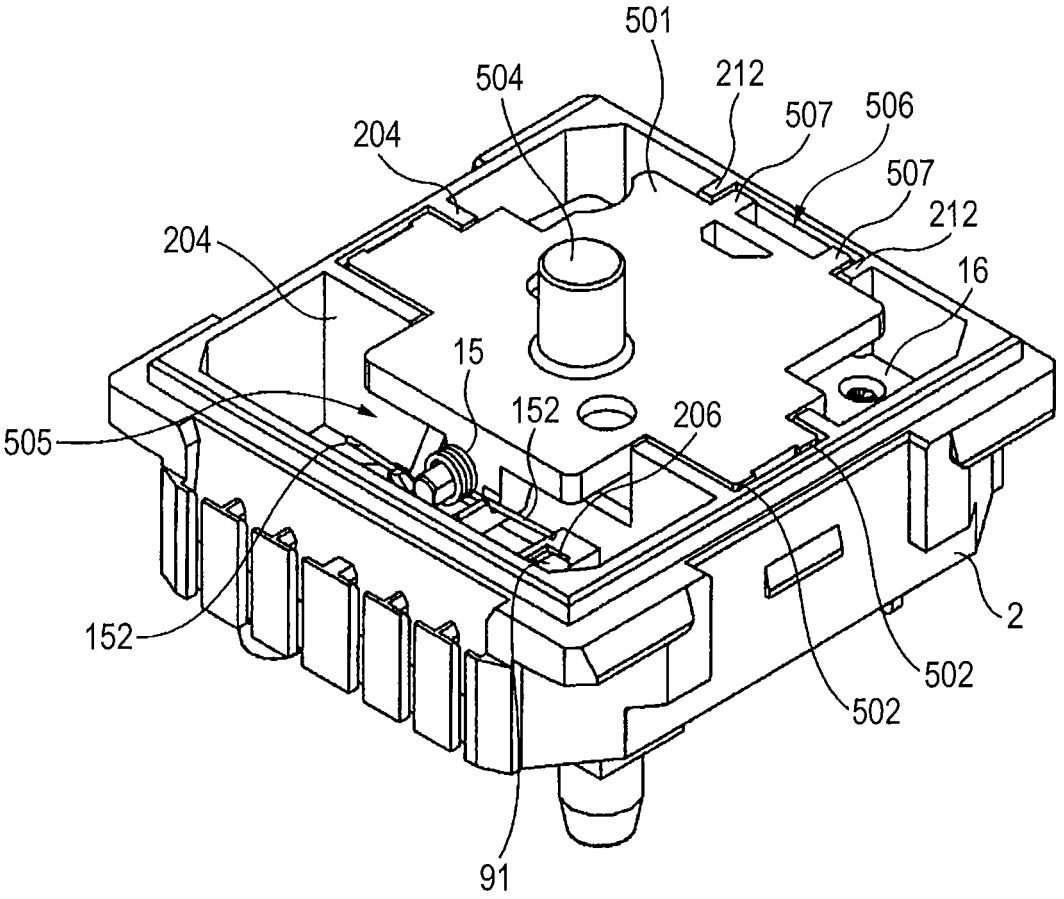

501
504
212
507
506
204
507
212
204
16
15
152
206
505
2
152
502
502
91

FIG. 7

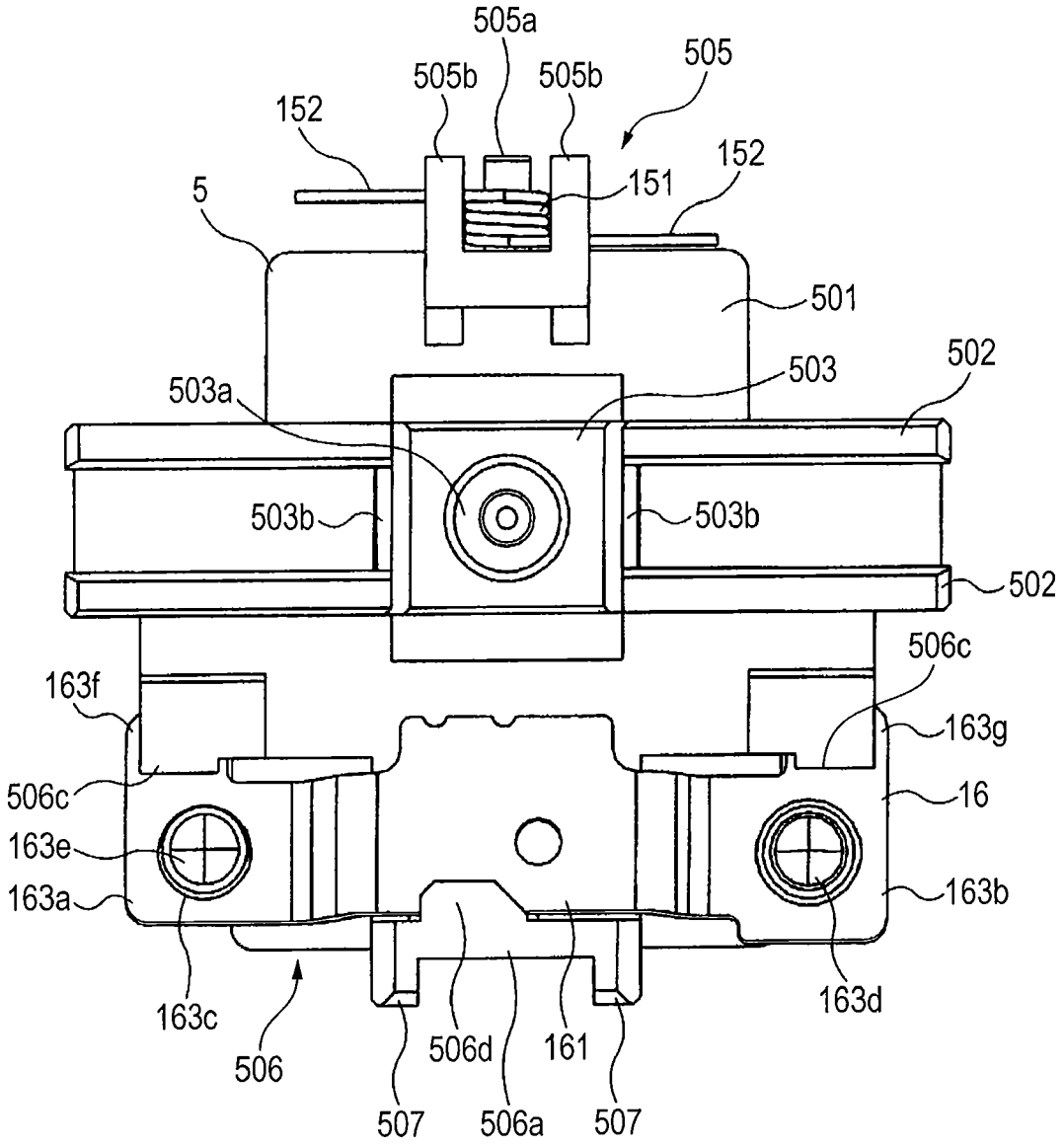

505a
505b
505b
505
152
152
151
5
501
503
502
503a
503b
503b
502
506c
163f
163g
506c
16
163e
163a
163b
163c
506
506d
161
163d
507
506a
507

FIG. 8

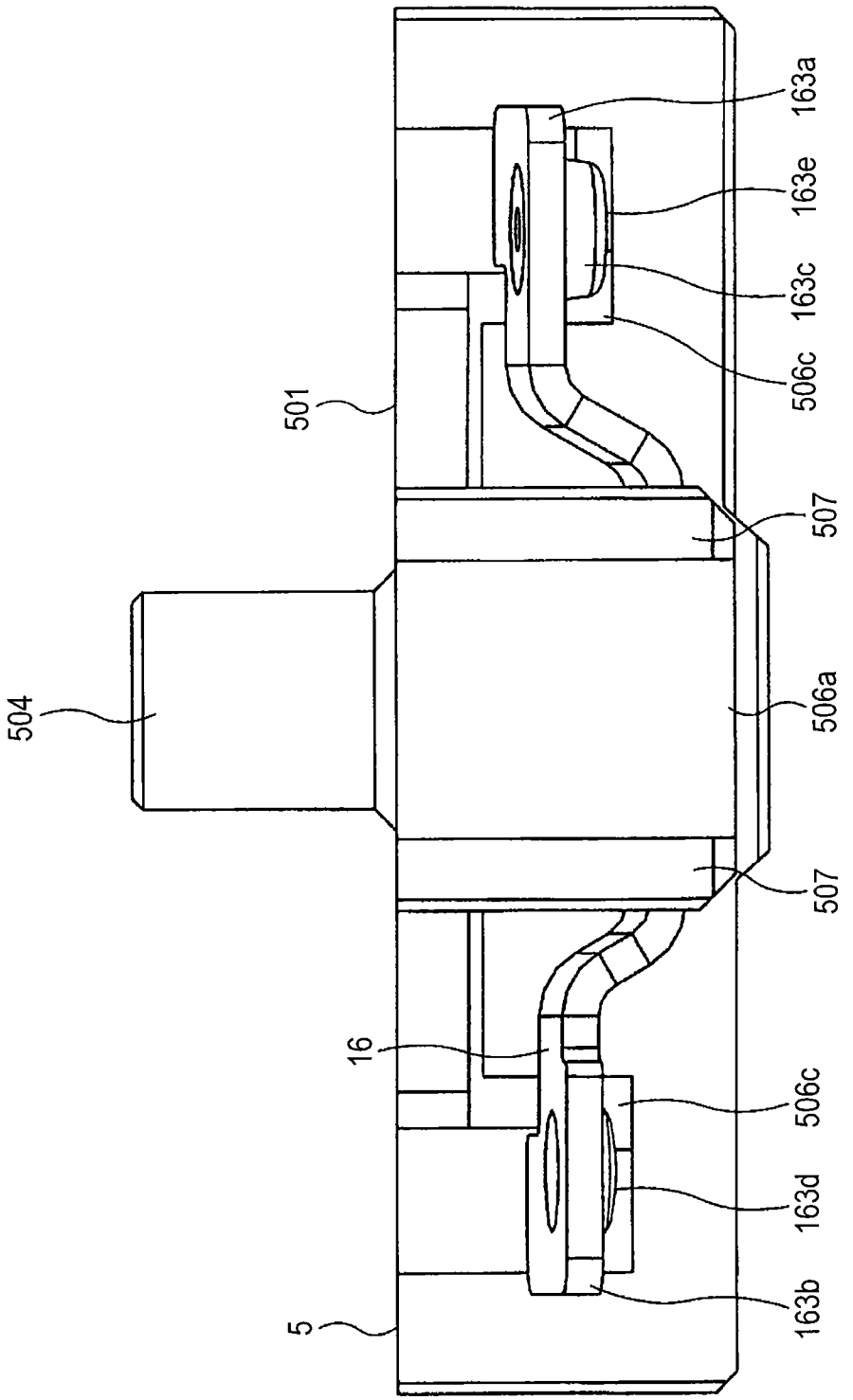
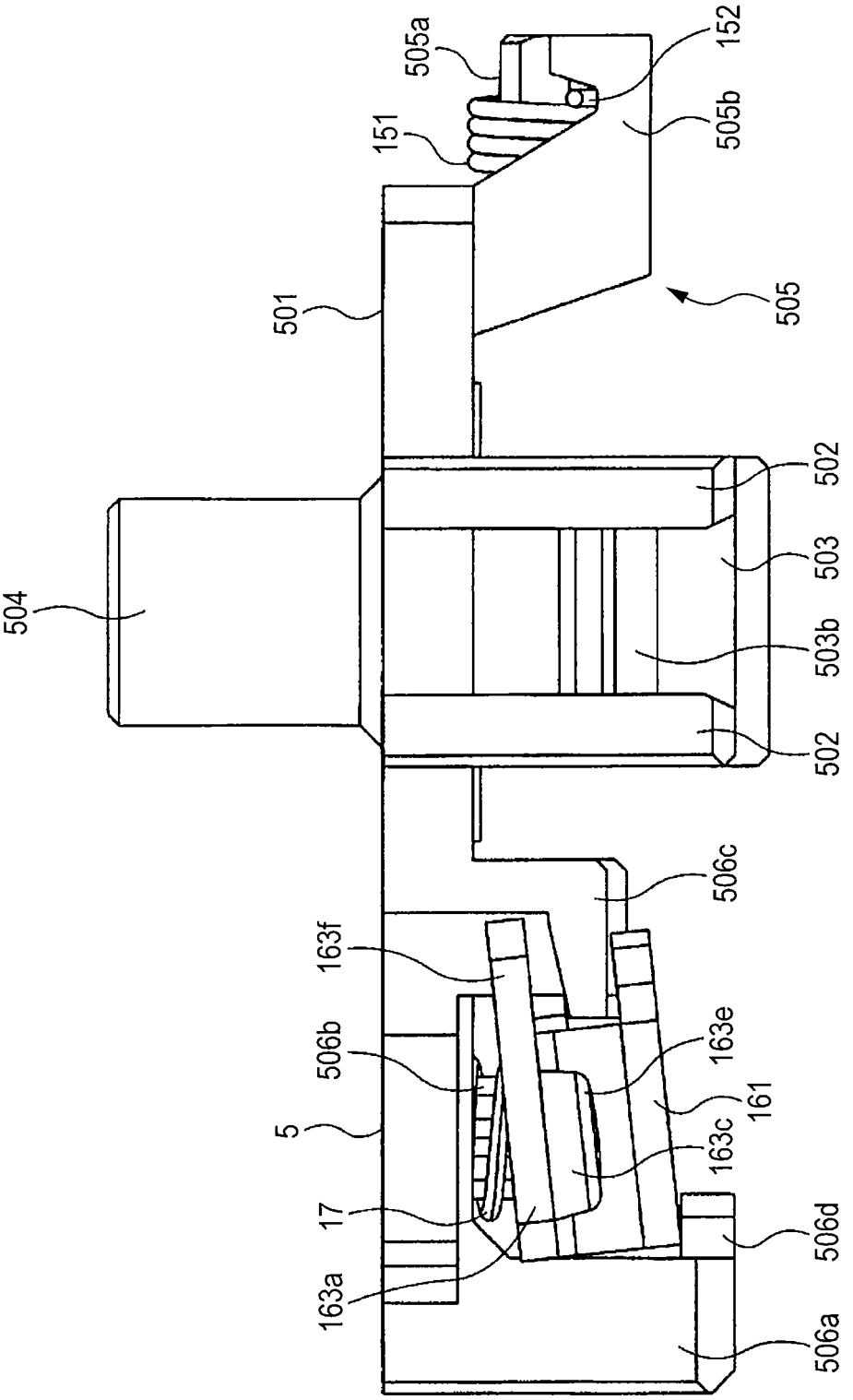


FIG. 9


505a
152
151
505b
501
505
502
504
503
503b
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506c
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506b
163e
161
5
163c
17
506d
163a
506a

FIG. 10

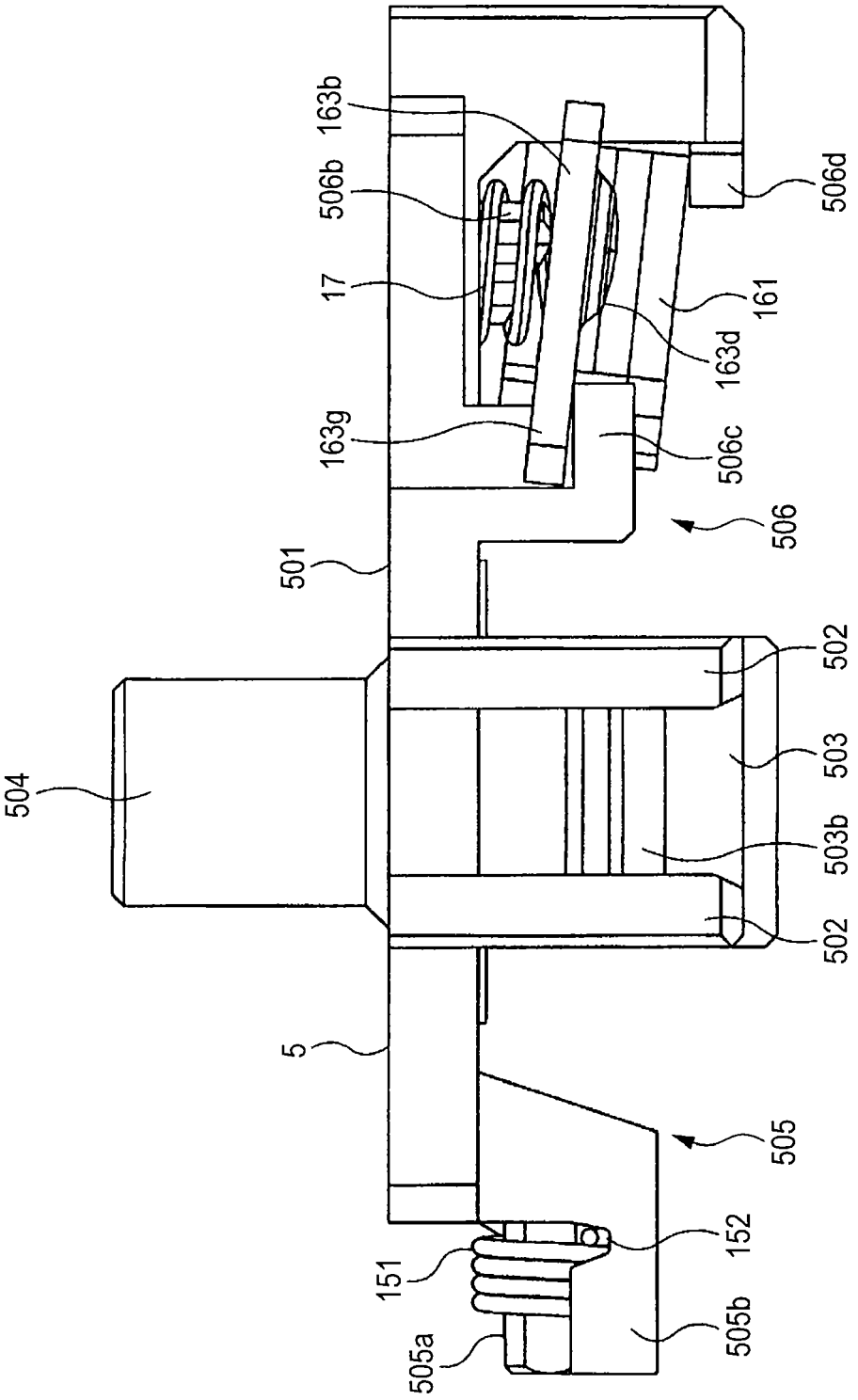

163b
506b
17
163g
501
504
5
151
505a
152
505b
505
506
506c
163d
161
506d
502
503
503b
502

FIG. 11

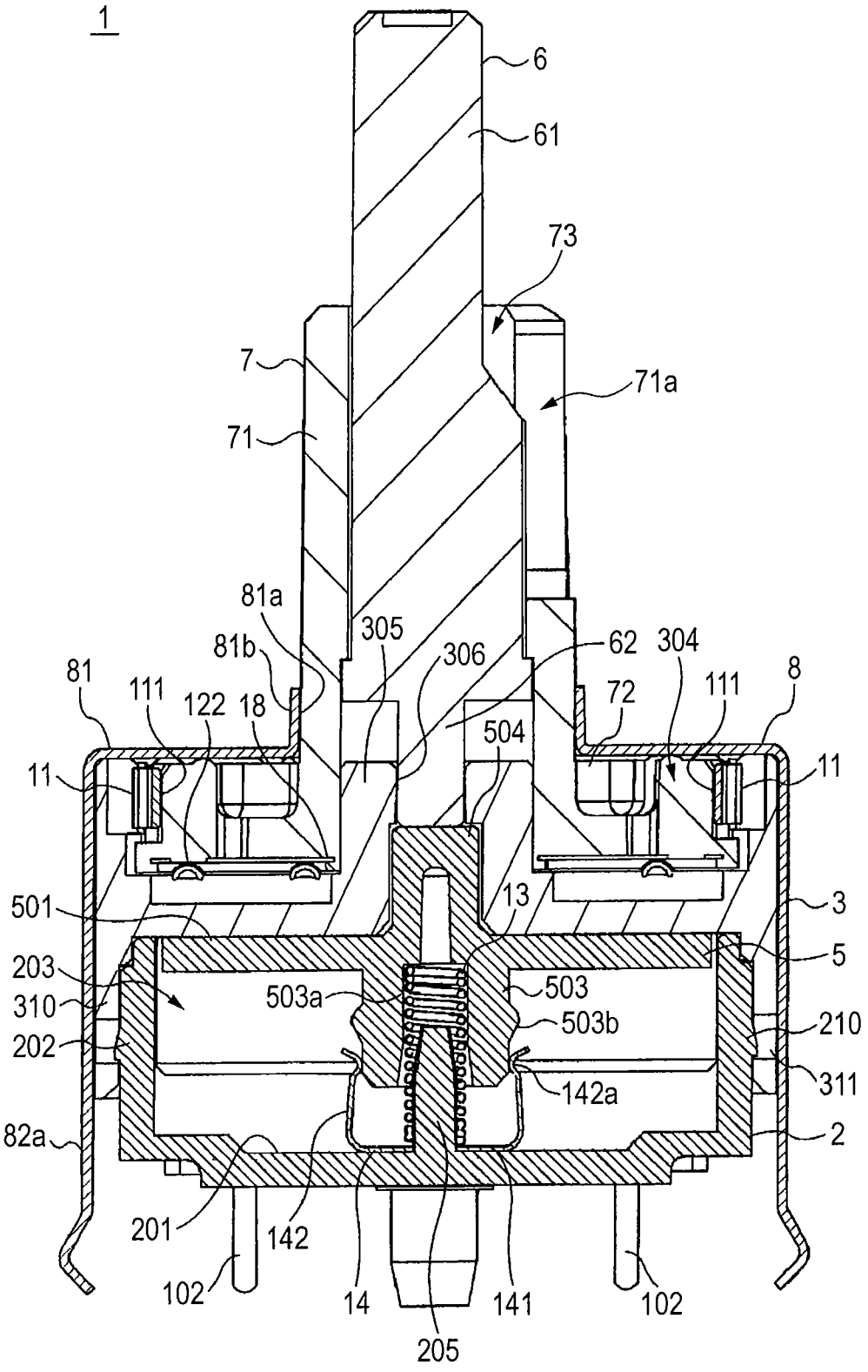

1
6
61
73
7
71a
71
81a
81b
305
306
62
304
81
111
122
18
72
111
8
504
11
11
501
13
3
203
310
202
503a
503
503b
210
311
142a
2
82a
201
142
102
14
141
102
205

FIG. 12

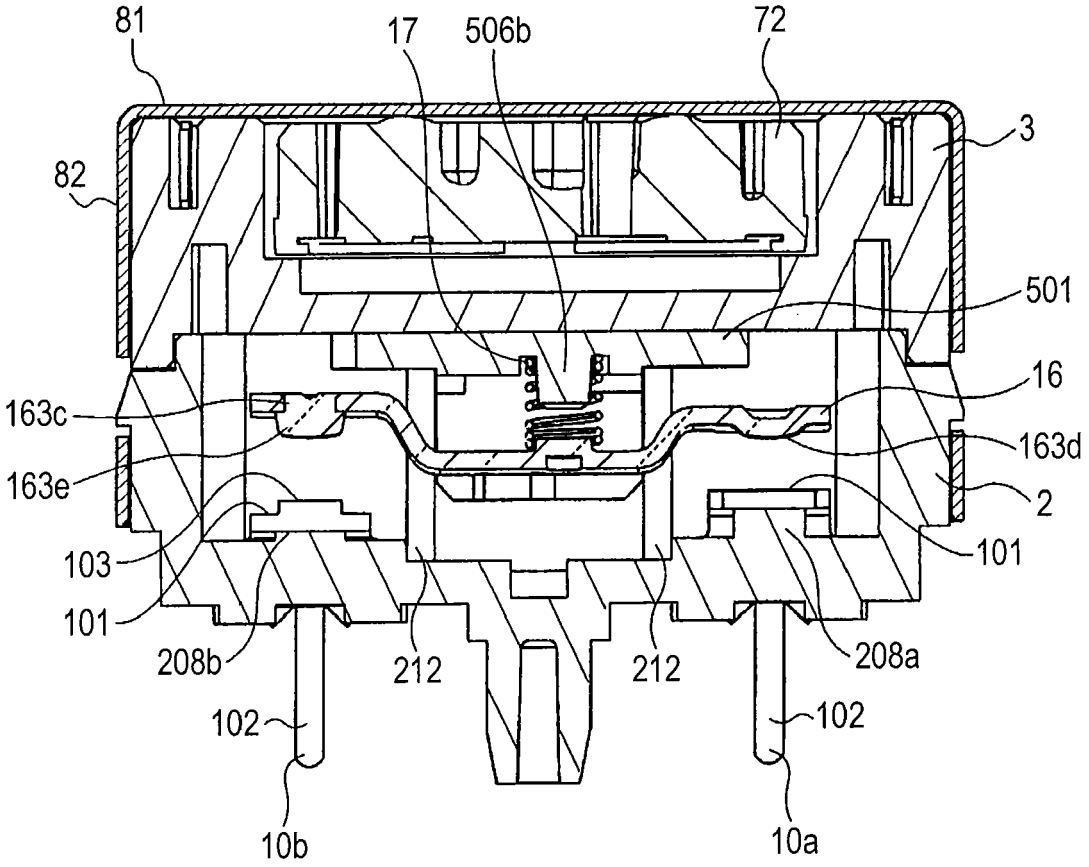

81
17
506b
72
3
82
501
16
163c
163d
163e
2
103
101
101
208b
212
212
208a
102
102
10b
10a

FIG. 13

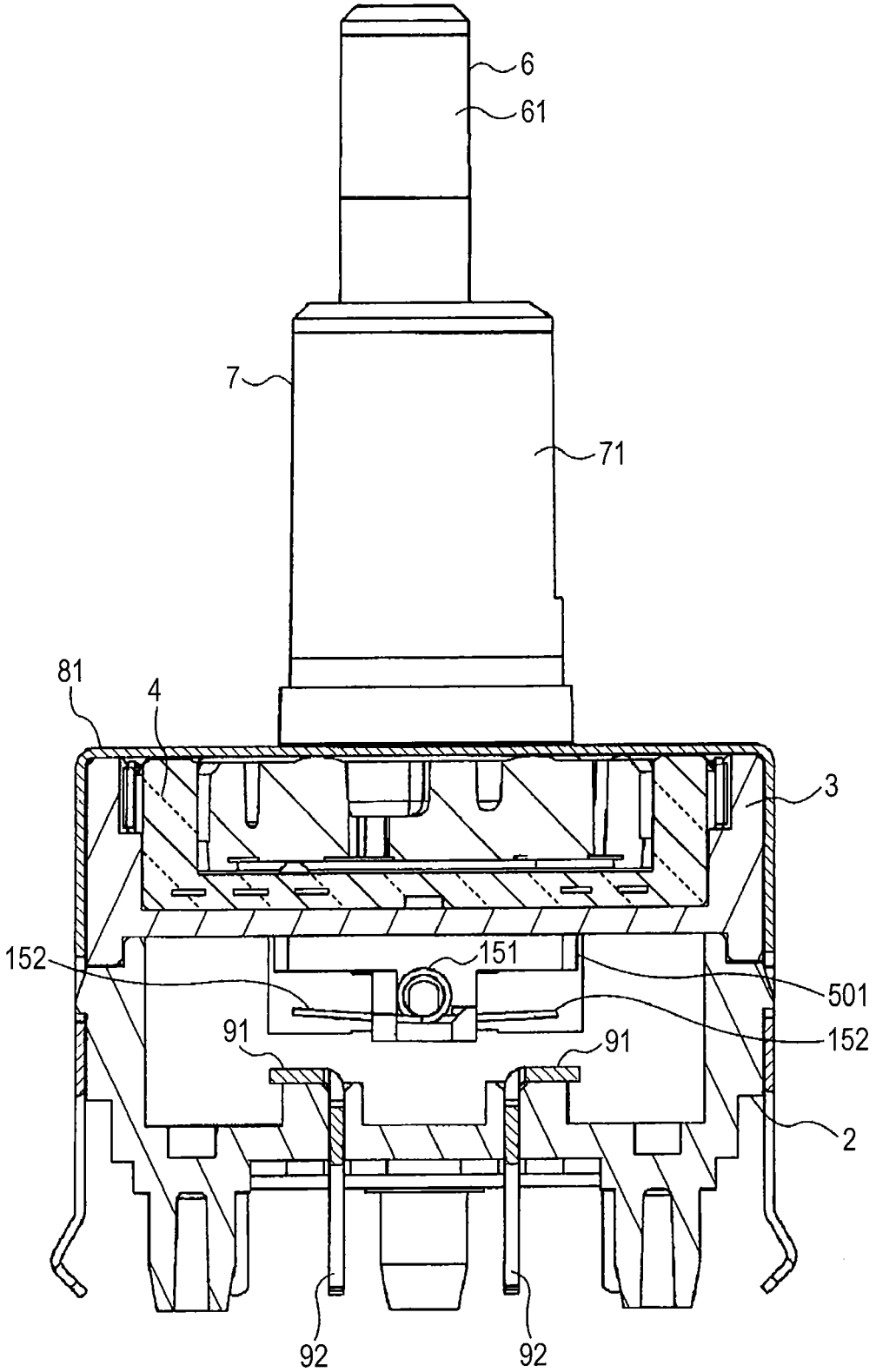
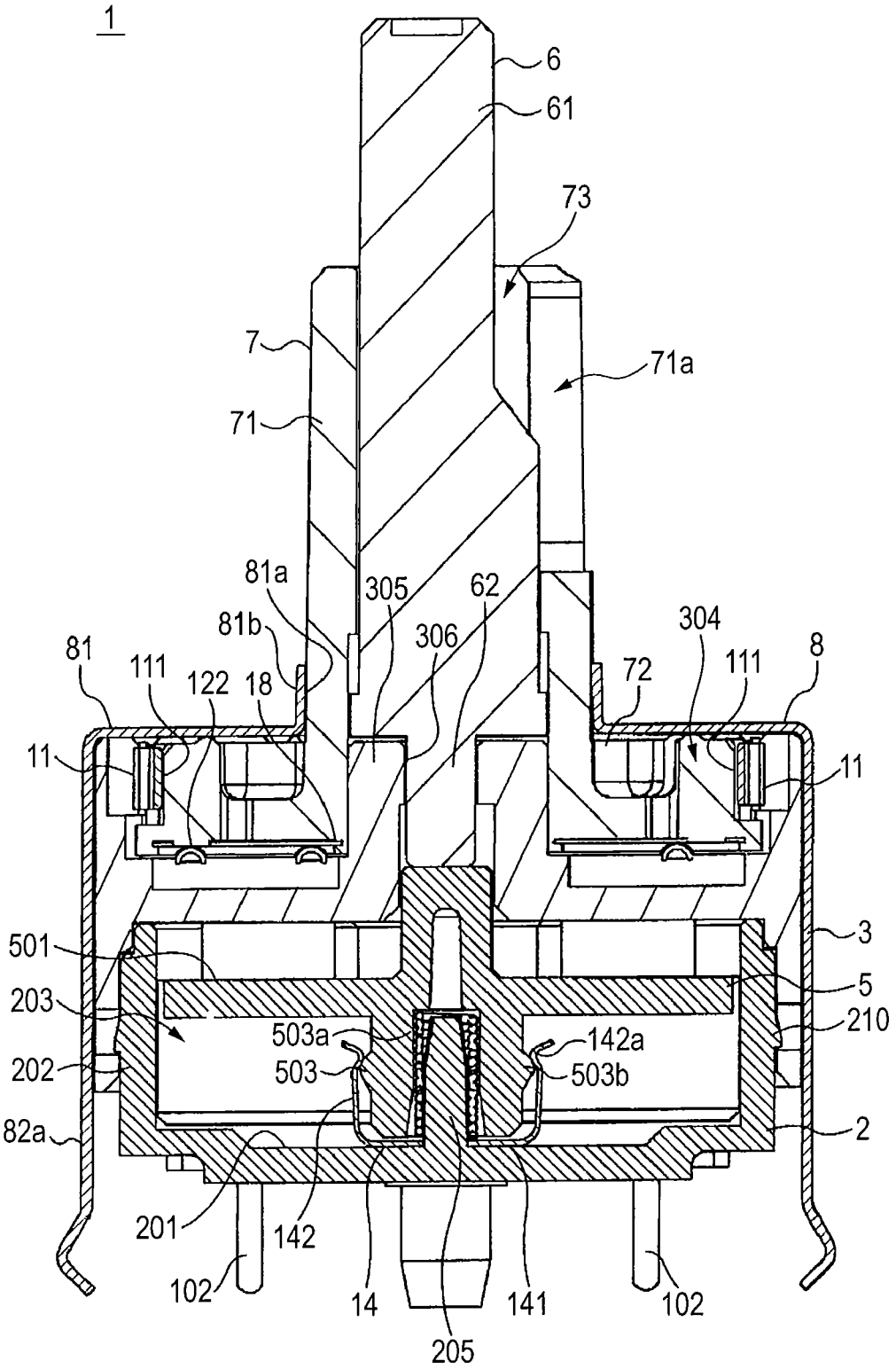


FIG. 14


1
6
61
73
7
71a
71
81a
305
62
81b
306
304
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111
122
18
72
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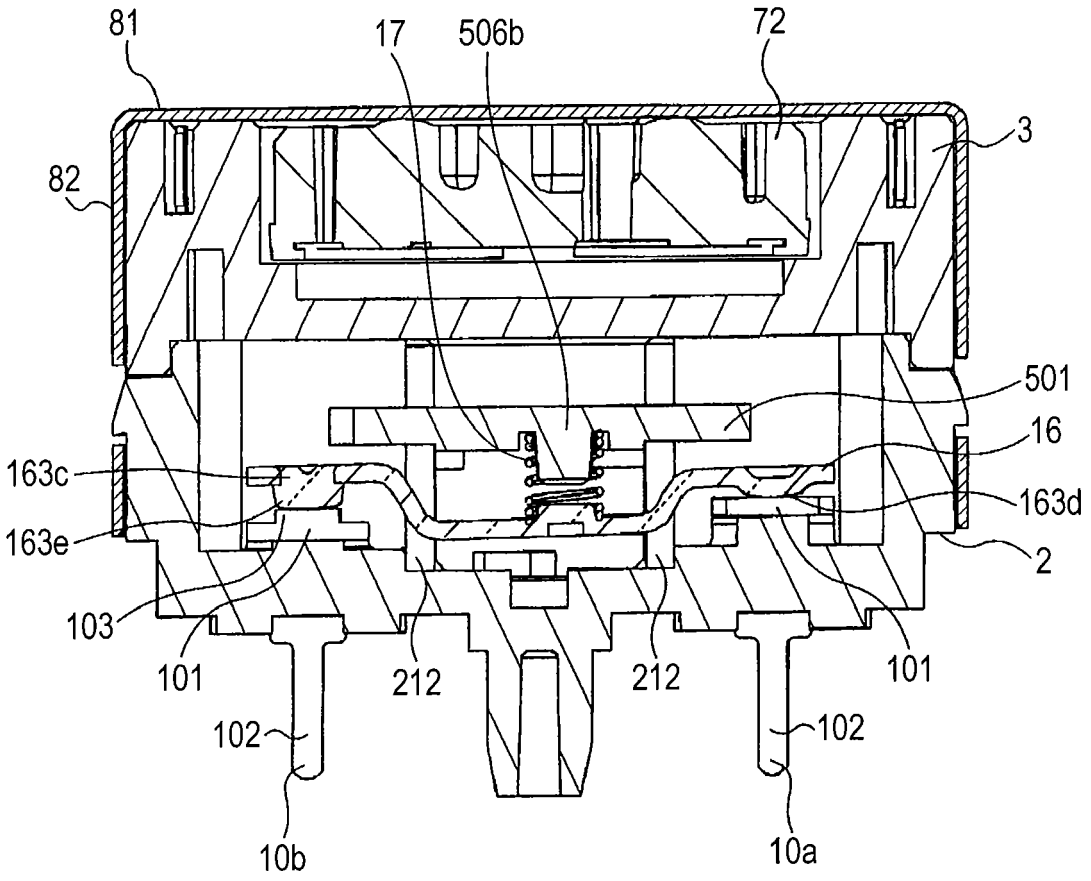
8
11
11
501
3
203
5
503a
142a
210
202
503
503b
82a
2
201
142
102
14
141
102
205

FIG. 15


81
17
506b
72
3
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501
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163c
163d
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103
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212
212
101
102
102
10b
10a

FIG. 16

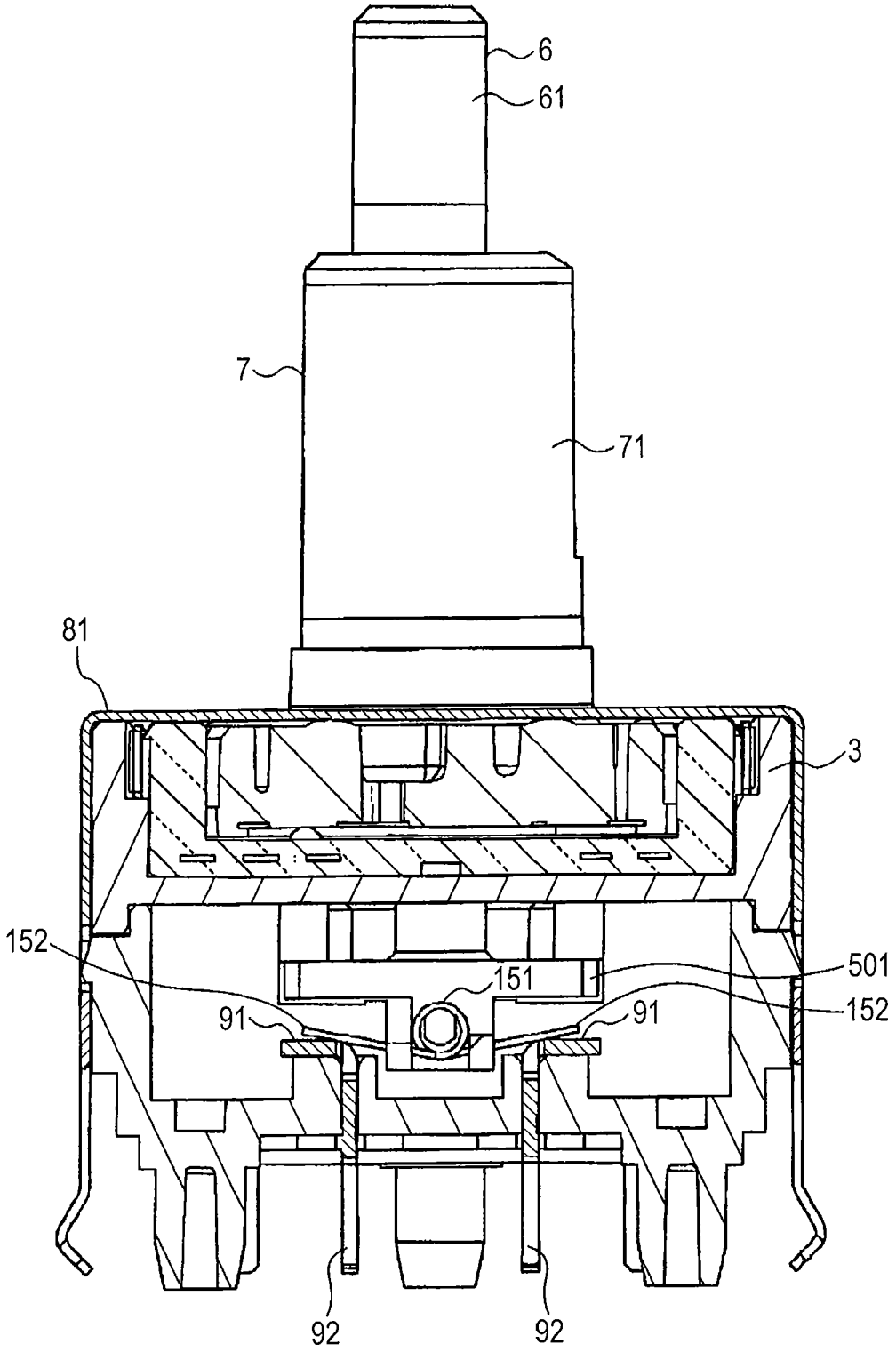


FIG. 17

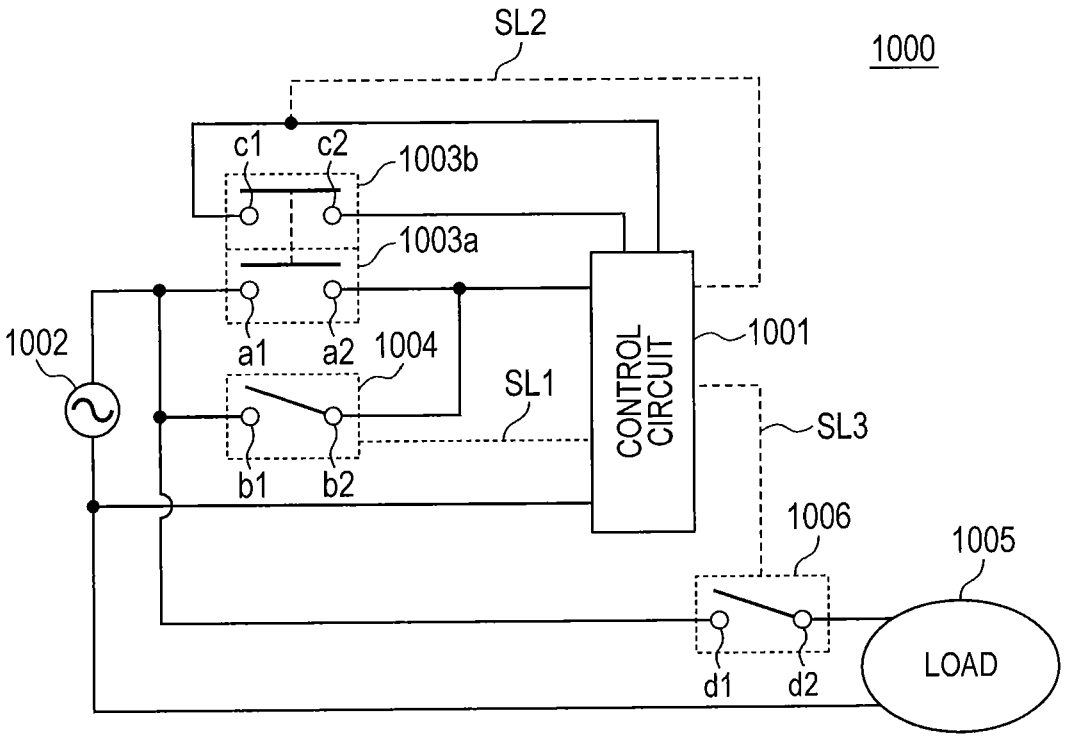
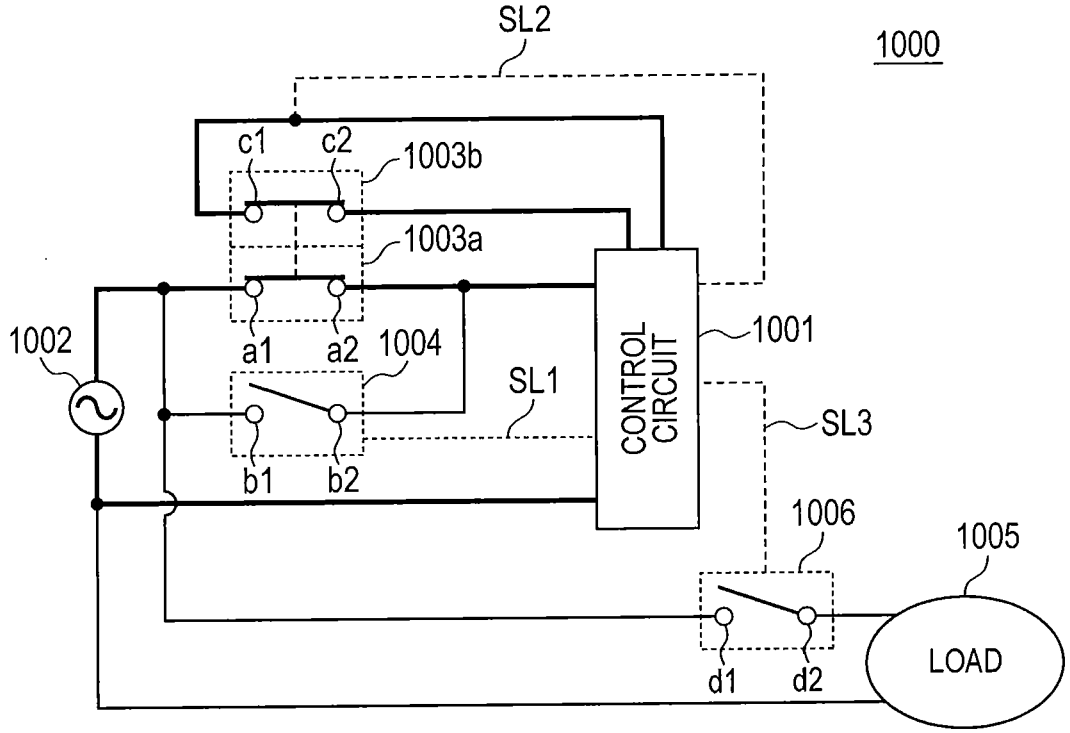

SL2
1000
c1
c2
1003b
1003a
1002
a1
a2
1004
SL1
CONTROL CIRCUIT
1001
SL3
b1
b2
1006
1005
d1
d2
LOAD

FIG. 18


SL2
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c1
c2
1003b
1003a
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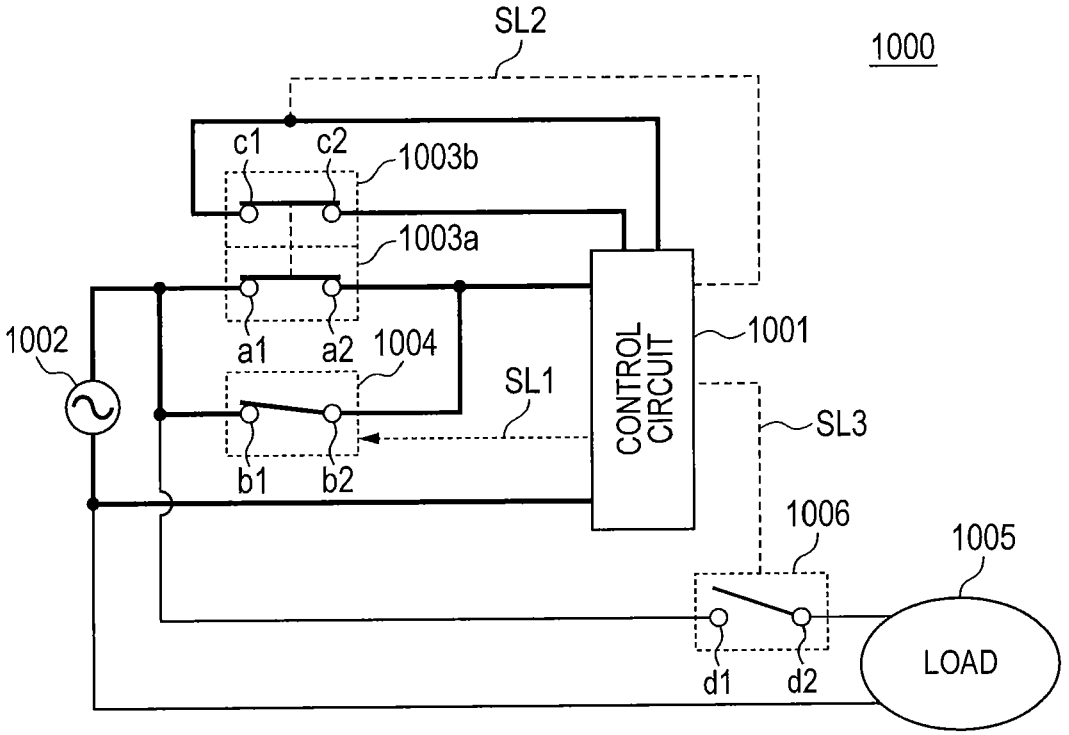
a1
a2
1004
SL1
CONTROL CIRCUIT
1001
SL3
b1
b2
1006
1005
d1
d2
LOAD

FIG. 19


SL2
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c1
c2
1003b
1003a
1002
a1
a2
1004
SL1
CONTROL CIRCUIT
1001
SL3
b1
b2
1006
1005
d1
d2
LOAD

FIG. 20

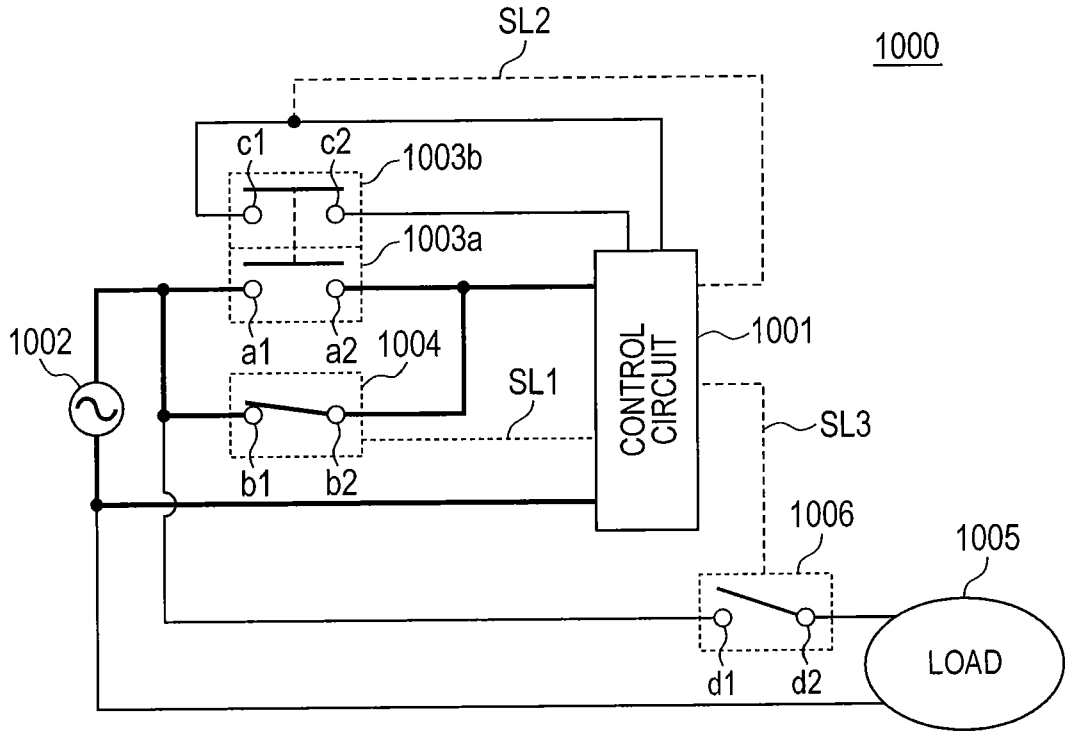

SL2
1000
c1
c2
1003b
1003a
1002
a1
a2
1004
SL1
CONTROL CIRCUIT
1001
SL3
b1
b2
1006
1005
d1
d2
LOAD

FIG. 21

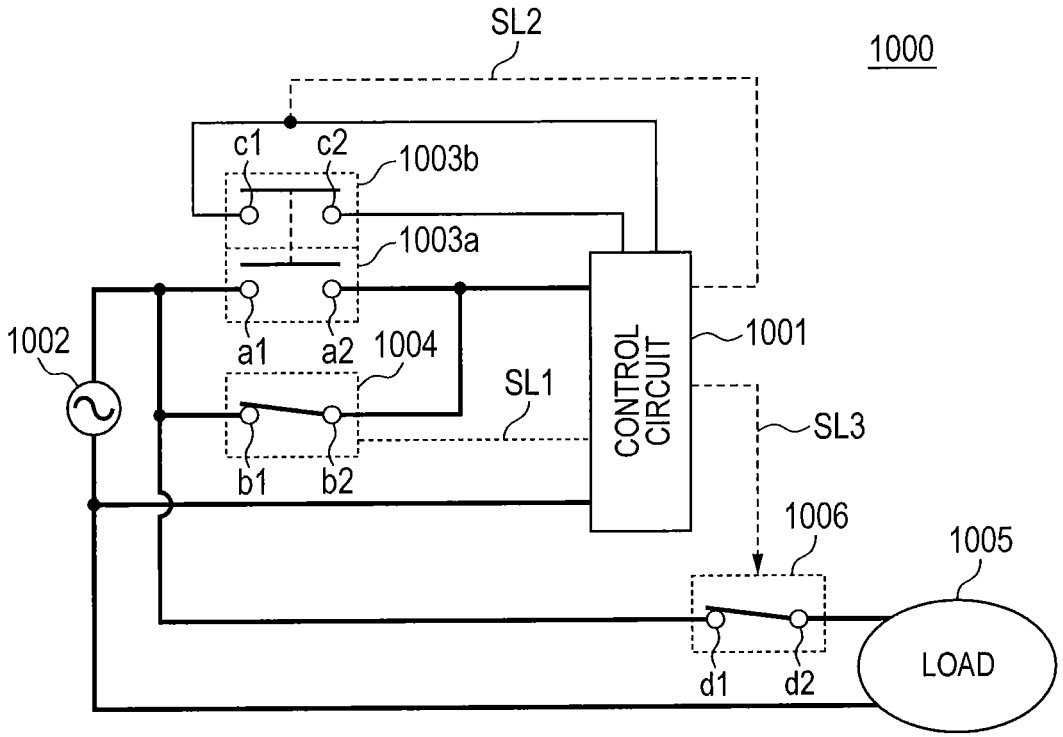

SL2
1000
c1
c2
1003b
1003a
1002
a1
a2
1004
SL1
CONTROL CIRCUIT
1001
SL3
b1
b2
1006
1005
d1
d2
LOAD

FIG. 22

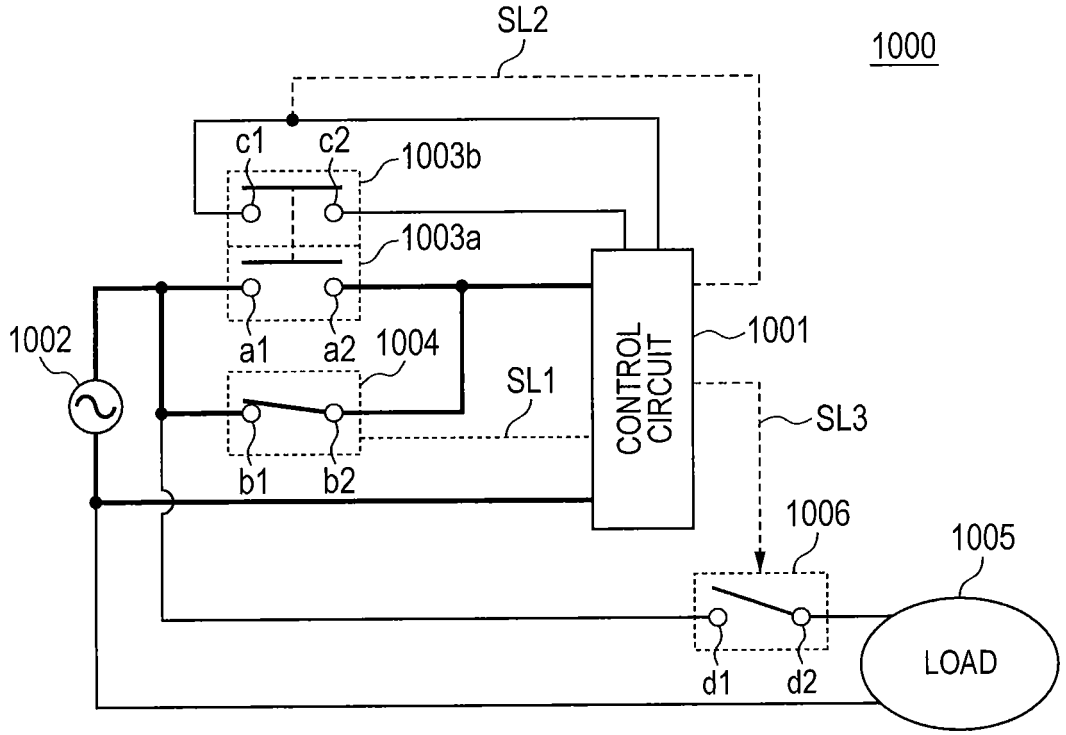

SL2
1000
c1
c2
1003b
1003a
1002
a1
a2
1004
SL1
CONTROL CIRCUIT
1001
SL3
b1
b2
1006
1005
d1
d2
LOAD

FIG. 23

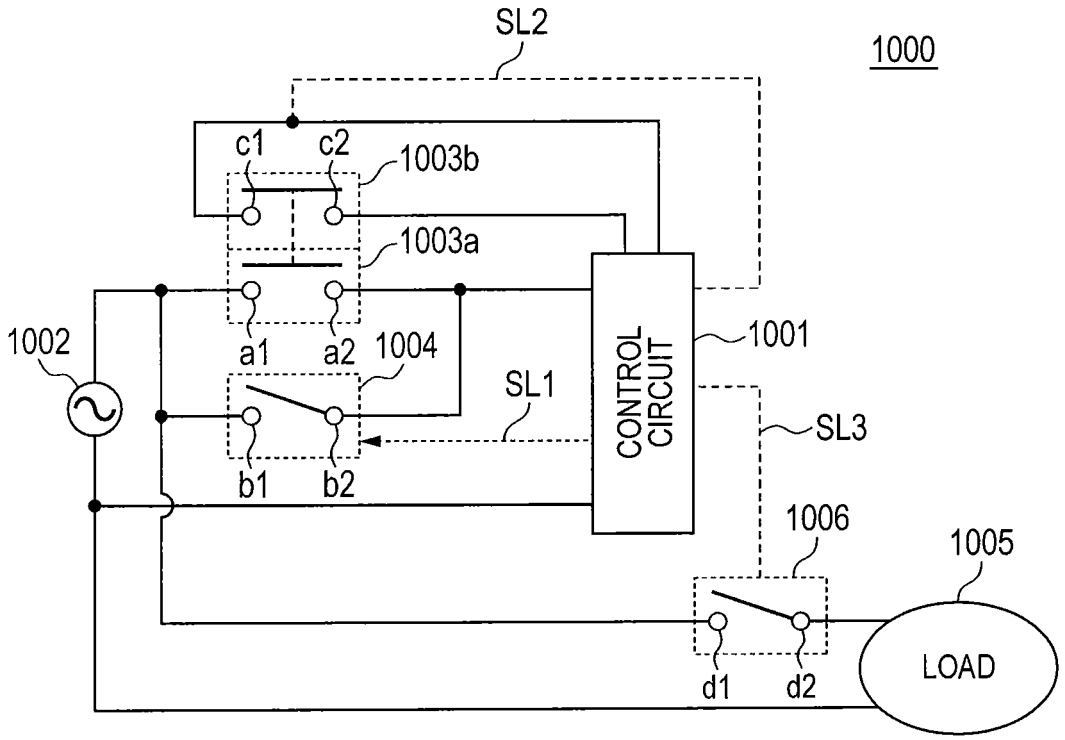

SL2
1000
c1
c2
1003b
1003a
a1
a2
1004
1002
SL1
CONTROL CIRCUIT
1001
SL3
b1
b2
1006
1005
d1
d2
LOAD

FIG. 24

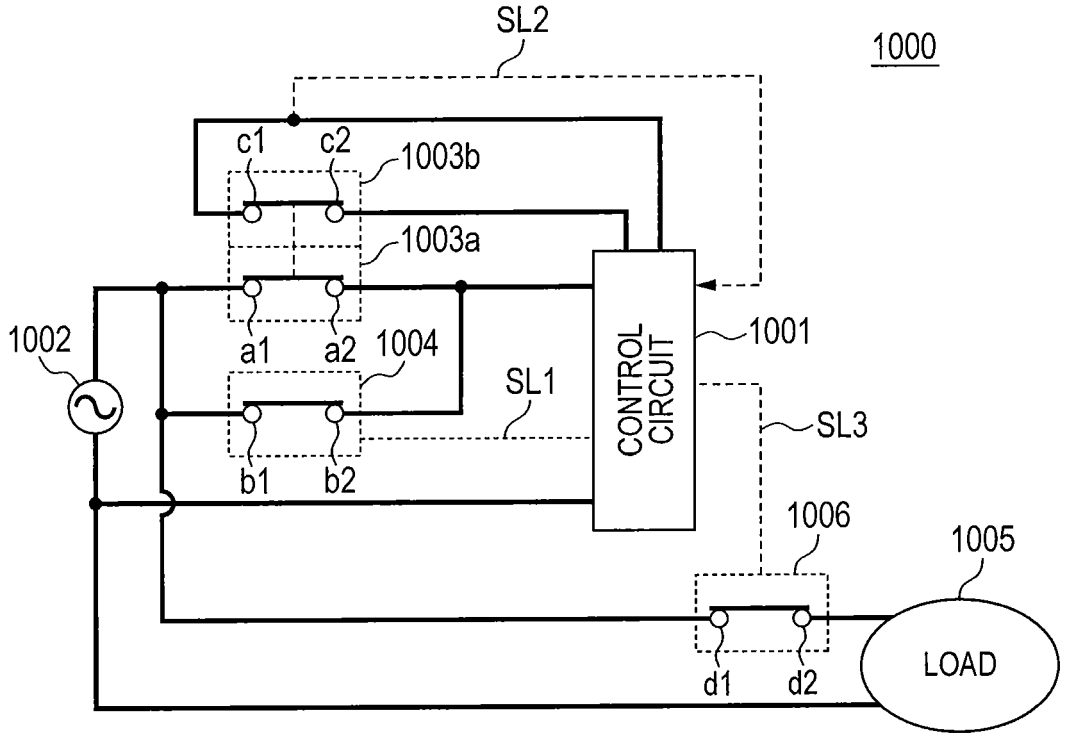

SL2
1000
c1
c2
1003b
1003a
a1
a2
1004
1002
SL1
CONTROL CIRCUIT
1001
SL3
b1
b2
1006
1005
d1
d2
LOAD

FIG. 25

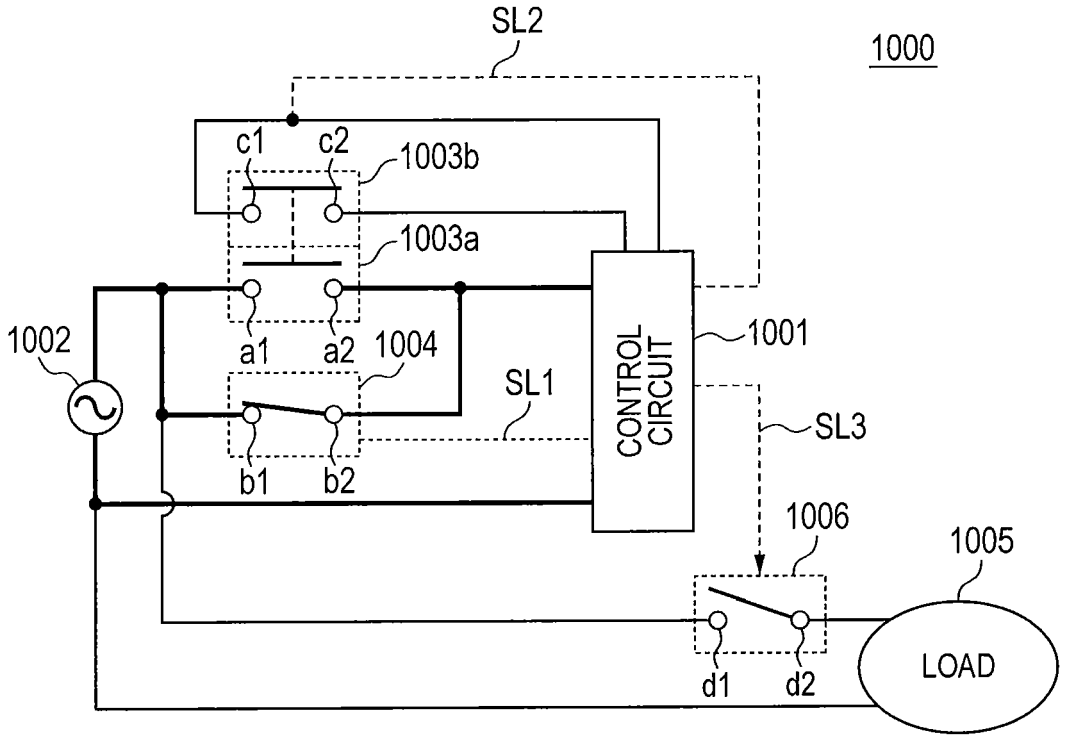
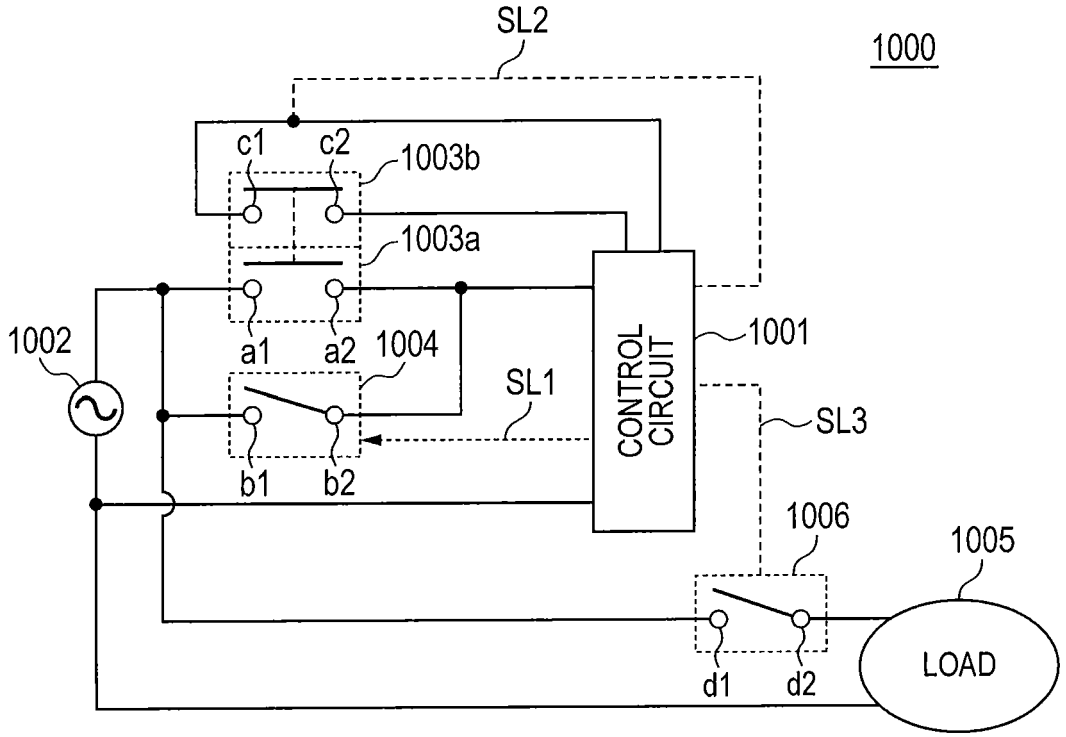

SL2
1000
c1
c2
1003b
1003a
1002
a1
a2
1004
SL1
CONTROL CIRCUIT
1001
SL3
b1
b2
1006
1005
d1
d2
LOAD

FIG. 26


SL2
1000
c1
c2
1003b
1003a
1002
a1
a2
1004
SL1
CONTROL CIRCUIT
1001
SL3
b1
b2
1006
1005
d1
d2
LOAD

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 June 2012	Dobbs, Harvey

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