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(54) **ELECTROMAGNETIC RELAY**

(57) An electromagnetic relay includes a first contact, a second contact configured to contact the first contact and be separated from the first contact, a case accommodating the first and second contacts therein and having an insertion hole provided therein, a terminal inserted into the insertion hole of the case, an adhesive fixer, and an inflow suppressor. The terminal is electrically connected to the first and second contacts while the first contact

contacts the second contact. The adhesive fixer is made of an adhesive applied onto an outer surface of the case and cured. The inflow suppressor is configured to suppress inflow of the adhesive to an inside of the case through a gap between the terminal and an inside surface of the insertion hole of the case. In this electromagnetic relay, the terminal is firmly fixed while securely suppressing hindrance of operation.

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to an electromagnetic relay. 5

BACKGROUND

[0002] A conventional electromagnetic relay is disclosed in, for example, Japanese Patent Laid-Open Publication No. 2012-104277. The electromagnetic relay disclosed in this document includes a fixed contact and a movable contact that relatively moves with respect to the fixed contact and is configured to contact and to be separated from the fixed contact. 10 15

[0003] This electromagnetic relay further includes a terminal electrically connected to the fixed contact and a terminal electrically connected to the movable contact. Each terminal is fixed to a body by press-fitting each terminal into the body. 20

SUMMARY

[0004] An electromagnetic relay includes a first contact, a second contact configured to contact the first contact and be separated from the first contact, a case accommodating the first and second contacts therein and having an insertion hole provided therein, a terminal inserted into the insertion hole of the case, an adhesive fixer, and an inflow suppressor. The terminal is electrically connected to the first and second contacts while the first contact contacts the second contact. The adhesive fixer is made of an adhesive applied onto an outer surface of the case and cured. The inflow suppressor is configured to suppress inflow of the adhesive to an inside of the case through a gap between the terminal and an inside surface of the insertion hole of the case. 25 30 35

[0005] In this electromagnetic relay, the terminal is firmly fixed while securely suppressing hindrance of operation. 40

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] 45

FIG. 1 is a perspective view of an electromagnetic relay according to a first exemplary embodiment.
FIG. 2 is an exploded perspective view of the electromagnetic relay according to the first exemplary embodiment. 50
FIG. 3 is a side sectional view of the electromagnetic relay according to the first exemplary embodiment.
FIG. 4 is an exploded perspective view of the electromagnetic relay according to the first exemplary embodiment. 55
FIG. 5A is a perspective view of a fixed contact unit of the electromagnetic relay according to the first ex-

emplary embodiment.

FIG. 5B is a perspective view of the fixed contact unit of the electromagnetic relay according to the first exemplary embodiment.

FIG. 5C is a side view of the fixed contact unit of the electromagnetic relay according to the first exemplary embodiment.

FIG. 6A is a perspective view of a movable contact unit of the electromagnetic relay according to the first exemplary embodiment.

FIG. 6B is a perspective view of the movable contact unit of the electromagnetic relay according to the first exemplary embodiment.

FIG. 7 is a rear view of a contactor of the electromagnetic relay according to the first exemplary embodiment.

FIG. 8 is a rear view of the contactor of the electromagnetic relay according to the first exemplary embodiment.

FIG. 9 is a perspective view of an auxiliary fixed contact and an auxiliary movable contactor element of the electromagnetic relay according to the first exemplary embodiment.

FIG. 10 is an exploded perspective view of the auxiliary fixed contact and the auxiliary movable contactor element of the electromagnetic relay according to the first exemplary embodiment.

FIG. 11 is a side sectional view of the electromagnetic relay according to the first exemplary embodiment.

FIG. 12 is a side sectional view of the electromagnetic relay according to the first exemplary embodiment.

FIG. 13 is a perspective view of an electromagnetic relay according to a second exemplary embodiment.

FIG. 14 is an exploded perspective view of the electromagnetic relay according to the second exemplary embodiment.

FIG. 15 is a side sectional view of a contactor of the electromagnetic relay according to the second exemplary embodiment.

FIG. 16 is a side sectional view of the contactor of the electromagnetic relay according to the second exemplary embodiment.

FIG. 17A is a perspective view of a fixed contact unit of the electromagnetic relay according to the second exemplary embodiment.

FIG. 17B is a perspective view of the electromagnetic relay according to the second exemplary embodiment.

FIG. 17C is a side view of the electromagnetic relay according to the second exemplary embodiment.

FIG. 18 is a side sectional view of the electromagnetic relay according to the second exemplary embodiment.

FIG. 19 is a side sectional view of a modification example of the electromagnetic relay according to the second exemplary embodiment.

FIG. 20 is a side sectional view of a modification example of the electromagnetic relay according to the second exemplary embodiment.

FIG. 21 is a side sectional view of a modification example of the electromagnetic relay according to the second exemplary embodiment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0007] Hereinafter, exemplary embodiments of the present disclosure will be described in detail with reference to the drawings. Below, a direction in which a terminal is inserted into an insertion hole is defined as a Z direction (up-to-down direction). A direction in which a fixed contact faces a movable contact is defined as an X direction (front-to-rear direction). A direction orthogonal to the X direction and the Z direction is defined as a Y direction (width direction of the terminal).

[0008] A direction in which a tip end of the terminal inserted into the insertion hole protrudes from a case is defined as a downward side in the up-to-down direction. A side on which the fixed contact is disposed is defined as a forward side in the front-to-rear direction. A side on which the movable contact is disposed is defined as a rearward side in the front-to-rear direction.

[0009] The exemplary embodiments below include the same constituents. Thus, hereinafter, the same constituents will be denoted by common reference numerals, and duplicate descriptions of such constituents will not be repeated.

FIRST EXEMPLARY EMBODIMENT

[0010] Electromagnetic relay 1 according to the present exemplary embodiment is a so-called normally open type including contacts turned off at an initial state. As illustrated in FIG. 2, electromagnetic relay 1 includes electromagnet device (driver) 20 positioned at the upper portion of the relay and contactor 30 positioned at the lower portion of the relay. Electromagnet device 20 and contactor 30 are accommodated in case 10 having a hollow box made of resin material. Electromagnetic relay 1 may be an electromagnetic relay of a so-called normally closed type including a contact is turned on in the initial state.

[0011] Case 10 includes base 110 and cover 120, and has an outside surface having substantially a rectangular parallelepiped shape. Electromagnet device 20 and contactor 30 are accommodated in internal space S1 of case 10 formed while cover 120 is attached to base 110.

[0012] The shape of the outside surface of case 10 is not limited to a rectangular parallelepiped shape and may be any shape.

[0013] Base 110 includes pedestal 111 having an approximately rectangular plate shape extending substantially a horizontal plane (directions intersecting the Z direction: XY plane) (refer to FIG. 3). Base 110 includes

upper periphery wall 112 extending upward from a periphery of pedestal 111, and lower periphery wall 113 extending downward from the periphery of pedestal 111 (refer to FIG. 2).

[0014] Electromagnet device 20 is mounted on an upper portion of upper periphery wall 112. Contactor 30 is accommodated in a space demarcated by lower periphery wall 113 (refer to FIG. 2 and FIG. 4).

[0015] Cover 120 includes upper cover 121 having substantially a box shape opening downward, and lower cover 122 having substantially a box shape opening upward. Upper cover 121 is attached to base 110 from an upward side of base 110. Electromagnet device 20 is covered with upper cover 121. Lower cover 122 is attached to base 110 from a downward side. Contactor 30 is covered with lower cover 122.

[0016] In accordance with the present exemplary embodiment, upper cover 121 is attached to base 110 by engaging engagement hole 121a formed in a lower end of upper cover 121 with engagement protrusion 110a formed on a side surface of base 110 (refer to FIG. 1 and FIG. 2). Similarly, lower cover 122 is attached to base 110 by engaging engagement hole 122a formed in an upper end of lower cover 122 with engagement protrusion 110a formed on the side surface of base 110.

[0017] As described above, internal space S1 of case 10 is divided into two spaces in the up-to-down direction by pedestal 111 of base 110 in accordance with the present exemplary embodiment. That is, internal space S1 of case 10 is divided into space S2 formed above pedestal 111 and accommodates electromagnet device 20, and space S3 formed below pedestal 111 and accommodates contactor 30 (refer to FIG. 3).

[0018] In accordance with the present exemplary embodiment, base 110 includes plural (in the present exemplary embodiment, three) partition walls 114. Each partition wall 114 extends downward from a lower surface of pedestal 111. Each of both ends of partition wall 114 in the Y direction (width direction) continuously connected with lower periphery wall 113.

[0019] Accordingly, the space demarcated by lower periphery wall 113 is divided into four spaces S4 arranged in the X direction (front-to-rear direction) by three partition walls 114. Each of four spaces S4 accommodates one set formed with two contact units that are fixed contact unit 310 and movable contact unit 320 (refer to FIG. 4).

[0020] As described above, in the present exemplary embodiment, contactor 30 includes four sets of fixed contact unit 310 and movable contact unit 320 forming a pair with each other (having contacts that are brought into contact with and separated from each other).

[0021] Electromagnet device 20 which is the driver generates electromagnetic force, and includes coil 210 and coil bobbin 220. Coil 210 generates magnetic flux by energizing coil 210. Coil bobbin 220 having a hollow cylindrical shape about which coil 210 is wound (refer to FIG. 2).

[0022] For example, a conductive wire can be used as

coil 210. Coil bobbin 220 is made of resin that is an insulating material. Insertion hole 220a that passes in the front-to-rear direction (X direction) is formed in a center portion of coil bobbin 220 (refer to FIG. 3). Coil bobbin 220 includes winding barrel 221 having substantially a cylindrical shape having an outer surface around which coil 210 is wound, and front flange 222 having substantially a circular shape that is continuously connected with a front end of winding barrel 221 and protrudes outside winding barrel 221 in radial directions. Coil bobbin 220 further includes rear flange 223 having substantially a circular shape that is continuously connected with a rear end of winding barrel 221 and protrudes outside winding barrel 221 in radial directions.

[0023] Electromagnet device 20 includes core 230 that is a fixed-side member inserted into a cylinder (insertion hole 220a) of coil bobbin 220 and magnetized by energized coil 210, that is, magnetic flux passes through the fixed-side member.

[0024] Core 230 includes shaft 231 having substantially a circular columnar shape that extends in the X direction (front-to-rear direction), and head 232 having substantially a circular columnar shape that has a larger diameter than shaft 231 and is continuously connected with a front end of shaft 231 (refer to FIG. 3). In accordance with the present exemplary embodiment, an outer diameter of shaft 231 is substantially identical to an inner diameter of insertion hole 220a formed in coil bobbin 220. An outer diameter of head 232 is larger than the inner diameter of insertion hole 220a.

[0025] Core 230 is disposed inside coil bobbin 220 by inserting a tip end (rear end) of shaft 231 into insertion hole 220a from a forward side. Core 230 is inserted into insertion hole 220a of coil bobbin 220 while the tip end (rear end) of shaft 231 of core 230 protrudes rearward beyond rear flange 223 of coil bobbin 220 and a front end of head 232 protrudes forward beyond front flange 222 of coil bobbin 220.

[0026] Electromagnet device 20 includes armature 240 that is a movable-side member arranged to oppose head 232 of core 230 in the front-to-rear direction (X direction).

[0027] Armature 240 is made of metal having conductivity and is swingable in the front-to-rear direction (X direction) with respect to head 232 of core 230. In accordance with the present exemplary embodiment, armature 240 includes main body 241 facing head 232 of core 230 in the front-to-rear direction (X direction), and card 242 extending downward from a lower end of a center portion of main body 241 in the Y direction (width direction) (refer to FIG. 2 and FIG. 3). Card 242 moves movable body 330, described later, in the front-to-rear direction (X direction) in accordance with swinging of armature 240 in the front-to-rear direction (X direction).

[0028] Electromagnet device 20 includes yoke 250 disposed around coil 210 wound around winding barrel 221. Yoke 250 has substantially a plate shape made of magnetic material, and substantially has an L shape when

view from side, that is, when viewed in the Y direction. That is, in accordance with the present exemplary embodiment, yoke 250 includes horizontal wall portion 251 extending downward coil 210 wound around winding barrel 221 substantially along a horizontal plane, and vertical wall portion 252 extending such that vertical wall portion 252 stands upward from a rear end of horizontal wall portion 251 (refer to FIG. 3). Yoke 250 can be formed by, for example, bending a single plate.

[0029] A lower end of main body 241 of armature 240 is attached to a front end of horizontal wall portion 251 in the front-to-rear direction (X direction) such that armature 240 can swing in the front-to-rear direction (X direction). Accordingly, armature 240 is swingable in the front-to-rear direction (X direction) about a part supported by yoke 250.

[0030] In accordance with the present exemplary embodiment, electromagnet device 20 includes hinge spring 260 attached to both of armature 240 and yoke 250. Hinge spring 260 urges armature 240 in a direction in which main body 241 of armature 240 is separated from head 232 of core 230 (refer to FIG. 3).

[0031] Through-hole 252a passing in the front-to-rear direction (X direction) is formed in vertical wall portion 252. The tip end (rear end) of shaft 231 of core 230 is inserted (press-fitted) into through-hole 252a.

[0032] Electromagnet device 20 includes one pair of coil terminals 270 fixed to coil bobbin 220. Both ends of coil 210 are connected to one pair of coil terminals 270, respectively. Electromagnet device 20 is driven by energizing coil 210 through one pair of coil terminals 270.

[0033] Main body 241 of armature 240 is attracted to head 232 of core 230 by energizing coil 210, and causes armature 240 to swing such that main body 241 approaches head 232 of core 230. That is, main body 241 of armature 240 swings rearward in the X direction (front-to-rear direction) by energizing coil 210 through one pair of coil terminals 270. At this moment, card 242 continuously connected with main body 241 rotates forward along the X direction (front-to-rear direction).

[0034] In accordance with the present exemplary embodiment, a swingable range in which armature 240 can swing is set to be between an initial position at which main body 241 is positioned separately forward from head 232 of core 230 by a predetermined gap, and a contacting position at which main body 241 contacts head 232 of core 230. That is, the swingable range of armature 240 ranges from the initial position to the contacting position in accordance with the present exemplary embodiment. Main body 241 is separated farthest from head 232 of core 230 at the initial position. Main body 241 is closest to head 232 of core 230 at the contacting position.

[0035] In accordance with the present exemplary embodiment, when coil 210 is energized, armature 240 moves to the contacting position at which main body 241 contacts head 232 of core 230. When energization of coil 210 is stopped, armature 240 returns to the initial position

by urging force of hinge spring 260.

[0036] As described above, when coil 210 is not energized, armature 240 according to the present exemplary embodiment faces head 232 of core 230 across a predetermined gap. When coil 210 is energized, armature 240 swings such that armature 240 is attracted toward a head 232 of core 230.

[0037] Electrical connection and disconnection between fixed contact unit 310 and movable contact unit 320 forming a pair with each other (having contacts contacting and being separated from each other) can be switched by switching a driving state of electromagnet device 20.

[0038] In accordance with the present exemplary embodiment, contactor 30 that opens and closes contacts depending on whether coil 210 is energized is disposed below electromagnet device 20.

[0039] As described above, contactor 30 includes four sets of fixed contact unit 310 and movable contact unit 320 forming a pair with each other (having contacts that contact and are separated from each other) (refer to FIG. 4).

[0040] In accordance with the present exemplary embodiment, each set of the four sets of fixed contact unit 310 and movable contact unit 320 having contacts that contact and are separated from each other is configured with one pair of fixed contact units 310 and one movable contact unit 320.

[0041] Specifically, one pair of fixed contact units 310 have the same shape. One pair of fixed contact units 310 are fixed to lower cover 122 (case 10) that is a housing constituting case 10, and one pair of fixed contact units 310 are separated from each other in the Y direction (width direction).

[0042] Each fixed contact unit 310 includes one fixed contact 311 that is one contact, and main body 312 on which fixed contact 311 is disposed (refer to FIGS. 5A to 5C). In accordance with the present exemplary embodiment, fixed contact 311 is formed on main body 312 by inserting a member to be the fixed contact into insertion hole 312c formed to pass through main body 312 in a plate thickness direction and performing riveting (refer to FIG. 11). Formation of fixed contact 311 in main body 312 is not necessarily performed by riveting, and can be performed by various methods. For example, a part protrudes by passing a dowel through main body 312 can be set to function as the fixed contact. Alternatively, a part of a flat surface of main body 312 may function as the fixed contact by allowing movable contacts 321 to contact the part of the flat surface of main body 312.

[0043] Fixed contact unit 310 includes terminal 313 that is continuously connected with a lower end of main body 312 and is fixed to lower cover 122 (case 10) such that a tip end of terminal 313 protrudes outward (downward) from lower cover 122 (case 10).

[0044] In accordance with the present exemplary embodiment, insertion hole 123 that passes in the Z direction (up-to-down direction) is formed in lower cover 122. Fixed

contact unit 310 is fixed to lower cover 122 (case 10) such that a tip end (lower end) of terminal 313 protrudes outward (downward) from lower cover 122 by inserting the tip end (lower end) of terminal 313 into insertion hole 123 from an upward side (refer to FIG. 11 and FIG. 12).

[0045] Fixed contact unit 310 is fixed to lower cover 122 (case 10) such that fixed contact 311 faces rearward in the X direction (front-to-rear direction). That is, fixed contact unit 310 is fixed to lower cover 122 (case 10) such that surface 312a (rear surface: a surface opposing movable contacts 321) of main body 312 on which fixed contact 311 is formed faces rearward.

[0046] Fixed contact 311, main body 312, and terminal 313 can be made of conductive material, such as copper-based material.

[0047] One movable contact unit 320 includes one pair of movable contacts 321 that are one pair of contacts linearly disposed in the Y direction (width direction), and one movable contactor element 322 in which one pair of movable contacts 321 are disposed (refer to FIG. 4).

[0048] In accordance with the present exemplary embodiment, movable contacts 321 are formed in movable contactor element 322 by inserting members as movable contacts into insertion holes 322d passing in the plate thickness direction on both sides of movable contactor element 322 having substantially a rectangular plate shape in a longitudinal direction and performing riveting (refer to FIG. 11). Formation of movable contacts 321 in movable contactor element 322 is not necessarily performed by riveting, and can be performed by various methods. For example, a part protruding by passing a dowel through movable contactor element 322 may function as the movable contact. Alternatively, a part of a flat surface of movable contactor element 322 can function as the movable contact by allowing the part of the flat surface of movable contactor element 322 to contact fixed contact 311.

[0049] One movable contact unit 320 is positioned on a rearward side in the X direction (front-to-rear direction) with respect to two fixed contact units 310 forming a pair while the plate thickness direction substantially matches the X direction (front-to-rear direction) and the longitudinal direction substantially matches the Y direction (width direction) (refer to FIG. 7 and FIG. 8). Movable contact unit 320 is disposed such that movable contacts 321 faces fixed contact 311 in the X direction (front-to-rear direction). Specifically, movable contactor element 322 is disposed such that movable contact 321 formed on one side in the Y direction (width direction) faces fixed contact 311 of fixed contact unit 310 arranged on one side in the Y direction (width direction) in the X direction (front-to-rear direction). Similarly, movable contactor element 322 is disposed such that movable contact 321 formed on the other side in the Y direction (width direction) faces fixed contact 311 of fixed contact unit 310 arranged on the other side in the Y direction (width direction) in the X direction (front-to-rear direction).

[0050] Movable contacts 321 and movable contactor

element 322 can be made of conductive material, such as copper-based material.

[0051] A set configured with one pair of fixed contact units 310 and one movable contact unit 320 is accommodated in each of four spaces S4 described above (refer to FIG. 4).

[0052] Each movable contact unit 320 is arranged in space S4 such that movable contact unit 320 can relatively reciprocate in the X direction (front-to-rear direction) with respect to one pair of fixed contact units 310 in the same set.

[0053] Specifically, contactor 30 includes movable body 330 that reciprocates in the X direction (front-to-rear direction) in accordance with swinging of armature 240. Each movable contact unit 320 relatively reciprocates in the X direction (front-to-rear direction) with respect to one pair of fixed contact units 310 in the same set by holding each movable contact unit 320 in movable body 330.

[0054] In accordance with the present exemplary embodiment, movable body 330 includes holder 331 opening downward, cover 332 that covers opening of holder 331 from downward, and coil spring 333 held in holder 331. Coil spring 333 pushes movable contactor element 322 forward, that is, toward fixed contacts 311.

[0055] Holder 331 includes ceiling wall 3311 extending slenderly in the X direction (front-to-rear direction), and plural partition walls 3312 extending downward in the Y direction (width direction) continuously from a lower surface of ceiling wall 3311. Holder 331 further includes periphery walls 3313 extending in the X direction (front-to-rear direction) continuously from both ends of each partition wall 3312 in the Y direction (width direction).

[0056] In accordance with the present exemplary embodiment, two partition walls 3312 connected continuously with both edges in the X direction (front-to-rear direction) and five partition walls 3312 provided between two partition walls 3312 are formed in ceiling wall 3311 separately in the X direction (front-to-rear direction) (refer to FIG. 4).

[0057] Two partition walls 3312 are adjacent to each other by a predetermined gap having a size in which movable contactor element 322 and coil spring 333 can be accommodated. Periphery wall 3313 extends continuously from both ends of two partition walls 3312 in the Y direction (width direction) such that periphery wall 3313 extends from one partition wall 3312 toward the other partition wall 3312. Tip ends of periphery walls 3313 extend toward the other partition wall 3312 face each other separately in the X direction (front-to-rear direction). A gap having a size in which movable contactor element 322 can be inserted is formed between the tip ends of periphery walls 3313 opposing each other.

[0058] Space S5 opening downward and on both sides in the Y direction (width direction) is formed in holder 331. A center portion of movable contactor element 322 in the Y direction (width direction) and coil spring 333 are accommodated in space S5. In a state where cover 332 is

assembled to holder 331, cover 332 demarcates a downward side of space S5. That is, space S5 that is demarcated by ceiling wall 3311, partition wall 3312, periphery wall 3313, and cover 332, and that partially opens on both sides in the Y direction (width direction) is formed in movable body 330.

[0059] In accordance with the present exemplary embodiment, four spaces S5 are linearly arranged in the X direction (front-to-rear direction) in movable body 330. One coil spring 333 is accommodated in each space S5. One movable contactor element 322 is accommodated in each space S5 in a state where parts (both end portions in the Y direction (width direction)) of one movable contactor element 322 in which movable contacts 321 protrude to outward of space S5. Coil spring 333 urges movable contactor element 322 forward in the X direction (front-to-rear direction).

[0060] In accordance with the present exemplary embodiment, spring receiver 322a that protrudes rearward is formed in the center portion of movable contactor element 322 in the Y direction (width direction). The center portion of movable contactor element 322 in the Y direction (width direction) and coil spring 333 are accommodated in space S5 in a state where coil spring 333 is held in spring receiver 322a.

[0061] While spring receiver 322a is formed by causing a dowel to pass through movable contactor element 322 in the present exemplary embodiment, spring receiver 322a can also be formed by other methods.

[0062] Protrusion 3313a that is engaged with recess 322b formed in a lower end of movable contactor element 322 is formed at a lower end of periphery wall 3313. Detachment of movable contactor element 322 from movable body 330 is suppressed by engaging protrusion 3313a with recess 322b (refer to FIG. 6A to FIG. 8).

[0063] In accordance with the present exemplary embodiment, movable contactor element 322 is held in a state where movable contactor element 322 is movable in the X direction (front-to-rear direction) relatively with respect to movable body 330. Recess 322c into which ceiling wall 3311 of holder 331 is inserted is formed in an upper end of movable contactor element 322. In a state where ceiling wall 3311 is inserted into recess 322c, movable contactor element 322 is movable in the X direction (front-to-rear direction) relatively with respect to movable body 330. As described above, in accordance with the present exemplary embodiment, movable contactor element 322 is moveable in the X direction (front-to-rear direction) relatively with respect to movable body 330 while being guided by ceiling wall 3311.

[0064] Movable body 330 is arranged in the space demarcated by lower periphery wall 113 of base 110 in a state where movable contactor element 322 and coil spring 333 are held in movable body 330. In accordance with the present exemplary embodiment, notches 114a are formed in center portions, in the Y direction (width direction), of three partition walls 114 dividing the space defined by lower periphery wall 113 into four spaces S4.

Movable body 330 is disposed in the space demarcated by lower periphery wall 113 in a state where a part of movable body 330 is accommodated in notches 114a.

[0065] Movable body 330 includes protrusion wall 3314 continuously protruding upward from an upper surface of ceiling wall 3311. In accordance with the present exemplary embodiment, protrusion wall 3314 is formed in a front end portion of ceiling wall 3311 in the X direction (front-to-rear direction). A space having opening portion 3314a opening upward is formed inside protrusion wall 3314 (refer to FIG. 3).

[0066] Opening portion 111a into which protrusion wall 3314 is inserted is formed in pedestal 111 of base 110. A tip end of protrusion wall 3314 protrudes upward beyond pedestal 111 in a state where movable body 330 is disposed in the space demarcated by lower periphery wall 113. Accordingly, card 242 of armature 240 is inserted into an internal space of protrusion wall 3314. As described above, movable body 330 moves in the front-to-rear direction (X direction) in accordance with swinging of armature 240 in the front-to-rear direction (X direction) by inserting card 242 of armature 240 into the internal space of protrusion wall 3314.

[0067] Movable body 330 includes pushing element 3315 continuously protruding upward from the upper surface of ceiling wall 3311. In accordance with the present exemplary embodiment, pushing element 3315 is formed at a rear end portion of ceiling wall 3311 in the X direction (front-to-rear direction).

[0068] Opening portion 111b into which pushing element 3315 is inserted is formed in pedestal 111 of base 110. A tip end of pushing element 3315 protrudes upward beyond pedestal 111 in a state where movable body 330 is arranged in the space defined by lower periphery wall 113. Pushing element 3315 is configured to be moved in the front-to-rear direction (X direction) in accordance with movement of movable body 330 and pushes auxiliary movable contact unit 342 of auxiliary contact unit 340 described later.

[0069] As described above, contactor 30 includes auxiliary contact unit 340 in accordance with the present exemplary embodiment. For example, auxiliary contact unit 340 is used for detecting whether fixed contacts 311 and movable contacts 321 that can contact each other and be separated from each other are welded.

[0070] Auxiliary contact unit 340 includes one set of auxiliary fixed contact unit 341 and auxiliary movable contact unit 342 having auxiliary contacts that contact each other and are separated from each other.

[0071] In accordance with the present exemplary embodiment, the set of auxiliary fixed contact unit 341 and auxiliary movable contact unit 342 that are auxiliary contact units having the auxiliary contacts which contact each other and are separated from each other is configured with one pair of auxiliary fixed contact units 341 and one movable contact unit 342 (refer to FIG. 9 and FIG. 10).

[0072] Specifically, one pair of auxiliary fixed contact

units 341 have approximately the same shape. Two auxiliary fixed contact units 341 forming a pair are fixed to lower cover 122 (case 10) separately in the Y direction (width direction).

[0073] One auxiliary fixed contact unit 341 of one pair of auxiliary fixed contact units 341 includes one fixed contact 341c and main body 341a in which one fixed contact 341c is disposed. Formation of auxiliary fixed contact 341c in main body 341a can be performed by various methods, such as riveting.

[0074] The other auxiliary fixed contact unit 341 of one pair of auxiliary fixed contact units 341 includes main body 341a to which auxiliary movable contactor element 342a of auxiliary movable contact unit 342 is fixed. Fixing of auxiliary movable contactor element 342a to main body 341a can also be performed by various methods, such as riveting.

[0075] Each of one pair of auxiliary fixed contact units 341 includes auxiliary terminal portion 341b that is connected continuously with a lower end of main body 341a and is fixed to lower cover 122 (case 10) such that a tip end of auxiliary terminal portion 341b protrudes outward (downward) from lower cover 122 (case 10).

[0076] In accordance with the present exemplary embodiment, one auxiliary fixed contact unit 341 is fixed to lower cover 122 (case 10) such that a surface on which auxiliary fixed contact 341c is formed faces forward in the X direction (front-to-rear direction). The other auxiliary fixed contact unit 341 is fixed to lower cover 122 (case 10) in a state where a surface to which auxiliary movable contactor element 342a is configured to be fixed faces a forward side in the X direction (front-to-rear direction).

[0077] Auxiliary fixed contact 341c, main body 341a, and auxiliary terminal portion 341b may be made of conductive material, such as copper-based material.

[0078] One auxiliary movable contact unit 342 includes one auxiliary movable contactor element 342a in which one pair of auxiliary movable contacts 342b linearly disposed in the Z direction (up-to-down direction) are formed. Formation of auxiliary movable contact 342b in auxiliary movable contactor element 342a can be performed by various methods, such as riveting. Auxiliary movable contact 342b and auxiliary movable contactor element 342a can also be made of a conductive material such as a copper-based material.

[0079] In accordance with the present exemplary embodiment, one auxiliary movable contactor element 342a has a strip shape extending in the Y direction (width direction) and is bent in the X direction (front-to-rear direction). One side of auxiliary movable contactor element 342a in the Y direction (width direction), that is, a side that is bent in a direction of being separated from auxiliary fixed contact unit 341 and faces auxiliary fixed contact 341c, is branched into two parts, upper and lower parts. One auxiliary movable contact 342b is formed in each of branched plate-shaped parts. Formation of auxiliary movable contact 342b in the plate-shaped parts can also

be performed by various methods, such as riveting.

[0080] The other side, in the Y direction (width direction), of auxiliary movable contactor element 342a that is not branched into upper and lower parts, that is, a side that is bent in a direction of approaching auxiliary fixed contact unit 341 and faces main body 341a in which auxiliary fixed contact 341c is not formed, is fixed to main body 341a of the other auxiliary fixed contact unit 341. Auxiliary movable contactor element 342a is fixed to main body 341a of the other auxiliary fixed contact unit 341 such that a side of auxiliary movable contactor element 342a on which auxiliary movable contact 342b is formed can elastically deform in the X direction (front-to-rear direction).

[0081] In accordance with the present exemplary embodiment, auxiliary contact unit 340 is configured such that auxiliary movable contact 342b does not contact auxiliary fixed contact 341c when auxiliary movable contactor element 342a is free. Auxiliary movable contactor element 342a faces pushing element 3315 of movable body 330 in the X direction (front-to-rear direction) in a state where auxiliary contact unit 340 is fixed to lower cover 122 (case 10).

[0082] Auxiliary movable contactor element 342a moves in the front-to-rear direction (X direction) in accordance with movement of pushing element 3315 in the front-to-rear direction (X direction). Contact and separation between auxiliary movable contact 342b and auxiliary fixed contact 341c are switched by moving pushing element 3315.

[0083] Specifically, in a state where coil 210 is not energized (state where energization of coil 210 is stopped), movable contact 342b of auxiliary movable contactor element 342a contacts fixed contact 341c of auxiliary fixed contact unit 341 by causing pushing element 3315 positioned rearward in the X direction (front-to-rear direction) to push auxiliary movable contactor element 342a rearward.

[0084] Meanwhile, in a state where coil 210 is energized, auxiliary movable contactor element 342a moves forward in the X direction (front-to-rear direction) by elastic restoring force of auxiliary movable contactor element 342a in accordance with forward movement of pushing element 3315 in the X direction (front-to-rear direction), and movable contact 342b of auxiliary movable contactor element 342a is separated from fixed contact 341c of auxiliary fixed contact unit 341.

[0085] Auxiliary contact unit 340 and pushing element 3315 having such a positional relationship switches separation and contact between auxiliary movable contact 342b and auxiliary fixed contact 341c by switching between energization and non-energization of coil 210.

[0086] Next, an example of operation of electromagnetic relay 1 including electromagnet device 20 and contactor 30 will be described below.

[0087] In a state where coil 210 is not energized, elastic force of hinge spring 260 moves main body 241 of armature 240 in a direction in which main body 241 is separated

from head 232 of core 230. At this moment, since card 242 of armature 240 is positioned rearward in the X direction (front-to-rear direction), movable body 330 is also positioned rearward in the X direction (front-to-rear direction). That is, movable contact unit 320 held by movable body 330 is separated from fixed contact unit 310, and is turned off, allowing movable contact 321 to be separated from fixed contact 311 (refer to FIG. 7).

[0088] When coil 210 turned off is energized, main body 241 of armature 240 is attracted rearward, that is, toward core 230, by electromagnetic force and moves to approach head 232 of core 230 against elastic force of hinge spring 260. Card 242 rotates forward in accordance with rearward (core 230 side) rotating of main body 241, and movable body 330 moves (slides) forward in accordance with forward rotating of card 242. Accordingly, each of four movable contactor elements 322 held by movable body 330 moves forward toward fixed contact unit 310 forming a set with each other, and movable contact 321 of each movable contactor element 322 contacts fixed contact 311 of fixed contact unit 310. Accordingly, one pair of fixed contact units 310 in one set are electrically connected by one movable contact unit 320 in the same set (refer to FIG. 8).

[0089] When energization of coil 210 is stopped, urging force of hinge spring 260 causes main body 241 of armature 240 to rotate forward, that is, in a direction in which main body 241 is separated from core 230, and main body 241 returns to the initial position.

[0090] Card 242 rotates rearward in accordance with forward rotating of main body 241, and movable body 330 moves (slides) rearward in accordance with rearward rotating of card 242. Accordingly, each of four movable contactor elements 322 held by movable body 330 moves rearward to be separated from fixed contact unit 310 forming a set with each other, and movable contact 321 of each movable contactor element 322 is separated from fixed contact 311 of fixed contact unit 310. This operation electrically disconnects one pair of fixed contact units 310 and 310 in one set from each other.

[0091] As described above, in accordance with the present exemplary embodiment, when armature 240 is positioned at the initial position, contacts of each set are located at a second position at which movable contact 321 is separated from fixed contact 311 (refer to FIG. 7). Meanwhile, when armature 240 is located at the contacting position, the contacts of each set are located at a first position at which movable contact 321 contacts fixed contact 311 (refer to FIG. 8).

[0092] Accordingly, one pair of fixed contact units 310 and 310 of each set are insulated from each other during a period in which coil 210 is not energized. One pair of fixed contact units 310 and 310 of each set are conducted to each other during a period in which coil 210 is energized. As described above, in accordance with the present exemplary embodiment, movable contact 321 is configured to relatively reciprocate along the X direction (front-to-rear direction) with respect to fixed contact 311

between the first position and the second position.

[0093] Movable body 330 is positioned on a rearward side in the X direction (front-to-rear direction) in a state where coil 210 is not energized (state where energization of coil 210 is stopped). Accordingly, auxiliary movable contactor element 342a is pushed rearward by pushing element 3315, and movable contact 342b of auxiliary movable contactor element 342a contacts fixed contact 341c of auxiliary fixed contact unit 341. That is, one pair of auxiliary fixed contact units 341 are electrically connected by auxiliary movable contact unit 342.

[0094] Movable body 330 moves (slides) forward in the X direction (front-to-rear direction) in a state where coil 210 is energized. In a case where movable body 330 moves (slides) forward in the X direction (front-to-rear direction), pushing element 3315 also moves forward in the X direction (front-to-rear direction), and auxiliary movable contactor element 342a moves forward in the X direction (front-to-rear direction) by the elastic restoring force of auxiliary movable contactor element 342a. Consequently, movable contact 342b of auxiliary movable contactor element 342a is separated from fixed contact 341c of auxiliary fixed contact unit 341, and one pair of auxiliary fixed contact units 341 and 341 are electrically disconnected from each other.

[0095] As described above, in accordance with the present exemplary embodiment, auxiliary contact unit 340 is configured to insulate one pair of auxiliary fixed contact units 341 and 341 from each other in a state where one pair of fixed contact units 310 and 310 of each set are electrically connected to each other. Furthermore, auxiliary contact unit 340 is configured to electrically connect one pair of auxiliary fixed contact units 341 and 341 to each other in a state where one pair of fixed contact units 310 and 310 of each set are insulated from each other.

[0096] For example, auxiliary contact unit 340 can be used for detecting whether fixed contact 311 and movable contact 321 that can contact and separated from each other are welded to each other or not.

[0097] Specifically, in a case where fixed contact 311 and movable contact 321 that can contact each other and that can be separated from each other are not welded, movable body 330 is movable to the initial position in a case where energization of coil 210 is stopped. Thus, auxiliary movable contactor element 342a is pushed rearward by pushing element 3315 of movable body 330, and movable contact 342b of auxiliary movable contactor element 342a contacts fixed contact 341c of auxiliary fixed contact unit 341.

[0098] In a case where fixed contact 311 and movable contact 321 that can contact each other and that can be separated from each other are welded to each other, movable body 330 is not moveable to the initial position even in a case where energization of coil 210 is stopped. Consequently, auxiliary movable contactor element 342a is not pushed by pushing element 3315, and a state where movable contact 342b of auxiliary movable con-

tactor element 342a is separated from fixed contact 341c of auxiliary fixed contact unit 341 is maintained.

[0099] Accordingly, in a case where a current flows between one pair of auxiliary fixed contact units 341 and 341 in a state where coil 210 is not energized, it is determined that fixed contact 311 and movable contact 321 that can contact each other and that can be separated from each other are not welded to each other.

[0100] In a case where a current does not flow between one pair of auxiliary fixed contact units 341 and 341 in a state where coil 210 is not energized, it is determined that fixed contact 311 and movable contact 321 that can be contact each other and that can be separated from each other are welded to each other.

[0101] In accordance with the present exemplary embodiment, fixed contact unit 310 including terminal 313 is more firmly fixed to lower cover 122 (case 10).

[0102] Specifically, fixed contact unit 310 is more firmly fixed to lower cover 122 (case 10) by fixing terminal 313 inserted into insertion hole 123 of lower cover 122 to lower cover 122 (case 10) with adhesive 125 (refer to FIG. 11 and FIG. 12).

[0103] In accordance with the present exemplary embodiment, adhesive 125 having fluidity is applied onto outer surface 122b of lower cover 122 in a state where the tip end of terminal 313 is inserted into insertion hole 123 of lower cover 122 from upward and the tip end of terminal 313 protrudes to an outward (downward) of lower cover 122.

[0104] In accordance with the present exemplary embodiment, adhesive accommodation space S6 in which adhesive 125 is accommodated is formed around a part of outer surface 122b of lower cover 122 in which insertion hole 123 is formed.

[0105] Thus, inside surface 123c of lower cover 122 demarcating insertion hole 123 passing through lower cover 122 in the Z direction (up-to-down direction) is continuously connected with inner surface S6a of adhesive accommodation space S6 in outside opening 123a. Inside surface 123c of lower cover 122 is continuously connected with inner surface 122c of lower cover 122 on inside opening 123b side. As described above, in accordance with the present exemplary embodiment, inner surface S6a of adhesive accommodation space S6 constitutes a part of outer surface 122b of lower cover 122.

[0106] Adhesive 125 is applied into adhesive accommodation space S6 formed on outer surface 122b of lower cover 122 and is cured in a state where the tip end of terminal 313 protrudes to an outward (downward) of lower cover 122. That is, terminal 313 is fixed to lower cover 122 (case 10) by adhesive 124 that is formed by curing adhesive 125 applied into adhesive accommodation space S6 formed on outer surface 122b of lower cover 122.

[0107] In accordance with the present exemplary embodiment, even in a case where gap D1 is formed between outer surface 313a of terminal 313 inserted into insertion hole 123 and inside surface 123c (surface of

case 10) of insertion hole 123 facing outer surface 313a of terminal 313, terminal 313 can be firmly fixed to lower cover 122 (case 10) while more securely suppressing hindrance of operation of contact and separation between the contacts.

[0108] That is, in a case where fixed contact unit 310 including terminal 313 for which gap D1 is formed between insertion hole 123 and terminal 313 is fixed to lower cover 122 (case 10) with adhesive 125, adhesive 125 before curing is prevented from entering into the inside of lower cover 122 (case 10) through gap D1.

[0109] Terminal 313 is firmly fixed to case 10 while suppressing hindrance of operation of electromagnetic relay 1 caused by adhesive 125 entering the inside of case 10.

[0110] In accordance with the present exemplary embodiment, a through-hole having substantially an oblong shape that is elongated in the Y direction (width direction) is illustrated as insertion hole 123 of lower cover 122. A case where fixed contact unit 310 in which a plate thickness (thickness in the X direction) of terminal 313 is smaller than a width (length in the X direction) of insertion hole 123 in a short direction is fixed to lower cover 122 (case 10) using adhesive 125 is illustrated.

[0111] In accordance with the present exemplary embodiment, terminal 313 included in fixed contact unit 310 includes root portion 3131 that is continuously connected with the lower end of main body 312 in which fixed contact 311 is formed, and that extends in the Z direction (up-to-down direction). In addition, terminal 313 includes intersection wall part 3132 that is continuously connected with a lower end of root portion 3131 and extends in a direction intersecting the Z direction (up-to-down direction), and tip end portion 3133 that is continuously connected with a lower end of intersection wall part 3132 and extends in the Z direction (up-to-down direction).

[0112] Intersection wall part 3132 extends in the X direction (front-to-rear direction), that is, a plate thickness direction of main body 312, intersecting the Z direction (up-to-down direction) that is a direction in which terminal 313 is inserted into insertion hole 123. In accordance with the present exemplary embodiment, intersection wall part 3132 is inclined with respect to the X direction and the Z direction, and a rear end of intersection wall part 3132 in the X direction (front-to-rear direction) is continuously connected with the lower end of root portion 3131. A front end of intersection wall part 3132 in the X direction (front-to-rear direction) is continuously connected with an upper end of tip end portion 3133.

[0113] As described above, in accordance with the present exemplary embodiment, tip end portion 3133 of terminal 313 is offset and shifted forward in the X direction (front-to-rear direction) with respect to root portion 3131. Terminal 313 can be formed by bending one plate-shaped member in the plate thickness direction.

[0114] Terminal 313 is inserted into insertion hole 123 in a state where at least a portion of intersection wall part 3132 is disposed in insertion hole 123. That is, at least

a portion of intersection wall part 3132 is disposed in insertion hole 123 in a case where terminal 313 according to the present exemplary embodiment is fixed to lower cover 122 (case 10).

[0115] In accordance with the present exemplary embodiment, the portion of intersection wall part 3132 except a front end portion continuously connected with tip end portion 3133 is disposed in insertion hole 123 in a state where terminal 313 is fixed to lower cover 122 (case 10). The front end portion of intersection wall part 3132 continuously connected with tip end portion 3133 is disposed in adhesive accommodation space S6 formed in outer surface 122b of lower cover 122.

[0116] Accordingly, in accordance with the present exemplary embodiment, a part of root portion 3131 continuously connected with intersection wall part 3132 and the portion of intersection wall part 3132 disposed in insertion hole 123 correspond to insertion portion 3134 that faces inside surface 123c of insertion hole 123 in a state where terminal 313 is inserted into insertion hole 123.

[0117] Gap D1 is formed between outer surface 3134a of insertion portion 3134 and inside surface 123c of insertion hole 123.

[0118] In accordance with the present exemplary embodiment, a width of terminal 313 in the Y direction (width direction) is substantially identical to a width of insertion hole 123 in the Y direction (width direction). That is, a gap through which adhesive 125 can enter up to space S3 is not formed between outer surface 3134a of insertion portion 3134 and inside surface 123c of insertion hole 123 facing each other in the Y direction (width direction).

[0119] In accordance with the present exemplary embodiment, the portion of intersection wall part 3132 disposed in insertion hole 123 intersects center line C1 that passes through a center of insertion hole 123 in the X direction (front-to-rear direction) and that extends in the Z direction (up-to-down direction) when the portion of intersection wall part 3132 is viewed in the Y direction (width direction).

[0120] As described above, in accordance with the present exemplary embodiment, intersection wall part 3132 intersects center line C1 that passes through the center of insertion hole 123 in the X direction and that extends in the Z direction in a state where at least a portion of intersection wall part 3132 is disposed in insertion hole 123 when viewed in the Y direction intersecting the Z direction and the X direction.

[0121] Accordingly, intersection wall part 3132 in insertion hole 123 shifted in any direction in the X direction (front-to-rear direction) is suppressed. That is, most of insertion hole 123 is covered with intersection wall part 3132 when view in the Z direction (up-to-down direction).

[0122] In accordance with the present exemplary embodiment, outer surface 3134a of insertion portion 3134 facing in the X direction (front-to-rear direction) does not contact inside surface 123c of insertion hole 123 in a state where insertion portion 3134 of terminal 313 is disposed in insertion hole 123 to be fixed to lower cover 122

(case 10). That is, gap D1 that is continuously connected from outside opening 123a to inside opening 123b is formed on both sides of insertion portion 3134 in the X direction (front-to-rear direction).

[0123] One side of gap D1 in the X direction (front-to-rear direction) is demarcated by intersection wall part 3132 (insertion portion 3134) which is inclined. Thus, a width of gap D1 in the X direction (front-to-rear direction) changes depending on a position on the gap in the Z direction (up-to-down direction).

[0124] For example, in gap D1 that is formed on a further rear side than insertion portion 3134 in the X direction (front-to-rear direction), the width in the X direction (front-to-rear direction) is the minimum at an upper end of intersection wall part 3132. Meanwhile, in gap D1 that is formed on a further front side than insertion portion 3134 in the X direction (front-to-rear direction), the width in the X direction (front-to-rear direction) is the minimum at a lower end (part opposing outside opening 123a) of insertion portion 3134.

[0125] As described above, in accordance with the present exemplary embodiment, the width of gap D1 in the X direction (front-to-rear direction) is the minimum part at a position between outside opening 123a and inside opening 123b. Accordingly, entrance of adhesive 125 into the inside of case 10, particularly, space S3 in which contactor 30 is accommodated, can be suppressed by a part of gap D1 having the minimum width in the X direction (front-to-rear direction).

[0126] That is, while adhesive 125 applied into adhesive accommodation space S6 is permitted to enter at least gap D1 on an outside opening 123a side of insertion hole 123, entrance into a deeper side than the part of gap D1 having the minimum width is suppressed.

[0127] The minimum value of the width of gap D1 in the X direction (front-to-rear direction) can be appropriately determined considering viscosity and the like of adhesive 125.

[0128] Electromagnetic relay 1 according to the present exemplary embodiment includes inflow suppressor 40 that suppresses inflow, to the inside, of adhesive 125 that flows into gap D1 as described above. In accordance with the present exemplary embodiment, intersection wall part 3132 of terminal 313 functions as inflow suppressor 40 that suppresses inflow of adhesive 125 to the inside through gap D1.

[0129] Accordingly, even in a case where gap D1 is formed between the inside surface of insertion hole 123 and terminal 313, entrance of adhesive 125 into the inside of case 10 can be suppressed. Thus, terminal 313 is firmly fixed to lower cover 122 (case 10) while more securely suppressing hindrance of operation of contact and separation between the contacts.

[0130] The size of insertion hole 123 does not necessarily change in accordance with a plate thickness of a contact unit (fixed contact unit 310) having terminal 313 fixed to lower cover 122 (case 10). Consequently, lower cover 122 (case 10) can be used in common. That is,

terminal 313 included in contact units having various plate thicknesses can be fixed to lower cover 122 (case 10) without replacing lower cover 122 (case 10).

[0131] However, in a case where gap D1 is formed between the inside surface of insertion hole 123 and terminal 313 as in the present exemplary embodiment, terminal 313 may be shifted in position with respect to lower cover 122 (case 10) in a case where terminal 313 is fixed to lower cover 122 (case 10).

[0132] In accordance with the present exemplary embodiment, a shift in position of terminal 313 with respect to lower cover 122 (case 10) in a case where terminal 313 is fixed to lower cover 122 (case 10) is suppressed.

[0133] Specifically, a positioner is disposed in the contact unit (fixed contact unit 310) having terminal 313 fixed to lower cover 122 (case 10).

[0134] In accordance with the present exemplary embodiment, inner wall 115 (vertical wall: wall portion) is disposed in base 110 that is another housing constituting case 10. Press-fitting space S7 that is demarcated by vertical walls (wall portions), such as inner wall 115, lower periphery wall 113, and partition wall 114 is formed in case 10.

[0135] The contact unit (fixed contact unit 310) having terminal 313 is held in base 110 by disposing press-fitting protrusion 314 in the contact unit (fixed contact unit 310) having terminal 313 and press-fitting a part in which press-fitting protrusion 314 is formed into press-fitting space S7. Accordingly, insertion portion 3134 of terminal 313 is positioned at a predetermined position in insertion hole 123 in a case where lower cover 122 is attached to base 110.

[0136] In accordance with the present exemplary embodiment, press-fitting protrusion 314 protrudes forward from a front surface of main body 312. That is, press-fitting protrusion 314 is formed on surface 312b (front surface; a surface of main body opposite to side facing movable contact 321) that is opposite to surface 312a on which fixed contact 311 is provided in the contact unit (fixed contact unit 310) having terminal 313.

[0137] Accordingly, even in a case where the plate thickness of the contact unit (fixed contact unit 310) having terminal 313 is changed, terminal 313 is held in base 110 in a state where a position of fixed contact 311 is the same by adjusting a protrusion amount of press-fitting protrusion 314. Consequently, a spring load of hinge spring 260 is not necessarily changed in accordance with the plate thickness of the contact unit (fixed contact unit 310) having terminal 313. Accordingly, electromagnetic relay 1 of various types having different energization capacities can be formed by simply replacing the contact unit (fixed contact unit 310) having terminal 313.

[0138] In accordance with the present exemplary embodiment, press-fitting protrusion 314 is formed by performing dowel processing on main body 312. However, the press-fitting protrusion is not limited to those formed by such a method and can be formed by various methods.

[0139] The positioner formed in the contact unit (fixed

contact unit 310) having terminal 313 is not limited to press-fitting protrusion 314 and may be, for example, a recess or a slit that is engaged with a protrusion formed in a vertical wall (inner wall 115 or the like) of base 110 (case 10).

SECOND EXEMPLARY EMBODIMENT

[0140] Electromagnetic relay 1a according to the present exemplary embodiment is also an electromagnetic relay of a so-called normally open type of which a contact is turned off in the initial state similarly to electromagnetic relay 1 in accordance with the first exemplary embodiment. In accordance with the present exemplary embodiment, electromagnetic relay 1a may be an electromagnetic relay of a so-called normally closed type of which a contact is turned on in the initial state.

[0141] As illustrated in FIGS. 14 to 16, electromagnetic relay 1a according to the present exemplary embodiment includes electromagnet device (driver) 20 positioned on a rearward side in the X direction (front-to-rear direction) and contactor 30 positioned on a forward side. Electromagnet device 20 and contactor 30 are accommodated in case 10 made of resin material having a hollow box shape.

[0142] Case 10 includes base 110 and cover 120, and has an outside surface having substantially a rectangular parallelepiped shape. Electromagnet device 20 and contactor 30 are accommodated in internal space S1 of case 10 in the state where cover 120 is attached to base 110.

[0143] The shape of the outside surface of case 10 is not limited to a rectangular parallelepiped shape and may be any shape.

[0144] Base 110 includes pedestal 111 having substantially a rectangular plate shape extending substantially along a horizontal plane (direction intersecting the Z direction: XY plane). Base 110 includes upper periphery wall 112 extending upward from a periphery of pedestal 111, and partition wall 114 standing on an upward side from an approximately center part in the X direction (front-to-rear direction) (refer to FIGS. 14 to 16).

[0145] Electromagnet device 20 is disposed further rearward than partition wall 114, and contactor 30 is arranged further forward than partition wall 114 (refer to FIGS. 14 to 16).

[0146] Cover 120 has substantially a box shape opening downward. Cover 120 is attached to base 110 from upward.

[0147] In accordance with the present exemplary embodiment, cover 120 is attached to base 110 by engaging engagement hole 120a formed at a lower end of cover 120 with engagement protrusion 110a formed on the side surface of base 110 (refer to FIGS. 14 to 16).

[0148] As described above, internal space S1 of case 10 is divided into two spaces in the front-to-rear direction by partition wall 114 of base 110 in accordance with the present exemplary embodiment. That is, internal space S1 of case 10 is divided into space S2 that is formed on

a rearward side of partition wall 114 and accommodates electromagnet device 20, and space S3 that is formed on a forward side of partition wall 114 and accommodates contactor 30 (refer to FIG. 15 and FIG. 16).

[0149] In accordance with the present exemplary embodiment, contactor 30 includes only one set of fixed contact unit 310 and movable contact unit 320 forming a pair with each other (having contacts that contact each other and that are separated from each other).

[0150] Electromagnet device 20 which is the driver is a device generating electromagnetic force, and includes coil 210 that generates magnetic flux by energizing coil 210, and coil bobbin 220 having a hollow cylindrical shape around which coil 210 is wound (refer to FIG. 14).

[0151] For example, a conductive wire can be used as coil 210. Coil bobbin 220 is made of resin that is insulating material. An insertion hole that passes in the Z direction (up-to-down direction) is formed in a center portion of coil bobbin 220. Coil bobbin 220 includes a winding barrel having substantially a cylindrical shape having an outer surface around which coil 210 is wound, and upper flange 222 of an approximately circular shape that is continuously connected with an upper end of the winding barrel and that protrudes outside the winding barrel in radial directions. Coil bobbin 220 further includes lower flange 223 having substantially a circular shape that is continuously connected with a lower end of the winding barrel and that protrudes outside the winding barrel in radial directions.

[0152] Electromagnet device 20 further includes core 230 that is a fixed-side member inserted into a cylinder of coil bobbin 220 and magnetized by energized coil 210, that is, magnetic flux passes through the fixed-side member.

[0153] Core 230 includes a shaft having substantially a circular columnar shape that extends in the Z direction (up-to-down direction), and head 232 having substantially a circular columnar shape that has a greater diameter than the shaft and that is continuously connected with an upper end of the shaft (refer to FIG. 14).

[0154] Electromagnet device 20 includes armature 240 (movable-side member) that faces head 232 of core 230 in the up-to-down direction (Z direction).

[0155] Armature 240 is made of metal having conductivity and is arranged to be swingable in the up-to-down direction (Z direction) with respect to head 232 of core 230. In accordance with the present exemplary embodiment, armature 240 includes horizontal wall portion 241 that faces head 232 of core 230 in the up-to-down direction (Z direction), and vertical wall portion 242 that extends downward from a front end of horizontal wall portion 241 in the X direction (front-to-rear direction) (refer to FIG. 15 and FIG. 16).

[0156] Electromagnet device 20 includes yoke 250 that is disposed around coil 210 wound around the winding barrel. Yoke 250 has substantially a plate shape made of magnetic material, and has substantially an L shape in a side view (when viewed in the Y direction). That is,

in accordance with the present exemplary embodiment, yoke 250 includes vertical wall portion 251 that extends forward of coil 210 wound around the winding barrel substantially along a vertical plane, and horizontal wall portion 252 that extends such that horizontal wall portion 252 extends rearward of a lower end of vertical wall portion 251 (refer to FIG. 14). Yoke 250 can be formed by, for example, bending one plate.

[0157] Horizontal wall portion 241 of armature 240 is attached to an upper end of vertical wall portion 251 such that horizontal wall portion 241 can swing in the up-to-down direction (Z direction). Accordingly, armature 240 can rotate in the up-to-down direction (Z direction) about a part of armature 240 supported by yoke 250 as a center.

[0158] In accordance with the present exemplary embodiment, electromagnet device 20 includes hinge spring 260 attached to both of armature 240 and yoke 250. Hinge spring 260 urges armature 240 in a direction in which horizontal wall portion 241 is separated from head 232 of core 230 (refer to FIG. 15).

[0159] Electromagnet device 20 includes one pair of coil terminals 270 that are fixed to coil bobbin 220 and that are connected to both ends of coil 210, respectively. Electromagnet device 20 is driven by energizing coil 210 through one pair of coil terminals 270.

[0160] Specifically, horizontal wall portion 241 of armature 240 is attracted to head 232 of core 230 by energizing coil 210, and causes armature 240 to rotate such that horizontal wall portion 241 approaches head 232 of core 230. That is, horizontal wall portion 241 of armature 240 rotates downward in the Z direction (up-to-down direction) by energizing coil 210 through one pair of coil terminals 270. At this moment, vertical wall portion 242 continuously connected with horizontal wall portion 241 rotates forward in the X direction (front-to-rear direction).

[0161] In accordance with the present exemplary embodiment, a swingable range of armature 240 in which armature 240 can swing is determined to be between an initial position at which horizontal wall portion 241 is separately arranged above head 232 of core 230 by a pre-determined gap, and a contacting position at which horizontal wall portion 241 contacts head 232 of core 230. The swingable range is from the initial position to the contacting position. When armature 240 is present at the initial position, horizontal wall portion 241 is located at a position separated farthest from head 232 of core 230. When the armature 240 is located at the contacting position, horizontal wall portion 241 is located at a position closest to head 232 of core 230.

[0162] Accordingly, in accordance with the present exemplary embodiment, in a case where coil 210 is energized, armature 240 moves to the contacting position at which horizontal wall portion 241 contacts head 232 of core 230. In a case where energization of coil 210 is stopped, armature 240 returns to the initial position by urging force of hinge spring 260.

[0163] As described above, when coil 210 is not energized, armature 240 according to the present exemplary

embodiment faces head 232 of core 230 across a pre-determined gap. When coil 210 is energized, armature 240 swings such that armature 240 is attracted toward head 232 of core 230.

[0164] The electrical connection and disconnection between fixed contact unit 310 and movable contact unit 320 forming a pair with each other (having contacts that contact each other and that are separated from each other) can be switched by switching a driving state of electromagnet device 20.

[0165] In accordance with the present exemplary embodiment, contactor 30 that opens and closes the contacts depending on whether coil 210 is energized or not is disposed on a forward side of electromagnet device 20.

[0166] As described above, contactor 30 includes only one set of fixed contact unit 310 and movable contact unit 320 forming a pair with each other (having contacts that contact each other and that are separated from each other) (refer to FIG. 14).

[0167] In accordance with the present exemplary embodiment, the set of fixed contact unit 310 and movable contact unit 320 having contacts that contact each other and that are separated from each other is configured with one pair of fixed contact units 310 and one movable contact unit 320.

[0168] Specifically, two fixed contact units 310 having shapes symmetrical to each other about an XZ plane perpendicular to the Y direction correspond to one pair of fixed contact units 310. Two fixed contact units 310 forming a pair are fixed to base 110 (case 10) while being separated from each other in the Y direction (width direction).

[0169] Each fixed contact unit 310 includes one fixed contact 311 and main body 312 in which one fixed contact 311 is disposed (refer to FIGS. 17A to 17C). In accordance with the present exemplary embodiment, fixed contact 311 is formed in main body 312 by inserting a member as a fixed contact into insertion hole 312c formed to pass through main body 312 in a plate thickness direction and performing riveting (refer to FIG. 15 and FIG. 16). Formation of fixed contact 311 in main body 312 is not necessarily performed by riveting, and can be performed by various methods. For example, a part that is caused to protrude by passing a dowel through main body 312 can be set to function as a fixed contact. Alternatively, a part of a flat surface of main body 312 may function as a fixed contact by allowing the part of the flat surface of main body 312 to contact movable contact 321.

[0170] Fixed contact unit 310 includes terminal 313 that is continuously connected with the lower end of main body 312. Terminal 313 is fixed to base 110 (case 10) such that the tip end of terminal 313 protrudes outward (downward) of base 110 (case 10).

[0171] In accordance with the present exemplary embodiment, insertion hole 116 that passes in the Z direction (up-to-down direction) is formed in base 110. Fixed contact unit 310 is fixed to base 110 (case 10) such that the tip end (lower end) of terminal 313 protrudes outward

(downward) of base 110 by inserting the tip end (lower end) of terminal 313 into insertion hole 116 from upward (refer to FIG. 18).

[0172] Fixed contact unit 310 is fixed to base 110 (case 10) in a state where fixed contact 311 faces a rearward side in the X direction (front-to-rear direction). That is, fixed contact unit 310 is fixed to base 110 (case 10) in a state where surface 312a (rear surface: a surface opposing movable contact 321) of main body 312 on which fixed contact 311 is formed faces a rearward side.

[0173] Fixed contact 311, main body 312, and terminal 313 can be made of conductive material, such as copper-based material.

[0174] One movable contact unit 320 includes one movable contactor element 322 in which one pair of movable contacts 321 linearly arranged in the Y direction (width direction) are formed (refer to FIG. 14).

[0175] In accordance with the present exemplary embodiment, insertion hole 322d that passes in the plate thickness direction on both sides of movable contactor element 322 having substantially a rectangular plate shape extending in the longitudinal direction is formed. Movable contact 321 is formed in movable contactor element 322 by inserting a member as a movable contact into insertion hole 322d and performing riveting (refer to FIG. 15 and FIG. 16). Formation of movable contacts 321 in movable contactor element 322 is not necessarily performed by riveting, and can be performed by various methods. For example, a part that is caused to protrude by passing a dowel through movable contactor element 322 can function as the movable contact. Alternatively, a part of a flat surface of movable contactor element 322 may function as the movable contact by allowing the part of the flat surface of movable contactor element 322 to contact fixed contact 311.

[0176] One movable contact unit 320 is positioned on a further rearward side in the X direction (front-to-rear direction) than two fixed contact units 310 forming a pair in a state where the plate thickness direction of one movable contact unit 320 substantially matches the X direction (front-to-rear direction) and the longitudinal direction substantially matches the Y direction (width direction) (refer to FIG. 14). Movable contact 321 of movable contact unit 320 faces fixed contact 311 in the X direction (front-to-rear direction). Specifically, movable contactor element 322 is disposed such that movable contact 321 formed on one side in the Y direction (width direction) faces fixed contact 311 of fixed contact unit 310 disposed on one side in the Y direction (width direction) in the X direction (front-to-rear direction). Similarly, movable contactor element 322 is disposed such that movable contact 321 formed on the other side in the Y direction (width direction) faces fixed contact 311 of fixed contact unit 310 disposed on the other side in the Y direction (width direction) in the X direction (front-to-rear direction).

[0177] Movable contacts 321 and movable contactor element 322 can be made of conductive material, such as copper-based material.

[0178] A set configured with one pair of fixed contact units 310 and one movable contact unit 320 is accommodated in space S3 described above (refer to FIG. 15 and FIG. 16).

[0179] Movable contact unit 320 is disposed in space S3 such that movable contact unit 320 can relatively swing in the X direction (front-to-rear direction) with respect to one pair of fixed contact units 310.

[0180] Specifically, contactor 30 includes movable body 330 that swings in the X direction (front-to-rear direction) in accordance with swinging of armature 240. Movable contact unit 320 relatively swings in the X direction (front-to-rear direction) with respect to one pair of fixed contact units 310 by movable body 330 holding movable contact unit 320.

[0181] In accordance with the present exemplary embodiment, movable body 330 includes holder 331 of which an upper portion is continuously connected with vertical wall portion 242 of armature 240, movable plate 334 that is continuously connected with a lower portion of holder 331, and movable spring 335 that connects movable plate 334 to movable contactor element 322. Holder 331 is made of insulating resin material.

[0182] Next, one example of operation of electromagnetic relay 1a (electromagnet device 20 and contactor 30) having the above configuration will be described.

[0183] In a state where coil 210 is not energized, horizontal wall portion 241 of armature 240 moves in a direction in which horizontal wall portion 241 is separated from head 232 of core 230 by elastic force of hinge spring 260. At this moment, since vertical wall portion 242 of armature 240 is positioned on a rearward side in the X direction (front-to-rear direction), movable body 330 is also positioned on a rearward side in the X direction (front-to-rear direction). That is, movable contact unit 320 held by movable body 330 is separated from fixed contact unit 310, and the contactor is turned off in which movable contact 321 is separated from fixed contact 311 (refer to FIG. 15).

[0184] In a case where coil 210 is energized in the turned-off state, horizontal wall portion 241 of armature 240 is attracted downward (core 230 side) by electromagnetic force, and moves to approach head 232 of core 230 against elastic force of hinge spring 260. Vertical wall portion 242 rotates forward in accordance with the downward (core 230 side) rotating of horizontal wall portion 241, and movable body 330 rotates forward in accordance with the forward rotating of vertical wall portion 242. Accordingly, movable contactor element 322 held by movable body 330 rotates forward toward fixed contact unit 310, and movable contact 321 of movable contactor element 322 contacts fixed contact 311 of fixed contact unit 310. Accordingly, one pair of fixed contact units 310 are electrically connected to each other by movable contact unit 320 (refer to FIG. 16).

[0185] In a case where energization of coil 210 is stopped, horizontal wall portion 241 of armature 240 rotates upward (in a direction separated from core 230) by

the urging force of hinge spring 260, and returns to the initial position.

[0186] Vertical wall portion 242 rotates rearward in accordance with upward rotating of horizontal wall portion 241. Movable body 330 rotates rearward in accordance with rearward rotating of vertical wall portion 242. Accordingly, movable contactor element 322 held by movable body 330 rotates rearward to be separated from fixed contact unit 310, and movable contact 321 of movable contactor element 322 is separated from fixed contact 311 of fixed contact unit 310. Accordingly, one pair of fixed contact units 310 and 310 are electrically disconnected from each other.

[0187] As described above, in the present exemplary embodiment, when armature 240 is located at the initial position, movable contact 321 and fixed contact 311 are located at the second position at which movable contact 321 and fixed contact 311 are separated from each other (refer to FIG. 15). Meanwhile, when armature 240 is located at the contacting position, movable contact 321 and fixed contact 311 are located at the first position at which movable contact 321 and fixed contact 311 contact each other (refer to FIG. 16).

[0188] Accordingly, one pair of fixed contact units 310 and 310 are insulated from each other during a period in which coil 210 is not energized, and one pair of fixed contact units 310 and 310 are electrically connected to each other during a period in which coil 210 is energized. As described above, in accordance with the present exemplary embodiment, movable contact 321 is configured to relatively reciprocate (swing) in the X direction (front-to-rear direction) with respect to fixed contact 311 between the first position and the second position.

[0189] In accordance with the present exemplary embodiment, fixed contact unit 310 having terminal 313 is firmly fixed to base 110 (case 10) as well.

[0190] Specifically, fixed contact unit 310 is firmly fixed to base 110 (case 10) by fixing terminal 313 inserted into insertion hole 116 of base 110 to base 110 (case 10) with adhesive 118 (refer to FIG. 18).

[0191] In accordance with the present exemplary embodiment, adhesive 118 having fluidity is applied onto outer surface 110b of base 110 in a state where the tip end of terminal 313 is inserted into insertion hole 116 of base 110 and the tip end of terminal 313 protrudes outward (downward) of base 110.

[0192] Furthermore, adhesive accommodation space S6 in which adhesive 118 is accommodated is formed around a part of outer surface 110b of base 110 in which insertion hole 116 is formed.

[0193] Thus, inside surface 116c of base 110 demarcating insertion hole 116 passing through base 110 in the Z direction (up-to-down direction) is continuously connected with inner surface S6a of adhesive accommodation space S6 in outside opening 116a. In addition, inside surface 116c of base 110 is continuously connected with inner surface 110c of base 110 in inside opening 116b. As described above, in accordance with the present ex-

emplary embodiment, inner surface S6a of adhesive accommodation space S6 constitutes a part of outer surface 110b of base 110.

[0194] Adhesive 118 is applied into adhesive accommodation space S6 formed on outer surface 110b of base 110 and is cured in a state where the tip end of terminal 313 protrudes outward (downward) of base 110. That is, terminal 313 is fixed to base 110 (case 10) by adhesive fixer 117 that is formed by curing adhesive 118 applied into adhesive accommodation space S6 formed on outer surface 110b of base 110.

[0195] In accordance with the present exemplary embodiment, even in a case where gap D1 is formed between outer surface 313a of terminal 313 inserted into insertion hole 116 and inside surface (surface of case 10) 116c of insertion hole 116 facing outer surface 313a of terminal 313, terminal 313 can be firmly fixed to base 110 (case 10) while securely suppressing hindrance of operation of contact and separation between the contacts.

[0196] That is, even in a case where gap D1 is formed between the inside surface of insertion hole 116 and terminal 313, entrance of adhesive 118 before curing into the inside of base 110 (case 10) through gap D1 is suppressed in a case where fixed contact unit 310 is fixed to base 110 (case 10) with adhesive 118.

[0197] In accordance with the present exemplary embodiment, a through-hole having substantially an oblong shape that is elongated in the Y direction (width direction) is illustrated as insertion hole 116 of base 110. A case where fixed contact unit 310 having the plate thickness (thickness in the X direction) of terminal 313 smaller than a width (length in the X direction) of insertion hole 116 in the short direction is fixed to base 110 (case 10) with adhesive 118 is illustrated.

[0198] In accordance with the present exemplary embodiment, terminal 313 included in fixed contact unit 310 includes root portion 3131 that is continuously connected with the lower end of main body 312 in which fixed contact 311 is formed, and that extends in the Z direction (up-to-down direction). In addition, terminal 313 includes intersection wall part 3132 that is continuously connected with a lower end of root portion 3131 and that extends in a direction intersecting the Z direction (up-to-down direction), and tip end portion 3133 that is continuously connected with a lower end of intersection wall part 3132 and that extends in the Z direction (up-to-down direction).

[0199] Intersection wall part 3132 extends in the X direction (front-to-rear direction: the plate thickness direction of main body 312) intersecting the Z direction (up-to-down direction) that is a direction in which terminal 313 is inserted into insertion hole 116. In accordance with the present exemplary embodiment, intersection wall part 3132 extends substantially in a horizontal direction, and a front end of intersection wall part 3132 in the X direction (front-to-rear direction) is continuously connected with the lower end of root portion 3131. A rear end of intersection wall part 3132 in the X direction (front-to-rear

direction) is continuously connected with an upper end of tip end portion 3133.

[0200] As described above, in accordance with the present exemplary embodiment, tip end portion 3133 of terminal 313 is offset and shifted rearward along the X direction (front-to-rear direction) with respect to root portion 3131. Terminal 313 can be formed by bending one plate-shaped member in the plate thickness direction.

[0201] Tip end portion 3133 of terminal 313 is inserted into insertion hole 116. In accordance with the present exemplary embodiment, a part of tip end portion 3133 disposed in insertion hole 116 in a state where terminal 313 is inserted into insertion hole 116 corresponds to insertion portion 3134 that faces inside surface 116c of insertion hole 116.

[0202] Gap D1 described above is formed between outer surface 3134a of insertion portion 3134 and inside surface 116c of insertion hole 116.

[0203] Furthermore, in accordance with the present exemplary embodiment, terminal 313 is inserted into insertion hole 116 in a state where tip end portion 3133 is positioned on a rearward side along the X direction (front-to-rear direction) in insertion hole 116.

[0204] That is, terminal 313 is inserted into insertion hole 116 such that a distance between outer surface 3134a of insertion portion 3134 and inside surface 116c of insertion hole 116 is different between a position thereof in one direction along the X direction and a position thereof in another direction along the X direction (front-to-rear direction: the plate thickness direction of main body 312) intersecting the Z direction (up-to-down direction) that is a direction in which terminal 313 is inserted into insertion hole 116.

[0205] Furthermore, in accordance with the present exemplary embodiment, a gap through which adhesive 118 can enter up to space S3 is not formed between outer surface 3134a facing a rear side of insertion portion 3134 and inside surface 116c facing a front side of insertion hole 116.

[0206] As described above, in accordance with the present exemplary embodiment, gap D1 that enables entrance of adhesive 118 is formed on only a further front side than insertion portion 3134, and a gap that enables entrance of adhesive 118 is not formed on a further rear side than insertion portion 3134.

[0207] In accordance with the present exemplary embodiment, outer surface 3134a of insertion portion 3134 facing the front side of insertion portion 3134 in the X direction (front-to-rear direction) does not contact inside surface 116c of insertion hole 116 in a state where insertion portion 3134 of terminal 313 is disposed in insertion hole 116 to be fixed to base 110 (case 10). That is, gap D1 that is continuously disposed from outside opening 116a to inside opening 116b is formed on the front side of insertion portion 3134 in the X direction (front-to-rear direction).

[0208] Gap D1 formed on a further front side than insertion portion 3134 is closed by intersection wall part

3132. Specifically, in accordance with the present exemplary embodiment, intersection wall part 3132 of terminal 313 is mounted on inner surface 110c of base 110 that is continuously connected with inside surface 116c of insertion hole 116. Accordingly, a gap is not formed between an outer surface of intersection wall part 3132 and inner surface 110c of base 110 facing the Z direction (up-to-down direction), and adhesive 118 cannot enter toward root portion 3131 through a space between the outer surface of intersection wall part 3132 and inner surface 110c of base 110.

[0209] As described above, in accordance with the present exemplary embodiment, intersection wall part 3132 covers inside opening 116b of insertion hole 116 and faces inner surface 110c of base 110 (case 10) continuously connected with inside surface 116c of insertion hole 116.

[0210] In the present exemplary embodiment, the width of terminal 313 in the Y direction (width direction) is substantially identical to a width of insertion hole 116 in the Y direction (width direction) as well. That is, a gap through which adhesive 118 can enter up to space S3 is not formed between outer surface 3134a of insertion portion 3134 and inside surface 116c of insertion hole 116 facing the Y direction (width direction).

[0211] As described above, in accordance with the present exemplary embodiment, gap D1 formed on a front side of insertion portion 3134 is closed by intersection wall part 3132. In this configuration, entrance of adhesive 118 into the inside of case 10, that is, space S3 in which contactor 30 is accommodated, can be suppressed by intersection wall part 3132 and base 110 facing the Z direction (up-to-down direction).

[0212] That is, while adhesive 118 applied into adhesive accommodation space S6 is permitted to enter gap D1 formed with inside surface 116c of insertion hole 116, entrance into a part in which the outer surface of intersection wall part 3132 faces inner surface 110c of base 110 is suppressed.

[0213] In a case where a gap is formed between the outer surface of intersection wall part 3132 and inner surface 110c of base 110, the size of the gap can be appropriately determined considering viscosity and the like of adhesive 118 to be used.

[0214] Electromagnetic relay 1a according to the present exemplary embodiment includes inflow suppressor 40 that suppresses inflow, to the inside, of adhesive 118 that flows into gap D1 as described above. In accordance with the present exemplary embodiment, intersection wall part 3132 formed in terminal 313 functions as inflow suppressor 40 that suppresses inflow, to the inside, of adhesive 118 that flows into gap D1. Accordingly, even in a case where gap D1 is formed between the inside surface of insertion hole 116 and terminal 313, entrance of adhesive 118 into the inside of case 10 can be suppressed. Thus, terminal 313 is firmly fixed to base 110 (case 10) while securely suppressing hindrance of operation of contact and separation between the con-

tacts.

[0215] Accordingly, a size of insertion hole 116 does not need to be changed in accordance with a plate thickness of a contact unit (fixed contact unit 310) having terminal 313 fixed to base 110 (case 10). Consequently, base 110 (case 10) can be used in common. That is, terminal 313 included in contact units having various plate thicknesses can be fixed to base 110 (case 10) without replacing base 110 (case 10).

[0216] In accordance with the present exemplary embodiment, a shift in position of terminal 313 with respect to base 110 (case 10) in a case where terminal 313 is fixed to base 110 (case 10) is suppressed. Specifically, a positioner is disposed in the contact unit (fixed contact unit 310) having terminal 313 fixed to base 110 (case 10). In accordance with the present exemplary embodiment, inner wall 115 (vertical wall: wall portion) is disposed in base 110 (case 10), and press-fitting space S7 demarcated by vertical walls (wall portions), such as inner wall 115 and upper periphery wall 112, is formed in case 10.

[0217] Press-fitting protrusion 314 is disposed in the contact unit (fixed contact unit 310) having terminal 313. The contact unit (fixed contact unit 310) having terminal 313 is held in base 110 by press-fitting a part of the terminal in which press-fitting protrusion 314 of fixed contact unit 310 is formed into press-fitting space S7. Accordingly, insertion portion 3134 of terminal 313 is positioned at a predetermined position in insertion hole 116 in a case where the contact unit (fixed contact unit 310) having terminal 313 is held in base 110.

[0218] In accordance with the present exemplary embodiment, press-fitting protrusion 314 protrudes rearward from a rear surface of main body 312. That is, press-fitting protrusion 314 is formed on surface 312a (rear surface: a surface on a side opposing movable contact 321) on which fixed contact 311 is provided in the contact unit (fixed contact unit 310) having terminal 313.

[0219] In accordance with the present exemplary embodiment, press-fitting protrusion 314 is formed by causing a dowel to pass through main body 312. However, press-fitting protrusion 314 is not limited to those formed by such a method and can be formed by various methods.

[0220] The positioner formed in the contact unit (fixed contact unit 310) having terminal 313 is not limited to the press-fitting protrusion and may be, for example, a recess or a slit that engages with a protrusion formed in a vertical wall (inner wall 115 or the like) of base 110 (case 10).

[0221] In accordance with the present exemplary embodiment, while press-fitting protrusion 314 is formed on surface 312a (rear surface: a surface on a side facing movable contact 321) on which fixed contact 311 is provided in the contact unit (fixed contact unit 310) having terminal 313, press-fitting protrusion 314 can also be formed in the same manner as the first exemplary embodiment.

[0222] That is, press-fitting protrusion 314 can be formed to protrude forward from the front surface of main

body 312 (refer to FIG. 19). In FIG. 19, press-fitting protrusion 314 is formed on surface 312b (front surface: a surface on an opposite side from a side opposing movable contact 321) that is opposite to surface 312a on which fixed contact 311 is provided in the contact unit (fixed contact unit 310) having terminal 313. Accordingly, even in a case where the plate thickness of the contact unit (fixed contact unit 310) having terminal 313 is changed, the contact unit is held in base 110 in a state where a position of fixed contact 311 is the same, by adjusting the protrusion amount of press-fitting protrusion 314. Consequently, a spring load of hinge spring 260 is not necessarily changed in accordance with the plate thickness of the contact unit (fixed contact unit 310) having terminal 313. Accordingly, electromagnetic relay 1a of various types having different energization capacities is obtained by simply switching the contact unit (fixed contact unit 310) having terminal 313.

[0223] In a case where fixed contact unit 310 having the plate thickness (thickness in the X direction) of terminal 313 greater than the width (length in the X direction) of insertion hole 116 in the short direction is used, fixed contact unit 310 can be fixed to base 110 (case 10) with adhesive 118 as illustrated in FIG. 20.

[0224] Specifically, terminal 313 includes wide portion 3135 that is positioned on a root side, and narrow portion 3136 that is continuously connected with a tip end side of wide portion 3135 and that has a smaller width than wide portion 3135. The plate thickness (thickness in the X direction) of narrow portion 3136 is smaller than the width (length in the X direction) of insertion hole 116 in the short direction. Wide portion 3135 is positioned closer to the inside of case 10 than outside opening 116a of insertion hole 116 is. Narrow portion 3136 is connected to wide portion 3135, protrudes to the outside of case 10, and has a smaller width than wide portion 3135.

[0225] Narrow portion 3136 of terminal 313 is inserted into insertion hole 116. Accordingly, in FIG. 20, a part of narrow portion 3136 disposed in insertion hole 116 corresponds to insertion portion 3134 that faces inside surface 116c of insertion hole 116 in a state where terminal 313 is inserted into insertion hole 116.

[0226] Gap D1 is formed between outer surface 3134a of insertion portion 3134 and inside surface 116c of insertion hole 116.

[0227] In FIG. 20, narrow portion 3136 is inserted into insertion hole 116 in a state where narrow portion 3136 is positioned on a rearward side in the X direction (front-to-rear direction) in insertion hole 116. That is, narrow portion 3136 is inserted into insertion hole 116 such that the distance between outer surface 3134a of insertion portion 3134 and inside surface 116c of insertion hole 116 is different between a position thereof in one direction along the X direction and a position thereof in another direction along the X direction (front-to-rear direction: the plate thickness direction of main body 312) intersecting the Z direction (up-to-down direction) in which terminal 313 is inserted into insertion hole 116.

[0228] In FIG. 20, a gap through which adhesive 118 can enter up to space S3 is not formed between outer surface 3134a facing the rear side of insertion portion 3134 and inside surface 116c facing the front side of insertion hole 116.

[0229] As described above, in FIG. 20, gap D1 that enables entrance of adhesive 118 is formed on only a front side from insertion portion 3134.

[0230] In FIG. 20, outer surface 3134a of insertion portion 3134 facing the front side of insertion portion 3134 in the X direction (front-to-rear direction) does not contact inside surface 116c of insertion hole 116 in a state where insertion portion 3134 of narrow portion 3136 is disposed in insertion hole 116 to be fixed to base 110 (case 10). That is, gap D1 that is continuously connected from outside opening 116a to inside opening 116b is formed on the front side of insertion portion 3134 in the X direction (front-to-rear direction).

[0231] That is, gap D1 formed on a further front side from insertion portion 3134 is closed by outer surface 3135a of wide portion 3135 that is continuously disposed in a state of intersecting outer surface 3136a of narrow portion 3136. Specifically, a front end portion of wide portion 3135 is mounted on inner surface 110c of base 110 that is continuously connected with inside surface 116c of insertion hole 116. Accordingly, a gap is not formed between outer surface 3135a of wide portion 3135 and inner surface 110c of base 110 facing each other in the Z direction (up-to-down direction), and adhesive 118 cannot enter up to the root side.

[0232] As described above, in FIG. 20, wide portion 3135 covers inside opening 116b of insertion hole 116 and faces inner surface 110c of base 110 (case 10) continuously connected with inside surface 116c of insertion hole 116.

[0233] In FIG. 20, the width of terminal 313 in the Y direction (width direction) is substantially identical to a width of insertion hole 116 in the Y direction (width direction). That is, a gap through which adhesive 118 can enter up to space S3 is not formed between outer surface 3134a of insertion portion 3134 and inside surface 116c of insertion hole 116 facing each other in the Y direction (width direction).

[0234] As described above, in FIG. 20, gap D1 formed on a further front side of insertion portion 3134 is closed by wide portion 3135. Accordingly, entrance of adhesive 118 into the inside (space S3 in which contactor 30 is accommodated) can be suppressed by wide portion 3135 and base 110 facing each other in the Z direction (up-to-down direction).

[0235] That is, while adhesive 118 applied into adhesive accommodation space S6 enters in gap D1 formed with inside surface 116c of insertion hole 116, entrance into a part in which outer surface 3135a of wide portion 3135 faces inner surface 110c of base 110 is suppressed.

[0236] In a case where a gap is formed between outer surface 3135a of wide portion 3135 and inner surface 110c of base 110, the size of the gap can be appropriately

determined considering viscosity and the like of adhesive 118 to be used.

[0237] Electromagnetic relay 1a illustrated in FIG. 20 includes inflow suppressor 40 that suppresses inflow, to the inside, of adhesive 118 that flows into gap D1 as described above. In FIG. 20, outer surface 3135a of wide portion 3135 formed in terminal 313 functions as inflow suppressor 40 that suppresses inflow, to the inside, of adhesive 118 that flows into gap D1.

[0238] While fixed contact unit 310 which is straight in which terminal 313 is not bent is illustrated in FIG. 20, terminal 313 may be bent.

[0239] The configuration illustrated in FIG. 20 can be applied to electromagnetic relay 1 illustrated in the first exemplary embodiment.

[0240] Fixed contact unit 310 that is straight in which terminal 313 is not bent and in which the plate thickness (thickness in the X direction) of terminal 313 is smaller than the width (length in the X direction) of insertion hole 116 in the short direction is used, fixed contact unit 310 can be fixed to base 110 (case 10) using adhesive 118 as illustrated in FIG. 21.

[0241] Specifically, terminal 313 is inserted into insertion hole 116 in a state where terminal 313 is positioned on a forward side in the X direction (front-to-rear direction) in insertion hole 116. That is, terminal 313 is inserted into insertion hole 116 such that a distance between outer surface 3134a of insertion portion 3134 and inside surface 116c of insertion hole 116 is different between a position thereof in one direction along the X direction and a position thereof in another direction along the X direction (front-to-rear direction: the plate thickness direction of main body 312) intersecting the Z direction (up-to-down direction) that is a direction in which terminal 313 is inserted into insertion hole 116.

[0242] Furthermore, in FIG. 21, a gap through which adhesive 118 can enter up to space S3 is not formed between outer surface 3134a facing the front side of insertion portion 3134 and inside surface 116c facing the rear side of insertion hole 116.

[0243] As described above, in FIG. 21, gap D1 that enables entrance of adhesive 118 is formed on only a further rear side of insertion portion 3134. Gap D1 that is continuously connected from outside opening 116a to inside opening 116b is formed on the rear side of insertion portion 3134 in the X direction (front-to-rear direction).

[0244] A tip end (lower end) of inner wall 126 formed in cover 120 is inserted into gap D1 in a state where cover 120 that is a housing constituting a part of case 10 is attached to base 110 that is a housing constituting another part of case 10. That is, inner wall 126 that is located at a position corresponding to insertion hole 116 in a state where cover 120 is fixed to base 110 is formed in cover 120 that is a part of case 10 shown in FIG. 21. Inner wall 126 is located at a position at which inner wall 126 is inserted into gap D1 and closes gap D1.

[0245] The tip end (lower end) of inner wall 126 inserted into gap D1 functions as inflow suppressor 40 that sup-

presses inflow, to the inside, of adhesive 118 that flows into gap D1.

[0246] Accordingly, even in fixed contact unit 310 of a straight type that has terminal 313 and in which gap D1 is formed between fixed contact unit 310 and insertion hole 116, entrance of adhesive 118 into the inside can be suppressed. Thus, terminal 313 is firmly fixed to base 110 (case 10) while securely suppressing hindrance of operation of contact and separation between the contacts.

[0247] Accordingly, the size of insertion hole 116 is not necessarily changed in accordance with the plate thickness of the contact unit (fixed contact unit 310) having terminal 313 fixed to base 110 (case 10). Consequently, base 110 (case 10) can be used in common. That is, terminal 313 included in contact units having various plate thicknesses can be fixed to base 110 (case 10) without replacing base 110 (case 10).

[0248] In the configuration illustrated in FIG. 21, cover 120 is replaced in accordance with the plate thickness of the contact unit (fixed contact unit 310) having terminal 313 fixed to base 110 (case 10).

[0249] Even in FIG. 21, a shift in position of terminal 313 with respect to base 110 (case 10) in a case where terminal 313 is fixed to base 110 (case 10) is suppressed. Specifically, a positioner is disposed in inner wall 126 formed in cover 120. In FIG. 21, press-fitting protrusion 126a as the positioner is formed to protrude to a forward side from a front surface of inner wall 126. While formation of press-fitting protrusion 126a in inner wall 126 functioning as inflow suppressor 40 is illustrated in FIG. 21, press-fitting protrusion 126a can also be formed in inner wall 126 that is separately disposed from inner wall 126 functioning as inflow suppressor 40. The positioner formed in inner wall 126 is not limited to press-fitting protrusion 126a and may be a recess, a slit, or the like.

[0250] The configuration illustrated in FIG. 21 can also be applied to electromagnetic relay 1 illustrated in the first exemplary embodiment. The housing constituting a part of case 10 corresponds to lower cover 122, and the housing constituting the other part of case 10 corresponds to base 110.

EFFECTS

[0251] Configurations and effects of electromagnetic relays 1 and 1a in the following items illustrated in each of the above exemplary embodiments and modification examples will be described below.

(1) Electromagnetic relay 1 (1a) according to the present exemplary embodiments includes contact 311, contact 321 that is relatively moved with respect to contact 311 and can be brought into contact with and separated from contact 311, and case 10 accommodating therein contact 311 and contact 321. In addition, electromagnetic relay 1 (1a) includes terminal 313 that is electrically connected to contact

311 and contact 321 in a state where contact 311 contacts contact 321, insertion hole 123 (116) that is formed in case 10 and into which terminal 313 is inserted, and adhesive fixer 124 that is formed by curing adhesive 125 applied onto an outer surface of case 10 and fixes terminal 313 to case 10. Electromagnetic relay 1 (1a) further includes gap D1 that is formed between the outer surface of terminal 313 and a surface of case 10 facing the outer surface of terminal 313 in a state where terminal 313 is inserted into insertion hole 123 (116), and inflow suppressor 40 that suppresses inflow, to the inside, of adhesive 125 that flows into gap D1.

As described above, in a case where terminal 313 is fixed to case 10 with adhesive 125, terminal 313 can be firmly fixed to case 10.

In addition, in a case where inflow suppressor 40 that suppresses inflow, to the inside, of adhesive 125 that flows into gap D1 is included, entrance of adhesive 125 before curing into the inside of case 10 is suppressed. Thus, hindrance of operation of contact and separation between the contacts can be more securely suppressed.

That is, an electromagnetic relay that can firmly fix terminal 313 while more securely suppressing hindrance of operation is provided.

In addition, even in a case where gap D1 is formed between the outer surface of terminal 313 and the surface of case 10 opposing the outer surface of terminal 313, contact units having various plate thicknesses can be fixed to case 10 without replacing case 10 to which terminal 313 is fixed, by suppressing entrance of adhesive 125 before curing into the inside of case 10.

(2) In the electromagnetic relay of Item (1), terminal 313 may include intersection wall part 3132 that extends in the X direction intersecting the Z direction in which terminal 313 is inserted into insertion hole 123. Intersection wall part 3132 may be used as inflow suppressor 40.

In this configuration, the above effect can be achieved by simply modifying a shape of terminal 313. Thus, electromagnetic relay 1 that can more firmly fix terminal 313 while more securely suppressing hindrance of operation is readily provided.

For example, in a case where the size and the like of intersection wall part 3132 are appropriately determined in accordance with the plate thickness of terminal 313, contact units having various plate thicknesses can be fixed to case 10 without replacing case 10 to which terminal 313 is fixed.

(3) In the electromagnetic relay of Item (2), intersection wall part 3132 may have a part intersecting center line C1 that passes through the center of insertion hole 123 in the X direction and that extends in the Z direction, in a state where at least a portion of intersection wall part 3132 is disposed in insertion hole 123 when viewed in the Y direction intersecting the

Z direction and the X direction.

Accordingly, the position of intersection wall part 3132 in insertion hole 123 in a state where intersection wall part 3132 is shifted in any direction along the X direction can be suppressed. Consequently, an area in which intersection wall part 3132 is located in insertion hole 123 in a plan view of insertion hole 123 can increase, and entrance of adhesive 125 can be more securely suppressed.

(4) In the electromagnetic relay of Item (2) or Item (3), intersection wall part 3132 may have a wall portion that covers the inside opening of insertion hole 116 and that faces an inner surface of case 10 continuously connected with the inside surface of insertion hole 116.

Accordingly, since the inside opening of insertion hole 116 is covered with intersection wall part 3132, entrance of adhesive 125 into the inside can be more securely suppressed.

(5) In electromagnetic relay 1a of any one of Items (1) to (4), terminal 313 may include wide portion 3135 that is positioned on the root side, and narrow portion 3136 that is continuously connected with the tip end side of wide portion 3135 and has a smaller width than wide portion 3135. The outer surface of wide portion 3135 that is continuously disposed while intersecting the outer surface of narrow portion 3136 may function as inflow suppressor 40.

Accordingly, even in a case where the contact unit has a plate thickness greater than the width of insertion hole 116, terminal 313 is firmly fixed to case 10 while securely suppressing hindrance of operation of contact and separation between the contacts. Thus, it is possible to support electromagnetic relay 1a of a type in which a high current flows, without replacing case 10 to which terminal 313 is fixed.

(6) In the electromagnetic relay of any one of Items (1) to (5), terminal 313 may include insertion portion 3134 that faces the inside surface of insertion hole 116 in a state where terminal 313 is inserted into insertion hole 116. The distance between the outer surface of insertion portion 3134 and the inside surface of insertion hole 116 may be different between a position thereof in one direction along the X Direction and a position thereof in another direction along X direction intersecting the Z direction that is a direction in which terminal 313 is inserted into insertion hole 116.

In this configuration, inflow suppressor 40 may be formed on only a side on which the distance between the outer surface of insertion portion 3134 and the inside surface of insertion hole 116 is large. Thus, it is possible to more easily obtain the electromagnetic relay that can firmly fix terminal 313 while securely suppressing hindrance of operation.

(7) The electromagnetic relay of any one of Items (1) to (6) may further include contact unit 310 including contact 311, and contact unit 320 including contact

321. Contact unit 310 may have terminal 313, and contact unit 310 including terminal 313 may include a positioner that suppresses a shift in position of contact unit 310.

In this configuration, a shift in attitude of terminal 313 in a case where terminal 313 of which the plate thickness is smaller than the width of insertion hole 116 is fixed to case 10 can be suppressed. In addition, entrance of adhesive 125 caused by a shift in attitude can be suppressed.

(8) In electromagnetic relay 1 of Item (7), the positioner may be press-fitting protrusion 314.

In this configuration, the positioner can be more easily formed.

(9) In electromagnetic relay 1 of Item (8), press-fitting protrusion 314 may be formed on a surface of contact unit 310 including terminal 313 opposite to a surface contact unit 310 on which contact 311 is provided.

Accordingly, even in a case where the plate thickness of contact unit 310 having terminal 313 is changed, contact unit 310 can be held in case 10 in a state where a position of the contact is the same, by adjusting the protrusion amount of press-fitting protrusion 314. Consequently, the spring load of hinge spring 260 is not necessarily changed in accordance with the plate thickness of contact unit 310 including terminal 313, and it is possible to more easily support terminals having various plate thicknesses.

(10) In electromagnetic relay 1a of any one of Items (1) to (9), case 10 may include base 110 that is a housing constituting a part of case 10 to which terminal 313 is fixed, and cover 120 that is a housing constituting another part of case 10 fixed to base 110. An inner wall that is provided at a position corresponding to insertion hole 116 in a state where cover 120 is fixed to base 110 may be formed in cover 120. The inner wall formed in cover 120 may function as inflow suppressor 40.

Accordingly, even in a case where fixed contact unit 310 of a straight type in which terminal 313 is not bent is used, contact units 310 having various plate thicknesses can be fixed to case 10 without replacing case 10 to which terminal 313 is fixed.

(11) In the electromagnetic relay of Item (10), cover 120 may have an inner wall in which a positioner capable of contacting the contact unit having terminal 313 in a state where cover 120 is fixed to base 110 is formed.

[0252] In this configuration, a shift in attitude of contact unit 310 in a case where fixed contact unit 310 of a straight type of which the plate thickness is smaller than the width of insertion hole 116 is fixed to case 10 can be suppressed. In addition, entrance of adhesive 125 caused by a shift in attitude of the contact unit can be suppressed.

OTHERS

[0253] While electromagnetic relays 1 and 1a according to the present disclosure are described above, those skilled in the art will perceive that the present disclosure is not limited to the above disclosure and can be subjected to various modifications and improvements.

[0254] For example, configurations obtained by appropriately combining the configurations illustrated in each of the above exemplary embodiments and the modification examples are available.

[0255] While the contact unit having terminal 313 is fixed contact unit 310 in each of the above exemplary embodiments and the modification examples, the contact unit including terminal 313 may be movable contact unit 320, or each of fixed contact unit 310 and movable contact unit 320 may be contact units including terminal 313.

[0256] While terminal 313 is illustrated as having one intersection wall part 3132 in each of the above exemplary embodiments and the modification examples, terminal 313 may have a plurality of intersection wall parts 3132.

[0257] While the outer surface of insertion portion 3134 facing the front-to-rear direction is illustrated as not contacting the inside surface of insertion hole 123 (116) in each of the above exemplary embodiments and the modification examples, a part of the outer surface of insertion portion 3134 facing the front-to-rear direction may contact the inside surface of insertion hole 123 (116).

[0258] The number of fixed contact units or movable contact units is not limited to the illustration in each of the above exemplary embodiments and the modification examples and can be set from various numbers.

[0259] Specifications (shapes, sizes, layouts, and the like) of the driver, the contactor, and other details can be appropriately changed.

Claims

1. An electromagnetic relay comprising:

a first contact;
 a second contact configured to contact the first contact and be separated from the first contact;
 a case accommodating the first contact and the second contact therein, the case having an insertion hole provided therein;
 a terminal inserted into the insertion hole of the case, the terminal being electrically connected to the first contact and the second contact while the first contact contacts the second contact;
 an adhesive fixer made of an adhesive applied onto an outer surface of the case and cured, the adhesive fixer fixing the terminal to the case; and
 an inflow suppressor configured to suppress inflow of the adhesive to an inside of the case through a gap between the terminal and an in-

side surface of the insertion hole of the case.

2. The electromagnetic relay of claim 1,

wherein the terminal includes an intersection wall part, the terminal being inserted into the insertion hole in a first direction, the intersection wall part extending in a second direction intersecting the first direction, and
 wherein the intersection wall part functions as the inflow suppressor.

3. The electromagnetic relay of claim 2,

wherein the intersection wall part includes a portion disposed in the insertion hole, and
 wherein, when viewed in a third direction intersecting the first direction and the second direction, the portion of the intersection wall part intersects a center line extending in the first direction and passing through a center of the insertion hole in the second direction.

4. The electromagnetic relay of claim 2 or 3, wherein the intersection wall part includes a wall portion covering an inside opening of the insertion hole, the wall portion of the intersection wall part facing an inner surface of the case connected to the inside surface of the insertion hole.

5. The electromagnetic relay of any one of claims 1 to 4,

wherein the terminal includes a wide portion and a narrow portion which is connected to the wide portion and which has a smaller width than the wide portion, the wide portion being closer to the inside of the case than an outside opening of the insertion hole, the narrow portion protruding to an outside of the case, and
 wherein an outer surface of the wide portion that intersects and is connected to an outer surface of the narrow portion functions as the inflow suppressor.

6. The electromagnetic relay of any one of claims 1 to 5,

wherein the terminal includes an insertion portion facing the inside surface of the insertion hole, and
 wherein a distance from an outer surface of the insertion portion to the inside surface of the insertion hole is different between a position of the insertion portion in one direction along the second direction and a position on the insertion portion in another direction along the second direction.

7. The electromagnetic relay of any one of claims 1 to

6, further comprising:

a first contact unit having the first contact disposed thereon; and
a second contact unit having the second contact disposed thereon, 5
wherein the first contact unit includes the terminal, and
wherein the first contact unit includes a positioner suppressing a displacement of the first contact unit. 10

8. The electromagnetic relay of claim 7, wherein the positioner is a press-fitting protrusion that is disposed in the first contact unit. 15

9. The electromagnetic relay of claim 8, wherein the first contact unit has a first surface and a second surface opposite to the first surface of the first contact unit, the press-fitting protrusion being disposed on the first surface of the first contact unit, the first contact being disposed on the second surface of the first contact unit. 20

10. The electromagnetic relay of any one of claims 1 to 9, 25

wherein the case has a first housing and a second housing that is fixed to the first housing, the terminal is fixed to the first housing,
wherein the second housing includes an inner wall disposed at a position corresponding to the insertion hole, and 30
wherein the inner wall of the second housing functions as the inflow suppressor. 35

11. The electromagnetic relay of claim 10, wherein the second housing includes an inner wall including a positioner capable of contacting the first contact unit. 40

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FIG. 1

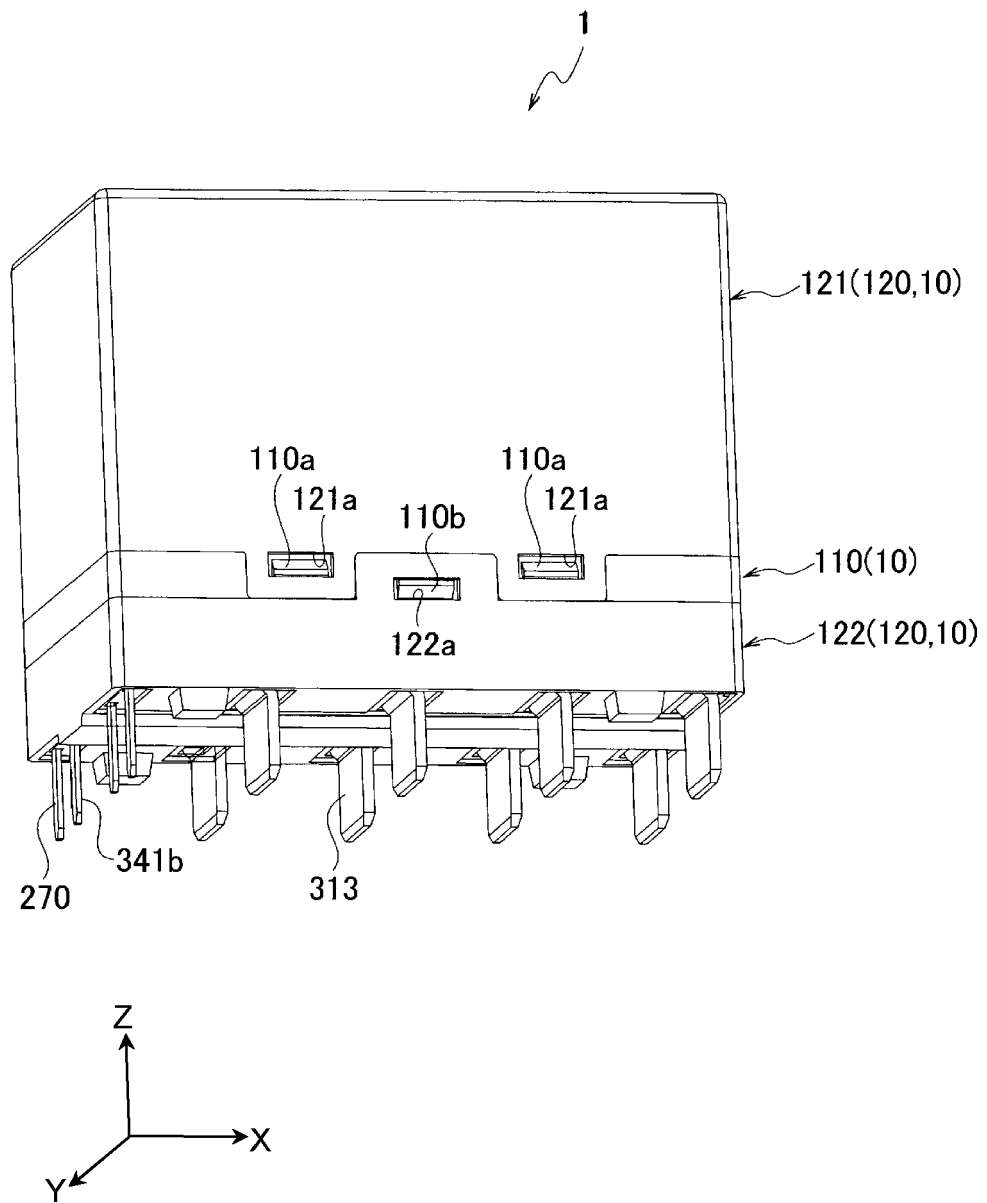


FIG. 2

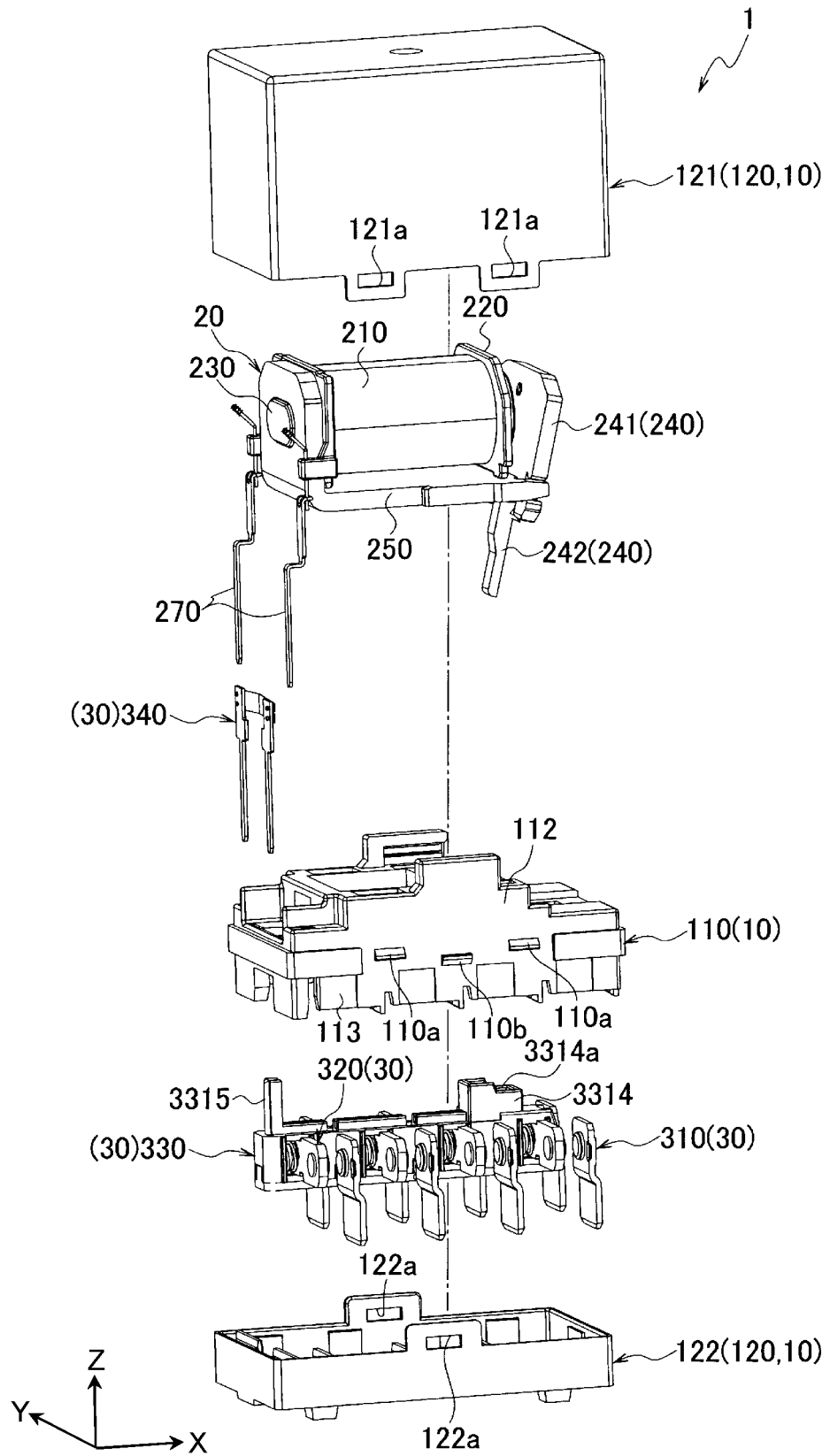


FIG. 3

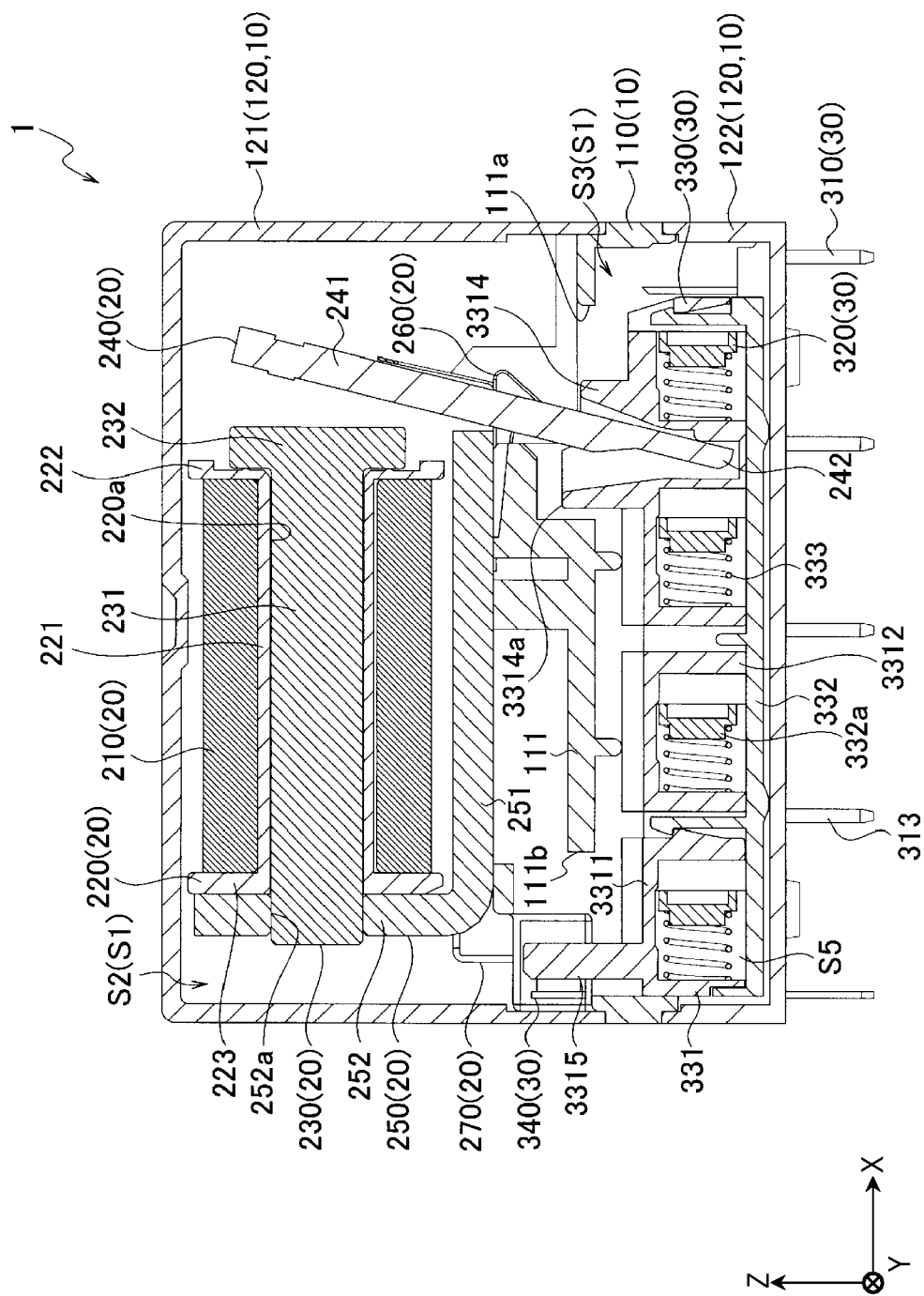


FIG. 4

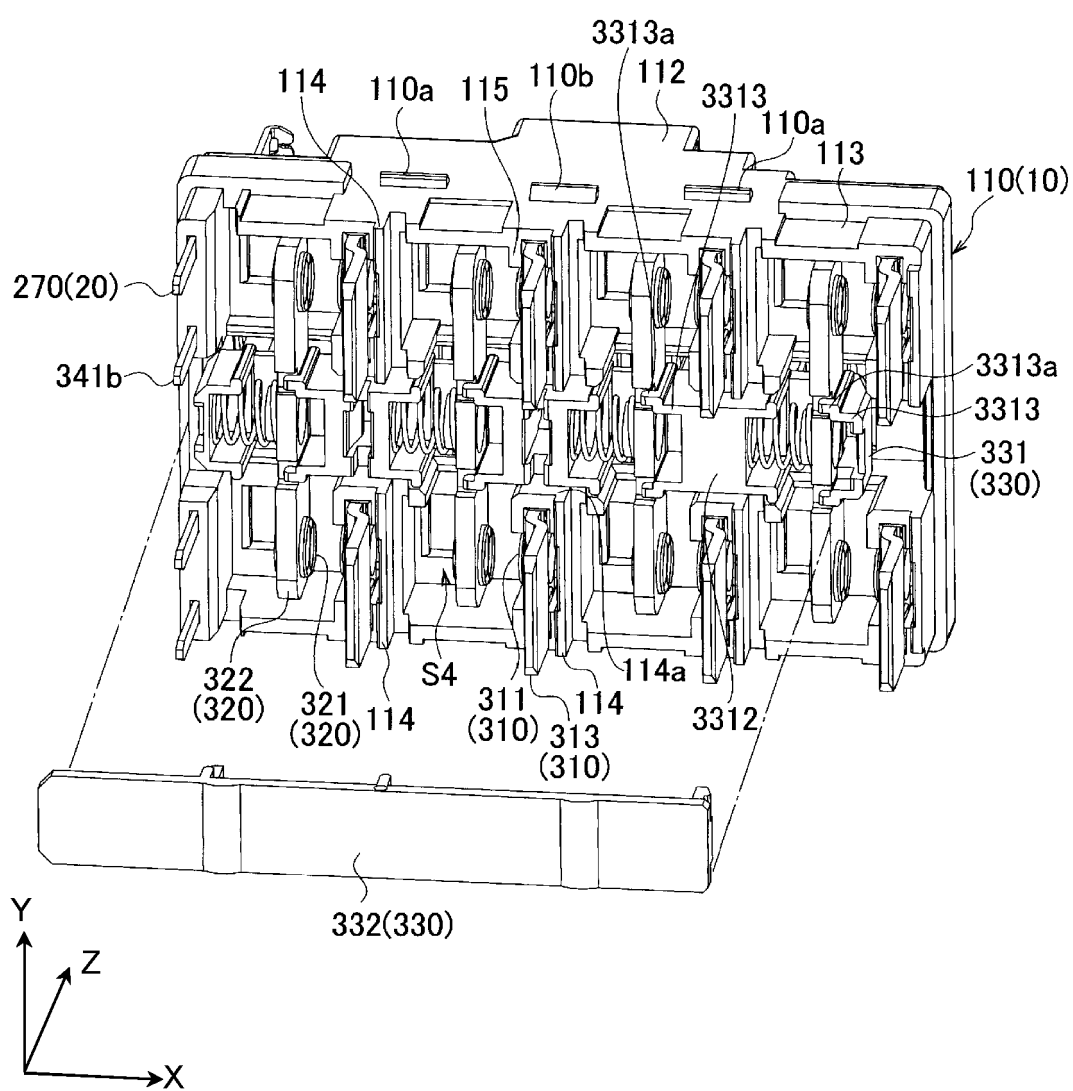


FIG. 5A

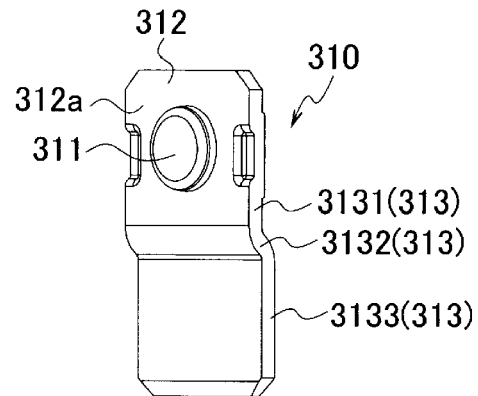


FIG. 5B

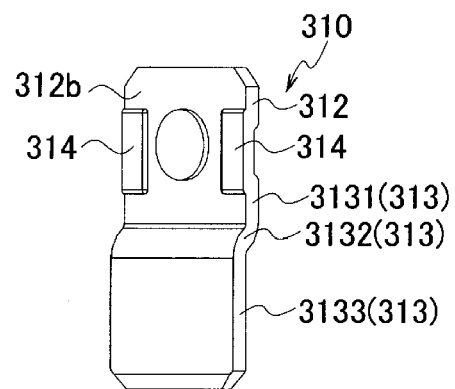


FIG. 5C

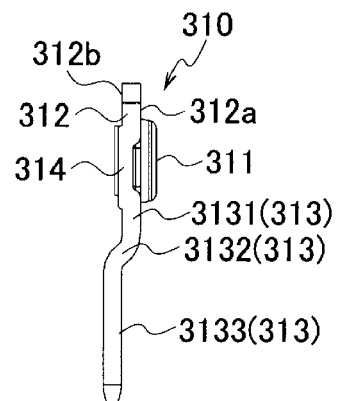


FIG. 6A

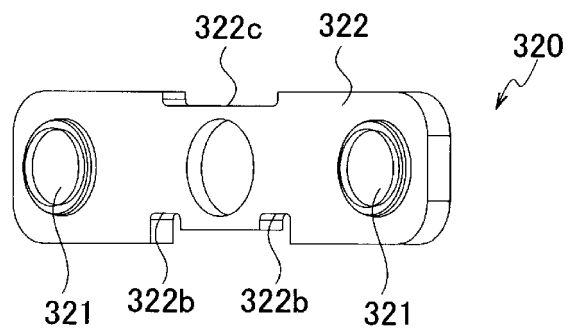


FIG. 6B

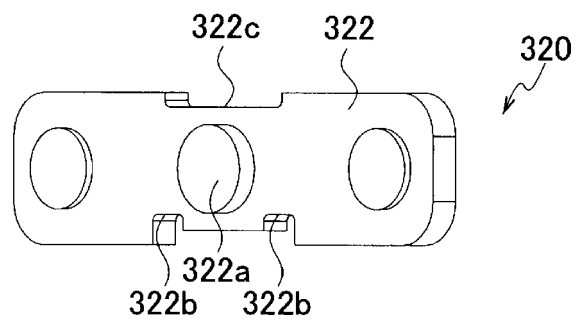


FIG. 7

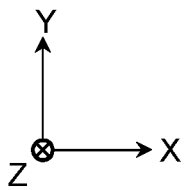
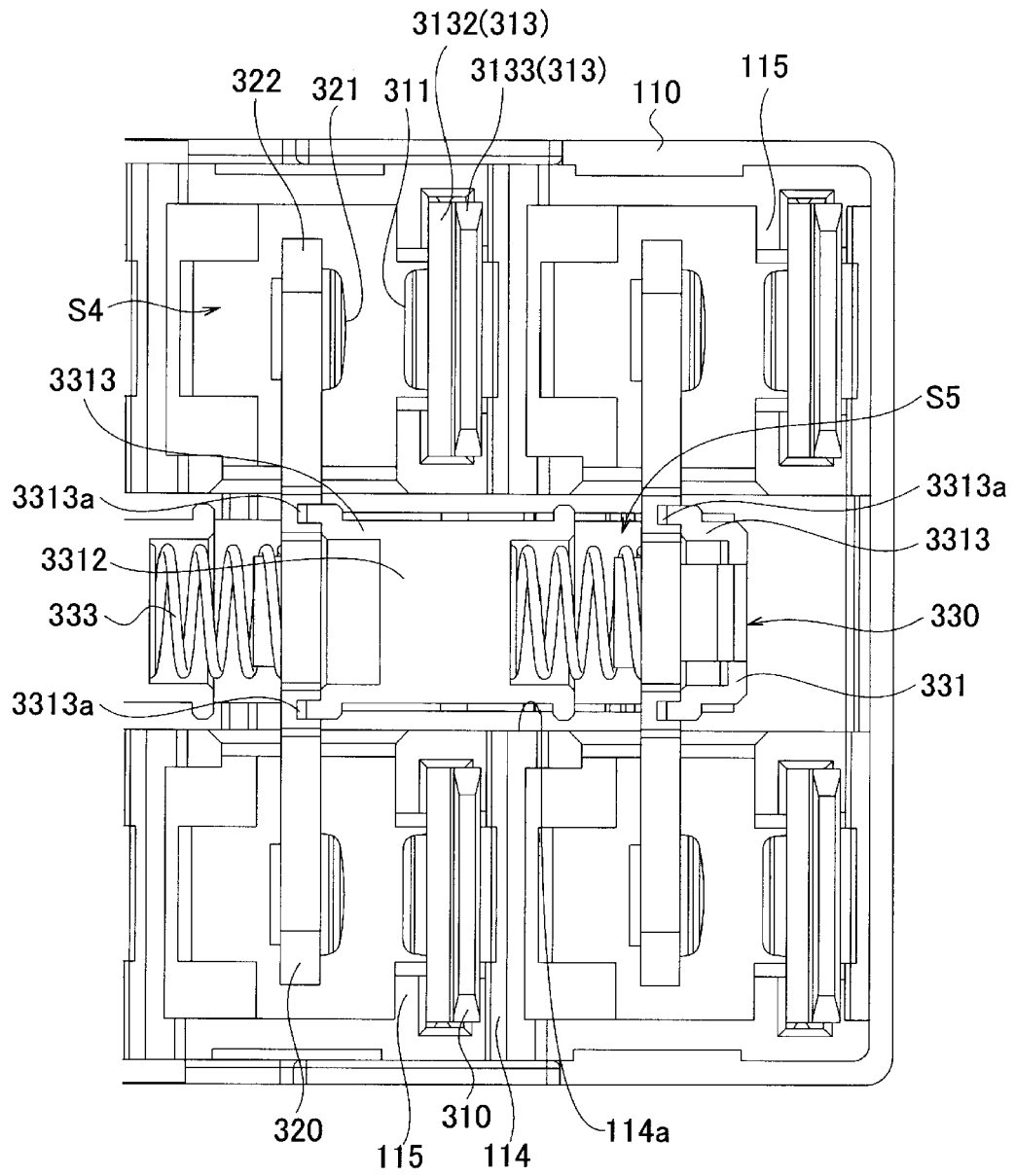


FIG. 8

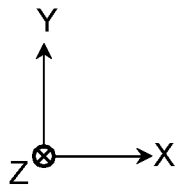
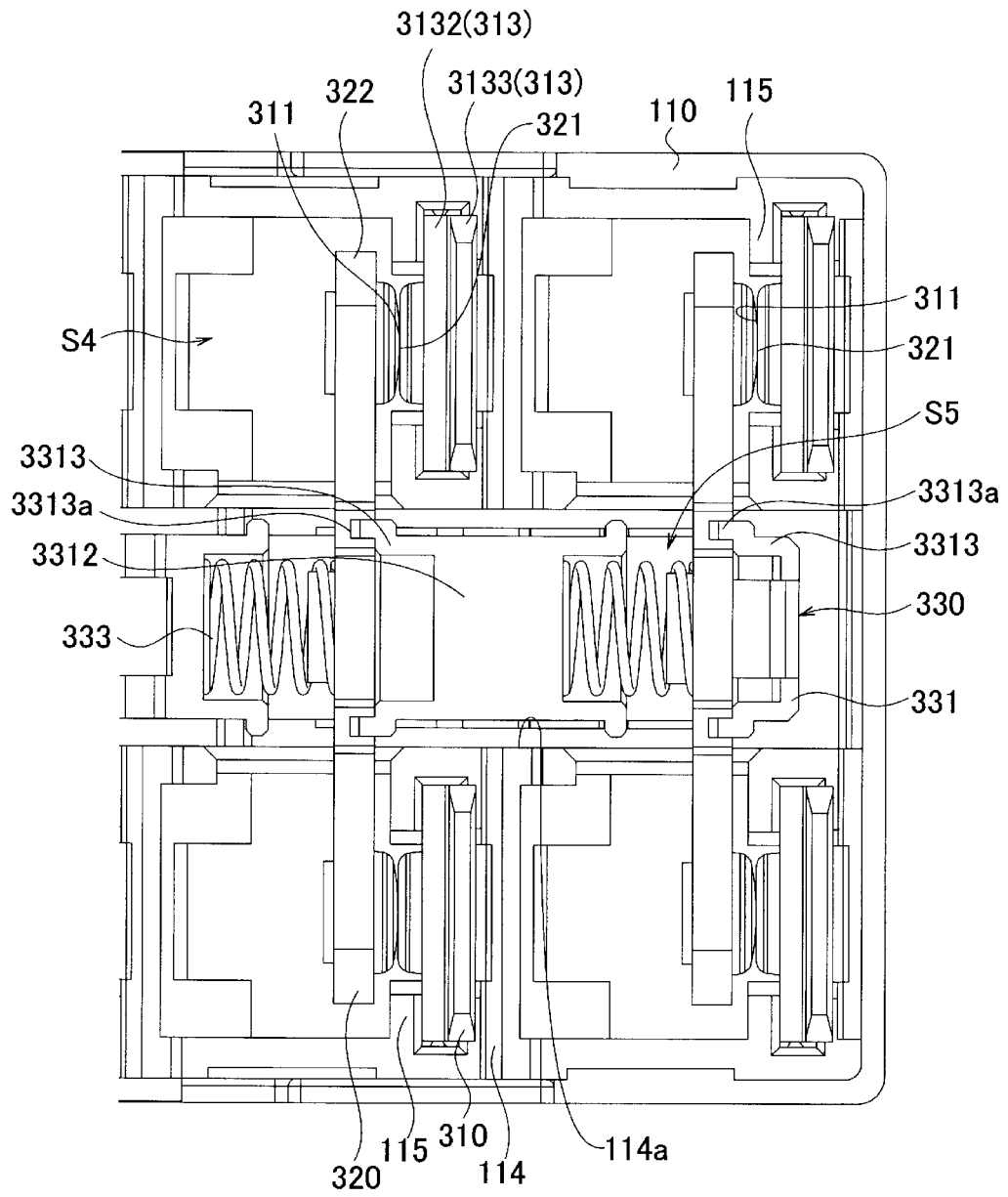


FIG. 9

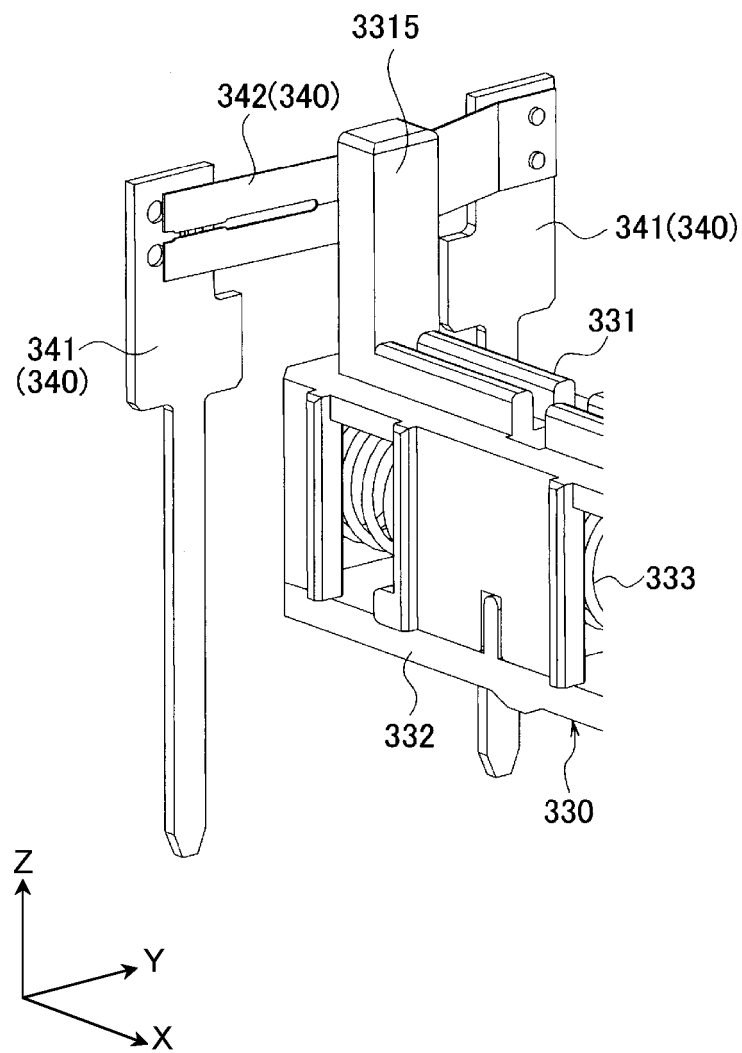


FIG. 10

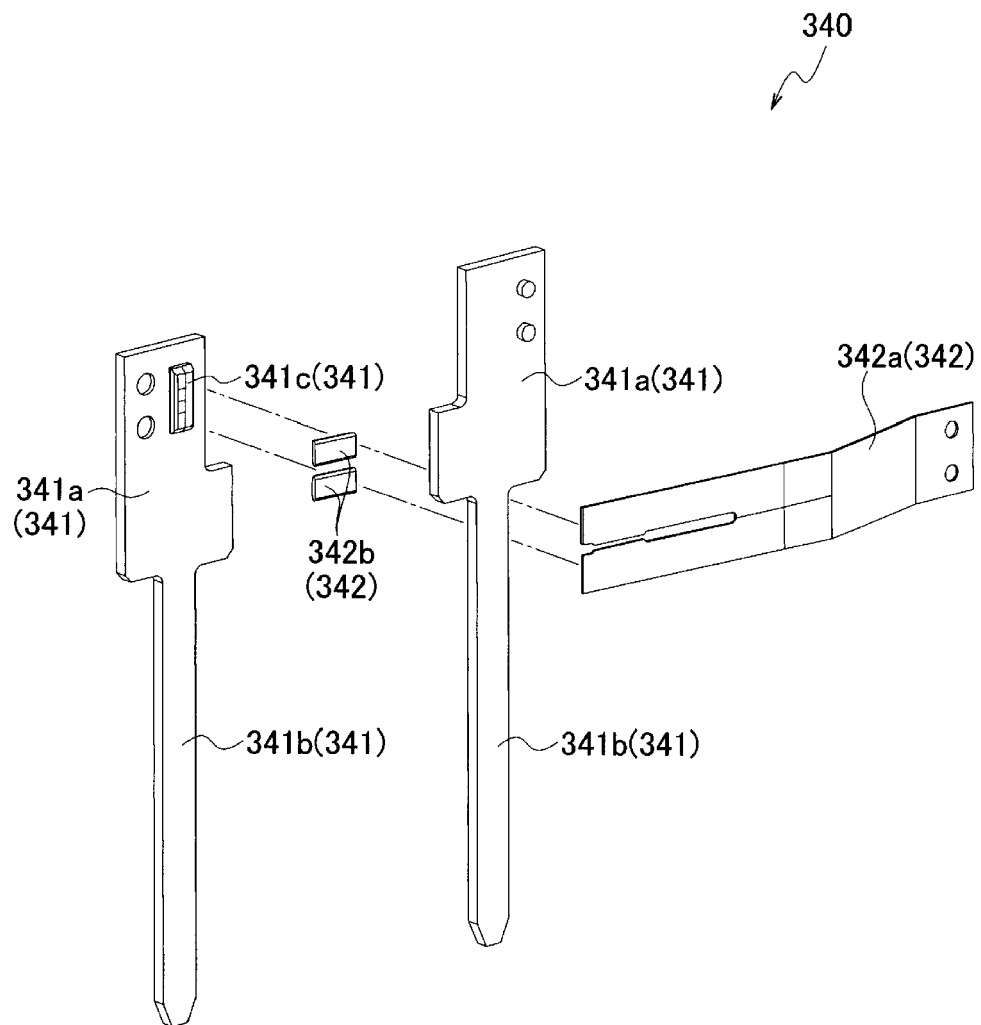


FIG. 11

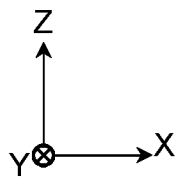
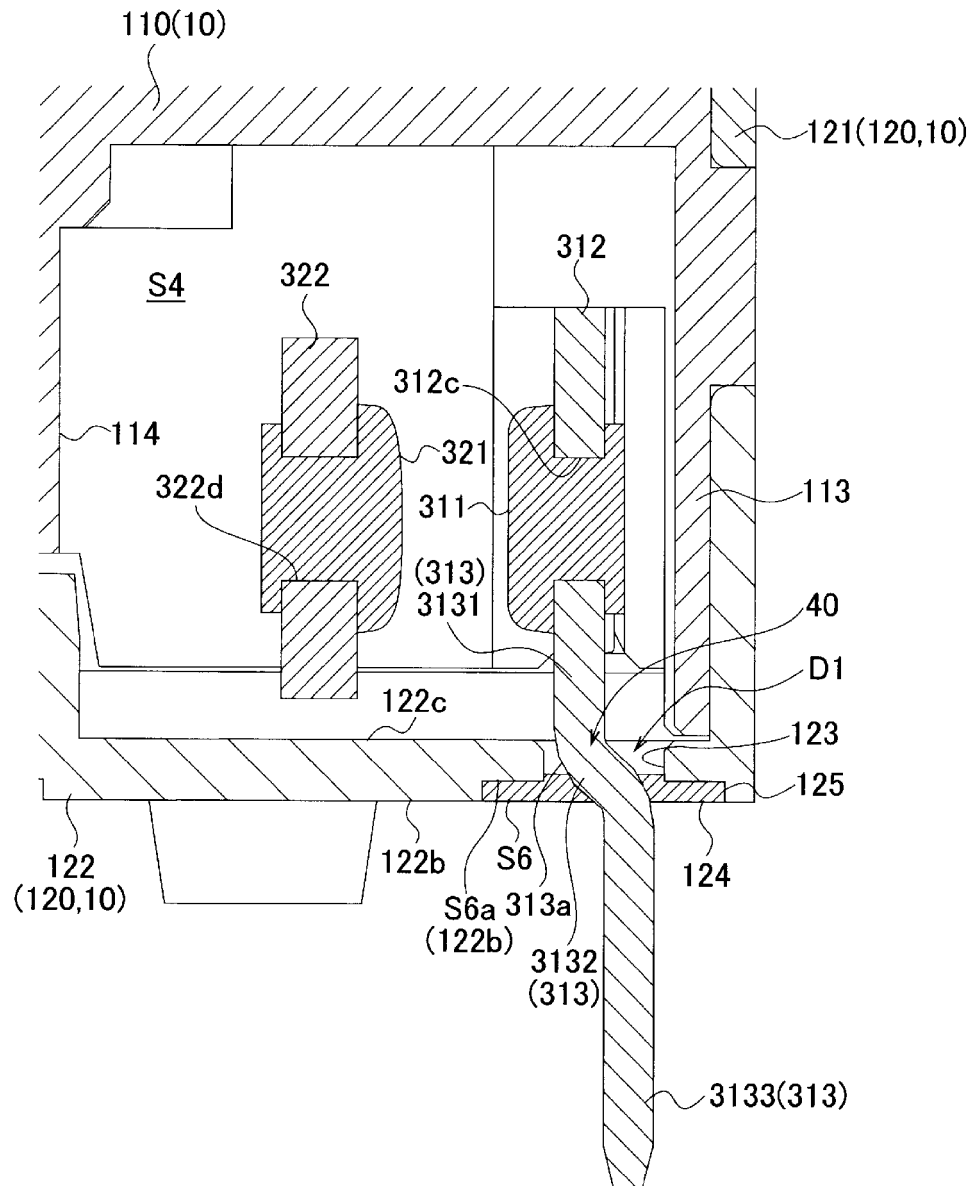


FIG. 12

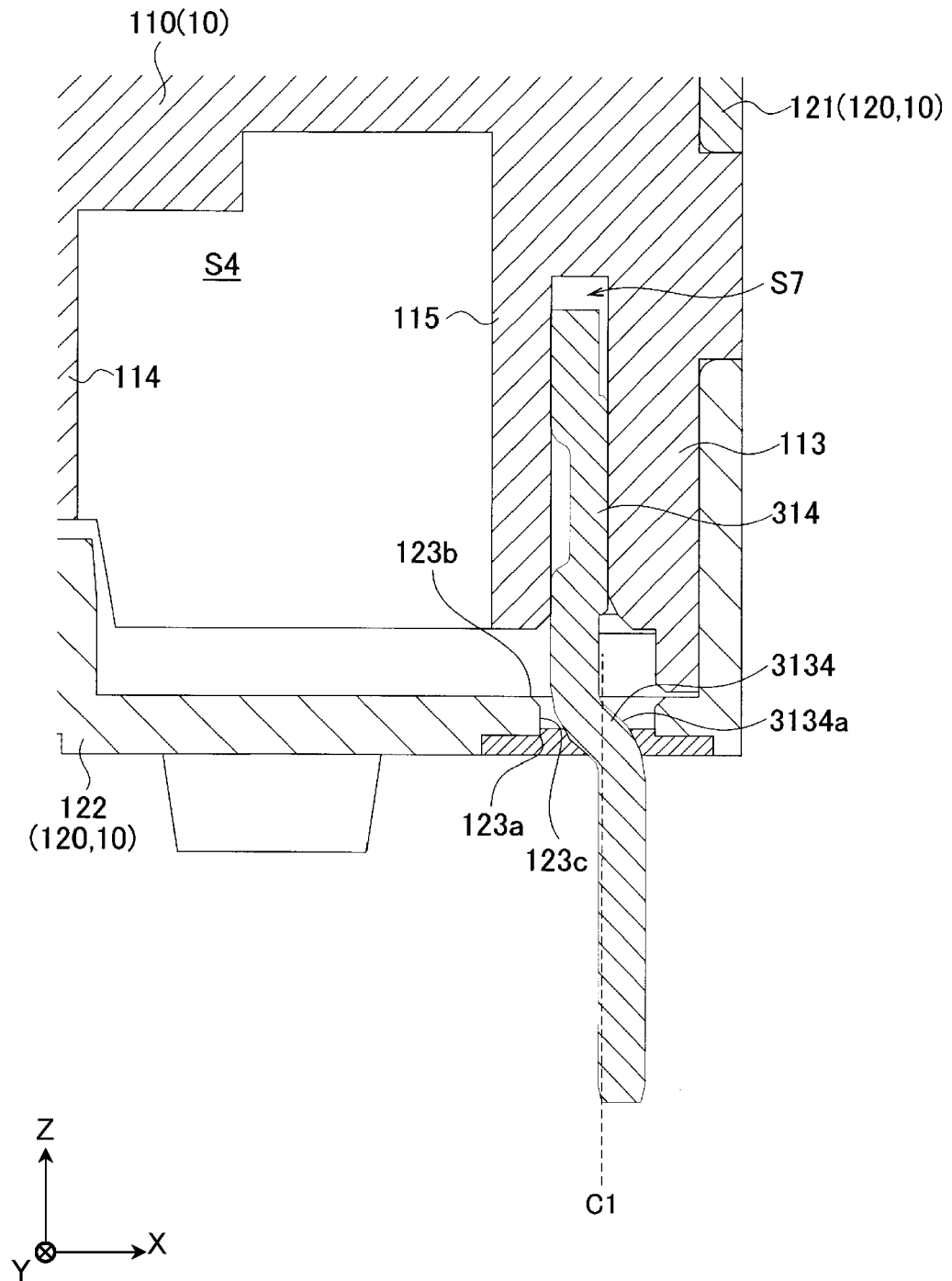


FIG. 13

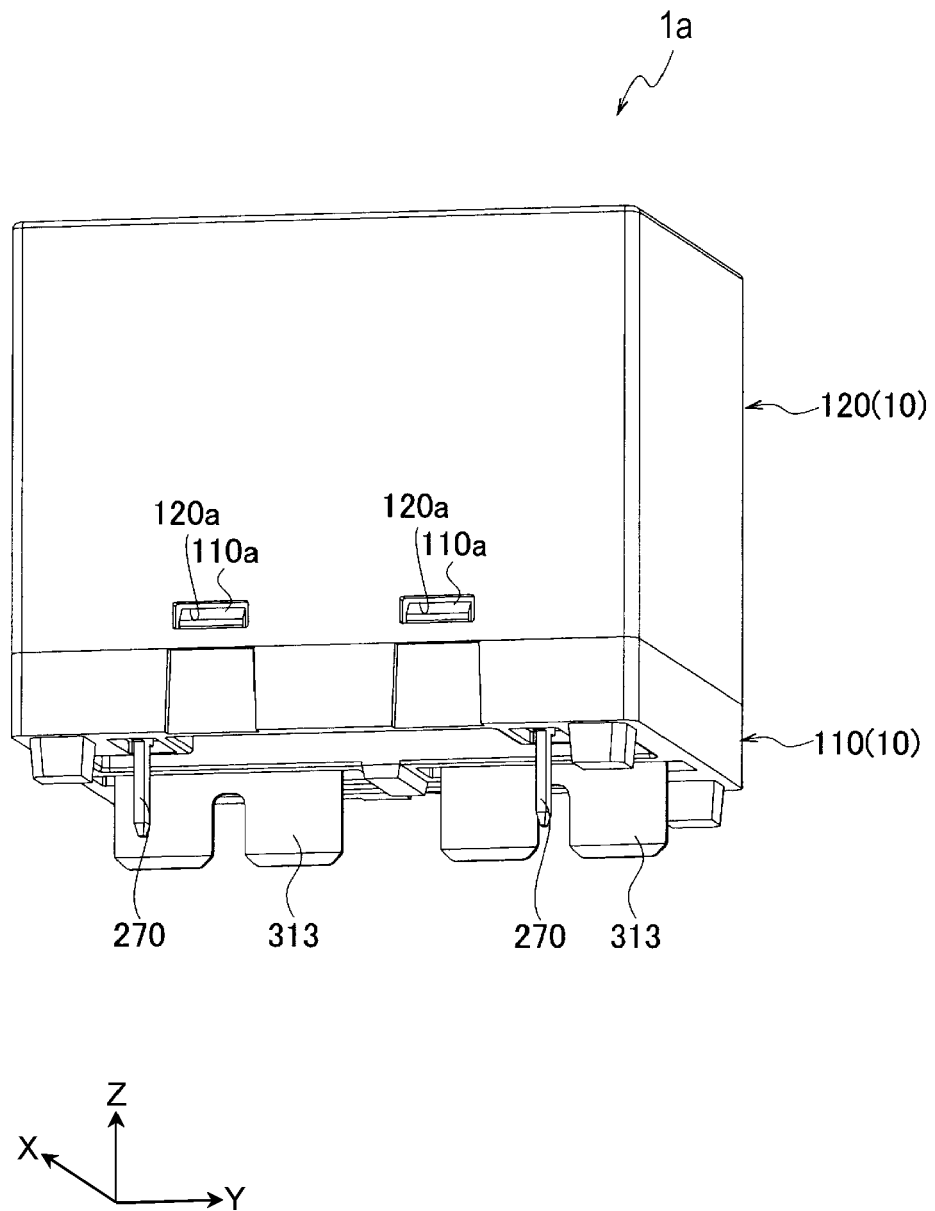


FIG. 14

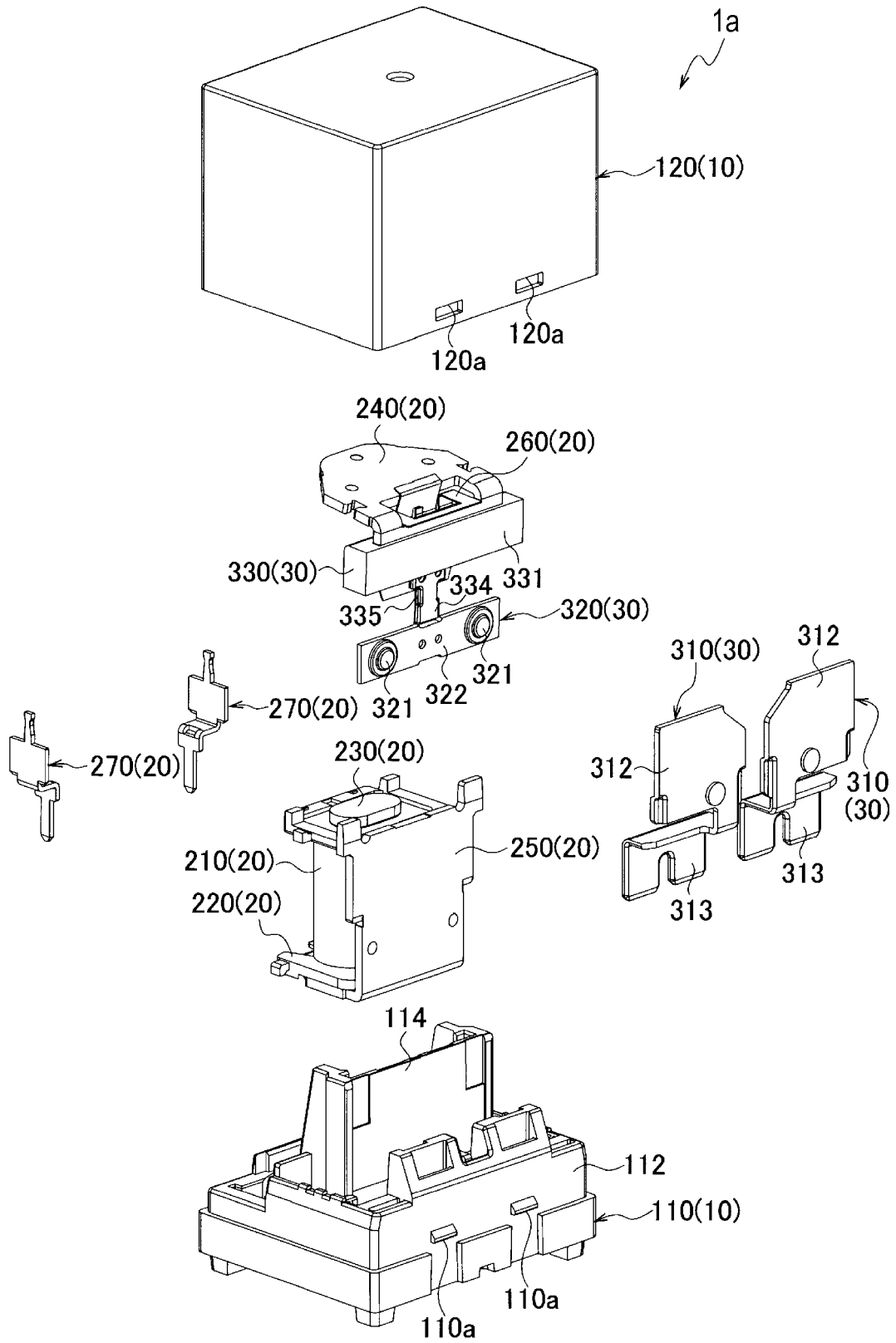


FIG. 15

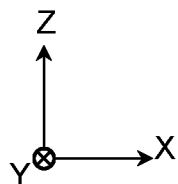
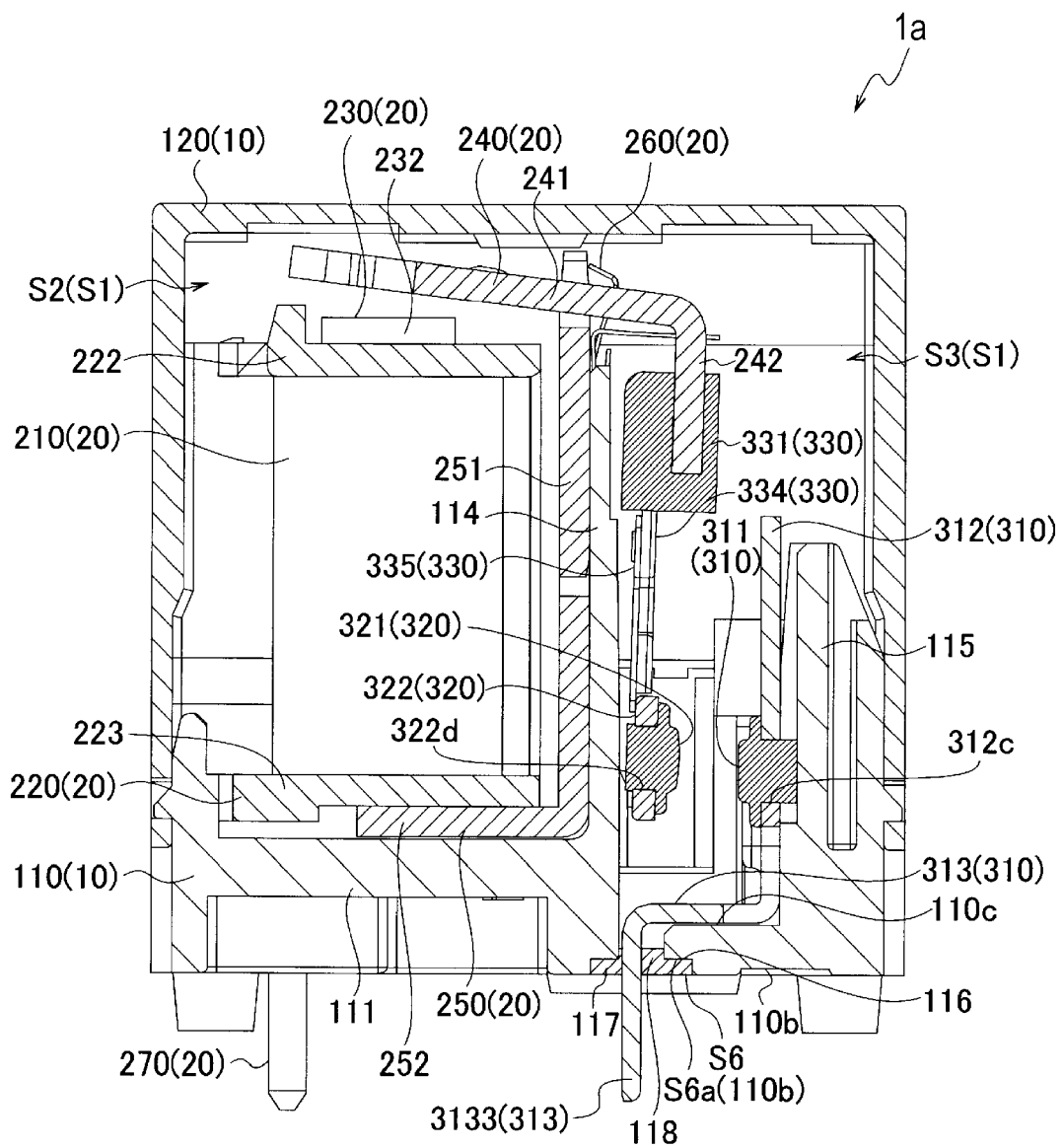


FIG. 16

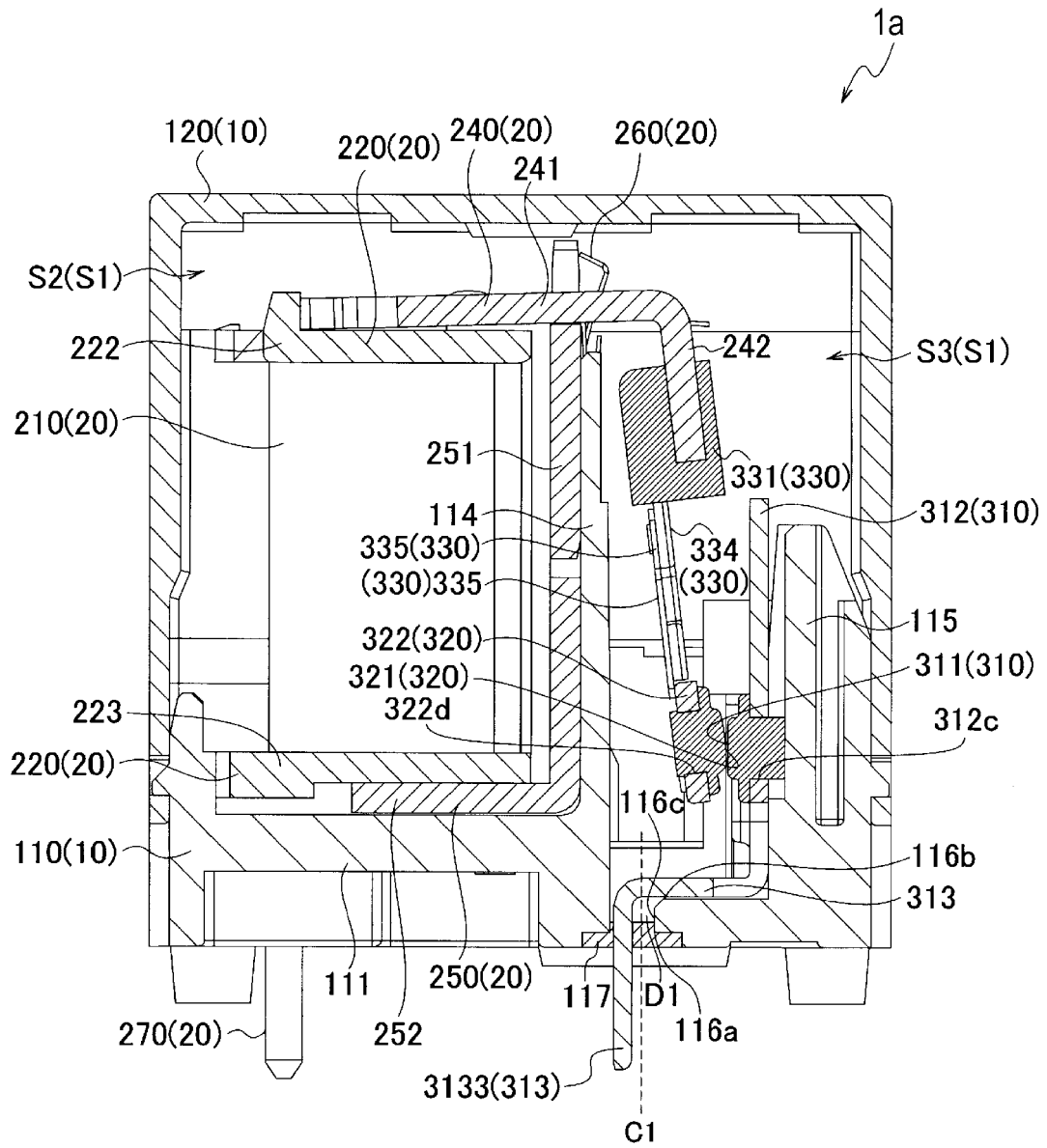


FIG. 17A

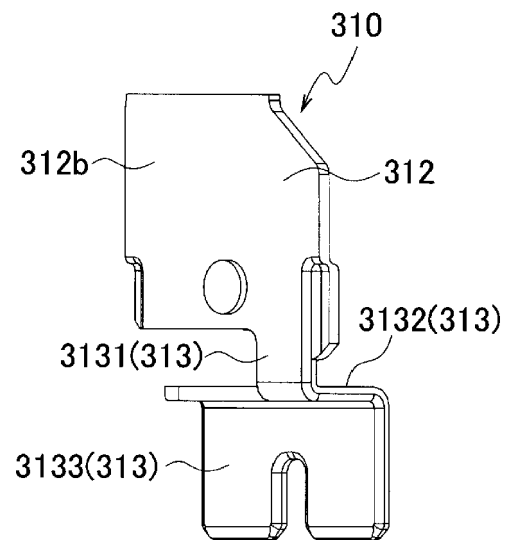


FIG. 17B

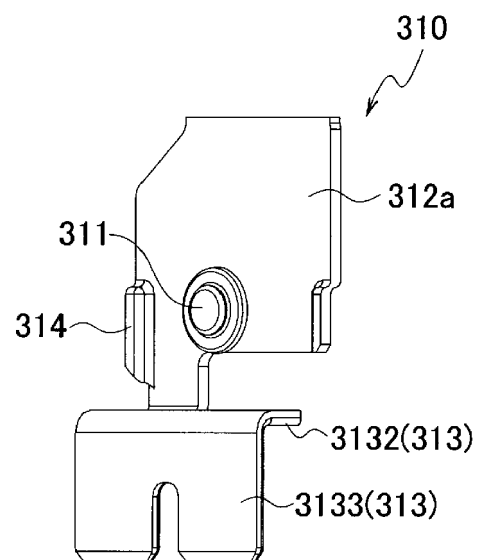


FIG. 17C

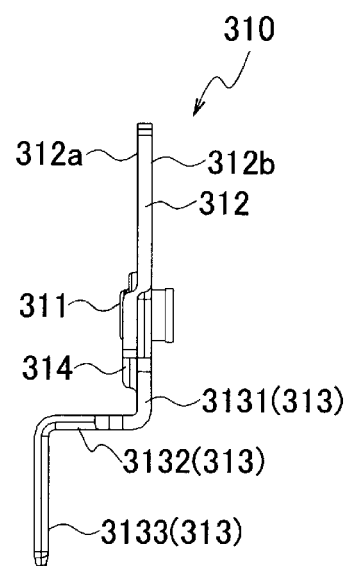


FIG. 18

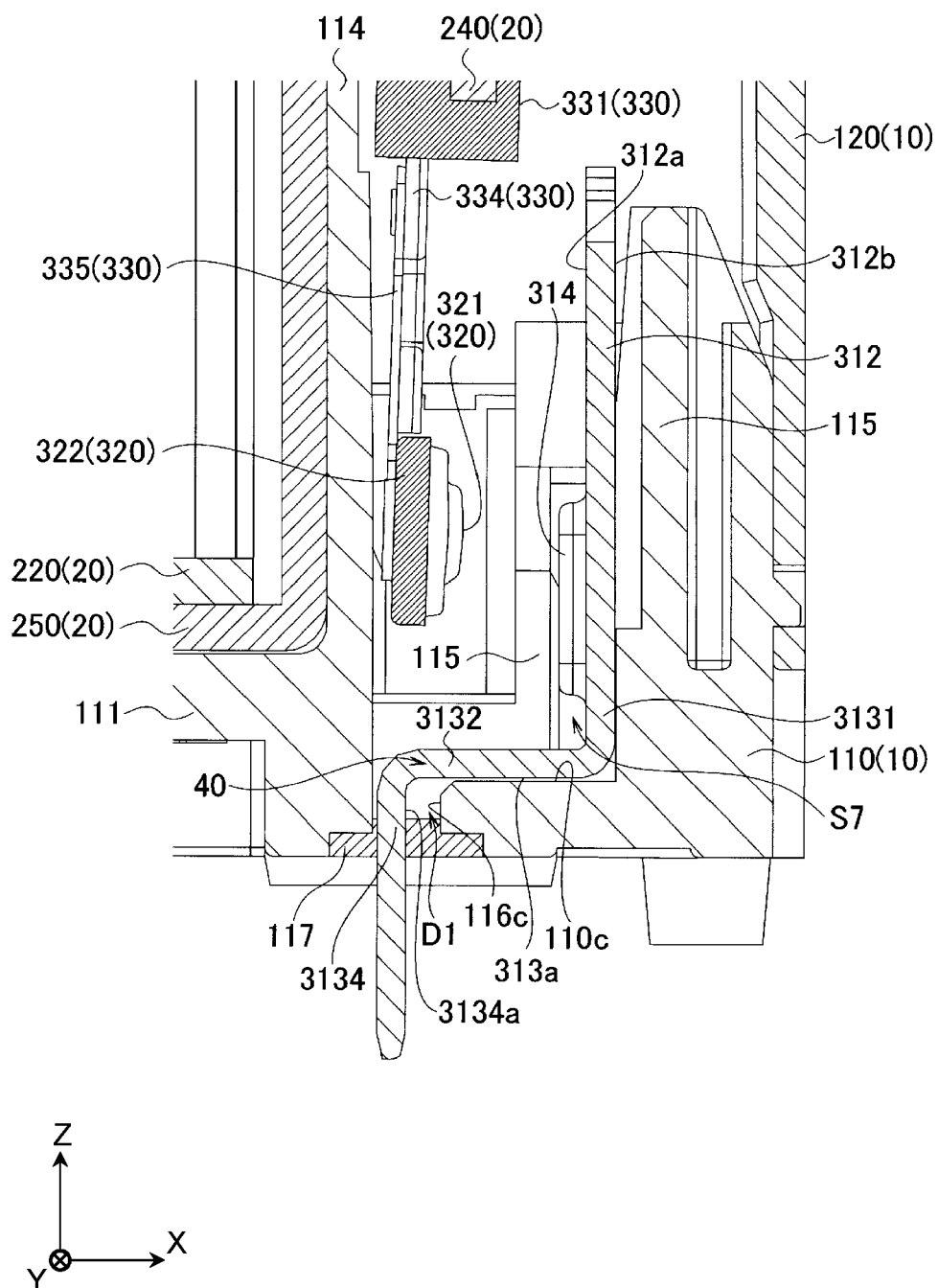


FIG. 19

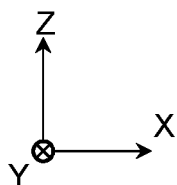
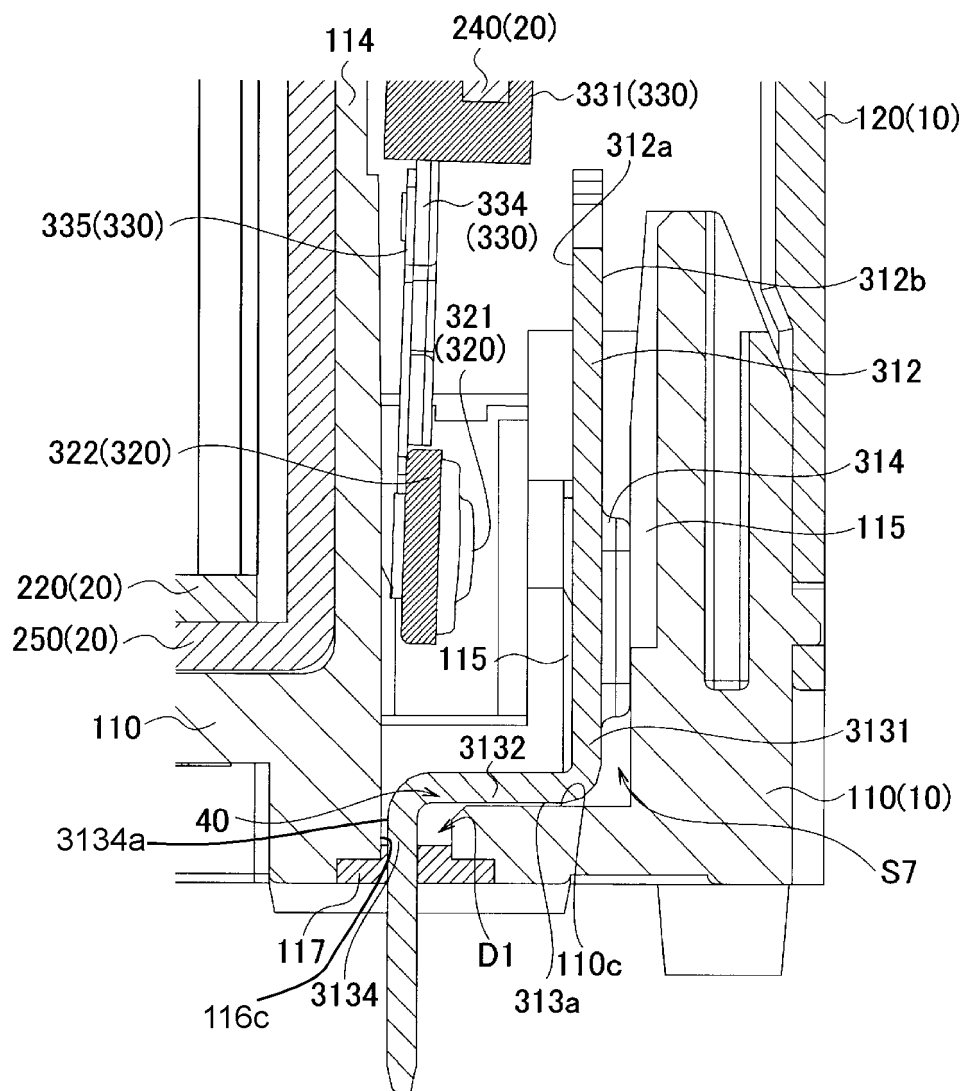


FIG. 20

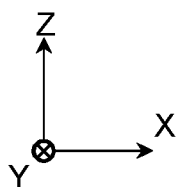
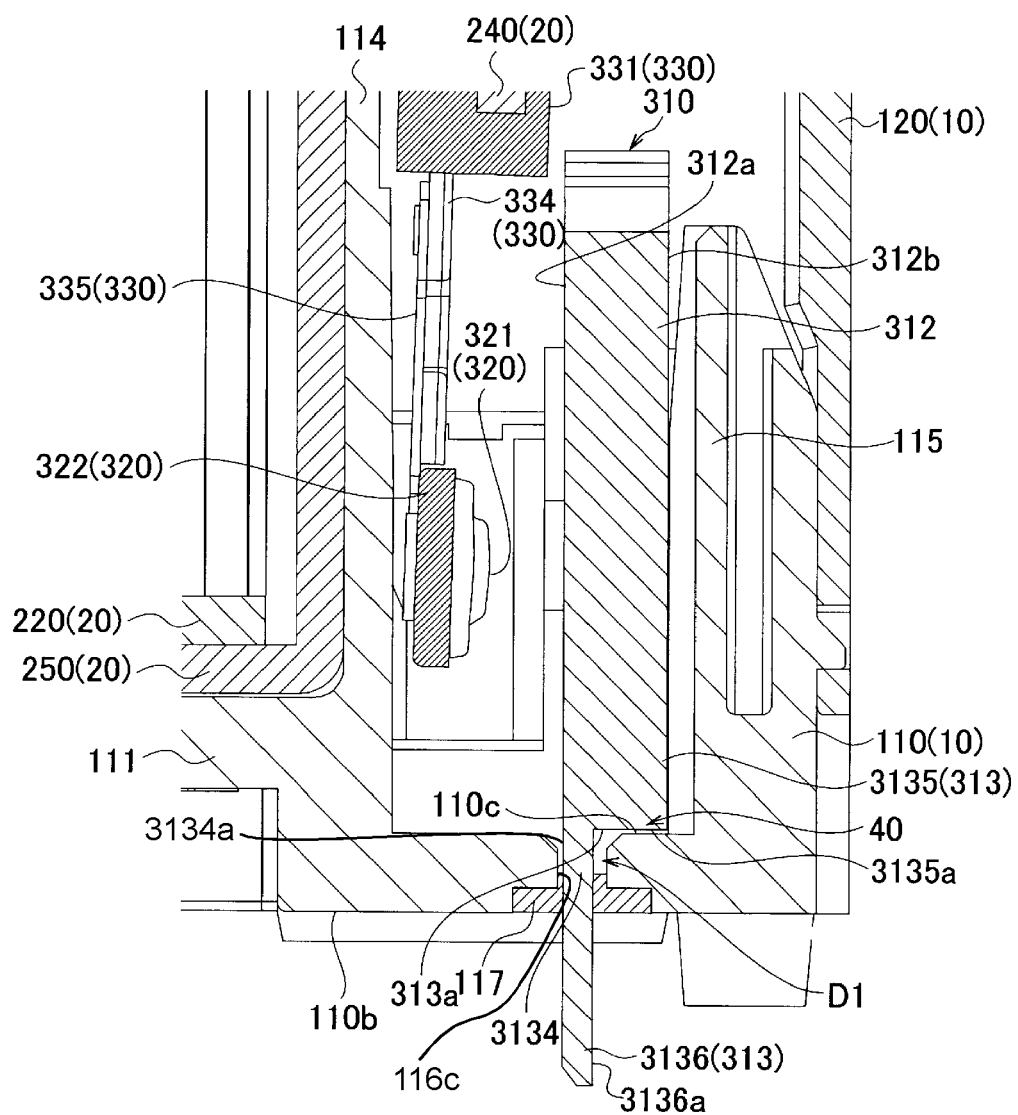
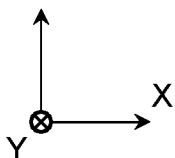
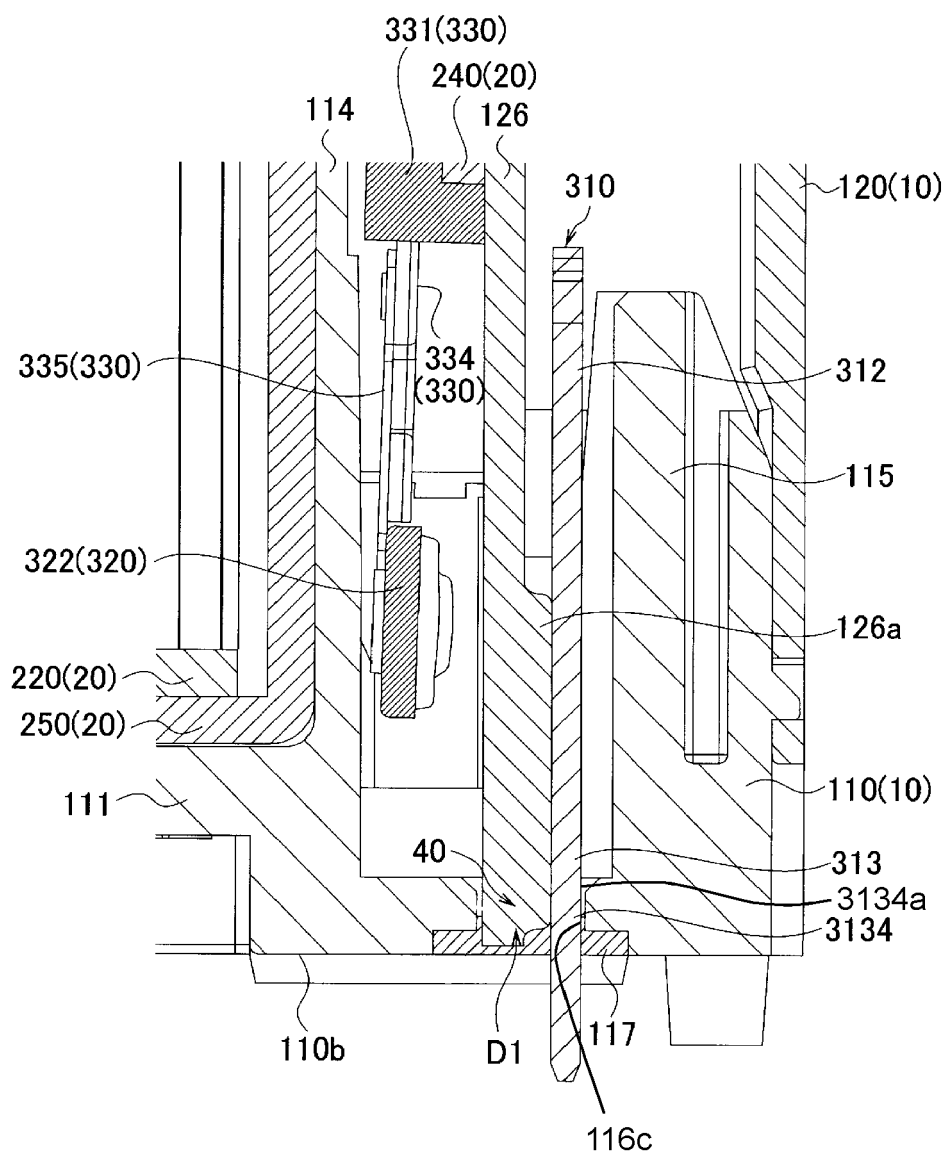


FIG. 21





EUROPEAN SEARCH REPORT

Application Number
EP 20 19 8063

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EPO FORM 1503 03.82 (P04C01)

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 108 172 468 B (ANHUI SENLI AUTOMOBILE ELECTRONICS CO LTD) 31 May 2019 (2019-05-31) * figure 1 *	1-11	INV. H01H50/14
A,P	US 2020/266018 A1 (MOCHIZUKI MASAHIRO [JP] ET AL) 20 August 2020 (2020-08-20) * claim 5; figure 2 *	1-11	
A	EP 3 462 472 A1 (TYCO ELECTRONICS COMPONENTES ELECTROMECANICOS LDA [PT]) 3 April 2019 (2019-04-03) * figure 7 *	1-11	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 February 2021	Examiner Socher, Günther
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 19 8063

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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15-02-2021

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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