(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 889 886 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
01.07.2015 Bulletin 2015/27

(51) Int Cl.:
H01H 3/50 *(2006.01)* ***H01H 15/10*** *(2006.01)*
H01H 50/32 *(2006.01)*

(21) Application number: **14192786.3**

(22) Date of filing: **12.11.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **27.12.2013 JP 2013272304**

(71) Applicant: **OMRON CORPORATION**
Kyoto-shi, Kyoto 600-8530 (JP)

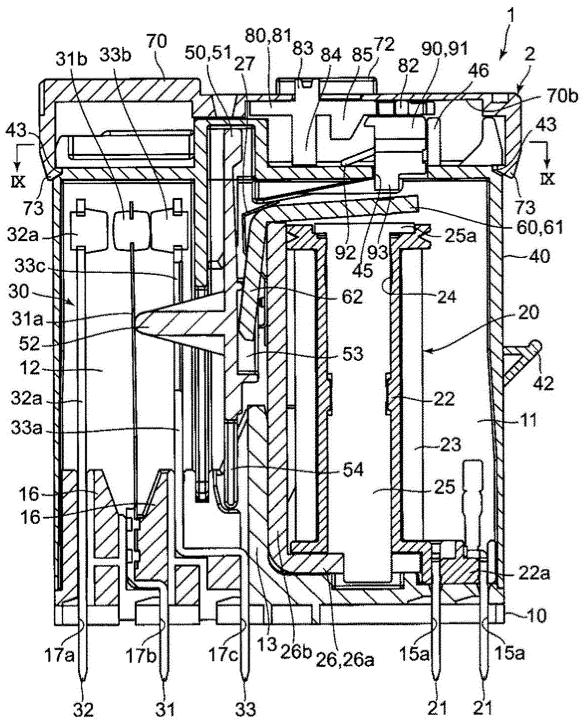
(72) Inventors:
- **Yamamoto, Shinya**
  Kumamoto, 861-0596 (JP)
- **Aso, Tatsuo**
  Kumamoto, 861-0596 (JP)

(74) Representative: **Kilian Kilian & Partner**
Aidenbachstraße 54
81379 München (DE)

(54) **Electromagnetic relay**

(57) An electromagnetic relay (1) includes a slide switch (2). The slide switch (2) includes a cover (70), and a slide lever (80) and an elastic test button (90) each housed in the cover (70). The cover (70) has an operation hole (71) formed in an opposite surface to one surface of a case (40). The operation hole (71) allows the sliding operation of the slide lever (80). The slide lever (80) is disposed to block the operation hole (71). The elastic test button (90) presses the slide lever (80) to bring the slide lever (80) into press contact with a ceiling surface (70b) of the cover (70). The slide switch (2) of the electromagnetic relay (1) inhibits the entry of foreign matters into the case (40), and prevents a contact failure or an actuation failure.

FIG. 3A



EP 2 889 886 A1

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is based on Japanese Patent Application No. 2013-272304 filed with the Japan Patent Office on December 27, 2013, the entire contents of which are incorporated herein by reference.

FIELD

[0002] The disclosure relates to an electromagnetic relay including a slide switch for use in, for example, verification of actuation.

BACKGROUND

[0003] JP 11-96875 A discloses a conventional electromagnetic relay including a switch for use in verification of actuation. The electromagnetic relay includes a turn lever disposed on a top surface of a casing, and a lever arm disposed inside the casing. Herein, the turn lever and the lever arm are formed by integral molding. Turning the turn lever in a direction perpendicular to the top surface of the casing allows the lever arm to open and close a contact.

[0004] In the electromagnetic relay, foreign matters enter the casing through a slit formed in the casing to verify the actuation of the turn lever, which may result in a contact failure or an actuation failure. Consequently, the electromagnetic relay fails to verify the actuation.

SUMMARY

[0005] One or more embodiments of the disclosure provide an electromagnetic relay including a slide switch capable of inhibiting the entry of foreign matters into a case and preventing a contact failure or an actuation failure.

[0006] An electromagnetic relay according to one or more embodiments of the disclosure is an electromagnetic relay including a case and a contact mechanism housed in the case. The electromagnetic relay is characterized by including a slide switch including a cover, a slide lever, and an elastic test button. The cover is mounted on one surface of the case. The slide lever is housed in the cover, and is configured to be slidable via an operation hole formed in the cover. The elastic test button is housed in the cover, and is actuated in a direction crossing one surface of the case in accordance with the sliding operation of the slide lever. The slide switch is configured to open and close a contact of the contact mechanism in conjunction with the actuation of the elastic test button according to the sliding operation of the slide lever. The slide lever has a planar shape to block the operation hole. The elastic test button presses the slide lever to bring the slide lever into press contact with a ceiling surface of the cover.

[0007] According to one or more embodiments of the disclosure, the slide lever has the planar shape to block the operation hole. Moreover, the elastic test button presses the slide lever to bring the slide lever into press contact with the ceiling surface of the cover. This configuration can securely block a clearance between the slide lever and the cover, and can also prevent the entry of foreign matters into the cover.

[0008] The electromagnetic relay according to one or more embodiments of the disclosure may have the following configuration. That is, the elastic test button has a protruding part and an elastic arm part. The protruding part serves to operate an internal drive component for opening and closing the contact, and the elastic arm part serves to press the slide lever.

[0009] According to one or more embodiments of the disclosure, the elastic arm part of the elastic test button eliminates the need for additionally providing an elastic member for pressing the slide lever, which leads to reduction in manufacturing costs.

[0010] The electromagnetic relay according to one or more embodiments of the disclosure may also have the following configuration. That is, the slide switch further includes a locking mechanism having an elastic locking claw and a pair of grooves. The elastic locking claw extends from the slide lever along a sliding direction. The pair of grooves is formed in an inner surface of the cover to receive the elastic locking claw and to maintain the slide lever at an actuation position and a return position. The slide switch is capable of maintaining the slide lever at the actuation position and the return position.

[0011] According to one or more embodiments of the disclosure, the locking mechanism having the elastic locking claw and the pair of grooves can ensure the pressing force to be applied to the slide lever by the elastic test button, and can also maintain the slide lever at the actuation position and the return position.

[0012] The electromagnetic relay according to one or more embodiments of the disclosure may also have the following configuration. That is, the cover has an erroneous operation preventing wall protruding from at least one of edges of the operation hole to prevent erroneous operation of the slide lever.

[0013] According to one or more embodiments of the disclosure, the erroneous operation preventing wall can prevent the erroneous operation of the slide switch by preventing unintended contact with the slide lever.

[0014] The electromagnetic relay according to one or more embodiments of the disclosure may also have the following configuration. That is, the slide lever has a slide support protruding toward the case.

[0015] According to one or more embodiments of the disclosure, the slide support allows the slide lever to securely block the operation hole, thereby securely preventing the entry of foreign matters, such as dust, into the cover.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig. 1 is a perspective view illustrating an electromagnetic relay according to one or more embodiments of the disclosure;
Fig. 2 is a perspective view illustrating a state that a cover is removed from the electromagnetic relay in Fig. 1;
Fig. 3A is a longitudinal sectional view taken along line III-III in Fig. 1, and illustrates a state that a slide lever of the electromagnetic relay is at a return position;
Fig. 3B is a cross sectional view taken along line IX-IX in Fig. 3A;
Fig. 4A is a longitudinal sectional view illustrating a state that the slide lever of the electromagnetic relay in Fig. 3A is at an actuation position;
Fig. 4B is a cross sectional view taken along line X-X in Fig. 4A;
Fig. 5 is an exploded perspective view illustrating the electromagnetic relay in Fig. 1;
Fig. 6 is an exploded perspective view seen from a different angle from Fig. 5;
Fig. 7 is a perspective view illustrating the cover of the electromagnetic relay in Fig. 1;
Fig. 8 is a plan view illustrating an internal configuration of the cover in Fig. 7;
Figs. 9A, 9B, and 9C are a perspective view, a front view, and a side view each illustrating an elastic test button of the electromagnetic relay in Fig. 1;
Figs. 10A, 10B, and 10C are a perspective view, a front view, and a side view each illustrating a modification of the elastic test button of the electromagnetic relay in Fig. 1;
Figs. 11A, 11B, and 11C are a perspective view, a front view, and a side view each illustrating another modification of the elastic test button of the electromagnetic relay in Fig. 1; and
Figs. 12A, 12B, and 12C are a perspective view, a front view, and a side view each illustrating still another modification of the elastic test button of the electromagnetic relay in Fig. 1.

DETAILED DESCRIPTION

[0017] An electromagnetic relay including a slide switch is specifically described below on the basis of one or more embodiments of the disclosure illustrated in the drawings.

[0018] As illustrated in Figs. 1 to 6, an electromagnetic relay 1 according to one or more embodiments of the disclosure includes a slide switch 2, a base plate 10, a coil block 20, a contact mechanism 30, a case 40, and a card 50. The coil block 20, the contact mechanism 30, the case 40, and the card 50 are mounted on the base plate 10. The slide switch 2 is mounted on the case 40. The coil block 20, the contact mechanism 30, and the card 50 are housed in the case 40.

[0019] As illustrated in Figs. 5 and 6, the base plate 10 is formed into a rectangular shape as seen in a plan view, and is made of an insulative resin. As illustrated in Figs. 3A, 3B, 4A, and 4B, moreover, the base plate 10 includes an insulating wall 13 for dividing the base plate 10 into a first area 11 where the coil block 20 is mounted and a second area 12 where the contact mechanism 30 is mounted. As illustrated in Figs. 5 and 6, the insulating wall 13 has case mounting projections 14 and 14 formed on both side surfaces thereof (Figs. 5 and 6 illustrate only one of the case mounting projections 14 and 14). The insulating wall 13 also has card mounting holes 18 and 18 formed above the case mounting projections 14 and 14. The card mounting holes 18 and 18 serve to mount the card 50 as will be described later.

[0020] The base plate 10 has terminal holes 15a and 15a formed in a bottom surface of the first area 11. The terminal holes 15a and 15a serve to receive a pair of coil terminals 21 and 21 of the coil block 20.

[0021] The base plate 10 also has terminal holes 17a, 17b, and 17c, and insulators 16 and 16 formed in and on a bottom surface of the second area 12. The terminal holes 17a, 17b, and 17c serve to receive a first fixed contact terminal 32, a movable contact terminal 31, and a second fixed contact terminal 33 (each of which will be described later) of the contact mechanism 30. The insulators 16 and 16 serve to fix the first fixed contact terminal 32 and second fixed contact terminal 33 of the contact mechanism 30. The movable contact terminal 31 is located between the insulators 16 and 16.

[0022] As illustrated in Figs. 3A, 3B, 4A, and 4B, the coil block 20 includes the pair of coil terminals 21 and 21, a spool 22, a coil 23, an iron core 25, and a yoke 26. The spool 22 has a through hole 24 formed therein. The coil 23 is wound around the spool 22. The iron core 25 is inserted into the through hole 24. The yoke 26 is formed into a substantially "L" shape, and is fixed by crimping to a lower end of the iron core 25. Each of the coil terminals 21 and 21 protrudes from the bottom surface of the base plate 10, and is fixed to a flange 22a formed on a lower end of the spool 22. The yoke 26 includes a horizontal part 26a and a vertical surface part 26b. The horizontal part 26a is fixed by crimping to the lower end of the iron core 25. The vertical surface part 26b extends upward along the coil 23. Herein, a hinge spring 27 is fixed by crimping to an upper end of a side surface of the vertical surface part 26b.

[0023] As illustrated in Figs. 3A, 3B, 4A, and 4B, the contact mechanism 30 includes a movable contact strip 31 a, a first fixed contact strip 32a, and a second fixed contact strip 33a. The movable contact strip 31 a is located between the first fixed contact strip 32a and the second fixed contact strip 33a.

[0024] The movable contact strip 31 a has a movable contact 31 b formed on an upper end thereof, and the movable contact terminal 31 formed on a lower end there-

of and bent in a crank shape. The movable contact 31 b is integrated with the movable contact strip 31 a such that the movable contact strip 31 a is located at a center. The first fixed contact strip 32a has a first fixed contact 32b fixed by crimping to an upper end thereof, and the first fixed contact terminal 32 formed on a lower end thereof. The second fixed contact strip 33a is formed of a plate having an opening 33c formed therein. The second fixed contact strip 33a has a second fixed contact 33b fixed by crimping to an upper end thereof, and the second fixed contact terminal 33 formed on a lower end thereof and bent in a crank shape. The movable contact terminal 31, the first fixed contact terminal 32, and the second fixed contact terminal 33 protrude from the bottom surface of the base plate 10.

[0025] As illustrated in Figs. 3A, 3B, 4A, and 4B, the card 50 and a movable steel piece 60, each of which is one of internal drive components, are disposed between the coil block 20 and the contact mechanism 30.

[0026] The card 50 includes a card main body 51, and a pushing protrusion 52 formed at a center of one surface of the card main body 51. A distal end of the pushing protrusion 52 passes through the opening 33c in the second fixed contact strip 33a. The card 50 also includes a press receiver 53 formed on the other surface of the card main body 51, that is, an opposite surface to the surface where the pushing protrusion 52 is formed. The press receiver 53 serves to join the card 50 and the movable steel piece 60 together.

[0027] As illustrated in Figs. 5 and 6, the card main body 51 has a pair of elastic pieces 54 and 54 formed on one end thereof with a predetermined clearance created between the elastic pieces 54 and 54. The elastic pieces 54 and 54 have columnar card mounting projections 55 and 55 formed on side surfaces thereof at free end sides. The card mounting projections 55 and 55 are fitted into the card mounting holes 18 and 18 in the base plate 10, so that the card 50 is mounted on the base plate 10 in a rotatable manner.

[0028] The movable steel piece 60 is formed into a substantially "L" shape, and includes a press receiving part 61 and a joint arm part 62. The press receiving part 61 is pressed by an elastic test button 90 of the slide switch 2, and the joint arm part 62 is narrower in width than the press receiving part 61. The movable steel piece 60 is disposed to be rotatable about the upper end of the vertical surface part 26b of the yoke 26. The movable steel piece 60 is also disposed such that the joint arm part 62 comes into contact with the press receiver 53 of the card 50. Moreover, the movable steel piece 60 is supported by the hinge spring 27, which is attached to the vertical surface part 26b of the yoke 26, such that a center of rotation thereof is not displaced.

[0029] As illustrated in Figs. 5 and 6, the case 40 is formed into a box shape, has an opening formed in one surface thereof, and is made of a translucent resin. The case 40 has case mounting holes 41 and 41 formed at centers of two edges of the opening. The case mounting projections 14 and 14 of the base plate 10 are fitted into the case mounting holes 41 and 41, so that the case 40 is mounted on the base plate 10. The case 40 also has a claw 42 formed on a side end surface thereof facing the coil block 20. In a state that the electromagnetic relay 1 is mounted on a panel (not illustrated), a user hitches his/her finger on the claw 42, thereby removing the electromagnetic relay 1 from the panel.

[0030] As illustrated in Fig. 2, the case 40 also has mounting grooves 43 and 43 formed on an upper end of a side end surface thereof. The mounting grooves 43 and 43 serve to mount the slide switch 2. The case 40 also has a hollow bump 44 and an actuation hole 45 each formed on a top surface thereof. As will be described later, the elastic test button 90 is disposed in the actuation hole 45. The hollow bump 44 receives an upper end of the card 50. The actuation hole 45 is located on the press receiving part 61 of the movable steel piece 60. The case 40 also has a supporting wall 46 formed on one of outer edges of the actuation hole 45. The supporting wall 46 serves to support the elastic test button 90.

[0031] As illustrated in Figs. 1 and 2, the slide switch 2 includes a cover 70, a slide lever 80, and the elastic test button 90. The cover 70 is mounted on the top surface of the case 40. The slide lever 80 and the elastic test button 90 are housed in the cover 70. The elastic test button 90 is inserted into the actuation hole 45 in the case 40. The slide lever 80 is disposed on the elastic test button 90 in a slidable manner.

[0032] As illustrated in Fig. 7, the cover 70 has an operation hole 71 allowing the sliding operation of the slide lever 80. The cover 70 also has a set of erroneous operation preventing walls 72 and 72 formed on edges of the operation hole 71. The erroneous operation preventing walls 72 and 72 extend along a sliding direction D of the slide lever 80 to prevent erroneous operation of the slide lever 80. The cover 70 also has mounting claws 73 and 73 formed on both end surfaces thereof in the longitudinal direction. The mounting claws 73 and 73 are fitted into the mounting grooves 43 and 43 of the case 40 such that the cover 70 is mounted on the case 40. As illustrated in Fig. 8, the cover 70 also has a pair of grooves, that is, a first groove 74 and a second groove 75 formed in an inner surface, that is, an inner side surface 70a thereof. The first groove 74 serves to maintain the slide lever 80 at a return position, and the second groove 75 serves to maintain the slide lever 80 at an actuation position. The first groove 74, the second groove 75, and an elastic locking claw 82 (which will be described later) of the slide lever 80 constitute a locking mechanism.

[0033] As illustrated in Fig. 2, the slide lever 80 includes a main body 81, the elastic locking claw 82, a slide support 84, and a pressing projection 85 which are integrally formed.

[0034] The main body 81 is formed into a plate shape, and is larger than the operation hole 71 of the cover 70. The main body 81 has a planar shape to block the operation hole 71 irrespective of the position of the slide lever

80.

[0035] The elastic locking claw 82 is formed into an "R" shape as seen in a plan view (see Fig. 5), and extends from the main body 81 along the sliding direction D of the slide lever 80. The "R"-shaped elastic locking claw 82 can secure an elastic force and prolong the lifetime of the slide lever 80 by spreading a force to be applied to a joint portion between the main body 81 and the elastic locking claw 82.

[0036] The slide lever 80 also has an operating projection 83 formed on a top surface of the main body 81. The operating projection 83 has a groove formed at a center thereof, and is formed into a substantially cubic shape. The operating projection 83 facilitates the sliding operation of the slide lever 80. The center groove allows the user to handle the electromagnetic relay 1 with a screwdriver or the like. The slide lever 80 does not necessarily have such a groove.

[0037] The slide support 84 is formed into a substantially rectangular column shape, and protrudes from a substantially center of a bottom surface of the main body 81. The slide support 84 has a length substantially equal to a distance from the bottom surface of the main body 81 to the top surface of the case 40 in the state that the slide lever 80 is in press contact with a ceiling surface 70b of the cover 70.

[0038] The pressing projection 85 is formed into a trapezoid shape as seen in a side view, and protrudes from the bottom surface of the main body 81 at an end where the elastic locking claw 82 is formed. The pressing projection 85 has an inclined side surface which faces the elastic locking claw 82. Thus, the elastic test button 90 can be pressed in a vertical direction by the sliding operation of the slide lever 80.

[0039] As illustrated in Figs. 3A and 3B, the return position of the slide lever 80 corresponds to the position of the slide lever 80 in the state that movable contact 31 b and the second fixed contact 33b are in contact with each other in the contact mechanism 30. As illustrated in Figs. 4A and 4B, on the other hand, the actuation position of the slide lever 80 corresponds to the position of the slide lever 80 in the state that the movable contact 31 b and the first fixed contact 32b are in contact with each other in the contact mechanism 30.

[0040] As illustrated in Figs. 9A to 9C, the elastic test button 90 is formed into a substantially "Π" shape as seen in a sectional view, and includes a flat plate part 91, elastic arm parts 92 and 92, and a protruding part 93 which are formed by integral molding. The flat plate part 91 is formed into a square shape as seen in a plan view. The elastic arm parts 92 and 92 are formed on opposite corners of the flat plate part 91. The protruding part 93 protrudes from the flat plate part 91 at a position between the elastic arm parts 92 and 92.

[0041] The elastic arm parts 92 and 92 linearly extend from two corners on one side of the flat plate part 91 along an orthogonal side to the side so as to be angled with respect to the flat plate part 91.

[0042] The protruding part 93 has two elastic pieces 93a and 93a with a clearance created therebetween. The protruding part 93 also has claws 93b and 93b formed on distal ends of outward surfaces of the elastic pieces 93a and 93a. The claws 93b and 93b are caught on an inner edge of the actuation hole 45 in the case 40 to prevent disconnection of the elastic test button 90. The protruding part 93 also has extruding protuberances 93c and 93c formed on inward surfaces of the elastic pieces 93a and 93a at positions where the protuberances 93c and 93c do not face each other. The extruding protuberances 93c and 93c are used for extruding the elastic test button 90 from a molding die.

[0043] In the following, description will be given of a method of assembling the electromagnetic relay 1. The electromagnetic relay 1 is assembled in the return state illustrated in Figs. 3A and 3B (the state that the slide lever 80 is at the return position).

[0044] First, the coil block 20 is assembled in advance. The coil terminals 21 and 21 are press fitted into the flange 22a of the spool 22. Both the ends of the coil 23 are wound around the coil terminals 21 and 21, respectively.

[0045] Next, the movable contact terminal 31 of the movable contact strip 31 a, the first fixed contact terminal 32 of the first fixed contact strip 32a, and the second fixed contact terminal 33 of the second fixed contact strip 33a are press fitted into the base plate 10 so as to protrude from the bottom surface of the base plate 10, respectively. As illustrated in Figs. 3A and 3B, herein, the movable contact 31 b and the second fixed contact 33b are in contact with each other. Moreover, the movable contact 31 b and the first fixed contact 32b face each other in a contactable and separatable manner.

[0046] Next, the card 50 is mounted on the base plate 10 such that the distal end of the pushing protrusion 52 of the card 50 passes through the opening 33c of the second fixed contact strip 33a.

[0047] Next, the coil block 20 is mounted on the base plate 10 such that the coil terminals 21 and 21 protrude from the bottom surface of the base plate 10. Subsequently, the movable steel piece 60 is disposed to be rotatable about the upper end of the vertical surface part 26b of the yoke 26. Herein, the movable steel piece 60 is disposed such that the joint arm part 62 comes into contact with the press receiver 53 of the card 50.

[0048] In this state, the movable steel piece 60 is in contact with the press receiver 53 of the card 50, but does not press the card 50 toward the contact mechanism 30.

[0049] After the coil block 20 and the contact mechanism 30 are mounted on the base plate 10, the case 40 is mounted on the base plate 10. Subsequently, the elastic test button 90 is inserted into the actuation hole 45 in the case 40. Moreover, the slide lever 80 is disposed on the case 40. Further, the cover 70 is mounted on the case 40 such that the elastic locking claw 82 of the slide lever 80 is located at the first groove 74 in the cover 70.

[0050] In this state, the elastic test button 90 presses the slide lever 80 so as to bring the elastic locking claw 82 into press contact with the ceiling surface 70b of the cover 70 with the elastic force of the elastic arm parts 92 and 92. Moreover, the slide support 84 and the elastic test button 90 support the slide lever 80 such that the slide lever 80 can be always maintained at a state substantially parallel with the ceiling surface 70b of the cover 70. Therefore, the clearance between the slide lever 80 and the operation hole 71 in the cover 70 can be securely blocked in the state that the slide lever 80 is at the return position.

[0051] Moreover, a slight clearance is created between the slide support 84 of the slide lever 80 and the top surface of the case 40 in order to prevent generation of unnecessary resistance upon the sliding operation. The clearance facilitates the sliding operation of the slide lever 80.

[0052] In the following, description will be given of the actuation of the electromagnetic relay 1 in the state that the slide lever 80 of the slide switch 2 slides from the return position to the actuation position.

[0053] As illustrated in Figs. 3A, 3B, 4A, and 4B, when the slide lever 80 slides from the return position to the actuation position via the operation hole 71, the elastic locking claw 82 is pushed out of the first groove 74, and then slides toward the second groove 75. Thus, the elastic test button 90 is pressed by the pressing projection 85 of the slide lever 80, and then is gradually pushed into the case 40.

[0054] During the slide lever 80 slides from the return position to the actuation position, the elastic arm parts 92 and 92 of the elastic test button 90 press the slide lever 80 with the elastic force. Therefore, the slide lever 80 is in press contact with the ceiling surface 70b of the cover 70.

[0055] Moreover, the supporting wall 46 of the case 40 supports the force to be applied to the elastic test button 90 by the pressing projection 85 in the sliding direction D. Thus, the elastic test button 90 can be prevented from dropping out of the actuation hole 45 because of the sliding operation of the slide lever 80. Further, the elastic test button 90 can securely move in an orthogonal direction to the top surface of the case 40.

[0056] The slide lever 80 moves to the actuation position to push the elastic test button 90 into the case 40, so that the elastic test button 90 presses the press receiving part 61 of the movable steel piece 60 against the coil block 20. Thus, the press receiving part 61 of the movable steel piece 60 comes into press contact with a magnetic plate 25a of the iron core 25. Further, the joint arm part 62 pushes the card 50 toward the contact mechanism 30. As a result, the pushing protrusion 52 of the card 50 pushes the movable contact strip 31 a toward the first fixed contact strip 32a to elastically deform the movable contact strip 31a. Then the movable contact 31 b comes into contact with the first fixed contact 32b. Thus, the actuation state illustrated in Figs. 4A and 4B is established.

[0057] Moving the slide lever 80 to the actuation position engages the elastic locking claw 82 of the slide lever 80 with the second groove 75 to maintain the slide lever 80 at the actuation position. As described above, the locking mechanism constituted of the elastic locking claw 82 of the slide lever 80, the first groove 74, and the second groove 75 is capable of ensuring the pressing force applied to the slide lever 80 by the elastic test button 90, and is also capable of maintaining the slide lever 80 at the actuation position and the return position.

[0058] Herein, sliding the slide lever 80 from the actuation position to the return position releases the pressing force applied to the elastic test button 90 by the pressing projection 85, and returns the elastic test button 90 to the return state illustrated in Figs. 3A and 3B. Thus, the elastic test button 90 releases the force to press the movable steel piece 60, so that the movable steel piece 60 returns to the return state with the elastic force of the hinge spring 27. Returning the movable steel piece 60 to the return state releases the pressing force applied to the card 50 by the movable steel piece 60, and returns the movable contact 31 b from the actuation state illustrated in Figs. 4A and 4B to the return state with the elastic force of the movable contact strip 31 a. Herein, the card 50 returns together with the movable contact 31 b to the return state with the elastic force of the movable contact strip 31 a. As described above, the electromagnetic relay 1 opens and closes the contact of the contact mechanism 30 in conjunction with the actuation of the elastic test button 90 according to the sliding operation of the slide lever 80.

[0059] The electromagnetic relay 1 is configured as follows. That is, the slide lever 80 is disposed to block the operation hole 71 in the cover 70, and the elastic test button 90 presses the slide lever 80 to bring the slide lever 80 into press contact with the ceiling surface 70b of the cover 70. This configuration can securely block the clearance between the slide lever 80 and the cover 70, and can also prevent the entry of foreign matters into the cover 70.

[0060] The electromagnetic relay 1 may employ any other contact mechanisms in addition to the contact mechanism 30.

[0061] The electromagnetic relay 1 includes the card 50 and the movable steel piece 60 as internal drive components for opening and closing the contact of the contact mechanism 30; however, the disclosure is not limited thereto. The electromagnetic relay 1 may employ any other components as long as such components can open and close the contact in accordance with the sliding operation of the slide lever 80.

[0062] The slide switch 2 includes the locking mechanism constituted of the elastic locking claw 82 of the slide lever 80 and the first and second grooves 74 and 75 of the cover 70; however, the disclosure is not limited thereto. The slide switch 2 may employ any other mechanisms as long as such mechanisms can ensure the pressing force to be applied to the slide lever 80 by the elastic test

button 90 and can also maintain the slide lever 80 at the actuation position and the return position.

[0063] An elastic test button to be applicable to the slide switch 2 is not limited to the elastic test button 90. As illustrated in Figs. 10A to 10C, for example, the slide switch 2 may include an elastic test button 100 having linear elastic arm parts 102 and 102 extending from opposite corners of a flat plate part 91 along opposite sides of the flat plate part 91, respectively. As illustrated in Figs. 11A to 11C, alternatively, the slide switch 2 may include an elastic test button 110 having elastic arm parts 112 and 112 each formed into a "V" shape as seen in a side view. As illustrated in Figs. 12A to 12C, further, the slide switch 2 may include an elastic test button 120 having elastic arm parts 122 and 122 each formed into a substantially triangle shape as seen in a side view. Herein, the elastic arm parts 122 and 122 are formed on opposite sides of a flat plate part 91.

[0064] The actuating direction of the elastic test button 90 is not limited to the orthogonal direction to the top surface of the case 40. The elastic test button may be actuated in any other directions crossing one surface of the case as long as the actuation of the elastic test button allows open and close of the contact of the contact mechanism.

[0065] The cover 70 has the set of erroneous operation preventing walls 72 and 72 protruding from the two edges of the operation hole 71 along the sliding direction D of the slide lever 80; however, the disclosure is not limited thereto. The erroneous operation preventing wall may be formed on at least one of the two edges of the operation hole.

[0066] The electromagnetic relay 1 including the slide switch 2 is not particularly limited to the foregoing embodiment of the disclosure so long as to have the following configuration. That is, the electromagnetic relay includes a slide switch including: a slide lever disposed to block an operation hole formed in a cover; and an elastic test button configured to press the slide lever to bring the slide lever into press contact with a ceiling surface of the cover. Further, the electromagnetic relay prevents the entry of foreign matters into the slide switch.

Claims

1. An electromagnetic relay (1) comprising a case (40) and a contact mechanism (30) housed in the case (40),
the electromagnetic relay (1) being **characterized by** comprising:

a slide switch (2) including:

a cover (70) mounted on one surface of the case (40);
a slide lever (80) housed in the cover (70) and configured to be slidable via an operation hole (71) formed in the cover (70); and
an elastic test button (90; 100; 110; 120) housed in the cover (70) and actuated in a direction crossing one surface of the case (40) in accordance with the sliding operation of the slide lever (80),

the slide switch (2) being configured to open and close a contact (31 b, 32b, 33b) of the contact mechanism (30) in conjunction with the actuation of the elastic test button (90; 100; 110; 120) according to the sliding operation of the slide lever (80),
wherein
the slide lever (80) has a planar shape to block the operation hole (71), and
the elastic test button (90; 100; 110; 120) presses the slide lever (80) to bring the slide lever (80) into press contact with a ceiling surface (70b) of the cover (70).

2. The electromagnetic relay (1) according to claim 1, **characterized in that** the elastic test button (90; 100; 110; 120) has:

a protruding part (93) for operating an internal drive component (50, 60) for opening and closing the contact (31 b, 32b, 33b); and
an elastic arm part (92; 102; 112; 122) for pressing the slide lever (80).

3. The electromagnetic relay (1) according to claim 1 or 2, **characterized in that**
the slide switch (2) further includes a locking mechanism having:

an elastic locking claw (82) extending from the slide lever (80) along a sliding direction (D); and
a pair of grooves (74, 75) formed in an inner surface (70a) of the cover (70) to receive the elastic locking claw (82) and to maintain the slide lever (80) at an actuation position and a return position, and

the slide switch (2) is capable of maintaining the slide lever (80) at the actuation position and the return position.

4. The electromagnetic relay (1) according to any one of claims 1 to 3, **characterized in that**
the cover (70) has an erroneous operation preventing wall (72) protruding from at least one of edges of the operation hole (71) to prevent erroneous operation of the slide lever (80).

5. The electromagnetic relay (1) according to any one of claims 1 to 4, **characterized in that**
the slide lever (80) has a slide support (84) protruding

toward the case (40).

FIG. 1

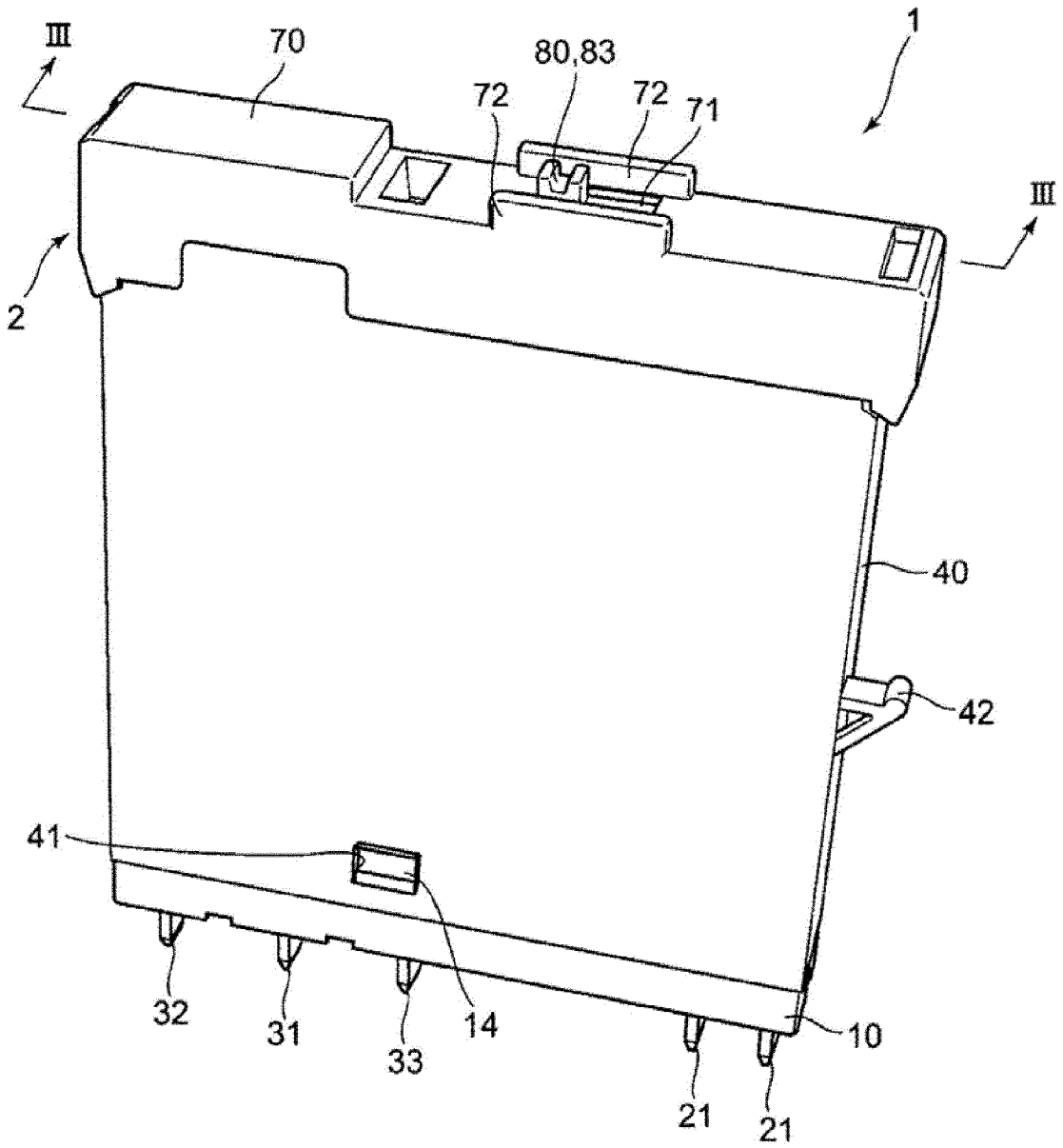


FIG. 2

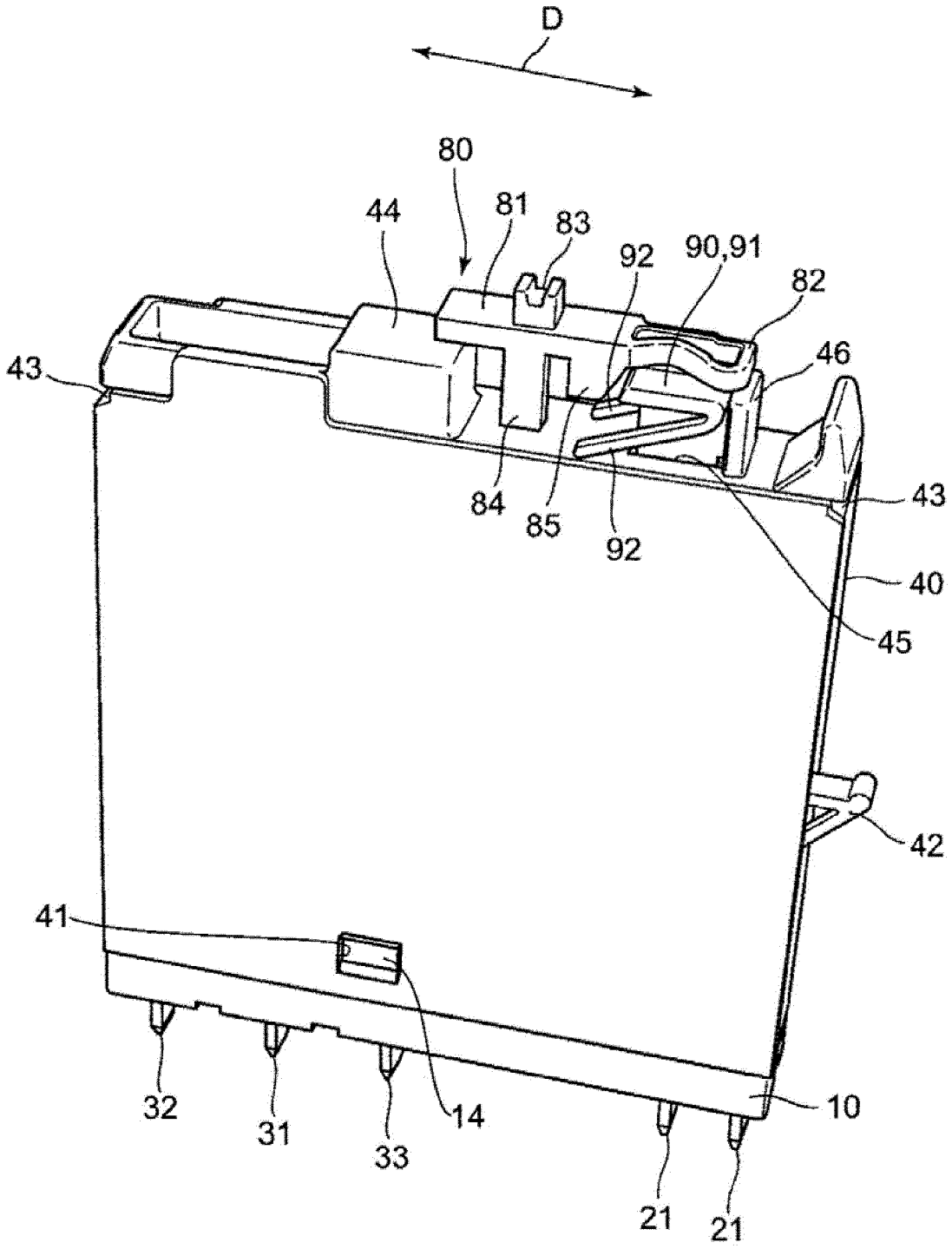

D
80
44
81
83
92
90,91
82
46
43
84
85
92
43
40
45
42
41
32
31
33
14
10
21
21

FIG. 3A

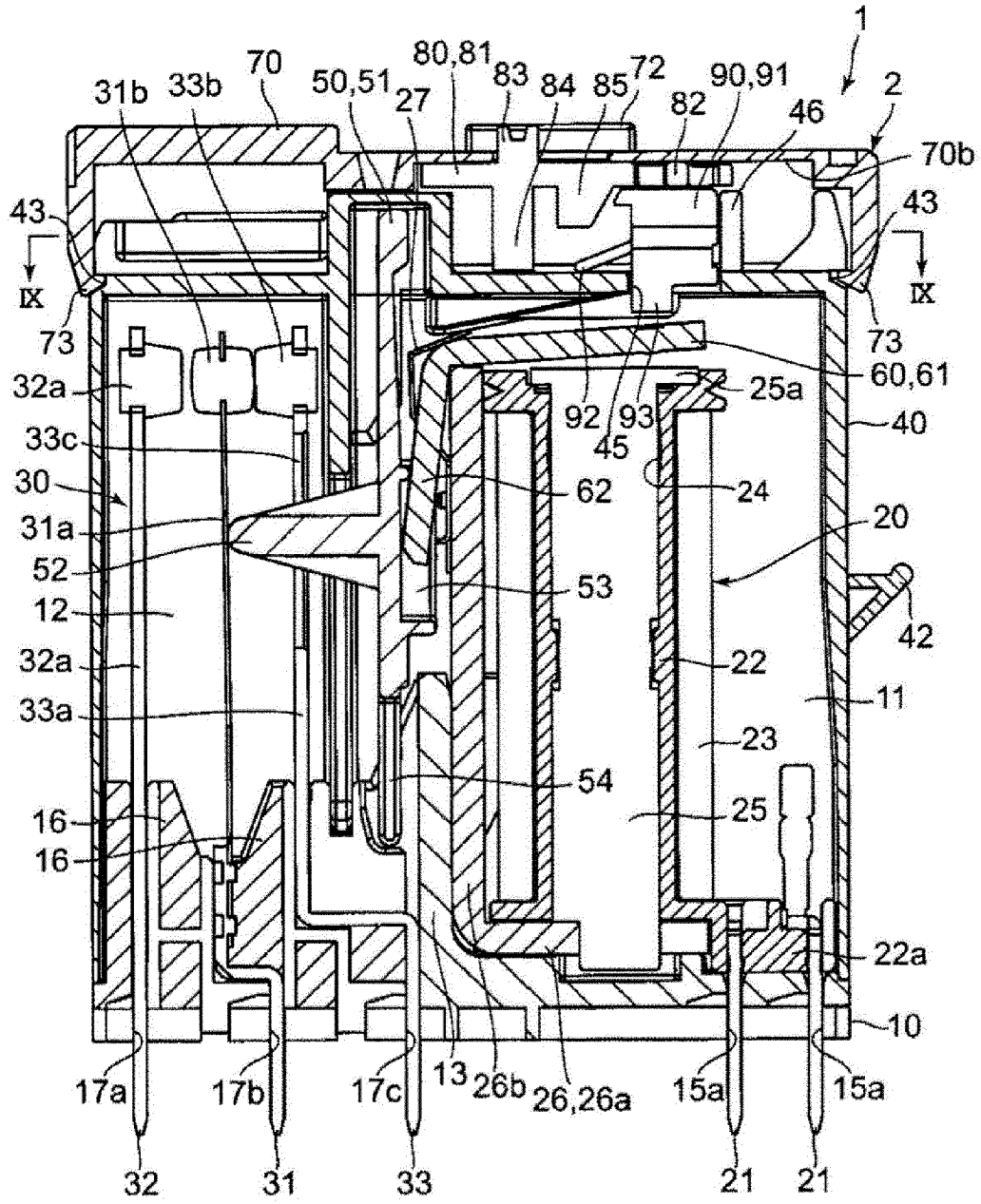

1
2
70
31b
33b
50,51
27
80,81
83
84
85
72
82
90,91
46
70b
43
IX
73
60,61
25a
40
92
93
45
24
62
20
42
32a
33c
30
31a
52
12
53
22
11
33a
23
54
25
16
22a
10
17a
17b
17c
13
26b
26,26a
15a
32
31
33
21

FIG. 3B

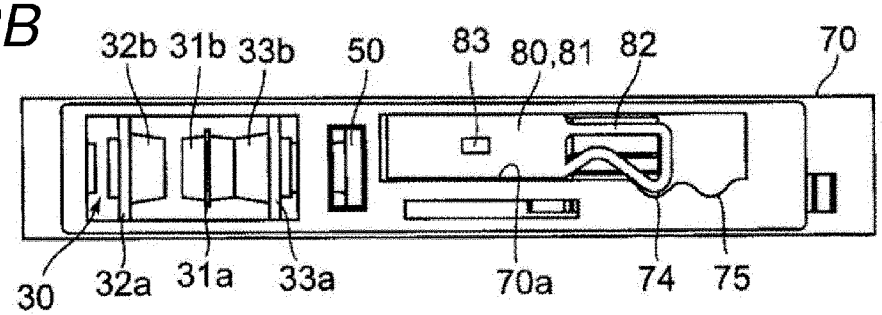

32b
31b
33b
50
83
80,81
82
70
30
32a
31a
33a
70a
74
75

FIG. 4A

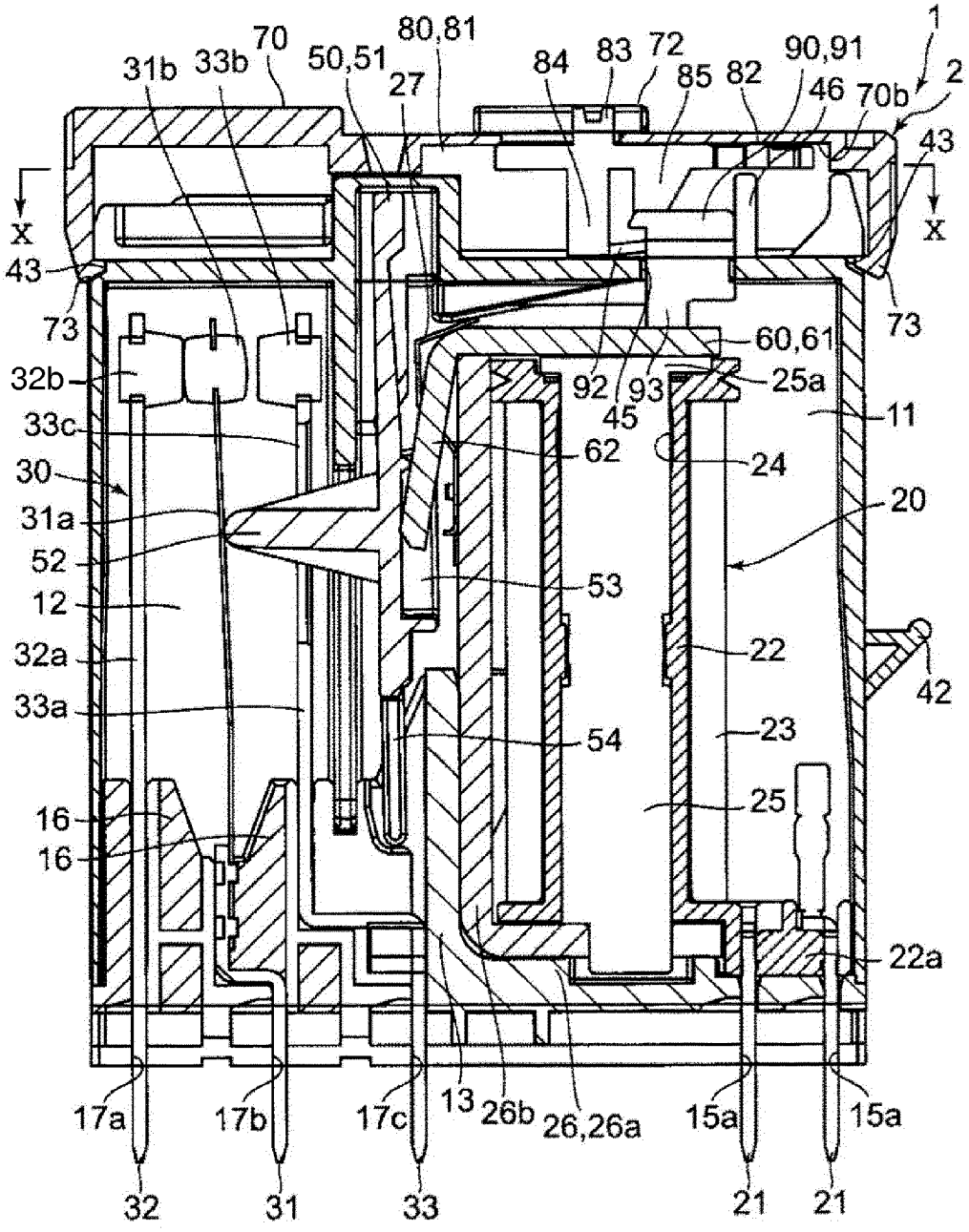

1
2
70
80,81
31b
33b
50,51
27
84
83
72
85
82
90,91
46
70b
43
X
X
43
73
73
60,61
32b
92
93
25a
45
11
33c
62
24
30
20
31a
52
53
12
22
42
32a
33a
54
23
16
25
16
22a
17a
17b
17c
13
26b
26,26a
15a
15a
32
31
33
21
21

FIG. 4B

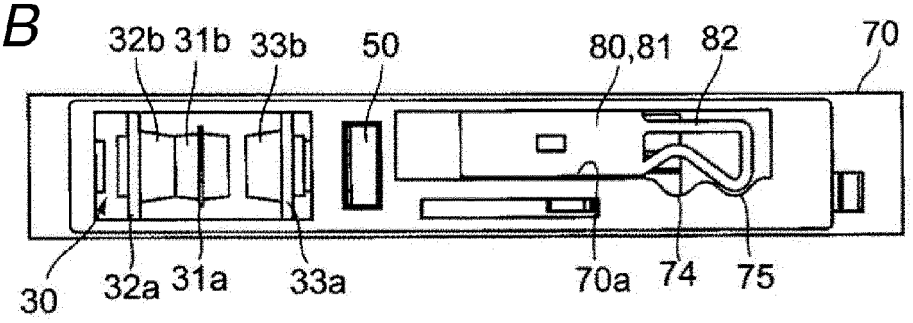

32b
31b
33b
50
80,81
82
70
30
32a
31a
33a
70a
74
75

FIG. 5

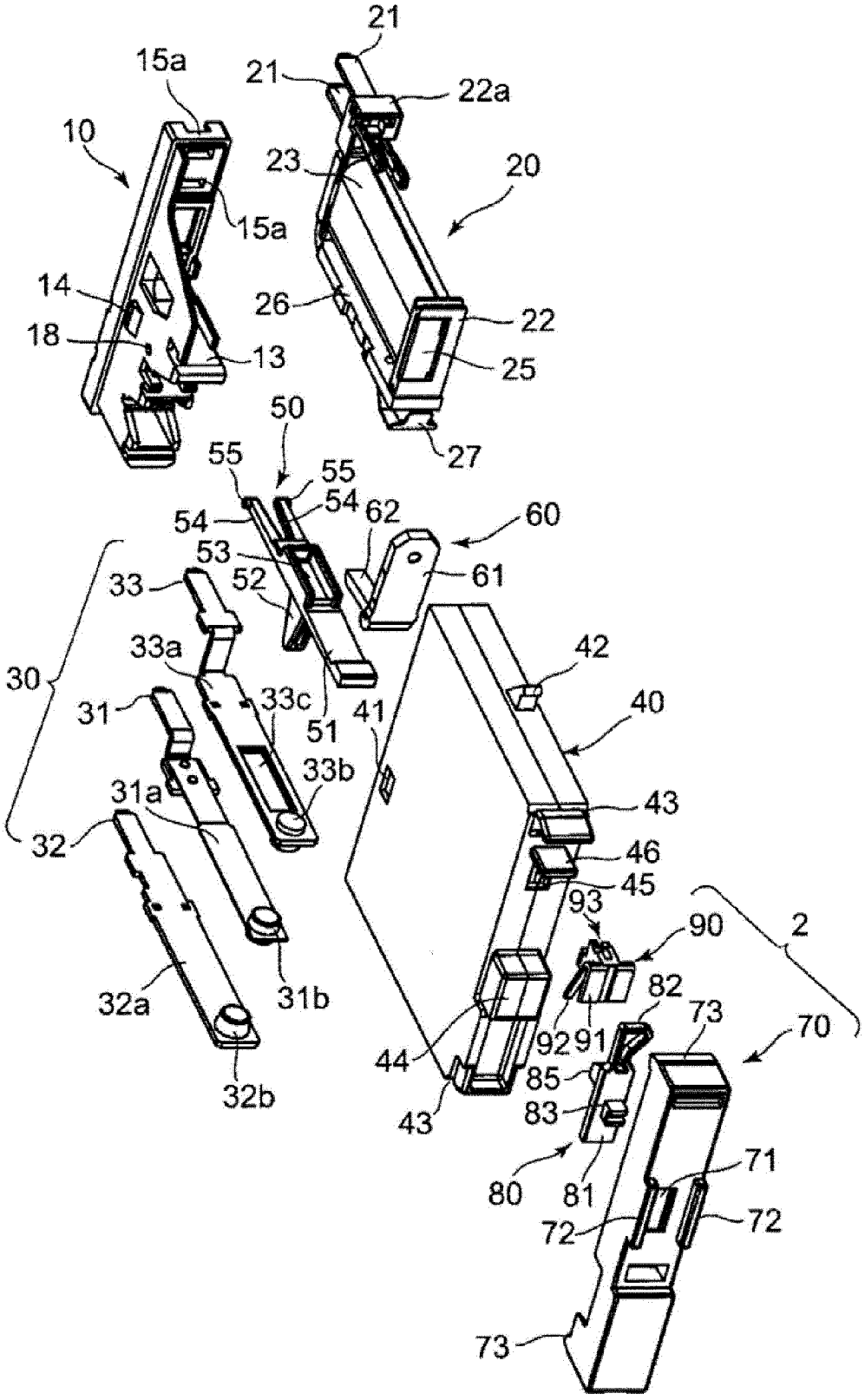

21
15a
21
22a
10
23
20
15a
14
26
22
18
13
25
50
27
55
55
54
54
62
60
53
61
33
52
42
33a
30
40
31
33c
51
41
33b
43
31a
46
32
45
93
90
2
82
73
70
32a
31b
44
92
91
85
83
43
80
81
71
72
72
32b
73

FIG. 6

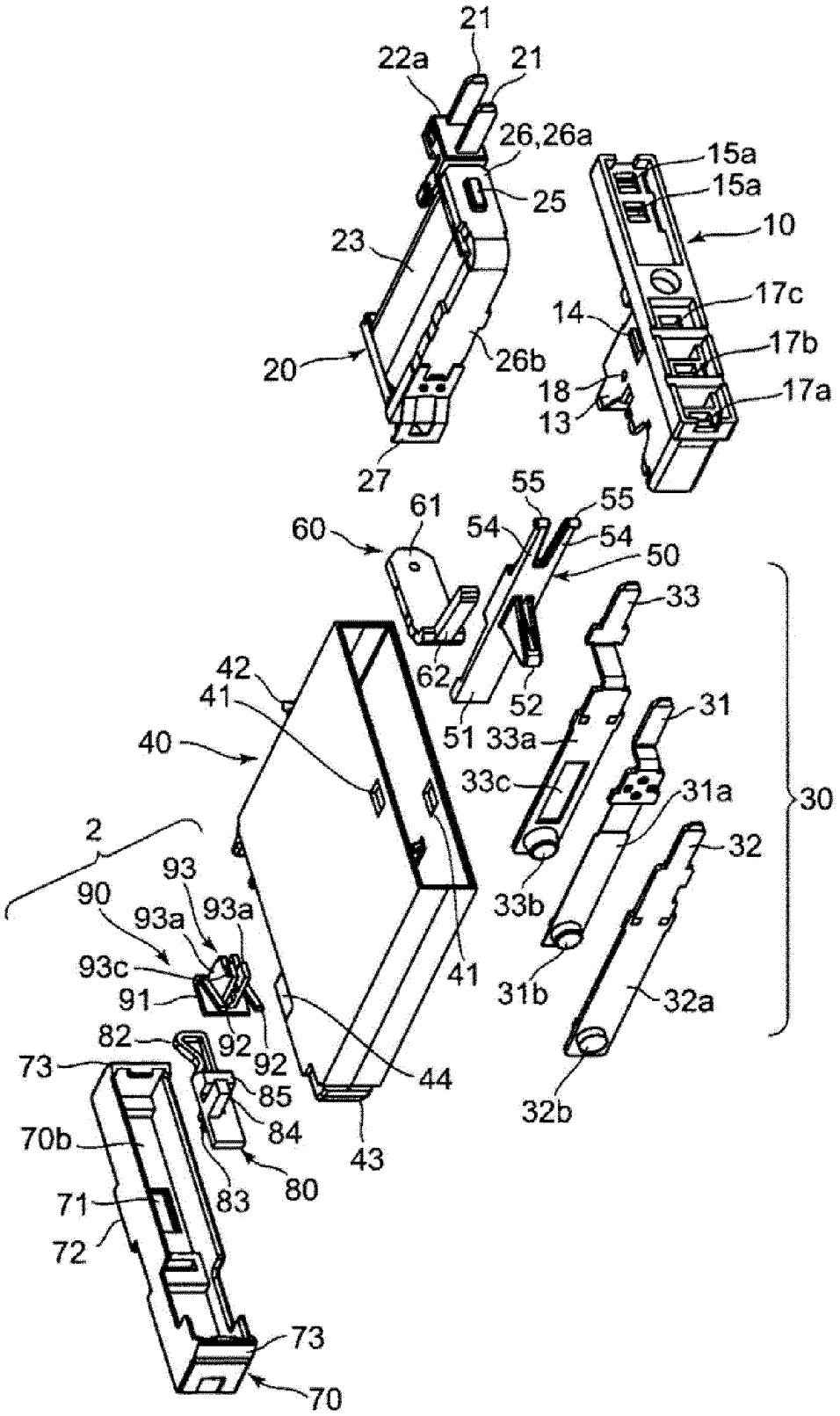

21
22a
21
26,26a
25
15a
15a
10
23
17c
14
17b
20
26b
18
17a
13
27
55
55
61
60
54
54
50
33
62
52
42
41
51
33a
31
40
33c
31a
30
2
32
93
90
93a
93a
33b
93c
91
31b
32a
82
92
92
44
73
85
84
32b
70b
43
80
71
83
72
73
70

FIG. 7

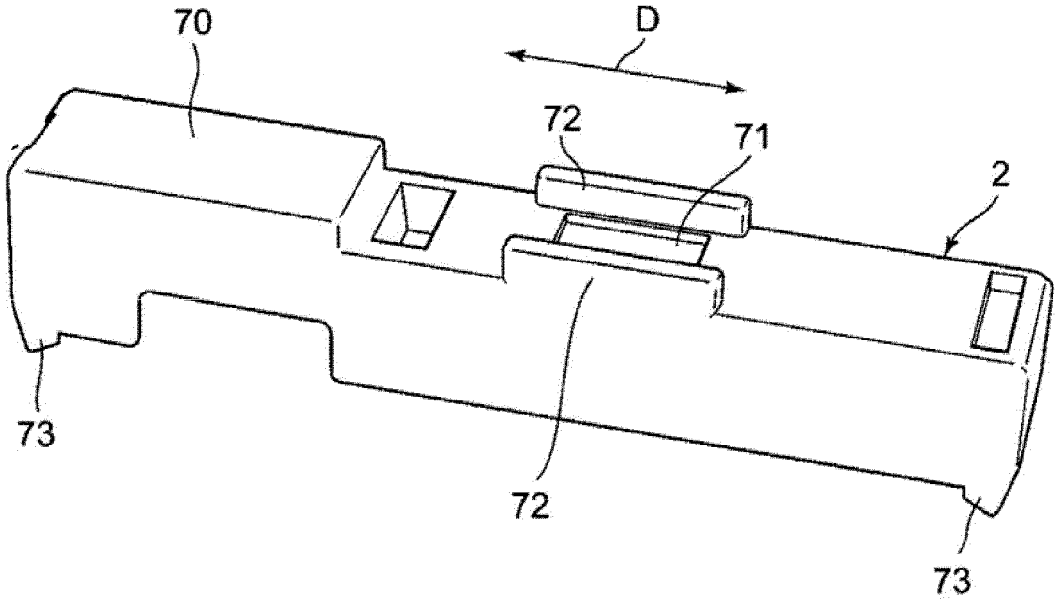


FIG. 8

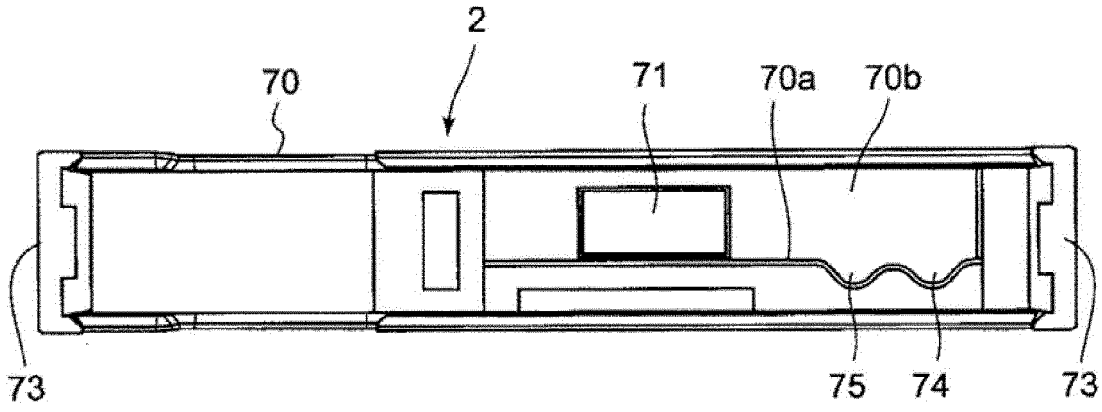


FIG. 9C

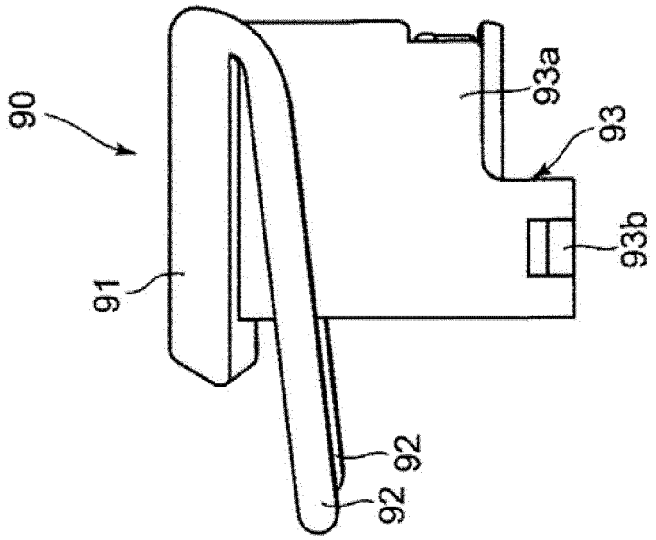


FIG. 9B

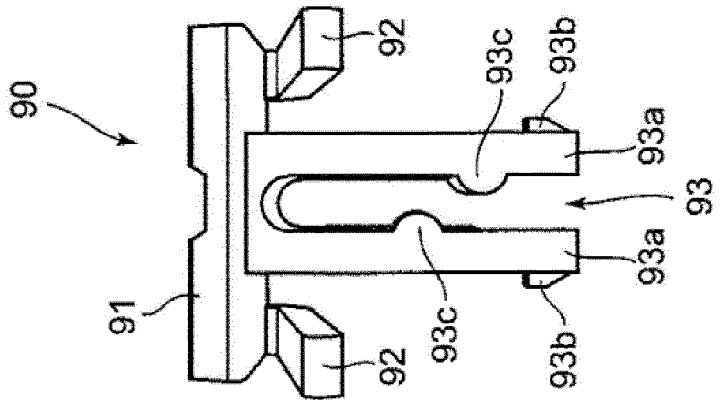


FIG. 9A

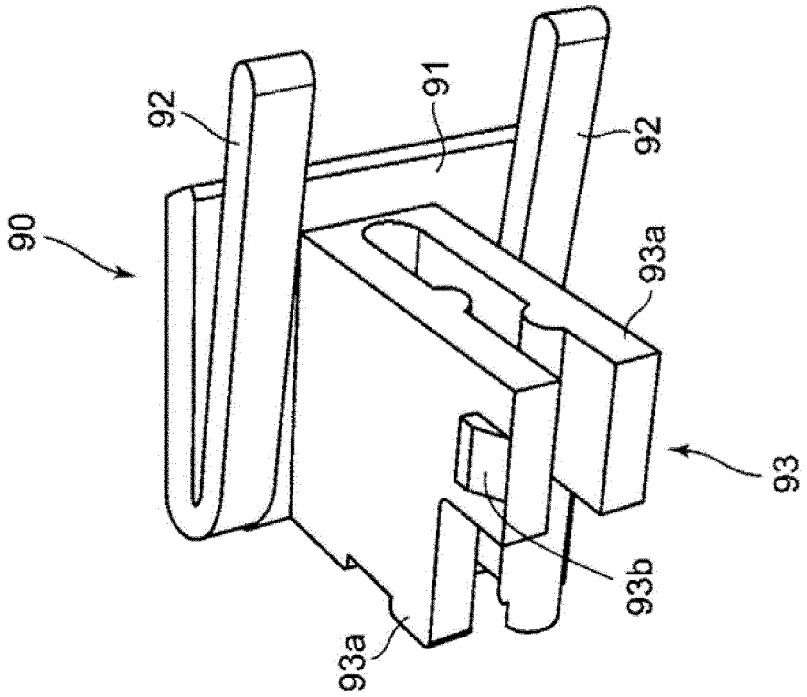


FIG. 10C

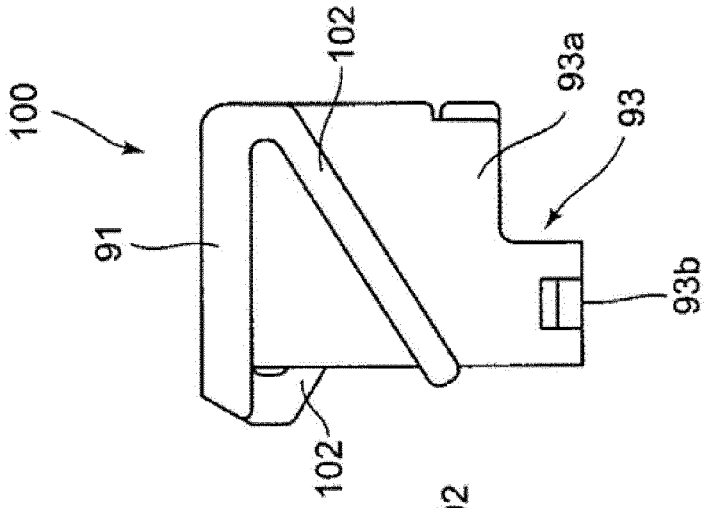


FIG. 10B

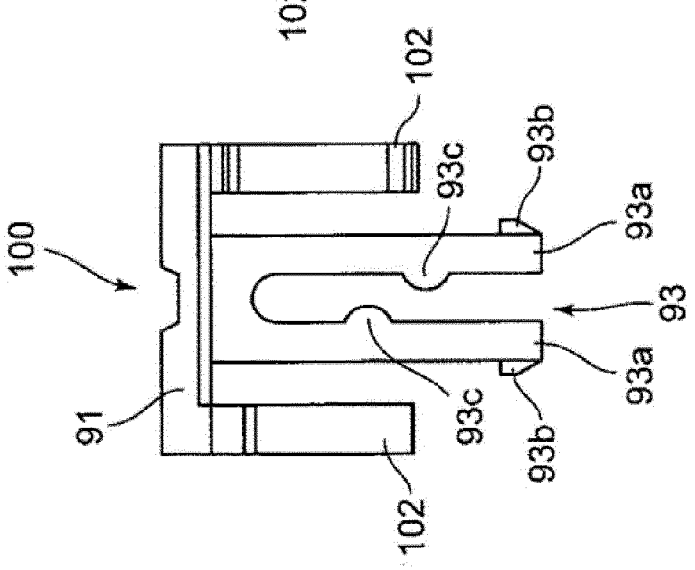


FIG. 10A

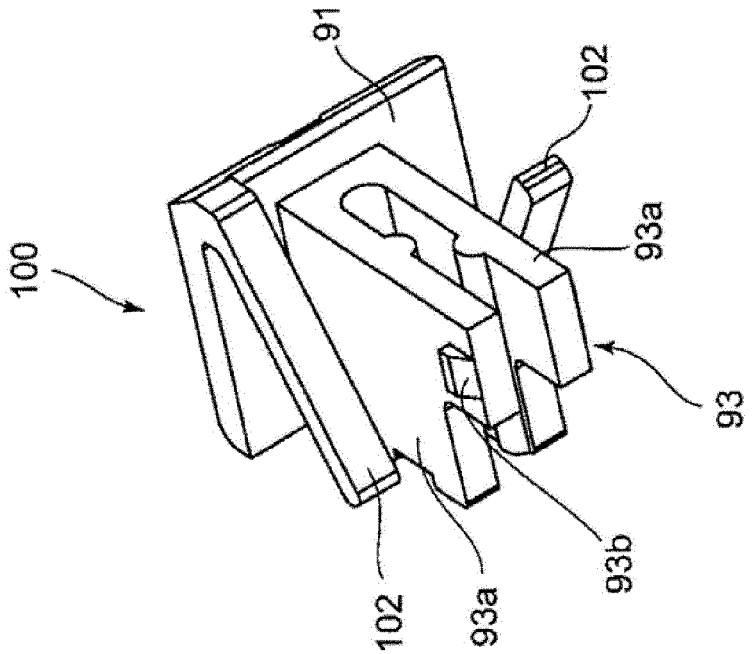


FIG. 11C

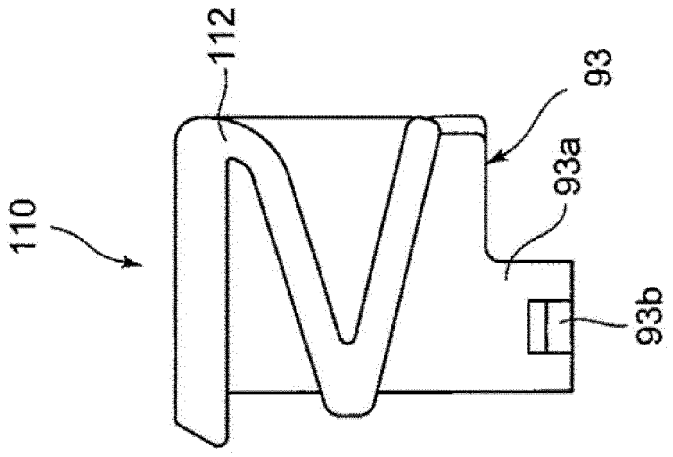


FIG. 11B

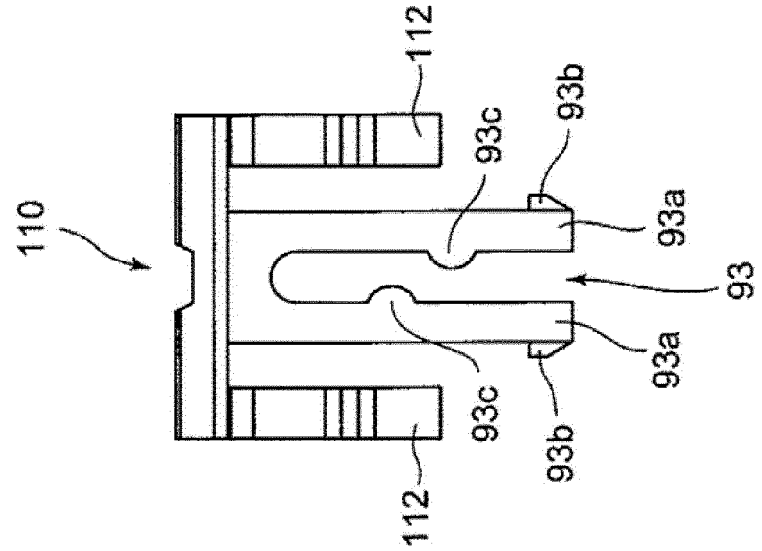


FIG. 11A

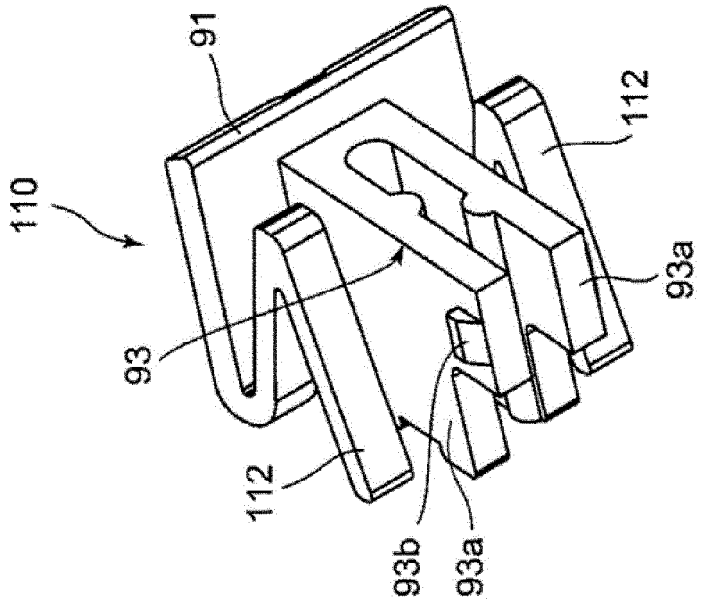


FIG. 12A

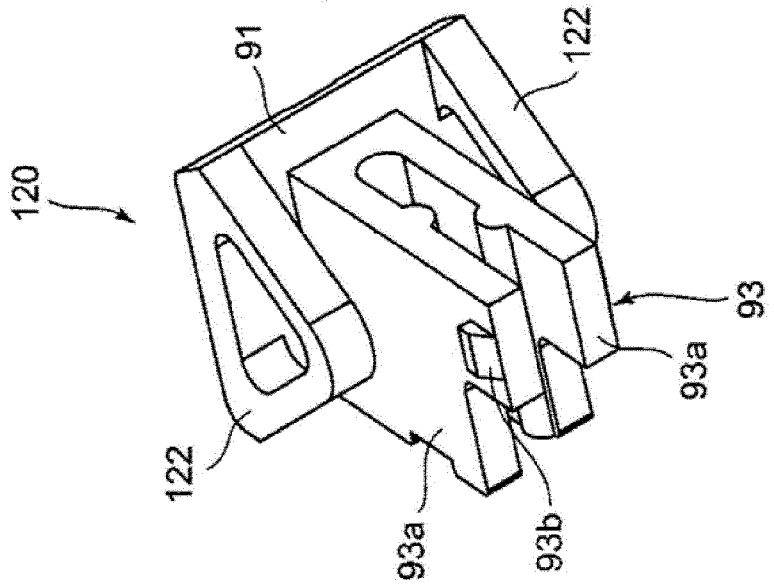


FIG. 12B

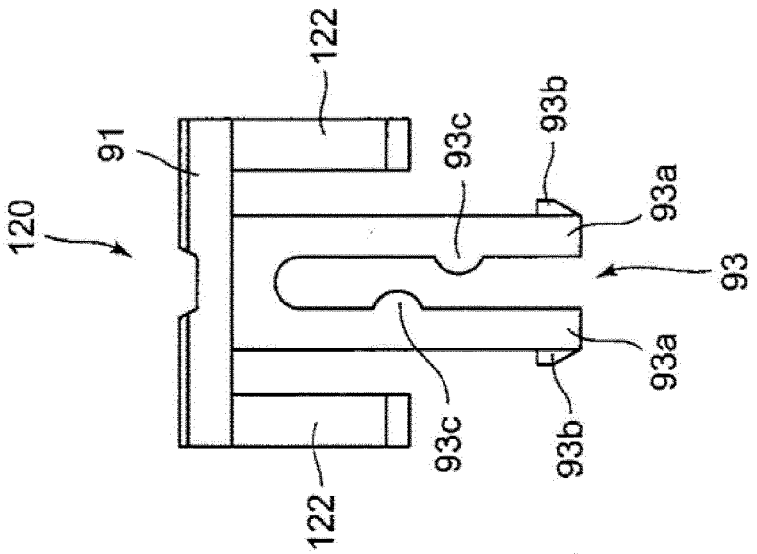
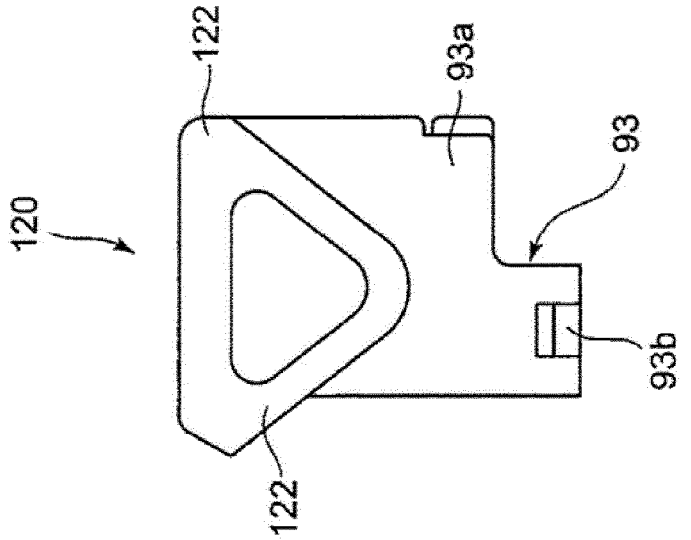


FIG. 12C



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 14 19 2786

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 230 384 A (TELEMECANIQUE [FR]) 17 October 1990 (1990-10-17) * page 3, line 12 - page 6, line 18; figures 1-7 *	1,4	INV. H01H3/50 H01H15/10 H01H50/32
Y	EP 1 487 001 A1 (OMRON TATEISI ELECTRONICS CO [JP]) 15 December 2004 (2004-12-15) * paragraphs [0019] - [0057]; figures 1-16 *	1-5	
Y	EP 0 551 777 A1 (HAGER ELECTRO [FR]) 21 July 1993 (1993-07-21) * column 1, lines 1-41 * * column 5, line 40 - column 9, line 31; figures 1-6 *	1-5	
A	US 2009/218202 A1 (FIETZ RALF-PETER [DE] ET AL) 3 September 2009 (2009-09-03) * paragraphs [0018], [0019]; figures 1a, 1b *	4	
			TECHNICAL FIELDS SEARCHED (IPC) H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 May 2015	Meyer, Jan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 19 2786

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

05-05-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2230384 A	17-10-1990	AT 404411 B	25-11-1998
		CH 682603 A5	15-10-1993
		DE 4010142 A1	18-10-1990
		ES 2021509 A6	01-11-1991
		FR 2646012 A1	19-10-1990
		GB 2230384 A	17-10-1990
		IT 1242220 B	03-03-1994
EP 1487001 A1	15-12-2004	CN 1551273 A	01-12-2004
		DE 602004002146 T2	19-07-2007
		EP 1487001 A1	15-12-2004
		ES 2268519 T3	16-03-2007
		JP 4168820 B2	22-10-2008
		JP 2004327238 A	18-11-2004
		KR 20040093008 A	04-11-2004
		US 2004263293 A1	30-12-2004
EP 0551777 A1	21-07-1993	AT 145494 T	15-12-1996
		DE 69215348 D1	02-01-1997
		DE 69215348 T2	13-03-1997
		EP 0551777 A1	21-07-1993
		FR 2686188 A1	16-07-1993
US 2009218202 A1	03-09-2009	DE 102008011707 A1	10-09-2009
		DE 202008017695 U1	22-04-2010
		EP 2096654 A1	02-09-2009
		US 2009218202 A1	03-09-2009

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- JP 2013272304 A **[0001]**
- JP 11096875 A **[0003]**