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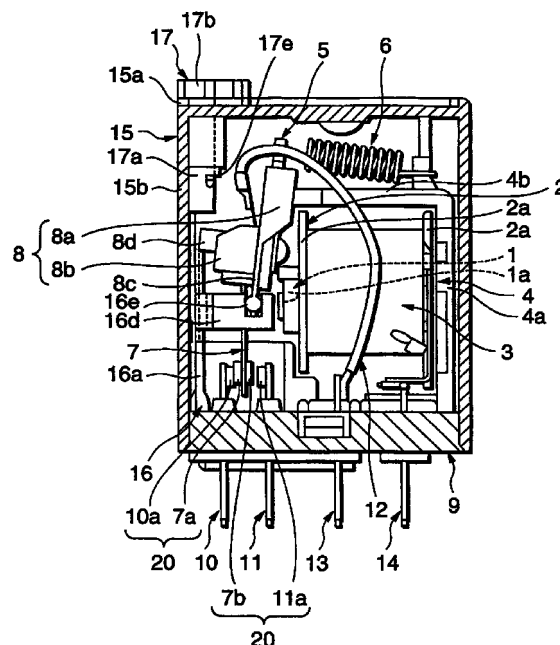
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(54) **Electromagnetic relay**

(57) In an electromagnetic relay having: an iron core 1 around which a coil 3 is wound and on which a magnetic pole portion 1a is provided; an armature 5 which is attracted to and separated from the magnetic pole portion 1a of the iron core 1 and driven; a contact point portion 20 which comes into contact with and is separated from its partner, when the armature 5 is driven; and a switch 17 in which an operation portion 17b which can be pressed so that the contact point portion 20 comes into contact with and is separated from its partner, when the armature is not driven, is extended to the direction which is intersected with the pressing direction; and a case 15 having an opposing portion 15a opposite to the operation portion 17b, the electromagnetic relay is structured such that, in at least either one of the operation portion 17b or the opposing portion 15a, the contact point portion 15c which can come into contact with the other when the operation portion 17b is not pressed, is protruded toward the other.

FIG.1



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Description

BACKGROUND OF INVENTION

Field of invention

[0001] The present invention relates to an electromagnetic relay in which a switch, which is operated so that the contact point portion is contacted with and separated from a partner portion, when an armature is not energized, is provided.

Related art

[0002] Conventionally, as this kind of electromagnetic relay, the relay structured as shown in Fig. 17 and Fig. 18 exist. This relay is structured being provided with: an iron core A; coil bobbin B; coil C; yoke D; armature E; return spring F; movable spring G; movable member H; base J; normal close side contact point terminal K; normal open side contact point terminal L; lead wire M; common terminal P; coil terminal Q; case R; display member S; and switch T.

[0003] The iron core A is formed of the magnetic material into the almost round bar-shape. The coil bobbin B is formed of the molding material such as plastics into the almost cylindrical shape having flange portions B₁ on the both ends of the winding drum portion, and the coil C is wound around the winding drum portion. Then, the iron core A is inserted into a through hole provided in the winding drum portion of the coil bobbin B and its one end portion is protruded from an opening portion of the through hole. That is, the coil C is wound around the iron core A through the coil bobbin B, and as the result, one end portion is a magnetic pole portion A₁.

[0004] The yoke D is formed of the magnetic material into the L letter shape having one side piece D₁ and the other side piece D₂, and the other end portion of the iron core A is fixed at almost the center of the one side piece D₁. This yoke D is a magnet path of the magnetic flux generated when the coil C is excited.

[0005] The armature E is formed of the magnetic material into the plate shape, and the base end portion side is rotatably supported by a leading edge portion of the other side piece D₂ of the yoke D so that the leading edge portion is oppositely positioned to the magnetic pole portion A₁.

[0006] The return spring F is a coil spring, and its one end is fixedly connected to a fixed portion D₃ provided on the base end portion of the other side piece D₂ of the yoke D, and the other end is connected to the base end portion of the armature E. This return spring F has the energizing force which becomes the returning force to the direction in which the armature E whose coil C is not excited, is separated from the magnetic pole portion A₁ of the iron core A.

[0007] The movable spring G is formed of the thin

plate spring member such as copper alloy into the plate shape, and on the both surfaces of the one end portion, the normal close side movable contact G₁ and the normal open side movable contact G₂ are respectively provided.

[0008] In the movable member H, the first member H₁ and the second member H₂ are connected by a pin(not shown), and when the one member is displaced, the other is displaced to the same direction. The first member H₁ is formed of the molding material such as plastics, and the central portion of the armature E is integrated by the integral molding. The second member H₂ is formed of the molding material such as plastics, in the same manner as the first member H₁, and the central portion of the movable, spring G is integrated by the integral molding. Accordingly, when the leading edge portion of the armature E is energized by the attraction and separation of the magnetic pole portion A₁ of the iron core A, the first member H₁ integrated with the armature E is displaced, and because the second member H₂ is displaced in the same direction together with the first member H₁, the movable spring G integrated with the second member H₂ is also energized.

[0009] The normal close side contact terminal K having the normal close side fixed contact K₁, which is opposite to the normal close side movable contact G₁, and constitutes the contact point portion U together with the normal close side movable contact G₁, the normal open side contact terminal L having the normal open side fixed contact L₁, which is opposite to the normal open side movable contact G₂, and constitutes the contact point portion U together with the normal open side movable contact G₂, common terminal P connected to the other end portion of the movable spring G by the lead wire M, and coil terminal Q connected to the coil C penetrate the base J and are fixed.

[0010] The case R is a box type having a bottom portion and a wall portion R₁ vertically provided from the bottom portion, and by being attached to the base J, it houses each of the above described parts in the inside.

[0011] The base end portion of the display member S is rotatably supported by the base J, and the extension portion S₁ is extended from the central portion. In this extension portion S₁, when the bar-like insertion portion H₄ provided on the first member H₁ of the movable member H is inserted, a thin engagement portion S₂ which is engaged with the inserted insertion portion H₄, is provided. Further, in the display member S, the display portion S₃ to display the contact and separation condition of the contact point portion U through the penetration portion R₃ provided in the bottom portion of the case R, is provided on the leading edge portion.

[0012] The switch T is composed of the bar-like penetration portion T₁ which penetrates the case R from its leading edge, and the operation portion T₂ which is extended in the direction perpendicular to the penetrating direction from the base end portion of the

penetration portion T_1 and opposite to the base portion of the case R. In other words, the operation portion T_2 is opposite to the opposing portion R_2 which is the base portion of the case R. In this switch T, the leading edge of the penetration portion T_1 is in contact with the extension portion H_3 extended from the second member H_2 of the movable member H, by its self weight.

[0013] Next, the operation of this apparatus will be described below. When the current flows to the coil C and the magnetic flux penetrating the iron core A is generated, the armature E is energized so that the closed loop is formed, when its other end portion is attracted to the magnetic pole portion A_1 , and is rotated against the energizing force of the return spring F. As described above, when the armature E is energized, the movable spring G is also driven as described above, and the normal close side movable contact G_1 of the movable spring G is separated from the normal close side fixed contact K_1 of the normal close side contact terminal K, and next to that, the normal open side movable contact G_2 of the movable spring G comes into contact with the normal open side fixed contact L_2 of the normal open side contact terminal L.

[0014] As described above, when the armature E is energized, because the first member H_1 in which the central portion of the armature E is integrated, is also driven, the display member S in which the extension portion S_1 , on which the engagement portion S_2 engaged with the insertion portion H_4 of the first member H_1 is provided, is extended, is also driven so that it is rotated around the portion supported by the base J, as the fulcrum of the rotation, and the display portion S_3 of the leading edge portion of the display member S is visually confirmed through the penetration portion R_1 of the case R, and the contact and separation condition of the contact point portion U is displayed.

[0015] When the current flow to the coil C stops, the magnetic flux penetrating the iron core A is eliminated, and by being forced by the return spring F, the armature E is released from the magnetic pole portion A_1 of the iron core A, and is rotated in the reverse direction to the case where the current flows to the coil C, and returns to the condition before the current flow. According to this, when the armature E returns, the movable spring G is driven being interlocked with the returning armature E, and the normal open side movable contact G_2 of the movable spring G is separated from the normal open side fixed contact L_2 of the normal open side contact terminal L, and next to this, the normal close side movable contact G_1 of the movable spring G comes into contact with the normal close side fixed contact K_1 of the normal close side contact terminal K.

[0016] As described above, when the armature E returns, the first member H_1 and display member S are driven in the reverse direction to the above description, and the display portion S_3 of the leading edge portion of the display member S is not visually confirmed through the penetration R_1 of the case R, and the contact and

separation condition of the contact point portion U is not displayed.

[0017] Further, this apparatus is, in the case where the coil C is not excited and the armature E is not energized, when the operation portion T_2 of the switch T is pressed in the penetration direction of the penetration portion T_1 , the leading edge of the penetration portion T_1 of the switch T presses and drives the extension portion H_3 of the second member H_2 of the movable member H, and the movable spring G integrated with the second member H_2 is also energized, and in the same manner as in the case where the armature E is energized, the normal close side movable contact of the movable spring G is separated from the normal close side fixed contact of the normal close side contact terminal K, and succeedingly, the normal open side movable contact of the movable spring G comes into contact with the normal open side fixed contact of the normal open side contact terminal L. This operation is performed at the continuity test, for example.

[0018] In the above described conventional electromagnetic relay, because the penetration portion is in contact with the extension portion H_3 of the second member H_2 of the movable member H, by its self weight, in the case where the armature E is energized, when the first member H_1 with which the central portion of the armature E is integrated, is driven, the switch T is driven through the second member H_2 constituting the movable member H, also with the first member H_1 . In short, the switch T always moves along the movement of the armature E. Accordingly, when the switch T is positioned on the wall portion R_1 of the case R being in contact with the wall portion R_1 , the switch T causes the friction with the wall portion R_1 of the case R, and the frictional powder generated by the friction invades in the vicinity of the contact point portion U, thereby, there is a possibility that the contact point portion U causes the contact trouble.

SUMMARY OF INVENTION

[0019] The present invention is attained by having an eye to the foregoing points, and the object of the present invention is to provide an electromagnetic relay in which the contact point portion does not cause the contact trouble.

[0020] In order to solve the above described problems, the invention of the first aspect or the present invention is structured as follows. In an electromagnetic relay having: an iron core around which a coil is wound and on which a magnetic pole portion is provided;

an armature attracted to and separated from the magnetic pole portion of the iron core to be driven; a contact point portion coming into contact with and separated from its mating portion, when the armature is energized; a switch having an operation portion extended to a

direction which is intersected with the pressing direction, said operation portion is pressed to come the contact point portion into contact with its mating portion and to separate the contact point portion from its mating portion, when the armature is not energized; and

a case having an opposing portion opposite to the operation portion; and

a contact portion provided in at least one of the operation portion and the opposing portion, the contact portion protruded toward the other, the contact portion coming into contact with the other when the operation portion is not pressed.

[0021] The invention of the second aspect according to the present invention is, in the invention of the first aspect of the present invention, structured as follows: the operation portion has a spring portion having the flexibility along the pressing direction.

[0022] The invention of the third aspect according to the present invention is, in the invention of the second aspect of the present invention, structured as follows: the spring portion is defined by partially decreasing the dimension of the thickness of the operation portion, and the contact portion is provided in the opposing portion such that the contact portion is opposite to the spring portion, and the spring portion is formed so that the spring portion is flexibility deformed within the range of the dimension of the thickness.

[0023] The invention of the fourth aspect according to the present invention is, in the invention of the second aspect of the present invention, structured as follows: the other portion, with which the contact portion comes into contact, has an engagement portion to engage with the contact portion.

[0024] The invention of the fifth aspect according to the present invention is, in the invention of the first aspect of the present invention, structured as follows: the contact portion is provided in the opposing portion, and when the operation portion is displaced in a direction perpendicular to the pressing direction, the contact condition is released, and the operation portion is provided with the inclined portion in the contact portion with which the contact portion comes into contact.

[0025] The invention of the sixth aspect according to the present invention is, in the invention of the first aspect of the present invention, structured as follows: a display member has a display portion to carry out a display operation to display the contact and separation condition of the contact point portion through a penetration portion provided in the case.

[0026] The invention of the seventh aspect according to the present invention is, in the invention of the sixth aspect of the present invention, the display member has a deformable soft portion.

[0027] The invention the eighth aspect according to the present invention is, in the invention of the seventh aspect of the present invention, the soft portion is metal-

lic.

[0028] The invention of the ninth aspect according to the present invention is, in the invention of the first aspect of the present invention, structured as follows: a display member having a display portion to carry out a display operation to display the contact and separation condition of the contact point portion through a penetration portion provided in the case;

a movable member moving in response to the contact and separation condition of the contact point portion, the movable member having an insertion portion;

an engagement portion to engage with the inserted insertion portion which is provided on the display member, and

wherein the display member is provided with a regulation portion to regulate the slipping out of the inserted insertion portion in the engagement portion.

[0029] The invention of the tenth aspect of the present invention is structured as follows. In an electromagnetic relay having:

an iron core around which a coil is wound and on which a magnetic pole portion is provided;

an armature attracted to and separated from the magnetic pole portion of the iron core to be energized;

a contact point portion coming into contact with and separated from its mating portion, when the armature is energized;

a switch for forcedly switching the contact portion into connect/disconnect condition when the armature is not energized; and a case having an opposing portion opposite to the switch.

BRIEF DESCRIPTION OF DRAWINGS

[0030]

Fig. 1 is a front sectional view of the first embodiment of the present invention.

Fig. 2 is a side sectional view of the first embodiment of the present invention.

Fig. 3 is a plan view of the first embodiment of the present invention.

Fig. 4 is a front sectional view when a switch is operated, of the first embodiment of the present invention.

Fig. 5 is a side sectional view when the switch is operated, of the first embodiment of the present invention.

Fig. 6 is a plan view when the switch is operated, of the first embodiment of the present invention.

Fig. 7 is a front view showing the condition that an insertion portion of a movable member is inserted

into an engagement portion of a display member, of the first embodiment of the present invention.

Fig. 8 is a partial front sectional view showing a spring portion of the switch, of the first embodiment of the present invention.

Fig. 9 is a partial front sectional view showing the condition that the spring portion of the switch is pressed, of the first embodiment of the present invention.

Fig. 10 is a partial front sectional view showing the spring portion of the switch of the second embodiment of the present invention.

Fig. 11 is a partial front sectional view showing the spring portion of the switch of the third embodiment of the present invention.

Fig. 12 is a partial front sectional view showing the spring portion of the switch of the fourth embodiment of the present invention.

Fig. 13 is a plan view in the case where the spring portion is not provided on the operation portion of the switch.

Fig. 14 is a partial plan sectional view of Fig. 13.

Fig. 15 is a partial front view showing the condition that a contact portion provided on an operation portion on which the spring portion is not provided, comes into contact with an opposing portion.

Fig. 16 is a partial front sectional view showing the condition that an engagement portion is provided on the spring portion of the operation portion.

Fig. 17 is a front sectional view of the conventional example.

Fig. 18 is a plan view of the conventional example.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0031] Referring to Fig. 1 through Fig. 9, the first embodiment of the present invention will be described below. This electromagnetic relay is structured being provided with: an iron core 1; coil bobbin 2; coil 3; yoke 4; armature 5; return spring 6; movable spring 7; movable member 8; base 9; normal close side contact terminal 10; normal open side contact terminal 11; lead wire 12; common terminal 13; coil terminal 14; case 15; display member 16; and switch 17.

[0032] The iron core 1 is formed of the magnetic material into the almost round bar shape. The coil bobbin 2 is formed of the molding material such as plastics into the almost cylindrical shape having colors 2a on both ends of the winding drum portion, and the coil 3 is wound around the winding drum portion. Then, the iron core 1 is inserted into a through hole provided in the coil bobbin 2 winding drum portion, and its one end portion protrudes from the opening portion of the through hole. That is, the coil 3 is wound around the iron core 1 through the coil bobbin 2, and as the result, one end portion of the iron core 1, is formed as the magnetic pole portion 1a.

[0033] The yoke 4 is formed of the magnetic material into the L letter shape having one side piece 4a and the other side piece 4b, and the other end portion of the iron core 1 is fixed at almost the center of the one side piece 4a. This yoke 4 becomes a magnetic path of the magnetic flux generated when the coil 3 is excited.

[0034] The armature 5 is formed of the magnetic material into the plate shape, and the base end portion side is rotatably supported by the leading edge portion of the other side piece 4b of the yoke 4 so that its leading edge portion is oppositely positioned to the magnetic pole portion 1a of the iron core 1.

[0035] The return spring 6 is a coil spring, and its one end is connected to the fixed portion provided on the base end portion of the other side piece 4b of the yoke 4 and fixed, and the other end is connected to the base end portion of the armature 5. This return spring 6 has the return force toward the direction in which the armature 5 whose coil 3 is not excited, is separated from the magnetic pole portion 1a of the iron core 1.

[0036] The movable spring 8 is formed of the thin plate spring material such as copper alloy into the plate shape, and on the both surfaces of the one end portion, the normal close side movable contact 7a and the normal open side movable contact 7b are respectively provided.

[0037] In the movable member 8, the first member 8a and the second member 8b are connected by a pin (not shown), and when the one member is displaced, the other member is also displaced in the same direction. The first member 8a is formed of the molding material such as plastic, and the central portion of the armature 5 is integrated by the integral molding. The second member 8b is formed of the molding material such as plastic, in the same manner as the first member 8a, and the central portion of the movable spring 7 is integrated by the integral molding. Accordingly, when the leading edge portion of the armature 5 is attracted to and separated from the magnetic pole portion 1a of the iron core 1 and driven, because the first member 8a integrated with the armature 5 is displaced, and the second member 8b is also displaced in the same direction together with the first member 8a, the movable spring 7 integrated with the second member 8b is also driven.

[0038] The normal close side contact terminal 10 having the normal close side fixed contact 10a, which is opposite to the normal close side movable contact 7a, and constitutes the contact point portion 20 together with the normal close side movable contact 7a, the normal open side contact terminal 11 having the normal open side fixed contact 11a, which is opposite to the normal open side movable contact 7b, and constitutes the contact point portion 20 together with the normal open side movable contact 7b, common terminal 13 connected to the other end portion of the movable spring 7 by the lead wire 12, and coil terminal 14 connected to the coil 3 penetrate the base 9 and are fixed.

[0039] The case 15 is a box type having a bottom

portion, which is an opposing portion 15a, which will be described below, and a wall portion 15b vertically provided from the bottom portion, and by being attached to the base 9, it houses each of the above described parts in the inside.

[0040] The display member 16 is integrally molded so that the soft portion 16c formed of bendable and deformable metallic plate, together with the first display piece 16a and the second display piece 16b both of which are formed of resin material, is positioned at the intermediate position between the both display pieces 16a and 16b. The first display piece 16a is positioned at the base end side of the display member 16, and is rotatably supported by the base 9, and the extension portion 16d is extended from the central portion.

[0041] In this extension portion 16d, as shown in Fig. 7, a groove type engagement portion 16e to engage with the insertion portion 8c having the leading edge portion whose cross section is round, and extended from the first member 8a of the movable member 8, is provided. In details, this engagement portion 16e protrudes the convex stripe type regulation portion 16f to regulate the insertion portion 8c which is inserted from the side portion and engaged, from the slipping out from the opening portion in the direction almost perpendicular to the insertion direction, that is, in the reverse direction to the extension direction of the insertion portion 8c, from both side opening edges toward the inside.

[0042] The second display piece 16b is positioned on the leading edge side of the display member 16, and the display portion 16g to display the contact and separation condition of the contact point portion 20, through the penetration portion 15d provided in the bottom portion of the case 15, is provided on the leading edge portion.

[0043] The switch 17 is composed of the bar-like penetration portion 17a which penetrates the case 15 from its leading edge, and the operation portion 17b which is extended in the direction perpendicular to the penetrating direction from the base end portion of the penetration portion 17a and opposite to the base portion of the case 15. In other words, the operation portion 17b is opposite to the opposing portion 15a which is the base portion of the case 15.

[0044] This operation portion 17b is composed of a constant thickness portion 17c which is almost elliptical on the plan view together with the penetration portion 17a, and has the constant thickness, and a spring portion 17d extended in the reverse direction to the extension direction of the constant thickness portion 17c. This spring portion 17d is formed in such a manner that, as shown in Fig. 8, the dimension of the thickness of the extension portion in the reverse direction is thinner than the constant thickness portion 17c, and is made locally thinner. Further, in the spring portion 17d, the leading edge in the extension direction is formed narrower, and the opposite surface which is opposite to the opposing portion 15a of the case 15 is positioned on the same

plane as the constant thickness portion 17c.

[0045] On this opposing portion 15a which is opposite to the operation portion 17b, that is, on the bottom portion of the case 15, the protrusion-like contact portion 15c whose leading edge in the protrusion direction is round, is protruded toward the spring portion 17d. Accordingly, when the operation portion 17d is not pressed toward the penetration direction of the penetration portion 17a, the spring portion 17d is in contact with the contact portion 15c provided in the case 15, and a gap corresponding to the dimension of the height of the contact portion 15c is formed between the opposing surface and the opposing portion 15a of the case 15.

[0046] Next, the operation of this apparatus will be described below. When the current flows to the coil 3 and the magnetic flux penetrating the iron core 1 is generated, the armature 5 is energized so that the closed loop is formed, when its other end portion is attracted to the magnetic pole portion 1a of the iron core 1, and is rotated against the energizing force of the return spring 6. As described above, when the armature 5 is energized, the movable spring 7 is also driven as described above, and the normal close side movable contact 7a of the movable spring 7 is separated from the normal close side fixed contact 10a of the normal close side contact terminal 10, and next to that, the normal open side movable contact 7b of the movable spring 7 comes into contact with the normal open side fixed contact 11a of the normal open side contact terminal 11.

[0047] As described above, when the armature 5 is energized, because the first member 8a with which the central portion of the armature 5 is integrated, is also driven, the display member 16 in which the extension portion 16d, on which the engagement portion 16e engaged with the insertion portion 8c of the first member 8a is provided, is extended, is also driven so that it is rotated around the portion supported by the base 9, as the fulcrum of the rotation, and the display portion 16g of the leading edge portion of the display member 16 is visually confirmed through the penetration portion 15d of the case 15, and the contact and separation condition of the contact point portion 20 is displayed.

[0048] When the current flow to the coil 3 stops, the magnetic flux penetrating the iron core 1 is eliminated, and by being forced by the return spring 6, the armature 5 is released from the magnetic pole portion 1a of the iron core 1, and is rotated in the reverse direction to the case where the current flows to the coil 3, and returns to the condition before the current flow. According to this, when the armature 5 returns, the movable spring 7 is driven being interlocked with the returning armature 5, and the normal open side movable contact 7b of the movable spring 7 is separated from the normal open side fixed contact 11a of the normal open side contact terminal 11, and next to this, the normal close side movable contact 7a of the movable spring 7 comes into contact with the normal close side fixed contact 10a of the normal close side contact terminal 10.

[0049] As described above, when the armature 5 returns, the first member 8a and display member 16 are driven in the reverse direction to the above description, and the display portion 16g of the leading edge portion of the display member 16 is not visually confirmed through the penetration portion 15d of the case 15, and the contact and separation condition of the contact point portion 20 is not displayed.

[0050] Further, this apparatus is, as shown in Fig. 1 to Fig. 3, in the case where the coil 3 is not excited and the armature 5 is not energized, when the constant thickness portion 17c of the operation portion 17b of the switch 17 is pressed in the penetration direction of the penetration portion 17a, the leading edge of the penetration portion 17a of the switch 17 comes into contact with the extension portion 8d extended from the second member 8b of the movable member 8, and presses and drives it, and the movable spring 7 integrated with the second member 8b is also driven, and in the same manner as in the case where the armature 5 is energized, the normal close side movable contact 7a of the movable spring 7 is separated from the normal close side fixed contact 10a of the normal close side contact terminal 10, and succeedingly, the normal open side movable contact 7b of the movable spring 7 comes into contact with the normal open side fixed contact 11a of the normal open side contact terminal 11.

[0051] As described above, when the constant thickness portion 17c is pressed, and the spring portion 17d comes into contact with the contact portion 15c, the spring portion 17d is elastically deformed, as shown in Fig. 9, however, because the elastic deformation is conducted within the range of the dimension of the thickness, the leading edge portion in the extension direction is not protruded from the reverse surface on the reverse side to the opposing surface.

[0052] Further, under the condition that the spring portion 17d is pressed, when the switch 17 is rotationally operated by using the penetration portion 17a as the rotation axis, because the operation portion 17b is displaced in the direction perpendicular to the pressing direction, the contact condition of the operation portion 17b with the contact portion 15c is released. By this rotational operation, an engage protrusion 17e provided on the switch 17 is engaged with the engaged portion provided on the inside direction of the wall portion 15b of the case 15, and as shown in Fig. 4 to Fig. 6, the contact release condition of the operation portion 17b with the contact portion 15c is maintained. At this time, the following condition is maintained, that is, the movable contact 7b is brought into contact with an normal open side fixed contact 11a. This condition is used at continuity test in the case where a plurality of electric magnetic relays are electrically connected, when one relay is tested, it is necessary to maintain the other relays in the connecting condition.

[0053] In such the electromagnetic relay, when the contact portion 15c protrudingly provided on the oppos-

ing portion 15a comes into contact with the operation portion 17b, because it is regulated that the operation portion 17b displaces toward the opposing portion 15a, when pressing is not conducted, the switch 17 itself does not displace in the pressing direction, therefore, even when the switch 17 is located in contact with the wall portion 15b of the case 15 along the pressing direction, the friction is not caused between the switch 17 and the wall portion 15b of the case 15 with which the switch 17 is located in contact, and the friction powder is not generated accompanied by the friction, thereby, the contact point portion 20 does not cause the contact trouble by the friction powder. Namely, the operation portion 17d urges the switch 17 upwardly so that the switch is maintained normally in the condition that the gap is defined between the switch 17 and the armature 5 except at the continuity test.

[0054] Further, because the spring portion 17d having the elasticity along the pressing direction, returns to the condition before the pressing, when the pressing is released during the pressing, it is not necessary to manually operate so that the spring portion 17d returns to that condition.

[0055] Further, because the spring portion 17d has the elasticity along the pressing direction, the pressing operation itself becomes easy.

[0056] Further, even when the spring portion 17d which elastically deforms within the range of the dimension of the thickness of the operation portion 17b, is elastically deformed by being brought into contact with the contact portion 15c, because it is not locally protruded from the operation portion 17d to the thickness direction, the finger does not erroneously contact with it, and there is no mis-operation.

[0057] Further, generally, the protruded portion is easily broken when the excessive weight is loaded, however, because the spring portion 17d is not locally protruded from the operation portion 17b to the thickness direction, the breakage hardly occurs.

[0058] Further, when the deformable soft portion 16c is appropriately deformed, the display motion can be adjusted so that the display motion to display the contact and separation condition of the contact point portion 20 is carried out through the penetration portion 15d provided in the case 15.

[0059] Further, because the soft portion 16c is made of the metallic material which has the larger strength than the molding material such as plastic, even when deformation are conducted many times for the adjustment, there is no deterioration from the deformed portion, thereby, the life of the soft portion 16c can be made long.

[0060] Further, because the display member 16 regulates the slipping-out of the insertion portion 8c inserted into engagement portion 16b by the regulation portion 16f, the engagement portion 16b can surely engage with the insertion portion 8c, thereby, the assembling operation becomes easy.

[0061] Next, referring to Fig. 10, the second embodiment of the present invention will be described below. Incidentally, the member having practically the same function as the first embodiment is denoted by the same numerals and signs, and only the different part from the first embodiment will be described. The present embodiment is basically the same as the first embodiment, and in the spring portion 17d, the leading edge portion in its extension direction is bent toward the direction separating from the opposing portion 15a of the case 15, and the inclined portion 17f having the curvature is provided on the contact portion with which the contact portion 15c is brought into contact. Incidentally, this inclined portion 17f may not have the curvature.

[0062] In such the electromagnetic relay, in addition to the effect of the first embodiment, the operation portion 17b in which the inclined portion 17f is provided on the contact portion with which the contact portion 15c is brought into contact, can be smoothly displaced under the condition that it is brought into contact with the contact portion 15c, when the operation portion 17b is displaced in the direction perpendicular to the pressing direction so that the contact condition with the contact portion 15c is released, thereby, the release operation of the contact condition of the operation portion 17b with the contact portion 15c becomes easy.

[0063] Next, referring to Fig. 11, the third embodiment of the present invention will be described below. Incidentally, the member having practically the same function as the first embodiment is denoted by the same numerals and signs, and only the different part from the first embodiment will be described. In the first embodiment, the contact portion 15c is protruded on the opposing portion 15a of the case 15, however, in the present embodiment, the contact portion 15c is structured such that it is protruded on the leading edge in the extension direction of the spring portion 17d of the operation portion 17b.

[0064] In such the electromagnetic relay, the same effects as the first embodiment can be obtained.

[0065] Next, referring to Fig. 12, the fourth embodiment of the present invention will be described below. Incidentally, the member having practically the same function as the third embodiment is denoted by the same numerals and signs, and only the different part from the third embodiment will be described. The present embodiment is basically the same as the third embodiment, however, the opposing portion 15a is structured such that an engage portion 15e whose cross section is almost semi-circular concave portion which is engaged with the contact portion 15c is provided.

[0066] In such the electromagnetic relay, when the engage portion 15e provided on the other side which is brought into contact with the contact portion 15c, is engaged with the contact portion 15c, the contact condition is stabilized, therefore, the effects of the first embodiment in which there is no contact trouble of the

contact point portion 20 by the friction powder, can be stably obtained.

[0067] Further, in the same manner as the third embodiment, it is not necessary to manually operate so that the spring portion 17d returns, and the pressing operation itself becomes easy, and there is no mis-operation, the spring portion 17d is hardly broken, and can be adjusted so that the display motion to display the contact and separation condition of the contact point portion 20 is conducted, and the life of the soft portion 16c can be made long, and the assembling operation becomes easy.

[0068] Incidentally, in the first through the fourth embodiments, the spring portion 17d having the elasticity along the pressing direction is provided, however, as shown in Fig. 13 and Fig. 14, and further as shown in Fig. 15, even when the spring portion 17d is not provided, it is regulated by the contact portion 15c that operation portion 17b is displaced toward the opposing portion 15a, therefore, when there is no pressing, the switch 17 itself is not displaced to the pressing direction, and accordingly, the effect that the contact point portion 20 does not cause the contact trouble by the friction powder, can be attained. However, as shown in Fig. 13 and Fig. 14, and further in Fig. 15, when the spring portion 17d is not provided in the operation portion 17b, the pressing operation is conducted while the rotational operation is being conducted.

[0069] Further, in the fourth embodiment, the contact portion 15c is provided on the spring portion 17d of the operation portion 17b, and the engagement portion 15e is provided on the opposing portion of the case 15, however, as shown in Fig. 16, even when the contact portion 15c is provided on the opposing portion 15a of the case 15, and the engagement portion 15e is provided on the spring portion 17d of the operation portion 17b, because, when the engagement portion 15e is engaged with the contact portion 15c, the contact condition is stabilized, the same effect can be attained.

[0070] Further, in the first through the fourth embodiments, the member from which the friction powder is not generated even when it is located in contact with the penetration portion 17a of the switch 17, is the wall portion 15b of the case 15, however, it is not limited to the wall portion 15b of the case 15.

[0071] Furthermore, in the first through the fourth embodiments the switch 17 is located at one corner of the bottom portion. However, the position of the switch 17 is not limited by these embodiments. It is applicable to locate the switch 17 at the other corner under a relay mounting condition.

[0072] Further, the present embodiment follows alternative contact type relay. The present invention is not limited by this relay type. it is applicable for normal-close contact type or normal-open contact type contact.

[0073] Furthermore, this invention is also applicable for so called "mono-stable or bi-stable" type

[0074] In the invention of the first aspect, because,

when the contact portion protruded on at least either one of the operation portion or the opposing portion comes into contact with the other, it is regulated that the operation portion is displaced toward the opposing portion, when there is no pressing, because the switch itself is not displaced in the pressing direction, even when the switch is located in contact with the other member along the pressing direction, the friction does not occur between the switch and the other members which are located in contact with, and the friction powder is not generated accompanied by the friction, thereby, the contact point portion does not cause the contact trouble by the friction powder.

[0075] In the invention of the second aspect, in addition to the effect of the invention of the first aspect, because the spring portion having the elasticity along the pressing direction returns to the condition before the pressing, when the pressing is released during the pressing, it is not necessary to conduct the manual operation for returning.

[0076] In the invention of the third aspect, in addition to the effect of the invention of the second aspect, even when the spring portion which is elastically deformed within the range of the dimension of the thickness of the operation portion is elastically deformed by being contacted with the contact portion, because it is not locally protruded from the operation portion to the thickness direction, thereby, the finger does not erroneously touch to it, and the mis-operation is not caused.

[0077] In the invention of the fourth aspect, when the engagement portion provided on the other member with which the contact portion comes into contact, is engaged with the contact portion, the contact condition is stabilized, and the effect of the invention according to the first aspect in which the contact point portion does not cause the contact trouble by the friction powder, can be stably attained.

[0078] In the invention of the fifth aspect, in addition to the effect of the invention according to the first aspect, when the operation portion in which the inclined portion is provided on the contact portion with which the contact portion comes into contact, is displaced in the direction perpendicular to the pressing direction so that the contact condition with the contact portion is released, because the operation portion can be smoothly displaced under the condition that it is in contact with the contact portion, the release operation of the contact condition of the operation portion with the contact portion becomes easy.

[0079] In the invention of the sixth aspect, in addition to the effect of the invention according to the first aspect, when the deformable soft portion is appropriately deformed, the display motion can be adjusted so that the display motion to display the contact and separation condition of the contact point portion is conducted through the penetration portion provided in the case.

[0080] In the invention of the seventh aspect, in addition to the effect of the invention according to the

sixth aspect, because the soft portion is made of the metallic material whose strength is higher than the molding material such as plastics, even when it is deformed many times for the adjustment, the deterioration does not occur from the deformed portion, and the life can be made longer.

[0081] In the invention of the eighth aspect, in addition to the effect of the invention according to the first aspect, because the display member regulates the slipping out of the insertion portion inserted into the engagement portion by the regulation portion, the engagement portion can surely engage with the insertion portion, thereby, the assembly operation becomes easy.

[0082] In the conventional relay, in the case where the electromagnet is energized, when the armature is driven, the manual operation lever is falling downward. Under this condition, if an external force is applied to the lever to rotate the lever, the lever is undesirably locked. According to the present invention, the lever is always urged upwardly. Under this condition, the projection extended from a side surface of the lever is communicated with the key groove so that the lever does not rotate so as to avoid the undesirable lock.

[0083] In an electromagnetic relay having: an iron core 1 around which a coil 3 is wound and on which a magnetic pole portion 1a is provided; an armature 5 which is attracted to and separated from the magnetic pole portion 1a of the iron core 1 and driven; a contact point portion 20 which comes into contact with and is separated from its partner, when the armature 5 is driven; and a switch 17 in which an operation portion 17b which can be pressed so that the contact point portion 20 comes into contact with and is separated from its partner, when the armature is not driven, is extended to the direction which is intersected with the pressing direction; and a case 15 having an opposing portion 15a opposite to the operation portion 17b, the electromagnetic relay is structured such that, in at least either one of the operation portion 17b or the opposing portion 15a, the contact portion 15c which can come into contact with the other when the operation portion 17b is not pressed, is protruded toward the other.

Claims

1. An electromagnetic relay comprising:

an iron core around which a coil is wound and on which a magnetic pole portion is provided;
an armature attracted to and separated from the magnetic pole portion of the iron core to be driven;
a contact point portion having a mating portion coming into contact therewith or separated from each other when the armature is energized;
a switch having a penetration portion and an

operation portion extended from one end of said penetration portion to define a substantially right angle therebetween, the operation portion manually pressed to come the contact point portion into contact with its mating portion or to separate the contact point portion from its mating portion, when the armature is not energized; and

a case having an opposing portion opposite to the operation portion; and

a contact portion provided in at least one of the operation portion and the opposing portion, the contact portion protruded toward the other, the contact portion coming into contact with the other when the operation portion is not pressed.

2. The electromagnetic relay according to Claim 1 or 11, wherein the operation portion has a spring portion having the flexibility along the axis of the penetration portion .
3. The electromagnetic relay according to Claim 2, wherein the spring portion is defined by partially decreasing the dimension of the thickness of the operation portion, and the contact portion is provided in the opposing portion such that the contact portion is opposite to the spring portion, and the spring portion is formed so that the spring portion is flexibility deformed within the range of the dimension of the thickness.
4. The electromagnetic relay according to Claim 2, wherein the other portion, with which the contact portion comes into contact, has an engagement portion to engage with the contact portion.
5. The electromagnetic relay according to Claim 1 or 11, wherein the contact portion is provided in the opposing portion, and when the operation portion is displaced in a direction perpendicular to an axis of the penetration portion, the contact condition is released, and the operation portion is provided with the inclined portion in the contact portion with which the contact portion comes into contact.
6. The electromagnetic relay according to Claim 1 or 10 further comprising;

a display member having a display portion to carry out a display operation to display the contact and separation condition of the contact point portion through a penetration portion provided in the case.
7. The electromagnetic relay as claimed in claim 6, wherein the display member has a deformable soft portion.

8. The electromagnetic relay according to Claim 6, wherein the soft portion is metallic.

9. The electromagnetic relay according to Claim 1 or 10 further comprising:

a display member having a display portion to carry out a display operation to display the contact and separation condition of the contact point portion through a penetration portion provided in the case;

a movable member moving in response to the contact and separation condition of the contact point portion, the movable member having an insertion portion;

an engagement portion to engage with the inserted insertion portion which is provided on the display member, and

wherein the display member is provided with a regulation portion to regulate the slipping out of the inserted insertion portion in the engagement portion.

10. An electromagnetic relay comprising:

an iron core around which a coil is wound and on which a magnetic pole portion is provided;

an armature attracted to and separated from the magnetic pole portion of the iron core to be driven;

a contact point portion coming into contact with and separated from its mating portion, when the armature is energized;

a switch for forcedly switching the contact portion into one of temporary and permanently connect/disconnect condition when the armature is not energized; and

a case having an opposing portion opposite to the switch.

11. An electromagnetic relay as claimed in claim 10, wherein the switch includes a penetration portion and an operation portion extended from one end of said penetration portion to define a substantially right angle therebetween, said operation portion manually pressed to come the common contact into contact with said normal open contact and to separate the common contact from said normal close contact, when the armature is not energized, and

a contact portion is provided in at least one of the operation portion and the opposing portion, the contact portion is protruded toward the other, the contact portion comes into contact with the other when the operation portion is not pressed.

FIG.1

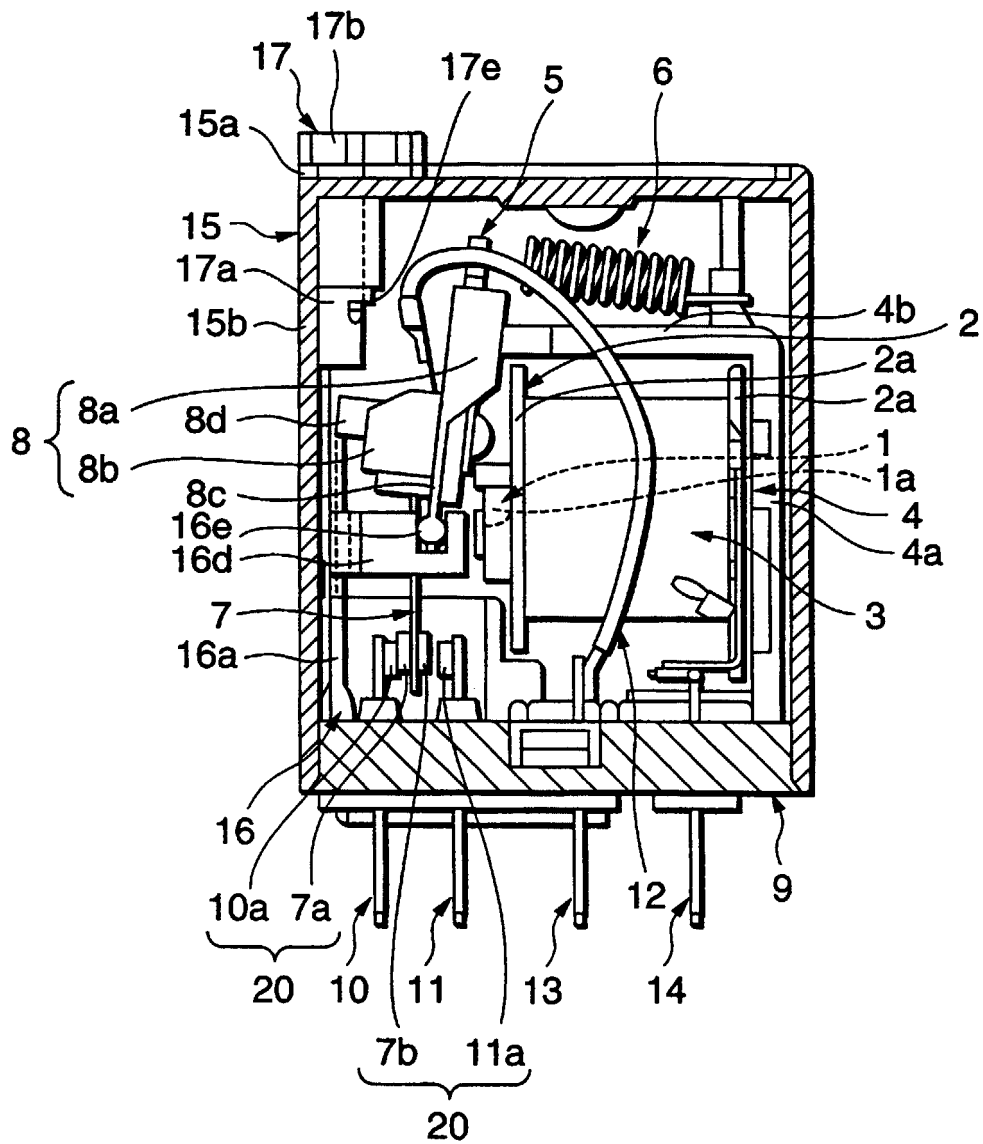


FIG.2

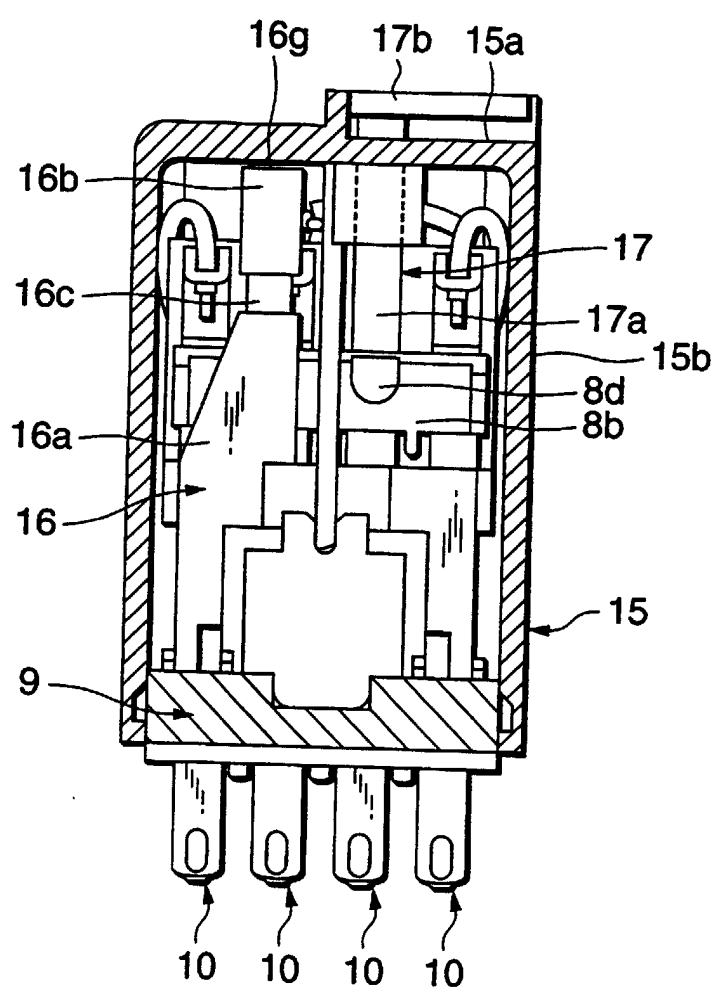


FIG.3

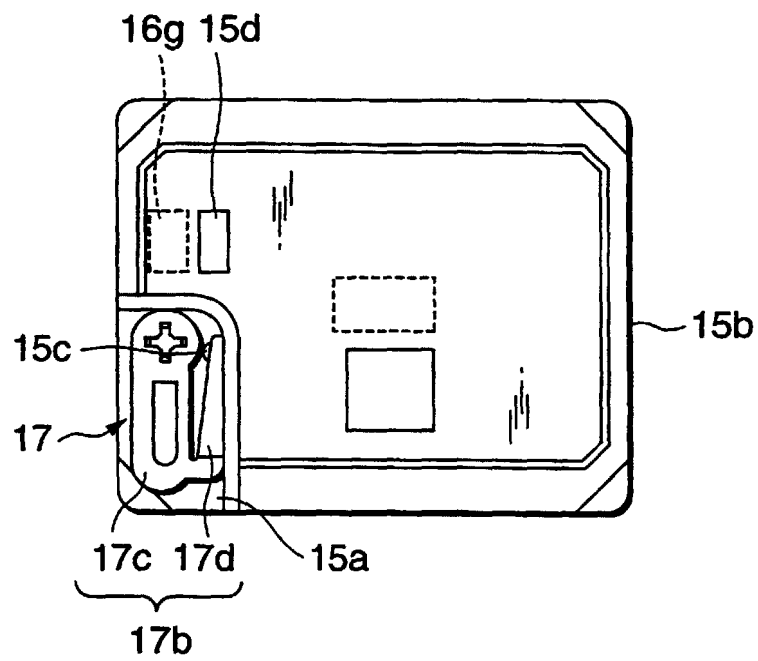


FIG.4

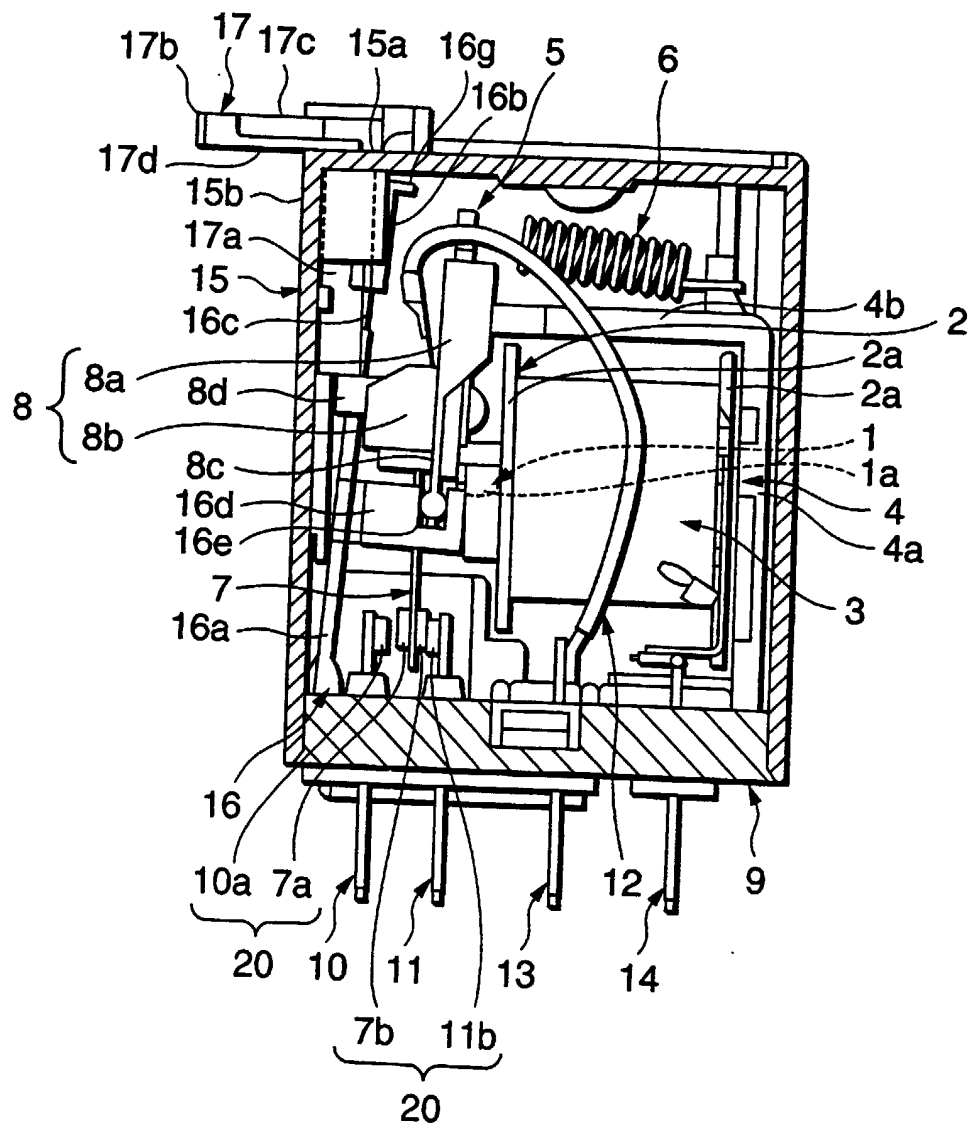


FIG.5

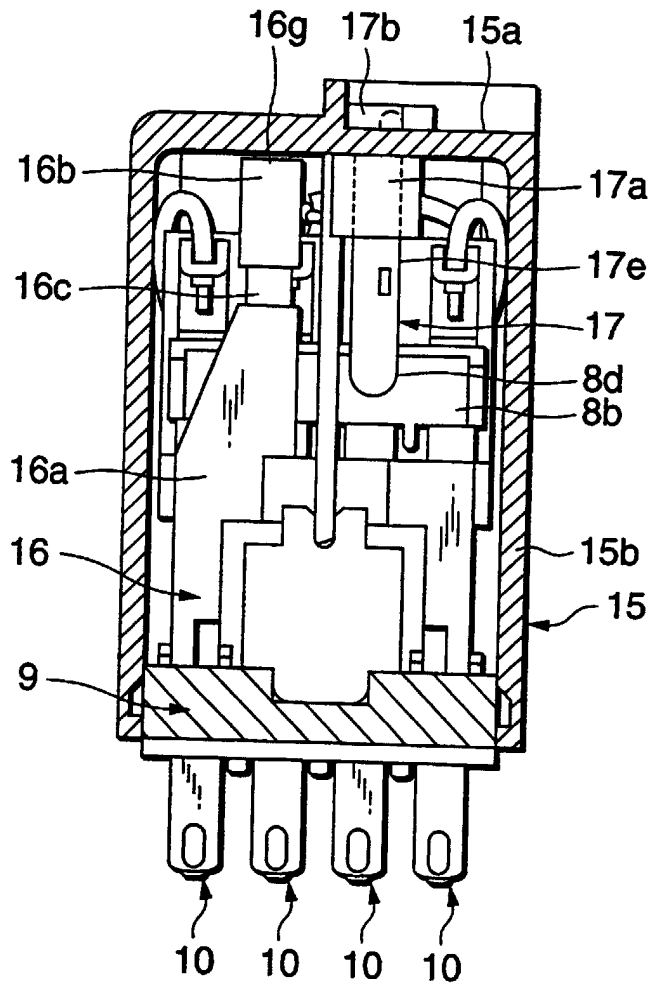


FIG.6

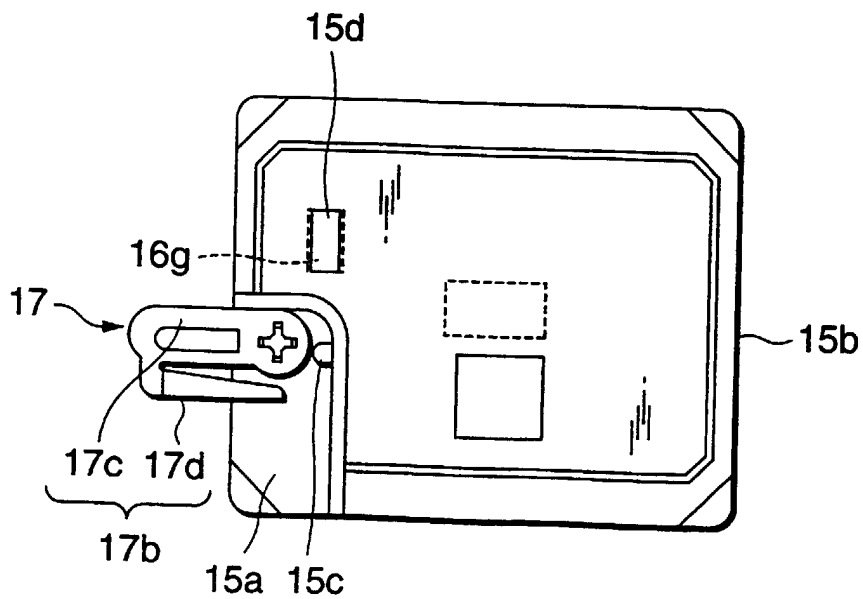


FIG.7

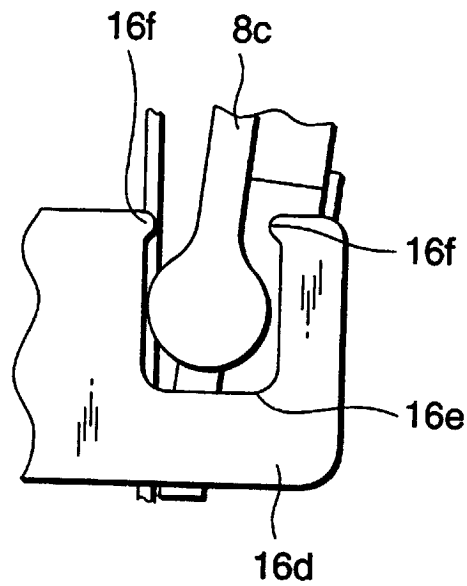


FIG.8

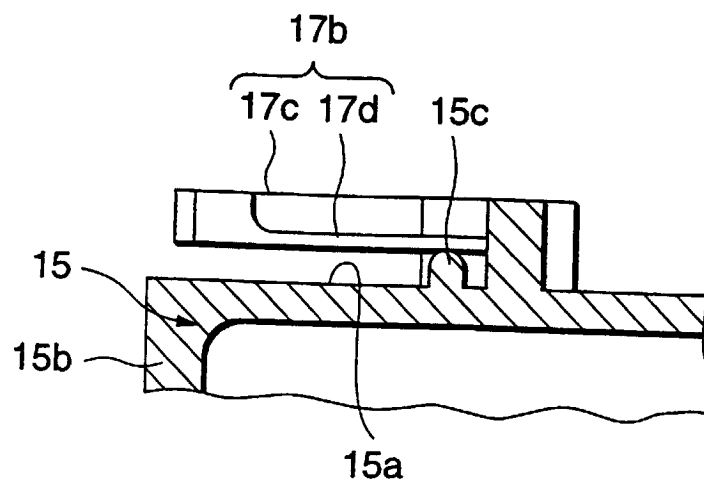


FIG.9

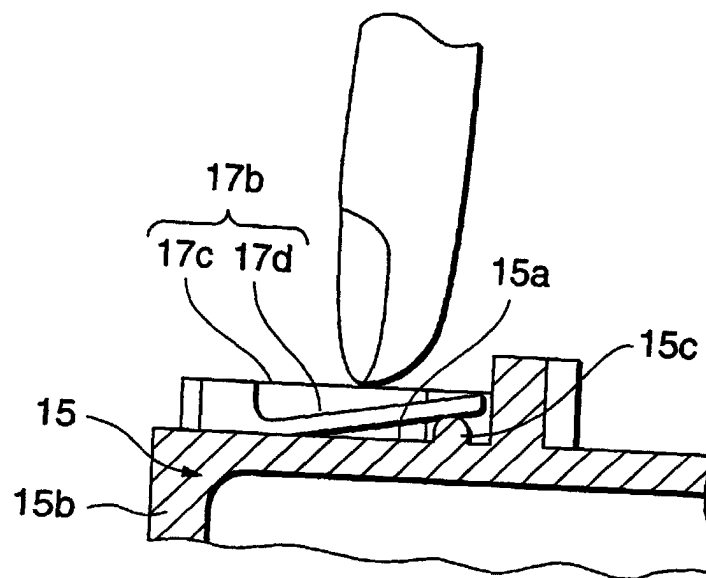


FIG.10

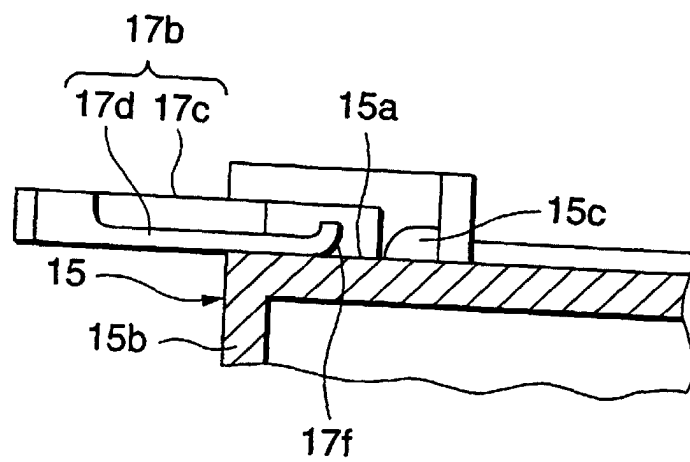


FIG.11

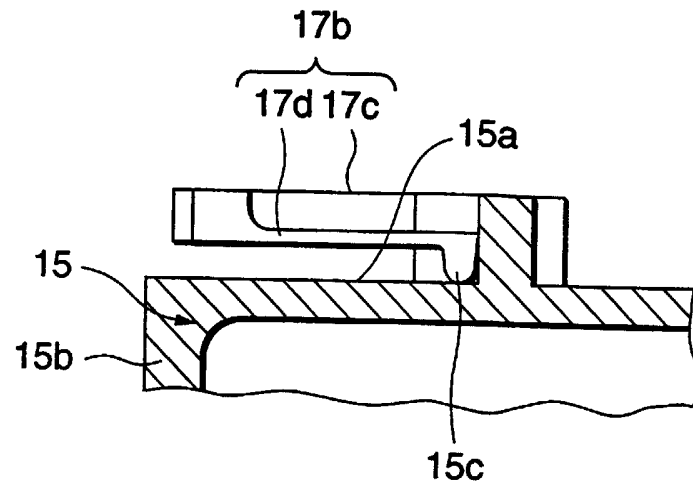


FIG.12

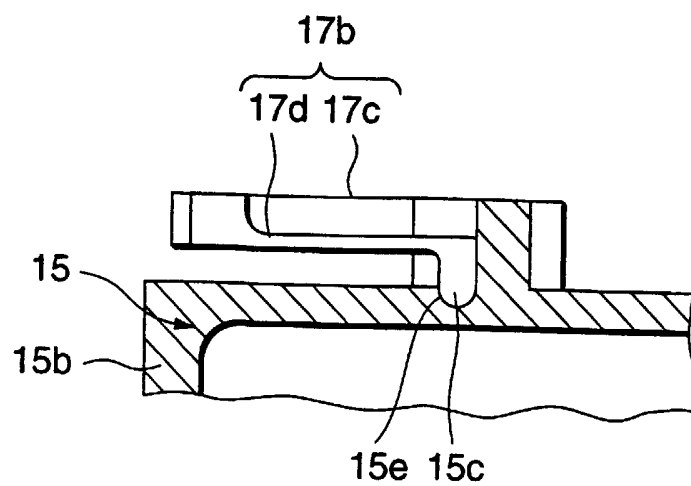


FIG.13

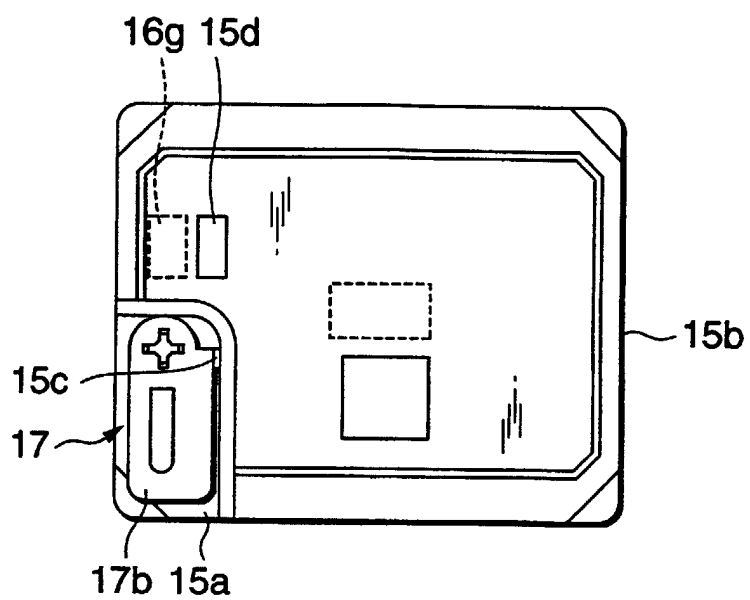


FIG.14

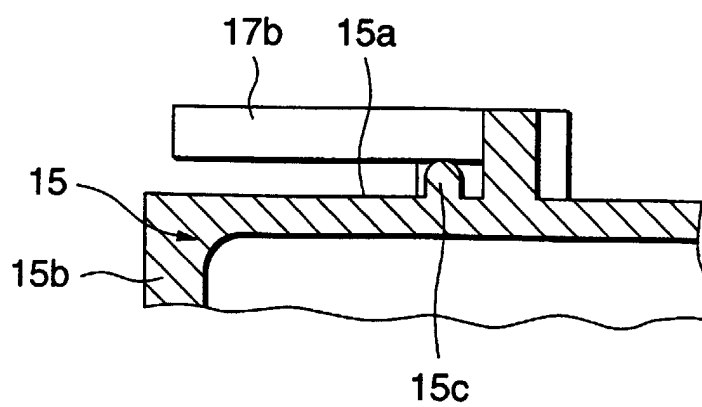


FIG.15

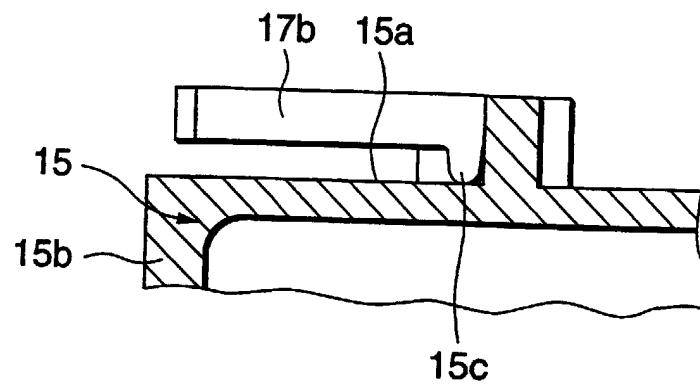


FIG.16

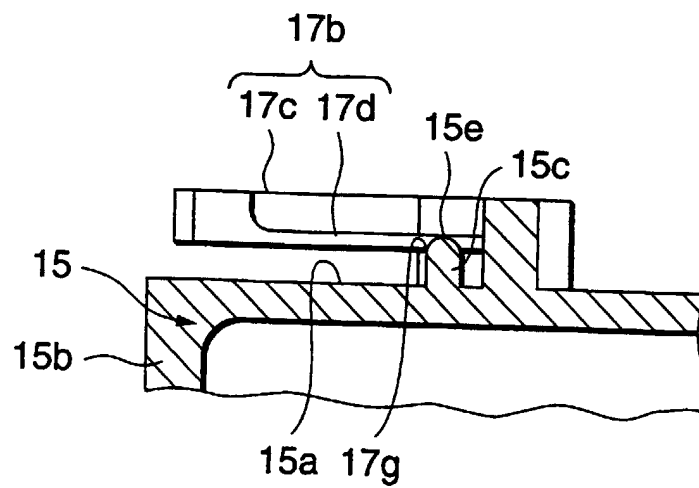


FIG.17

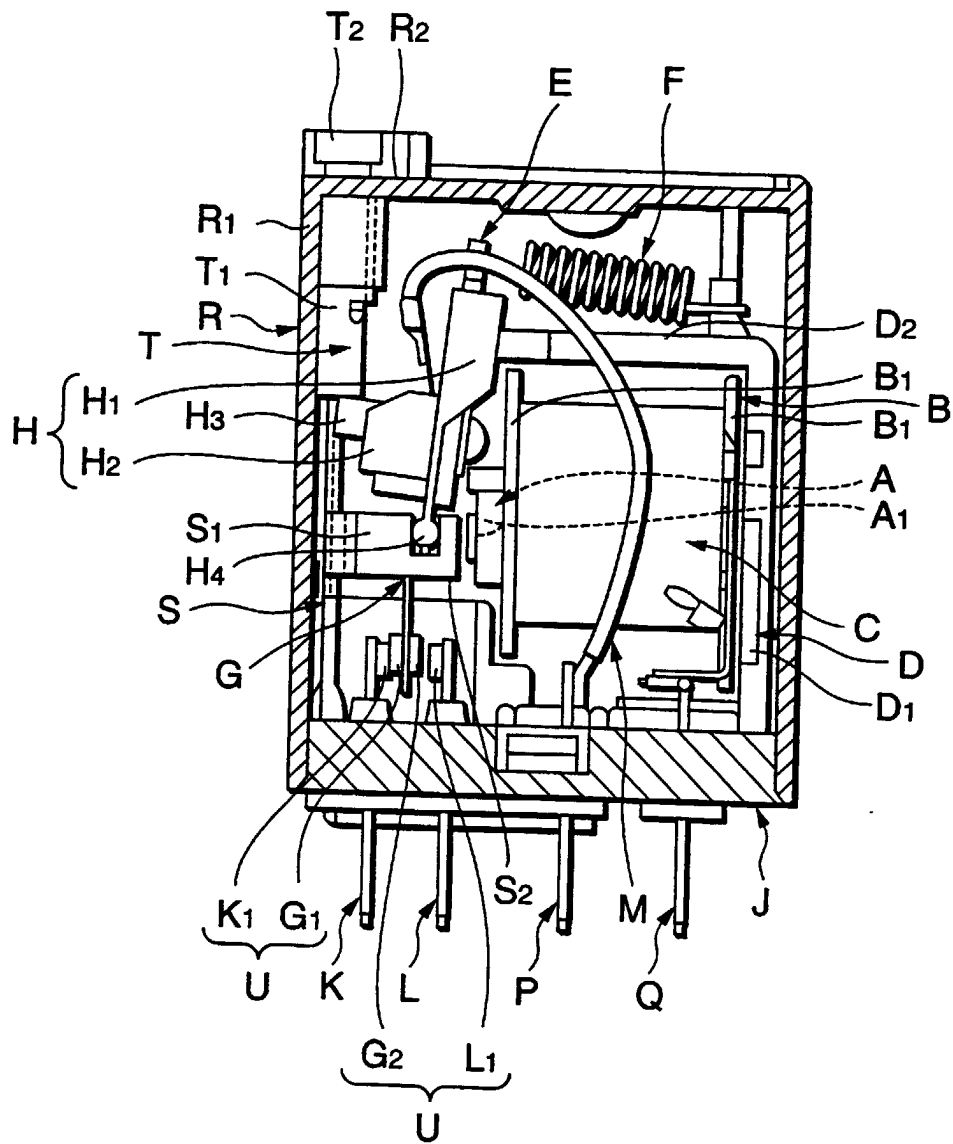


FIG.18

