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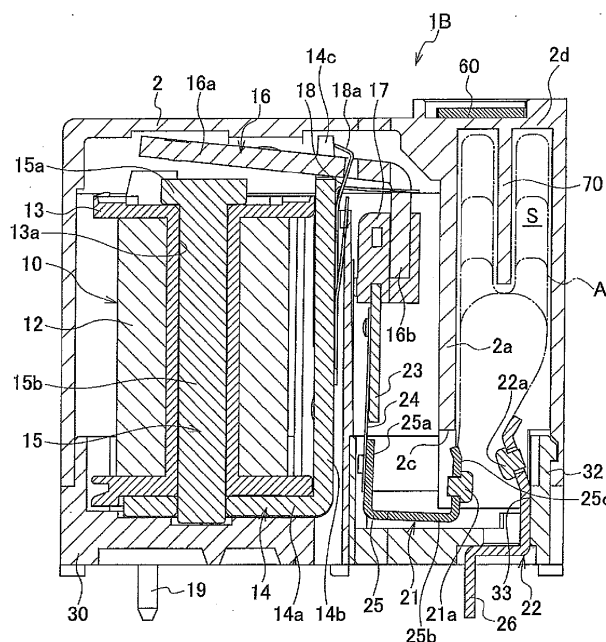
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(54) **Electromagnetic relay**

(57) An electromagnetic relay (1) includes an armature (16) that oscillates according to excitation and non-excitation of an electromagnetic block (10), movable contact members (21) provided with movable contact points (21a) and attached to the armature (16) to move in association with the moving armature (16), and fixed contact members (22) provided with fixed contact points (22a) with and from which the movable contact points

(21a) come into contact and separate. The electromagnetic relay (1) is provided with arc extension spaces (S) for extension of an arc generated at the point of contact and separation between the movable contact points (21a) and the fixed contact points (22a), and magnetic field generating means (50) is provided to introduce, into the arc extension spaces (S), the arc generated at the point of contact and separation between the movable contact points (21a) and the fixed contact points (22a).

FIG. 9



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an electromagnetic relay.

[0002] As described in Japanese Patent Unexamined Publication No. 2010-123545, there is known an electromagnetic relay including an armature that moves according to excitation and non-excitation of an electromagnetic block, a movable contact member that is provided with movable contact points and moves in association with the movement of the armature, and a fixed contact member that is provided with fixed contact points with and from which the movable contact points come into contact and separate.

SUMMARY OF THE INVENTION

[0003] However, the conventional electromagnetic relay tends to fail to interrupt an arc at the point of contact and separation between the movable contact points and the fixed contact points in a case in which, for example, a high DC voltage of 400 V is applied to the electromagnetic relay. If the generated arc cannot be interrupted, the movable contact points and the fixed contact points are welded together, which may decrease the reliability of the contact points.

[0004] Therefore, it is an object of the present invention to provide an electromagnetic relay capable of preventing loss of the reliability of the contact points.

[0005] A first aspect of the present invention is to provide an electromagnetic relay comprising: an armature that moves according to excitation and non-excitation of an electromagnetic block; a movable contact member provided with a movable contact point and attached to the armature to move in association with the moving armature; and a fixed contact member provided with a fixed contact point with and from which the movable contact point comes into contact and separates, wherein the electromagnetic relay is provided with an arc extension space for extension of an arc generated at a point of contact and separation between the movable contact point and the fixed contact point, and a magnetic field generating means is provided to introduce, into the arc extension space, the arc generated at the point of contact and separation between the movable contact point and the fixed contact point.

[0006] A second aspect of the present invention is to provide the electromagnetic, wherein an arc extinction member is provided in the arc extension space.

[0007] A third aspect of the present invention is to provide the electromagnetic relay, wherein the movable contact member includes a first extending piece extending from the armature in a direction away from the armature, a second extending piece extending from a tip of the first extending piece in a direction intersectional to the first extending piece, and a third extending piece extending

from a tip of the second extending piece in a direction away from the second extending piece an oppositer end, and to have the movable contact point provided on the third extending piece.

[0008] A fourth aspect of the present invention is to provide the electromagnetic relay, wherein the arc extension space is defined by a wall member, and an opening through which the third extending piece is inserted is provided on a lower portion of the wall member.

[0009] A fifth aspect of the present invention is to provide the electromagnetic relay, wherein a partition wall is provided to divide the arc extension space.

[0010] A sixth aspect of the present invention is to provide the electromagnetic relay, wherein an indented portion is provided on a wall surface facing the arc extension space.

[0011] A seventh aspect of the present invention is to provide the electromagnetic, wherein the indented portion is provided along an extending direction of the arc.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a front view of an electromagnetic relay according to a first embodiment of the present invention.

Fig. 2 is a perspective view of a cover of the electromagnetic relay according to the first embodiment of the present invention.

Fig. 3 is a perspective view of the electromagnetic relay according to the first embodiment of the present invention, from which the cover is removed.

Fig. 4 is a cross-sectional view along the line A-A in Fig. 1.

Fig. 5 is a perspective view showing a state in which part of a magnetic insulation yoke and an arc extinction member is removed from Fig. 3.

Fig. 6 is a partial view of the electromagnetic relay, from which some parts are removed, according to the first embodiment of the present invention, and is a perspective view showing movable contact members and fixed contact members.

Fig. 7 is a cross-sectional view along the line B-B in Fig. 4.

Fig. 8 is a vertical cross-sectional view of an electromagnetic relay according to a second embodiment of the present invention.

Fig. 9 is a vertical cross-sectional view of an electromagnetic relay according to a third embodiment of the present invention.

Fig. 10 is a vertical cross-sectional view of an electromagnetic relay according to a fourth embodiment of the present invention.

Fig. 11 is a vertical cross-sectional view of an electromagnetic relay according to a fifth embodiment of the present invention.

Fig. 12 is a vertical cross-sectional view of an elec-

tromagnetic relay according to a sixth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] Embodiments of the present invention will be explained in detail below with reference to the drawings. Note that the side on which an electromagnetic block of an electromagnetic relay is provided is defined as the front in the front-back direction, and the side on which movable contact members and fixed contact members are provided is defined as the back in the front-back direction. Further, the direction in which a case is attached is defined as a vertical direction, and the direction perpendicular to the front-back direction and the vertical direction is defined as a width direction.

[0014] The respective embodiments described below include the same components. Therefore, the same components are indicated by the same reference numerals, and the explanations thereof are not repeated in each embodiment.

(First embodiment)

[0015] An electromagnetic relay 1 according to the present embodiment includes a case 2, a base 30, an electromagnetic block 10, an armature 16, movable contact members 21 and fixed contact members 22.

[0016] The base 30 is made of synthetic resin that is an insulating material, and includes an insulating wall 31 formed into substantially a U-shape in a planar view provided approximately in the middle thereof. An electromagnetic housing 34 that houses the electromagnetic block 10 is provided in front of the insulating wall 31 (on the left in Fig. 7), and a wall member 32 is provided on the back side of the insulating wall 31 (on the right in Fig. 7). A contact point housing 33 is surrounded by the insulating wall 31 and the wall member 32. The movable contact members 21 and the fixed contact members 22 are provided in the contact point housing 33. The insulating wall 31 functions to insulate the electromagnetic block 10 from the contact members (the movable contact members 21 and the fixed contact members 22).

[0017] The electromagnetic block 10 includes a yoke 14, a coil block 11 and an iron core 15.

[0018] The yoke 14 is bent and formed substantially into an L-shape. The coil block 11 in which a coil is wound around a coil bobbin 13 is placed on a base plate 14a of the yoke 14. The coil 12 is connected to coil terminals 19 implanted in an insulating body 30. The iron core 15 includes a body part 15b and a flange-shaped attracting piece 15a provided on the top of the body part 15b. The iron core 15 is fixed to a fixing hole 14b of the base plate 14a of the yoke 14 in such a manner as the body part 15b is inserted into the through-hole 13a of the coil bobbin 13.

[0019] The armature 16 includes a pole piece 16a and

hanging pieces 16b, and is formed into an L-shape by the pole piece 16a and the hanging pieces 16b. In the present embodiment, the armature 16 is provided in an inverted L-shape in a side view in which the pole piece 16a on the upper side extends substantially in a horizontal direction, and the hanging pieces 16b on the lower side extend substantially in a vertical direction. Holding pieces 14c projecting upward from both sides of the yoke 14 engage with cutout portions 16c provided on both upper end sides of the pole piece 16a so that the armature 16 is oscillatably supported. The pole piece 16a of the armature 16 is positioned opposed to the attracting piece 15a of the iron core 15.

[0020] A hinge spring 18 is placed between the armature 16 and the yoke 14, and is provided (on the upper side) with a spring piece 18a that presses an upper portion of an insulating member 17 described below. In the state where electric current is not supplied to the coil 12 (in the non-excitation state of the electromagnetic block 10), the pressing force of the spring piece 18a keeps the pole piece 16a of the armature 16 away from the attracting piece 15a of the iron core 15. On the other hand, when electric current is supplied to the coil 12 (in the excitation state of the electromagnetic block 10), the magnetic force level of the attracting piece 15a of the iron core 15 is higher than the pressing force level of the spring piece 18a, and therefore, the pole piece 16a of the armature 16 comes into contact with the attracting piece 15a of the iron core.

[0021] The movable contact members 21 that oscillate in association with the movement (oscillation) of the armature 16 are attached to the hanging pieces 16b of the armature 16 via the insulating member 17.

[0022] Each movable contact member 21 is provided with movable contact points 21a. The movable contact points 21a come into contact with and separate from fixed contact points 22a provided in each fixed contact member 22, in association with the movement of each movable contact member 21. Thus, the switching action between the contact points is carried out.

[0023] In the present embodiment, the respective movable contact members 21 include a fixing piece 23 fixed to the hanging piece 16b of the armature 16 via the insulating member 17, a movable contact plate 25 provided with the two movable contact points 21a, and a movable spring 24 that connects the movable contact plate 25 to the fixing piece 23.

[0024] In particular, the respective movable contact plates 25 include a connection piece 25a extending in the vertical direction and connected to the movable spring 24, a bottom plate 25b extending from the bottom of the connection piece 25a toward the back side in the horizontal direction, and vertical pieces 25c extending upward from the back end of the bottom plate 25b.

[0025] Each movable contact point 21a is fixed to each vertical piece 25c so as to face backward. In the present embodiment, the bottom plate 25b is bifurcated so that two branched end portions serve as the vertical pieces

25c. In the respective movable contact members 21 having the above-described configuration, the movable contact points 21a are located and project more backward than the insulating member 17, so that the movable contact points 21a and the insulating member 17 do not overlap each other in a planar view.

[0026] As shown in Fig. 6, the fixing pieces 23, the movable springs 24 and the movable contact plates 25 are provided in pairs. Thus, the four movable contact points are provided in the electromagnetic relay 1 according to the present embodiment.

[0027] The fixed contact members 22 include four fixed contact plates 26 each provided with a fixed contact point 22a and fixed to the contact point housing 33 of the base 30.

[0028] In particular, as shown in Fig. 7, each fixed contact plate 26 is bent into a crank shape, and is provided with the fixed contact point 22a at one end of the fixed contact plate 26. Note that the fixed contact plates 26 are not necessarily bent into a crank shape and may be formed into various shapes. For example, linear fixed contact plates without being bent as viewed from the side may be used.

[0029] The fixed contact plates 26 are inserted into the contact point housing 33 from below in such a manner that the fixed contact points 22a are positioned on the upper and back side of the fixed contact plates 26, and the fixed contact plates 26 are attached to the contact point housing 33 of the base 30. In this case, the four fixed contact plates 26 are attached in such a manner as the four fixed contact points 22a are opposed to the four movable contact points 21a, respectively. In the case where electric current is not supplied to the coil 12 (in the non-excitation state of the electromagnetic block 10), the four fixed contact points 22a and the four movable contact points 21a are separated from each other and positioned on the back side (on the right in Fig. 7) of the contact point housing 33 of the base 30. On the other hand, when electric current is supplied to the coil 12 (in the excitation state of the electromagnetic block 10), and when the movable contact members 21 start moving, the four movable contact points 21a come closer and into contact with the opposed four fixed contact points 22a.

[0030] In the present embodiment, the electromagnetic relay 1 is formed with arc extension spaces S for extension of an arc generated at the point of contact and separation between the movable contact points 21a and the fixed contact points 22a.

[0031] In particular, as shown in Fig. 2, a wall member 2a and side walls 2b are provided inside the case 2. When the base 30 to which the respective components are attached is covered with the case 2, the respective pairs of the movable contact points 21a and the fixed contact points 22a opposed to each other (each pair of the contact points coming into contact with and separating from each other) are surrounded by the wall member 2a and the side walls 2b. In the present embodiment, each space partitioned by the wall member 2a and the side walls 2b

serves as the arc extension space S. In this case, the fixed contact points 22a and the insulating member 17 are defined by the wall member 2a.

[0032] The electromagnetic relay 1 includes permanent magnets (magnetic field generating means) 50 that lead the arc generated at the point of the contact and separation between the movable contact points 21a and the fixed contact points 22a, into the arc extension spaces S. As shown in Fig. 4 and Fig. 5, the permanent magnets 50 are vertically elongated and located on one end side in the width direction of the respective pairs of the movable contact points 21a and the fixed contact points 22a. The arc generated at the point of the contact and separation between the movable contact points 21a and the fixed contact points 22a is elongated upward in each arc extension space S due to the magnetic effect of the permanent magnets 50.

[0033] In the respective arc extension spaces S, an arc extinction member 40 is provided at least at the periphery of the fixed contact member 22 so as to house the fixed contact point 22a. The arc extinction member 40 of the present embodiment is formed into a box of which the bottom is open, and is inserted into the arc extension space S to cover the fixed contact point 22a. An upper wall 42 of the arc extinction member 40 is provided with a small opening 42a so that the arc is easily introduced into the arc extension space S.

[0034] The arc extinction member 40 is made of an insulating material that may produce arc extinction gas by contact with the arc. The insulating material constituting the arc extinction member 40 is preferably unsaturated polyester or a material obtained by adding a metal hydroxide or hydrate to a chain compound.

[0035] The permanent magnet 50 and the arc extinction member 40 that houses the contact points (a pair of the movable contact point 21a and the fixed contact point 22a) are covered with a magnetic insulation yoke 60 along the upper and both sides in the width direction. The magnetic insulation yoke 60 prevents the permanent magnet 50 provided for a particular pair of the contact points from acting on the other pair of the contact points.

[0036] The respective movable contact members 21 include a first extending piece 21b that extends downward (in the direction away) from the hanging piece 16b of the armature 16, and a second extending piece 21c that extends rearward (in the direction intersectional to the first extending piece 21b: in the direction perpendicular to the first extending piece 21b) from the tip of the first extending piece 21b. The respective movable contact members 21 further include a third extending piece 21d that extends upward (in the direction away) from the tip of the second extending piece 21c, and is provided with the movable contact point 21a thereon.

[0037] In the present embodiment, the first extending piece 21b is formed with the fixing piece 23, the movable spring 24 and the connection piece 25a. The second extending piece 21c is formed with the bottom plate 25b, and the third extending piece 21d is formed with the ver-

tical piece 25c.

[0038] In the wall members (the wall member 2a, the side walls 2b, and the side walls of the case 2) that define the respective arc extension spaces S, openings from which the third extending pieces 21d can be inserted are formed on the lower side of the wall member 2a on the first extending piece 21b side.

[0039] In particular, openings 2c and openings 41a are formed on the lower side of the wall member 2a and the lower side of each front wall 41 of the respective arc extinction members 40, respectively, so that the third extending pieces 21d provided with the movable contact points 21a can be inserted into the respective arc extension spaces S.

[0040] Next, the contact action in the electromagnetic relay 1 having the above-described configuration is explained below.

[0041] When the electromagnetic block 10 in the electromagnetic relay 1 is in the non-excitation state, the spring piece 18a of the hinge spring 18 presses the upper surface of the insulating member 17, and the armature 16 then turns in a clockwise direction in Fig. 7. Thus, the pole piece 16a of the armature 16 is separated from the attracting piece 15a of the iron core 15. In this state, the respective movable contact points 21a are also separated from the fixed contact points 22a as shown in Fig. 7.

[0042] Once electric current is supplied to the coil 12 to excite the electromagnetic block 10, a magnetic force is caused and passes through the yoke 14, the iron core 15 and the armature 16 to attract the pole piece 16a of the armature 16 to the attracting piece 15a of the iron core 15. The pole piece 16a of the armature 16 is attracted to the attracting piece 15a of the iron core 15 against a spring force (a pressing force) of the hinge spring 18, so that the armature 16 turns in a counterclockwise direction in Fig. 7. In association with this, the movable contact plates 25 also move in the counterclockwise direction and accordingly, the four movable contact points 21a come into contact with the opposed fixed contact points 22a.

[0043] When the electric current supply to the coil 12 is stopped, the movable contact points 21a separate from the fixed contact points 22a by reversing this operation procedure.

[0044] By switching the on-off state of the electric current supplied to the coil 12, the movable contact points 21a and the fixed contact points 22a come into contact with and separate from each other. As a result, an arc may be generated at the point of the contact and separation between the movable contact points 21a and the fixed contact points 22a.

[0045] When the arc is generated, the arc is introduced into the arc extension spaces S due to the permanent magnets (magnetic field generation means) 50. In other words, the arc generated at the point of the contact and separation between the movable contact points 21a and the fixed contact points 22a extends in the spaces inside the arc extinction members 40 (the arc extension spaces

S). The generated arc runs and extends along the inner surface of each arc extinction member 40. That is, the arc extends while coming into contact with the inner surface of each arc extinction member 40. As a result, arc extinction gas is produced from the arc extinction members 40 and thereby extinguishes the arc.

[0046] Thus, the electromagnetic relay 1 according to the present embodiment can introduce the arc generated at the point of the contact and separation between the movable contact points 21a and the fixed contact points 22a, into the arc extension spaces S and thereby extinguish the arc.

[0047] As explained above, the electromagnetic relay 1 according to the present embodiment is provided with the arc extension spaces S for extension of the arc generated at the point of the contact and separation between the movable contact points 21a and the fixed contact points 22a.

[0048] In addition, the electromagnetic relay 1 is provided with the permanent magnets (magnetic field generation means) 50 that introduce, into the arc extension spaces S, the arc generated at the point of the contact and separation between the movable contact points 21a and the fixed contact points 22a. The permanent magnets (magnetic field generation means) 50 can extend the length of the arc generated at the point of the contact and separation between the movable contact points 21a and the fixed contact points 22a and, thus, can improve an arc extinction capacity (an arc interruption capacity).

[0049] Therefore, according to the present embodiment, the arc generated at the point of the contact and separation between the movable contact points 21a and the fixed contact points 22a, can be interrupted more reliably. Accordingly, it is possible to prevent loss of the reliability of the contact points (the reliability of contact and separation between the movable contact points 21a and the fixed contact points 22a).

[0050] In addition, the fixed contact points 22a and the insulating member 17 are defined by providing the wall member 2a, thus enabling to prevent the arc, which is generated at the point of the contact and separation between the movable contact points 21a and the fixed contact points 22a, from coming into contact with the insulating member 17. Therefore, it is possible to prevent adhesion of insulation gas to the fixed contact points 22a or the movable contact points 21a. Accordingly, a defect of electrical connection between the fixed contact points 22a and the movable contact points 21a can be prevented.

[0051] In the present embodiment, the arc extinction members 40 are provided at the peripheries of the fixed contact members 22 inside the respective arc extension spaces S. Therefore, it is possible to produce arc extinction gas by bringing the extending arc into contact with the inner surface of the respective arc extinction members 40 and accordingly, to further improve the arc extinction capacity (the arc interruption capacity).

[0052] In the present embodiment, the respective mov-

able contact members 21 include the first extending piece 21b that extends downward (in the direction away) from the hanging piece 16b of the armature 16, and the second extending piece 21c that extends rearward (in the direction intersectional to the first extending piece 21b: in the direction perpendicular to the first extending piece 21b) from the tip of the first extending piece 21b. The respective movable contact members 21 further include the third extending piece 21d that extends upward (in the direction away) from the tip of the second extending piece 21c, and is provided with the movable contact point 21a thereon. Therefore, each arc extension space S can be provided over each contact point without being blocked by the insulating member 17 so as to simplify the configuration of the electromagnetic relay 1. Further, since the space over the respective contact points in the electromagnetic relay 1 can be effectively used, the electromagnetic relay 1 can be reduced in size.

[0053] In the present embodiment, the openings 2c and the openings 41a are formed in the wall member 2a and the front walls 41 of the respective arc extinction members 40, through which the third extending pieces 21d provided with the movable contact points 21a can be inserted into the respective arc extension spaces S. Due to the provision of the openings 2c and the openings 41a within the areas, where the movable contact points 21a can move, it is possible to prevent the contact of the arc with the insulating member 17 and also prevent the arc introduced into the arc extension spaces S from being leaked outward. Accordingly, the arc extinction capacity (the arc interruption capacity) can be further improved. In addition, due to the openings 2c and the openings 41a, it is not necessary for the movable contact members 21 to bypass the wall member 2a and the front walls 41 of the arc extinction members 40 to prevent the movement of the movable contact points 21a from being interrupted by these wall members defining the arc extension spaces S. Accordingly, it is possible to reduce the size of the electromagnetic relay 1 in the height direction compared with the case where the openings 2c and the openings 41a are not provided in the wall member 2a and the front walls 41 of the respective arc extinction members 40.

(Second embodiment)

[0054] An electromagnetic relay 1A according to the present embodiment has the same configuration as the electromagnetic relay 1 according to the first embodiment.

[0055] That is, the electromagnetic relay 1A according to the present embodiment includes the case 2, the base 30, the electromagnetic block 10, the armature 16, the movable contact members 21 and the fixed contact members 22.

[0056] In the present embodiment, the electromagnetic relay 1A is also provided with the arc extension spaces S for extension of the arc generated at the point of contact and separation between the movable contact points 21a

and the fixed contact points 22a.

[0057] In particular, as in the case of the first embodiment, the wall member 2a and the side walls 2b are provided inside the case 2. When the base 30 to which the respective components are attached is covered with the case 2, the respective pairs of the movable contact points 21a and the fixed contact points 22a opposed to each other (each pair of the contact points coming into contact with and separating from each other) are surrounded by the wall member 2a and the side walls 2b. In the present embodiment, each space partitioned by the wall member 2a and the side walls 2b also serves as the arc extension space S. In this case, the fixed contact points 22a and the insulating member 17 are defined by the wall member 2a.

[0058] The electromagnetic relay 1A further includes the permanent magnets (magnetic field generating means) 50 that lead the arc generated at the point of the contact and separation between the movable contact points 21a and the fixed contact points 22a, into the arc extension spaces S.

[0059] Each permanent magnet (magnetic field generating means) 50 is covered with the magnetic insulation yoke 60 along the upper and both sides in the width direction.

[0060] In the present embodiment, the arc extinction member 40 is not provided inside the respective arc extension spaces S.

[0061] The present embodiment can also obtain the same effects as the first embodiment described above.

[0062] In the electromagnetic relay 1A shown in Fig. 8, the wall member 2a may be made of an insulating material that may produce arc extinction gas by contact with the arc (the same material as the arc extinction member 40 described in the first embodiment) so that the wall member 2a serves as an arc extinction member. Alternatively, the entire case 2 may be made of the same material as the arc extinction member 40 described in the first embodiment.

(Third embodiment)

[0063] An electromagnetic relay 1B according to the present embodiment has substantially the same configuration as the electromagnetic relay 1A according to the second embodiment which is not provided with the arc extinction member 40 inside the respective arc extension spaces S.

[0064] The electromagnetic relay 1B according to the present embodiment differs from the electromagnetic relay 1A according to the second embodiment mainly in that a partition wall 70 is provided to divide each arc extension space S.

[0065] In particular, also in the present embodiment, each space partitioned by the wall member 2a and the side walls 2b inside the case 2 serves as the arc extension space S. In addition, the respective pairs of the movable contact points 21a and the fixed contact points 22a op-

posed to each other (each pair of the contact points coming into contact with and separating from each other) are provided in each partitioned arc extension space S in which the partition wall 70 is provided.

[0066] The partition wall 70 in the present embodiment projects from the upper wall 2d of the case 2 toward the respective fixed contact points 22a, and vertically divides each arc extension space S into two regions in the extending direction of the arc A.

[0067] Although one partition wall 70 is provided in each arc extension space S to divide into two regions in the present embodiment, plural partition walls 70 may be provided in each arc extension space S so as to divide into more than two regions.

[0068] The present embodiment can also obtain the same effects as the first and second embodiments described above.

[0069] In the present embodiment, due to the provision of the partition wall 70 to divide each arc extension space S, the arc is allowed to further extend around the partition wall 70. Therefore, the length of the arc A can be further extended than the first and second embodiments and accordingly, the arc extinction capacity (the arc interruption capacity) can be further improved.

[0070] The improvement of the arc extinction capacity (the arc interruption capacity) contributes to increasing an interruption voltage which interrupts the arc generated between the movable contact points 21a and the fixed contact points 22a.

[0071] Further, in the present embodiment, each space partitioned by the wall member 2a and the side walls 2b provided inside the case 2 serves as the arc extension space S in which the partition wall 70 is provided. Therefore, it is possible to further extend the length of the arc A in the respective arc extension spaces S with the same size as the extinction spaces in the first and second embodiments. Accordingly, the case 2 can be reduced in size.

(Fourth embodiment)

[0072] An electromagnetic relay 1C according to the present embodiment has substantially the same configuration as the electromagnetic relay 1B according to the third embodiment which is provided with the partition wall 70 to divide each arc extension space S.

[0073] The electromagnetic relay 1C according to the present embodiment differs from the electromagnetic relay 1B according to the third embodiment mainly in that a wall surface facing the respective arc extension spaces S is provided with indented portions 73, as shown in Fig. 10.

[0074] In particular, also in the present embodiment, each space partitioned by the wall member 2a and the side walls 2b inside the case 2 serves as the arc extension space S. In addition, the respective pairs of the movable contact points 21a and the fixed contact points 22a opposed to each other (each pair of the contact points com-

ing into contact with and separating from each other) are provided in each partitioned arc extension space S in which the partition wall 70 and the indented portions 73 are provided.

[0075] The indented portions 73 are formed on the inner surface of the upper wall 2d of the case 2, which is the wall surface facing the respective arc extension spaces S. The indented portions 73 are provided in the right and left sections on the upper wall 2d of the case 2 that interpose the partition wall 70 therebetween, so that the indented portions 73 are formed along the extending direction of the arc A.

[0076] The present embodiment can also obtain the same effects as the first to third embodiments described above.

[0077] In the present embodiment, since the indented portions 73 are provided on the wall surface facing the respective arc extension spaces S, the arc extends along the indented portions 73. Therefore, the length of the arc A can be further extended than the third embodiment, and accordingly, the arc extinction capacity (the arc interruption capacity) can be further improved. In addition, the interruption voltage can also be further increased than the third embodiment.

[0078] Further, in the present embodiment, since the indented portions 73 are provided along the extending direction of the arc A, the arc A can surely be introduced into the indented portions 73, and therefore, the arc A can extend more reliably.

[0079] Although the indented portions 73, which are characteristic of the present embodiment, were applied to the electromagnetic relay of the third embodiment provided with the partition wall 70, the indented portions 73 may also be applied to the electromagnetic relays according to the first and second embodiments not provided with the partition wall 70.

(Fifth embodiment)

[0080] An electromagnetic relay 1D according to the present embodiment has substantially the same configuration as the electromagnetic relay 1A according to the second embodiment which is not provided with the arc extinction member 40 inside the respective arc extension spaces S.

[0081] The electromagnetic relay 1D according to the present embodiment differs from the electromagnetic relay 1A according to the second embodiment mainly in that a partition wall 70A, which divides each arc extension space S into arc extension spaces S1 and S2, is provided as shown in Fig. 11.

[0082] In particular, in the present embodiment, the openings 2c provided on the lower side of the wall member 2a are further elongated upward than the second embodiment, and the wall member 2a serves as the partition wall 70A. The space on the fixed contact point 22a side (on the right in Fig. 11) divided by the partition wall 70A is defined as a first arc extension space S1 and the

space on the movable contact plate 25 side (on the left in Fig. 11) divided by the partition wall 70A is defined as a second arc extension space S2. Therefore, in the present embodiment, the plural first arc extension spaces S1 corresponding to the respective pairs of the movable contact points 21a and the fixed contact points 22a are provided in the case 2, while only one second arc extension space S2 is provided and shared inside the case 2.

[0083] The present embodiment can also obtain the same effects as the first to fourth embodiments described above.

[0084] In the present embodiment, due to the provision of the partition wall 70A that divides each arc extension space S into the arc extension spaces S1 and S2, the arc is allowed to further extend around the partition wall 70A. Therefore, the length of the arc A can be further extended than the first to fourth embodiments, and accordingly, the arc extinction capacity (the arc interruption capacity) can be further improved. In addition, the interruption voltage can also be further increased than the first to fourth embodiments.

[0085] In the present embodiment, the partition wall 70A is provided to divide the respective arc extension spaces S into two regions of the arc extension spaces S1 and S2. Alternatively, for example, the partition wall 70 according to the third embodiment may be further provided in each arc extension space S1 so as to divide the respective arc extension spaces S into more than two regions.

(Sixth embodiment)

[0086] An electromagnetic relay 1E according to the present embodiment has substantially the same configuration as the electromagnetic relay 1D according to the fifth embodiment which is provided with the partition wall 70A that divides each arc extension space S into the arc extension spaces S1 and S2.

[0087] The electromagnetic relay 1E according to the present embodiment differs from the electromagnetic relay 1D according to the fifth embodiment mainly in that wall surfaces facing the respective arc extension spaces S1 and S2 are provided with the indented portions 73 as shown in Fig. 12.

[0088] In particular, also in the present embodiment, the openings 2c provided on the lower side of the wall member 2a are further elongated upward, and the wall member 2a serves as the partition wall 70A. The space on the fixed contact point 22a side divided by the partition wall 70A is defined as the first arc extension space S1, and the space on the movable contact plate 25 side divided by the partition wall 70A is defined as the second arc extension space S2. The indented portions 73 are provided in the respective first and second arc extension spaces S1 and S2.

[0089] The indented portions 73 in the present embodiment are provided on the inner surface of the upper wall 2d of the case 2, and further on the surface of a center

wall 35 of the base 30 on the movable contact plate 25 side, respectively, so that the indented portions 73 face the respective arc extension spaces S1 and S2. Each pair of the indented portions 73 is provided along the extending direction of the arc A.

[0090] The present embodiment can also obtain the same effects as the first to fifth embodiments described above.

[0091] In the present embodiment, since the indented portions 73 are provided on the wall surfaces facing the respective arc extension spaces S1 and S2, the arc can further extend along the indented portions 73. Therefore, the length of the arc A can be further extended than the fifth embodiment and accordingly, the arc extinction capacity (the arc interruption capacity) can be further improved. In addition, the interruption voltage can also be further increased than the fifth embodiment.

[0092] Moreover, in the present embodiment, since the indented portions 73 are provided along the extending direction of the arc A, the arc A can be surely introduced into the indented portions 73, and therefore, the arc A can extend more reliably.

[0093] Although the present invention has been described above by reference to the preferred embodiments, the present invention is not limited to these, and it will be apparent to those skilled in the art that various modifications and improvements can be made within the scope of the present invention.

[0094] For example, although the respective embodiments show the electromagnetic relay in which the movable contact members are attached to the armature via the insulating member, the movable contact members may be attached to the armature without providing the insulating member.

[0095] In the third to sixth embodiments, the electromagnetic relays 1B, 1C, 1D and 1E have substantially the same configuration as the electromagnetic relay 1A in which the arc extinction member is not provided in the respective arc extension spaces S. However, the electromagnetic relays 1B, 1C, 1D and 1E may be provided with the arc extinction member in the respective arc extension spaces S.

[0096] In addition, the armature, the hinge spring, and other specifications (such as shape, size and layout) may also be modified as considered appropriate.

Claims

1. An electromagnetic relay comprising:

an armature (16) that oscillates according to excitation and non-excitation of an electromagnetic block (10);

a movable contact member (21) provided with a movable contact point (21a) and attached to the armature (16) to move in association with the moving armature (16); and

a fixed contact member (22) provided with a fixed contact point (22a) with and from which the movable contact point (21a) comes into contact and separates,
 wherein the electromagnetic relay is provided with an arc extension space (S) for extension of an arc generated at a point of contact and separation between the movable contact point (21a) and the fixed contact point (22a), and a magnetic field generating means (50) is provided to introduce, into the arc extension space (S), the arc generated at the point of contact and separation between the movable contact point (21a) and the fixed contact point (22a).

2. The electromagnetic relay according to claim 1, wherein an arc extinction member (40) is provided in the arc extension space (S).

3. The electromagnetic relay according to claim 1 or 2, wherein:

the movable contact member (21) includes a first extending piece (21b) extending from the armature (16) in a direction away from the armature (16), a second extending piece (21c) extending from a tip of the first extending piece (21b) in a direction intersectional to the first extending piece (21b), and a third extending piece (21d) extending from a tip of the second extending piece (21c) in a direction away from the second extending piece (21c), and the movable contact point (21a) is provided on the third extending piece (21d).

4. The electromagnetic relay according to claim 3, wherein:

the arc extension space (S) is defined by a wall member (2a), and an opening (2c) through which the third extending piece (21d) is inserted is provided on a lower portion of the wall member (2a).

5. The electromagnetic relay according to any one of claims 1 to 4, wherein a partition wall (70) is provided to divide the arc extension space (S).

6. The electromagnetic relay according to any one of claims 1 to 5, wherein an indented portion (73) is provided on a wall surface facing the arc extension space (S).

7. The electromagnetic relay according to claim 6, wherein the indented portion (73) is provided along an extending direction of the arc.

FIG. 1

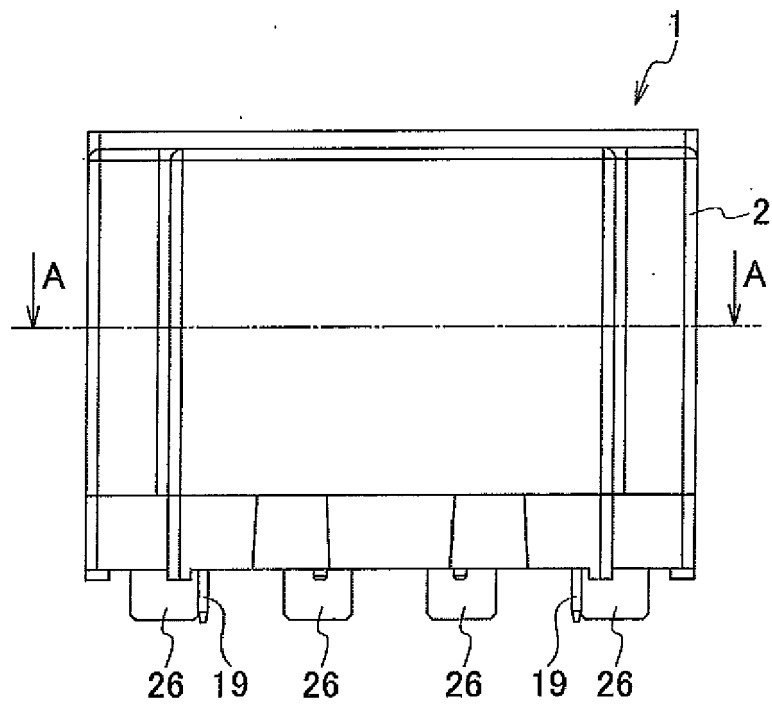


FIG. 2

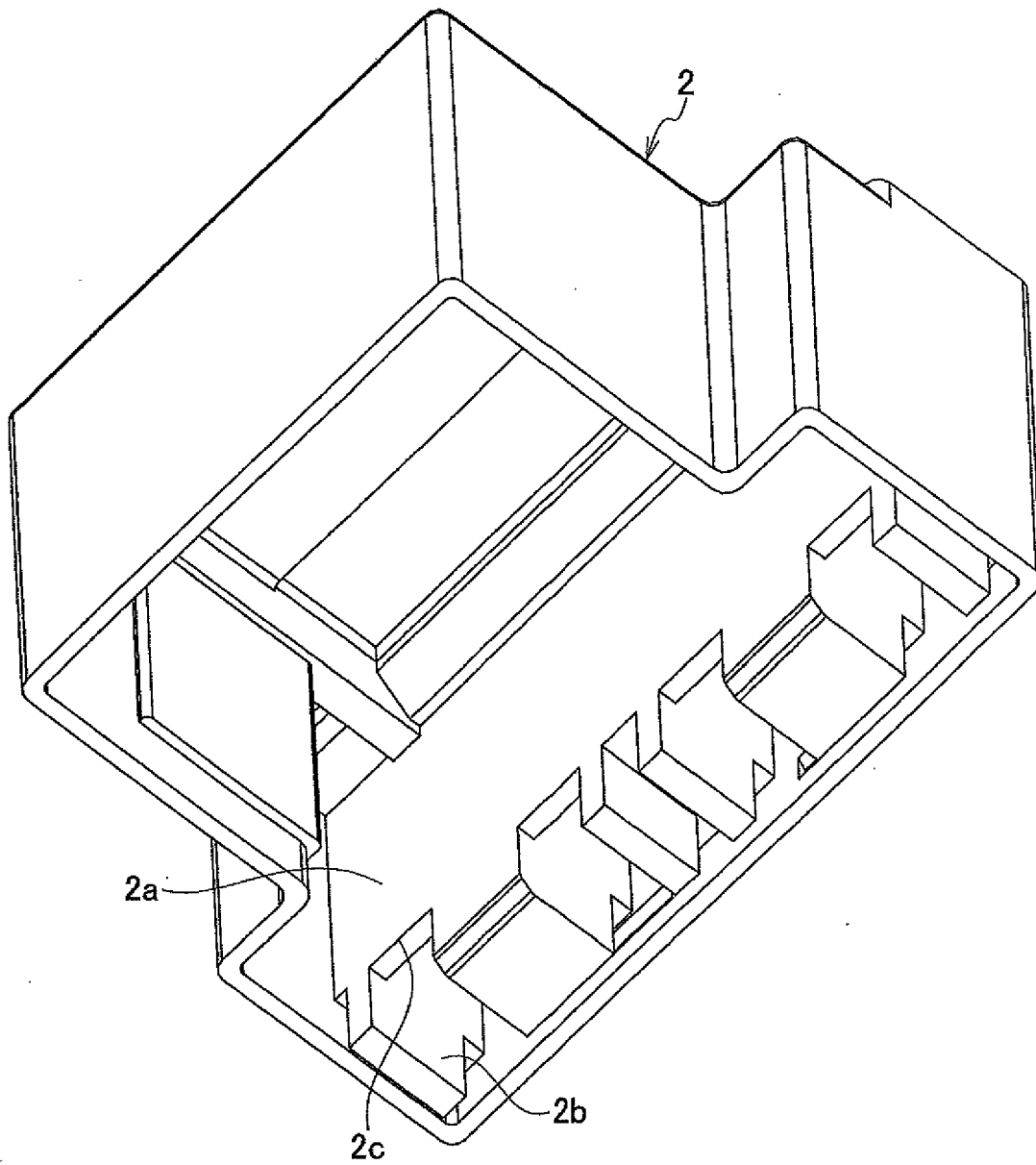


FIG. 3

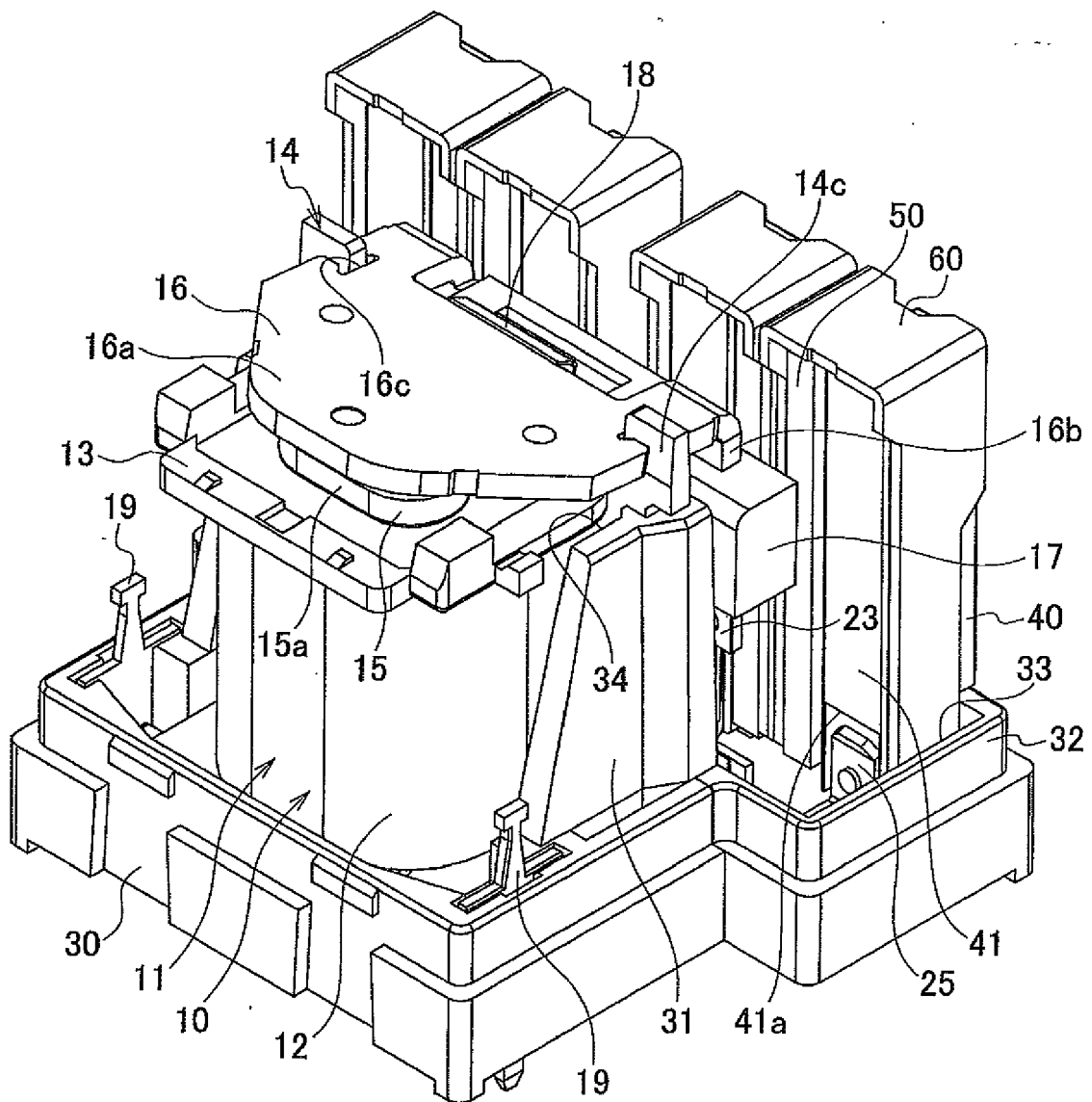


FIG. 4

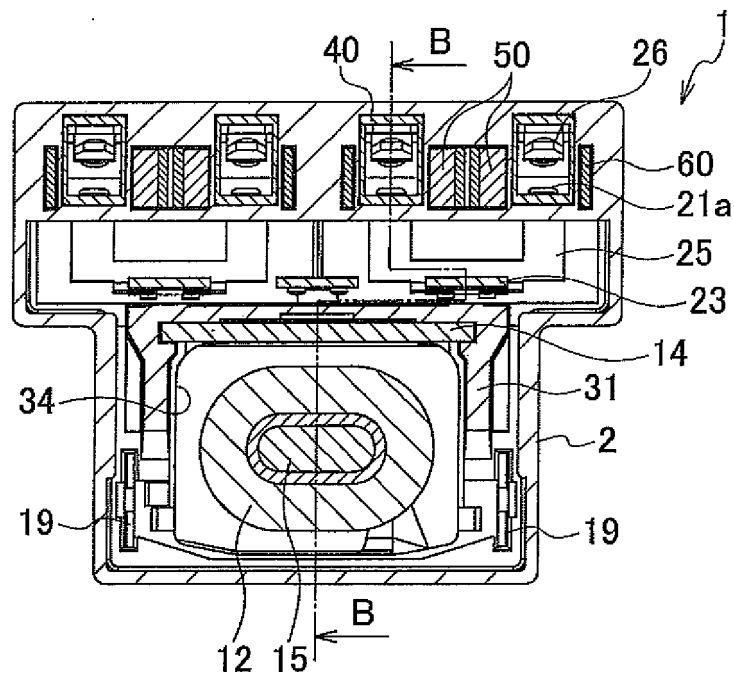


FIG. 5

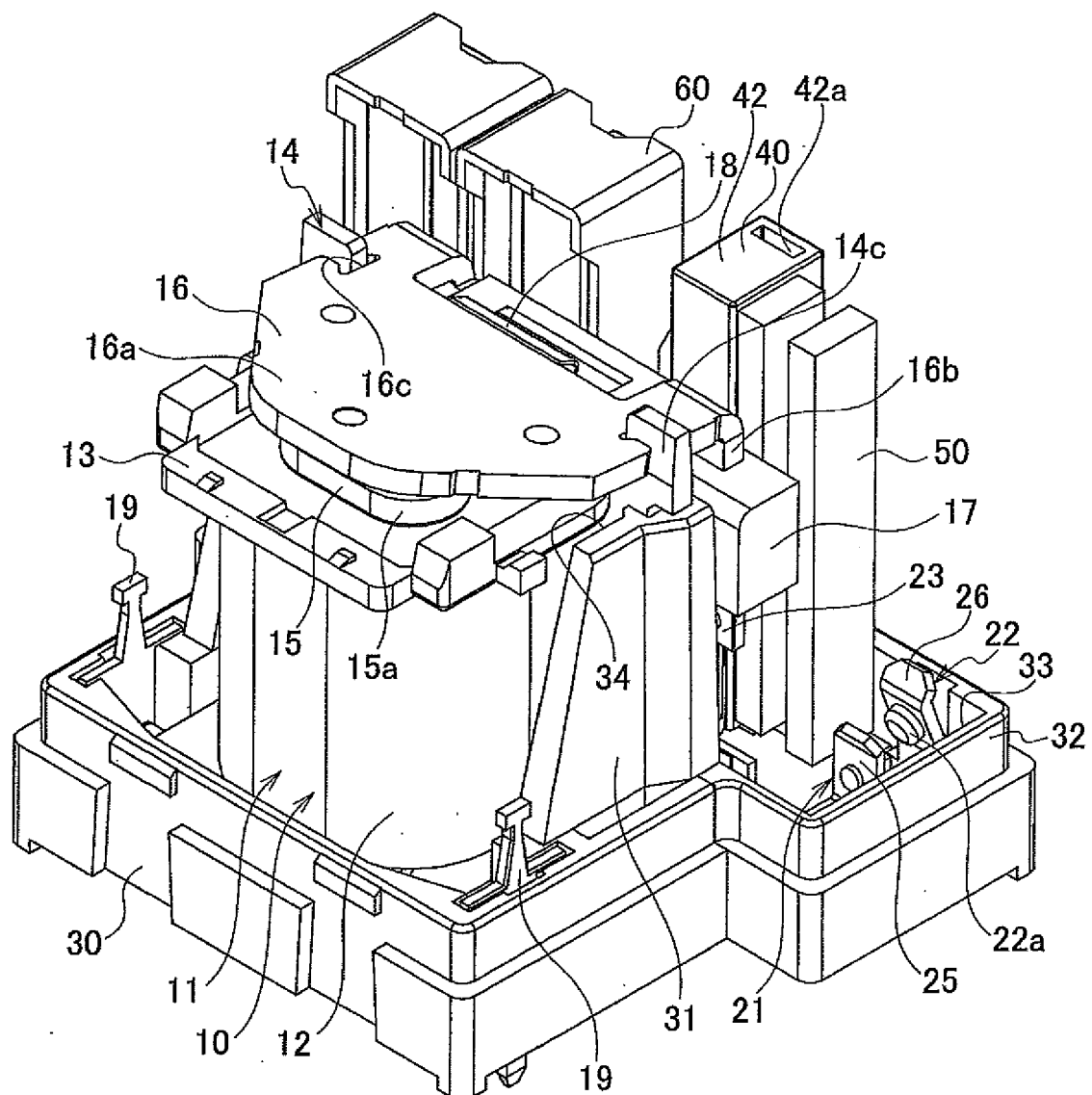


FIG. 6

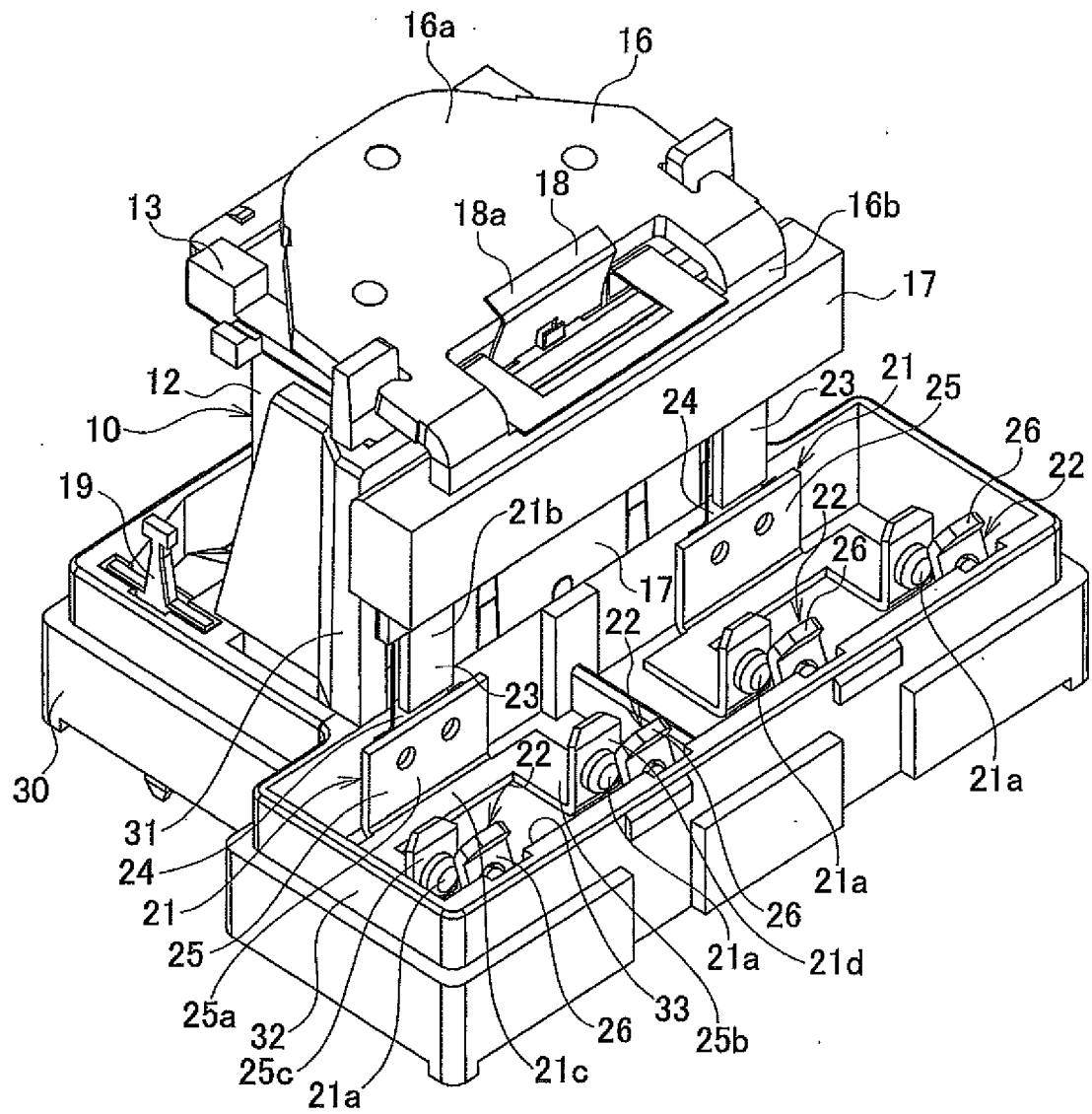


FIG. 7

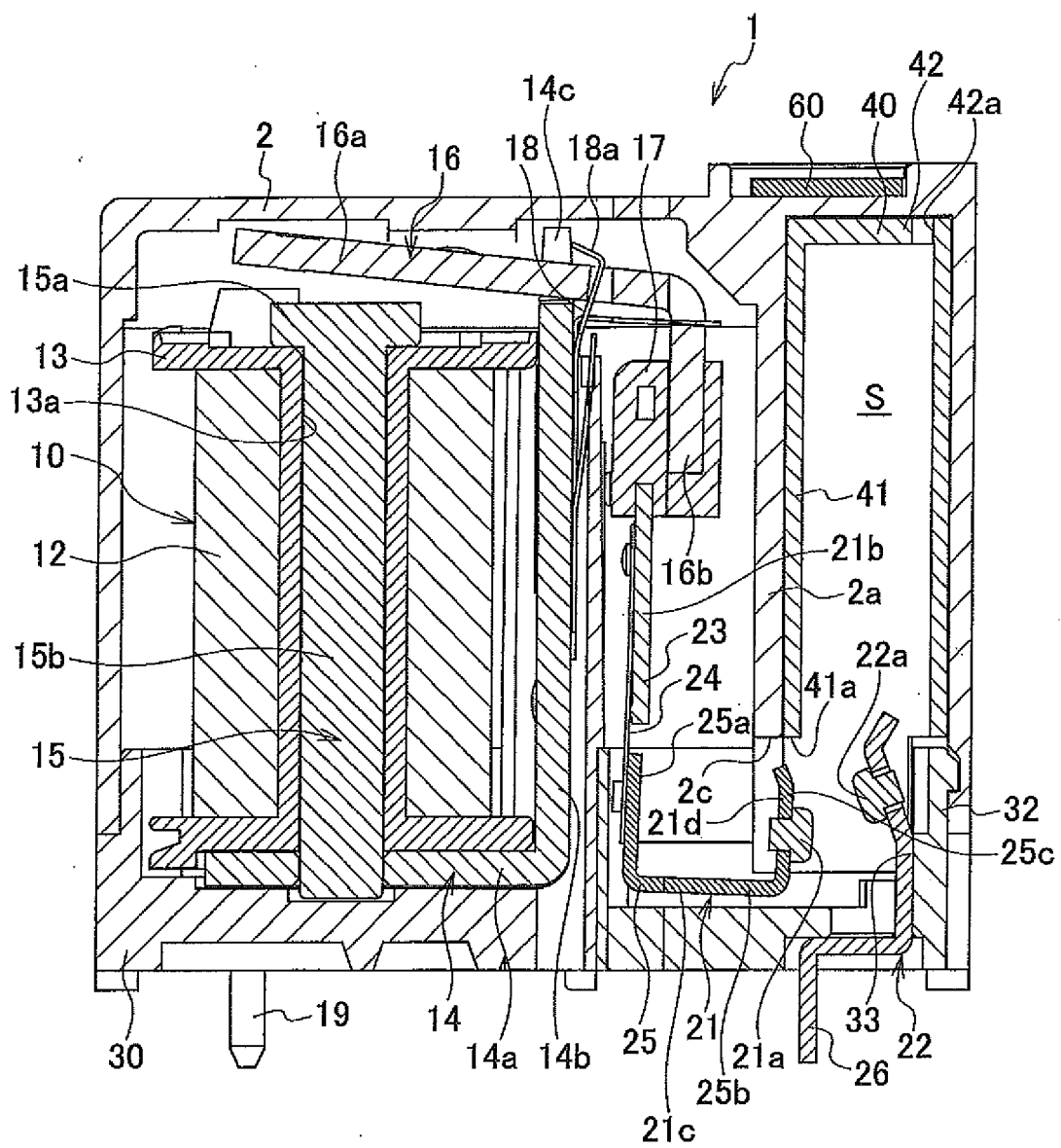


FIG. 8

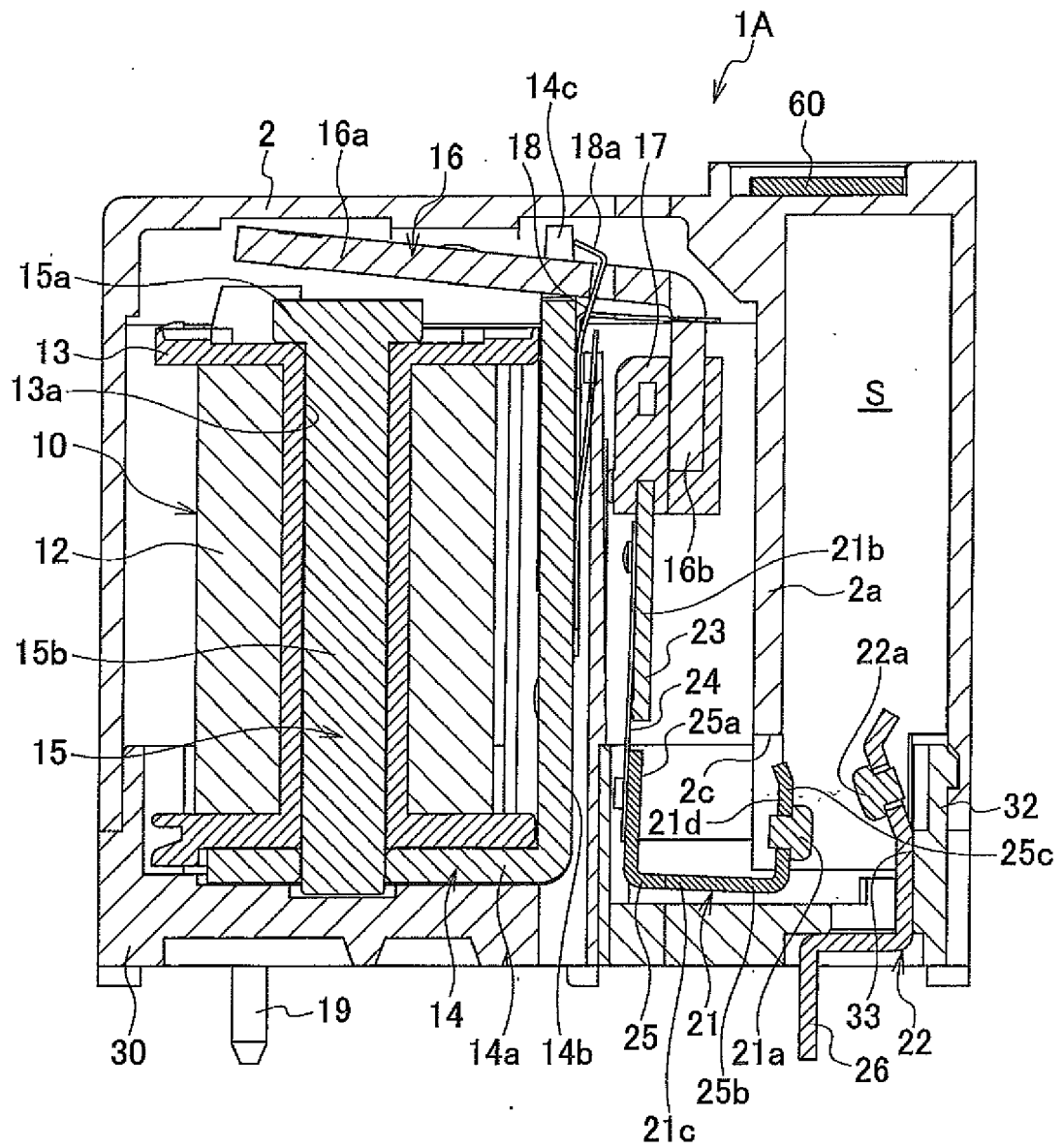


FIG. 9

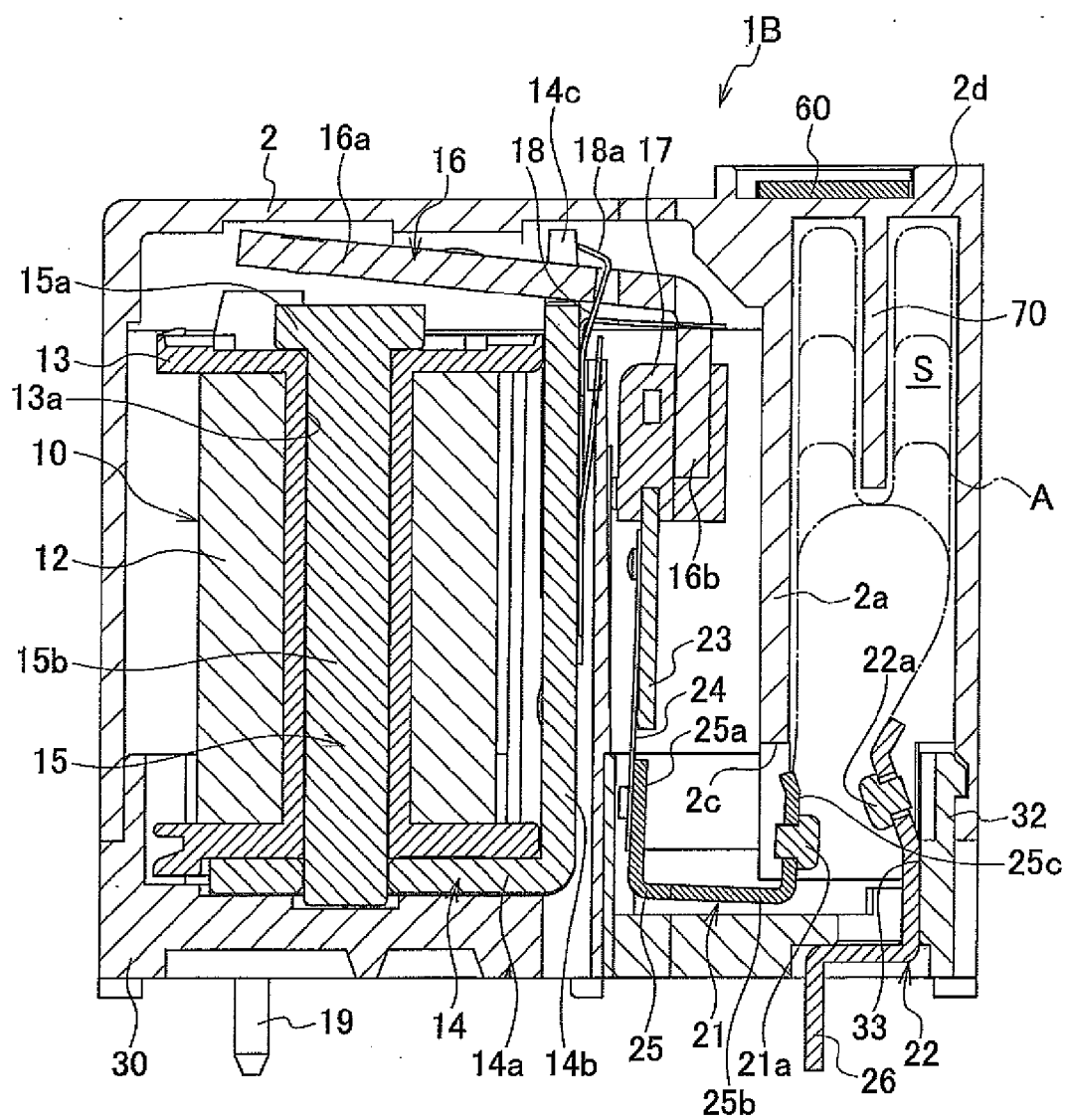


FIG. 10

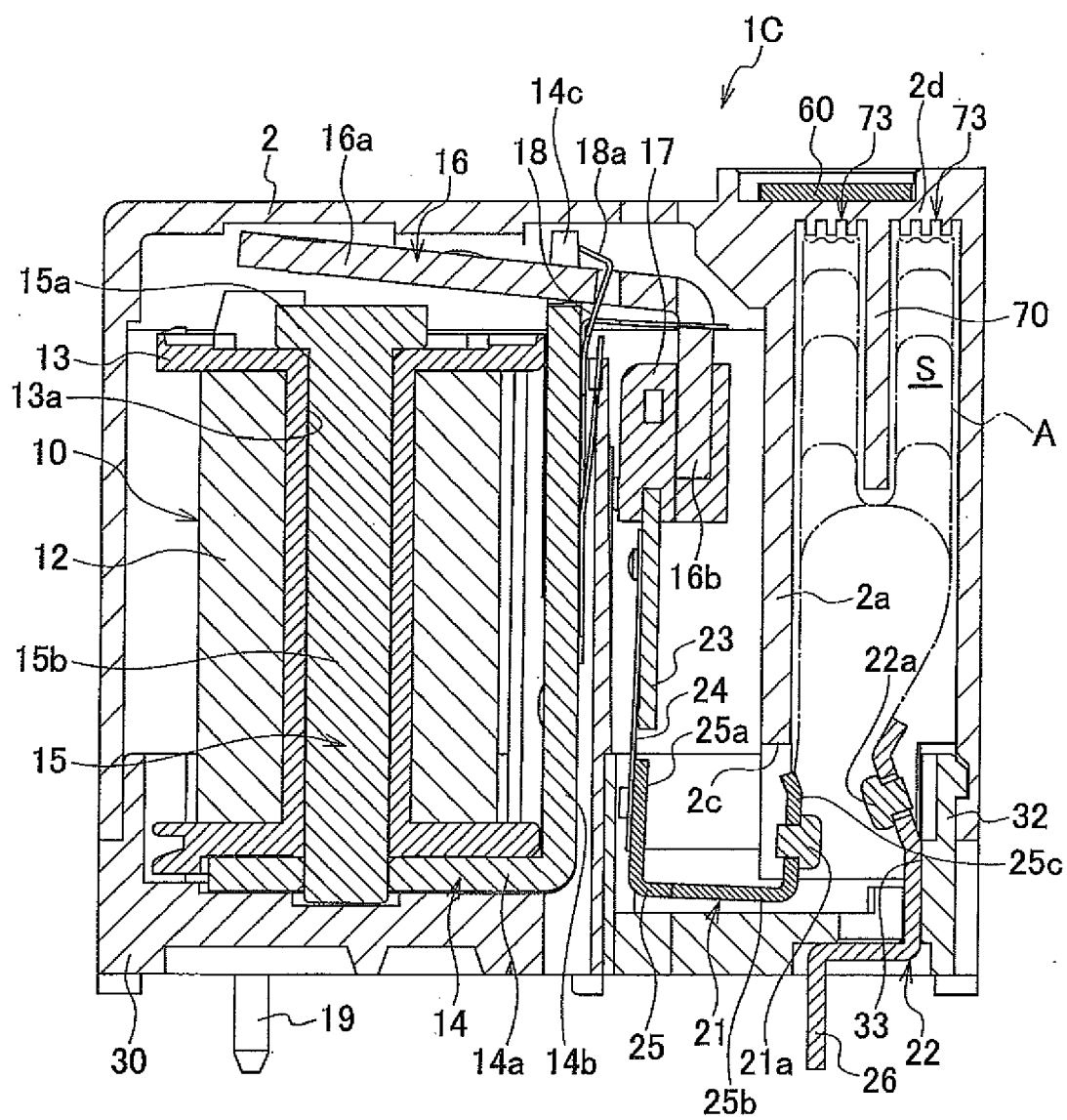


FIG. 11

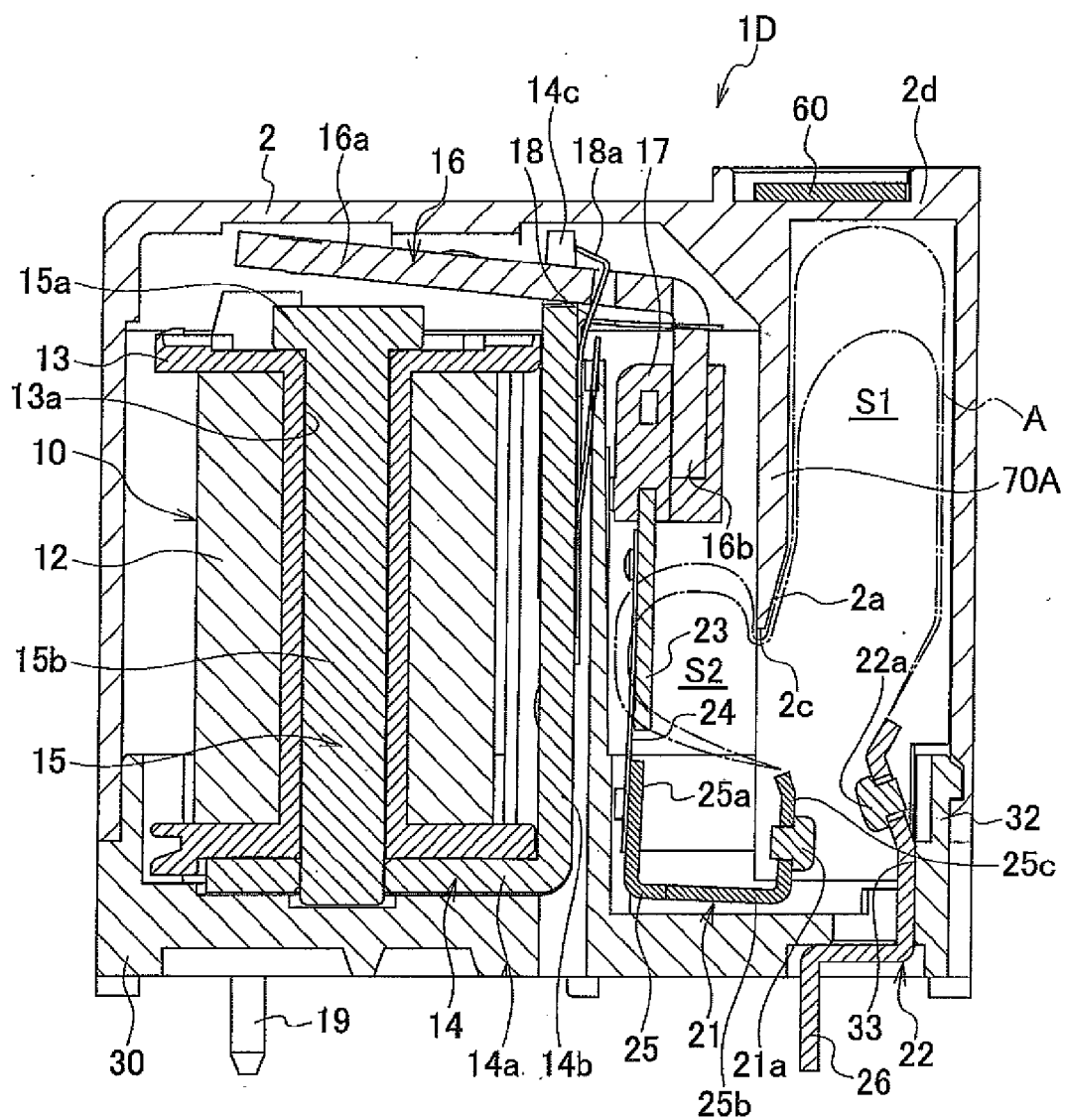
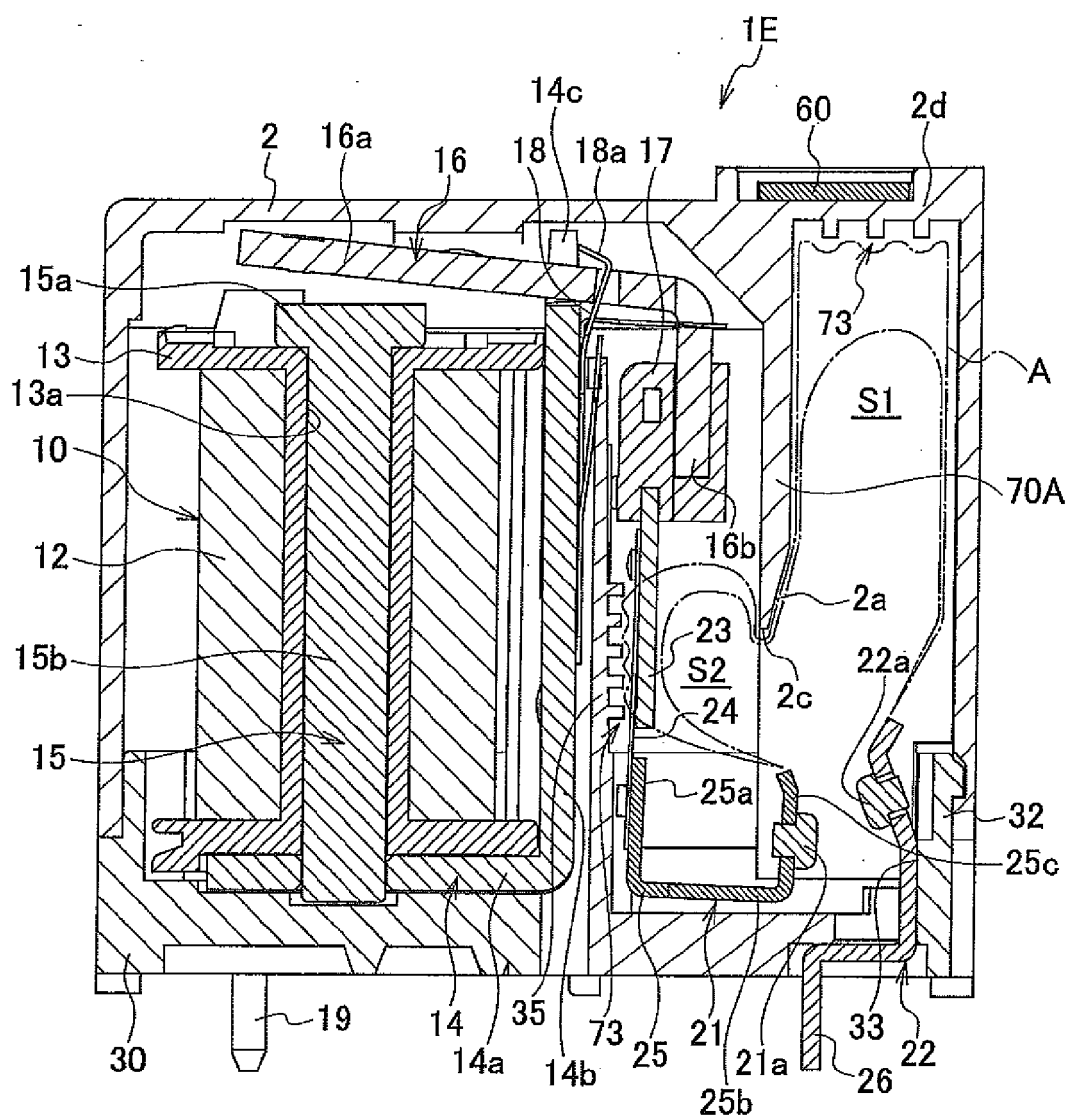


FIG. 12





EUROPEAN SEARCH REPORT

Application Number
EP 13 15 9891

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			H01H
Place of search		Date of completion of the search	Examiner
Munich		18 September 2013	Meyer, Jan
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