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

(11) **EP 2 919 253 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
02.08.2017 Bulletin 2017/31

(21) Application number: **15155194.2**

(22) Date of filing: **16.02.2015**

(51) Int Cl.:
H01H 50/32 *(2006.01)* *H01H 9/28* *(2006.01)*
H01H 15/10 *(2006.01)*

(54) **Electromagnetic relay**

Elektromagnetisches Relais

Relais électromagnétique

(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

(30) Priority: **11.03.2014 JP 2014047808**

(43) Date of publication of application:
16.09.2015 Bulletin 2015/38

(73) Proprietor: **OMRON CORPORATION**
Kyoto-shi, Kyoto 600-8530 (JP)

(72) Inventors:
- **Yamamoto, Shinya**
  Kyoto-shi, Kyoto 600-8530 (JP)
- **Aso, Tatsuo**
  Kyoto-shi, Kyoto 600-8530 (JP)

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

(56) References cited:
EP-A1- 1 487 001
GB-A- 2 230 384
JP-U- S 638 542
JP-U- S5 349 682
JP-U- S5 568 222
US-A1- 2006 278 504
US-A1- 2009 218 202

EP 2 919 253 B1

Description

FIELD

[0001] The disclosure relates to an electromagnetic relay including a slide switch for use in, for example, verification of actuation.

BACKGROUND

[0002] 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.

[0003] In the electromagnetic relay, however, the open or close state of the contact may be unintentionally changed if the turn lever is erroneously turned due to the touch of a user's hand or the like. In a situation in which the contact is required to be opened (contact OFF state), particularly, if the contact is erroneously closed (contact ON state), the electromagnetic relay malfunctions, which may result in failure of a device due to, for example, a short circuit.

Moreover, the prior art document GB 2 230 384 A discloses an electromagnetic relay according to the preamble of claim 1.

SUMMARY

[0004] It is the object of the invention to provide an electromagnetic relay by means of which unintentional open or close state of a contact can be prevented. This object is achieved by an electromagnetic relay according to claim 1. Further advantageous embodiments of the invention are the subject-matter of the dependent claims. Aspects of the invention are set out below.

[0005] One or more aspects of the invention provide an electromagnetic relay including a slide switch capable of preventing an unintentional change in open and close states of a contact.

[0006] An electromagnetic relay according to one or more aspects of the invention 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 that includes a cover, a slide lever, an elastic test button, and a stopper. 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 stopper is mounted on the cover and is disposed to restrict a position 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 stopper is capable of restricting the slide lever to a return position to maintain the contact mechanism at a return state.

[0007] According to one or more aspects of the invention, the stopper can restrict the slide lever to the return position to maintain the contact mechanism at the return state. This configuration allows prevention of erroneous operation of the slide lever, and also allows prevention of an unintentional change in open and close states of the contact.

[0008] The return state of the contact mechanism refers to a state in which the contact of the contact mechanism is located at a return position thereof. The return position of the contact refers to a position of the contact of the contact mechanism in the electromagnetic relay that generates no electromagnetic force.

[0009] The electromagnetic relay according to one or more aspects of the invention may have the following configuration. That is, the stopper is settable at a restriction position for restricting the slide lever to the return position and a release position indicating that the restriction of the slide lever to the return position is released.

[0010] According to one or moreaspects of the invention, the stopper can be set at the restriction position and the release position. Therefore, a user can clearly determine whether or not the slide lever is located at the return position. This configuration allows prevention of erroneous operation of the slide lever, and also allows prevention of an unintentional change in open and close states of the contact.

[0011] The electromagnetic relay according to one or more aspects of the invention may have the following configuration. That is, the stopper is mounted on the cover in a turnable manner so as to block a part of the operation hole and restrict the slide lever to the return position.

[0012] According to one or more aspects of the invention, the stopper can partly block the operation hole and also can restrict the slide lever to the return position. Therefore, the electromagnetic relay can securely regulate the sliding operation of the slide lever. Moreover, the stopper can partly block the operation hole, and therefore can prevent dust and the like from entering the slide switch through the operation hole.

[0013] The electromagnetic relay according to one or more aspects of the invention may have the following configuration. That is, a sliding direction of the slide lever from the return position to an actuation position for bringing the contact mechanism into an actuation state agrees with a turning direction of the stopper from the restriction position to the release position. Moreover, a sliding direction of the slide lever from the actuation position to the return position agrees with a turning direction of the stopper from the release position to the restriction position.

[0014] According to one or moreaspects of the invention, the sliding direction of the slide lever is in synchronization with the turning direction of the stopper. Therefore, the user can easily determine whether or not the slide lever is restricted to at least the return position. This configuration allows prevention of erroneous operation of the slide lever, and also allows prevention of an unintentional change in open and close states of the contact.

[0015] The actuation state of the contact mechanism refers to a state in which the contact of the contact mechanism is located at an actuation position thereof. The actuation position of the contact refers to a position of the contact of the contact mechanism in the electromagnetic relay that generates electromagnetic force.

[0016] The electromagnetic relay according to one or more aspects of the invention may 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.

[0017] According to one or moreaspects of the invention, the erroneous operation preventing wall can prevent unintentional contact with the slide lever, and also can prevent erroneous operation of the slide switch.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

Fig. 1 is a perspective view illustrating a state in which a stopper of an electromagnetic relay according to one or more embodiments of the disclosure is located at a restriction position;

Fig. 2 is a perspective view illustrating a state in which the stopper of the electromagnetic relay in Fig. 1 is located at a release position;

Fig. 3 is a perspective view illustrating a state in which a cover is removed from the electromagnetic relay in Fig. 1;

Fig. 4 is a longitudinal sectional view taken along line IV-IV in Fig. 1, and illustrates a state in which a slide lever of the electromagnetic relay in Fig. 1 is located at a return position;

Fig. 5 is a longitudinal sectional view taken along line V-V in Fig. 2, and illustrates a state in which the slide lever of the electromagnetic relay in Fig. 2 is located at an actuation position;

Fig. 6 is an exploded perspective view illustrating the electromagnetic relay in Fig. 1;

Fig. 7 is an exploded perspective view seen from a different angle from Fig. 6;

Fig. 8 is a perspective view illustrating the cover of the electromagnetic relay in Fig. 1;

Fig. 9 is a plan view illustrating an internal configuration of the cover in Fig. 8;

Figs. 10A, 10B, and 10C 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. 11A, 11 B, and 11C are a perspective view, a top view, and a bottom view each illustrating the stopper of the electromagnetic relay in Fig. 1;

Fig. 12 is a perspective view illustrating a slide switch of an electromagnetic relay different from the electromagnetic relay in Fig. 1; and

Fig. 13 is a perspective view illustrating a stopper of the slide switch in Fig. 12.

DETAILED DESCRIPTION

[0019] An electromagnetic relay according to one or more embodiments of the disclosure will be described below with reference to the attached drawings of Figs. 1 to 13.

[0020] 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, and a case 40. The coil block 20, the contact mechanism 30, and the case 40 are mounted on the base plate 10. The slide switch 2 is mounted on the case 40. The coil block 20 and the contact mechanism 30 are housed in the case 40.

[0021] As illustrated in Figs. 6 and 7, the base plate 10 is formed into a rectangular shape as seen in plan view, and is made of an insulative resin. As illustrated in Figs. 4 and 5, 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. 6 and 7, the insulating wall 13 has case mounting projections 14 and 14 formed on both side surfaces thereof (Figs. 6 and 7 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 a card 50 to be described later.

[0022] 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.

[0023] 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 the second fixed contact terminal 33 of the contact mechanism 30. The movable contact terminal 31 is located between the insulators 16 and 16.

[0024] As illustrated in Figs. 4 and 5, 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.

[0025] As illustrated in Figs. 4 and 5, 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.

[0026] 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 thereof 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 of the movable contact strip 31 a. The first fixed contact strip 32a has a normally-opened 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 normally-closed 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.

[0027] As illustrated in Figs. 4 and 5, the card 50 and a movable steel piece 60 are disposed between the coil block 20 and the contact mechanism 30.

[0028] 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.

[0029] As illustrated in Figs. 6 and 7, 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 of the base plate 10, so that the card 50 is mounted on the base plate 10 in a turnable manner.

[0030] 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.

[0031] As illustrated in Figs. 6 and 7, 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 in which 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.

[0032] As illustrated in Fig. 3, the case 40 also has mounting grooves 43 and 43 formed on side end surfaces of an upper end 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.

[0033] As illustrated in Figs. 1 to 3, the slide switch 2 includes a cover 70, a slide lever 80, the elastic test button 90, and a stopper 100. 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 stopper 100 is mounted on a top surface of the cover 70 so as to be turnable by 180°. 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.

[0034] As illustrated in Fig. 8, the cover 70 has an operation hole 71 formed in the top surface thereof. The operation hole 71 allows 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 prevent-

ing 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 bearings 77 and 77, positioning holes 79a and 79a, and positioning holes 79b and 79b formed on and in inner side surfaces of the erroneous operation preventing walls 72 and 72. The bearings 77 and 77 serve to support the stopper 100 in a turnable manner. The positioning holes 79a and 79a and the positioning holes 79b and 79b serve to set the position of the stopper 100. The cover 70 also has a supporting bump 76 formed on an end thereof so as to protrude from the top surface thereof. The supporting bump 76 serves to support the stopper 100. The supporting bump 76 has a recess 78 formed in one side surface thereof. The recess 78 serves to support, together with the bearings 77 and 77, the stopper 100 in a turnable manner. The recess 78 is formed to face one of the bearings 77 and 77.

[0035] 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. 9, 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.

[0036] As illustrated in Fig. 3, 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.

[0037] 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.

[0038] The elastic locking claw 82 is formed into an "R" shape as seen in plan view (see Figs. 6 and 7), 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 elastic force and prolong the lifetime of the slide lever 80 by spreading force to be applied to a joint portion between the main body 81 and the elastic locking claw 82.

[0039] The slide lever 80 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.

[0040] 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 in which the slide lever 80 is in press contact with a ceiling surface 70b of the cover 70.

[0041] The pressing projection 85 is formed into a trapezoid shape as seen in 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.

[0042] As illustrated in Fig. 4, the return position of the slide lever 80 corresponds to the position of the slide lever 80 in the state in which the movable contact 31 b and the normally-closed second fixed contact 33b are in contact with each other in the contact mechanism 30 (i.e., the contact mechanism 30 is in the return state). As illustrated in Fig. 5, on the other hand, the actuation position of the slide lever 80 corresponds to the position of the slide lever 80 in the state in which the movable contact 31 b and the normally-opened first fixed contact 32b are in contact with each other in the contact mechanism 30 (i.e., the contact mechanism 30 is in the actuation state).

[0043] As illustrated in Figs. 10A to 10C, the elastic test button 90 is formed into a substantially "Π" shape as seen in 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 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.

[0044] 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.

[0045] The protruding part 93 has two elastic pieces 93a and 93a with a clearance created between the elastic pieces 93a and 93a. 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.

[0046] As illustrated in Figs. 11A to 11C, the stopper 100 includes a stopper main body 101 and an operating flat plate 102 formed on the stopper main body 101.

[0047] The stopper main body 101 has a pair of arms 103 and 104 formed to protrude from one end thereof so as to face each other. The arms 103 and 104 have column-shaped first and second shafts 105 and 106 formed on distal ends thereof, respectively. The first and second shafts 105 and 106 extend in a widthwise direction W of the stopper main body 101, and have shaft projections 105a and 106a formed on outward ends thereof, respectively.

[0048] The first shaft 105 has both ends protruding from the arm 103. In the first shaft 105, the outward end can be attached to the bearing 77 of the erroneous operation preventing wall 72, and the inward end can be fitted into the recess 78 of the supporting bump 76. The second shaft 106 has an outward end protruding from the arm 104, and this outward end can be attached to the bearing 77 of the erroneous operation preventing wall 72. The first shaft 105 and the second shaft 106 each serve as an axis of turn of the stopper 100, and are arranged coaxially.

[0049] The stopper main body 101 also has positioning projections 107 and 107 formed on both side surfaces thereof, respectively. The positioning projections 107 and 107 can be fitted into the positioning holes 79a and 79b in the erroneous operation preventing wall 72 of the cover 70.

[0050] The operating flat plate 102 is formed into a rectangular shape as seen in plan view, and is integrally formed on the stopper main body 101. The size of the operating flat plate 102 in the widthwise direction W is substantially equal to the width of the cover 70. The operating flat plate 102 facilitates the operation of the stopper 100.

[0051] 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 Fig. 4 (the state in which the slide lever 80 is located at the return position and the contact mechanism 30 is in the return state).

[0052] 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.

[0053] 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 Fig. 4, herein, the movable contact 31 b and the normally-closed second fixed contact 33b are in contact with each other. Moreover, the movable contact 31 b and the normally-opened first fixed contact 32b face each other in a contactable and separatable manner.

[0054] 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.

[0055] 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.

[0056] 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.

[0057] 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 of the cover 70.

[0058] 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 part 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 in which the slide lever 80 is located at the return position.

[0059] 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. This clearance facilitates the sliding operation of the slide lever 80.

[0060] After the cover 70 is mounted on the case 40, further, the stopper 100 is mounted on the cover 70. Herein, the stopper 100 is mounted so as to be turnable about the first and second shafts 105 and 106 in the sliding direction of the slide lever 80. Thus, the operating direction of the slide lever 80 and the operating direction of the stopper 100 can be synchronized with each other, so that the user can easily determine whether or not the slide lever 80 is restricted to the return position. Moreover, when the top surface and bottom surface of the stopper 100 are colored with different colors, respectively, the user can more easily determine whether or not the slide lever 80 is restricted to the return position. The stopper 100 may be mounted on the cover 70 in advance.

[0061] In the following, description will be given of the actuation of the electromagnetic relay 1 in the state in which the slide lever 80 of the slide switch 2 slides from the return position to the actuation position.

[0062] In the state in which the slide lever 80 is located at the return position, the stopper 100 is disposed at the position illustrated in Fig. 1 (the restriction position). As illustrated in Fig. 4, the stopper main body 101 blocks the operation hole 71 except a portion where the operating projection 83 protrudes, to thereby securely restrict the slide lever 80 to the return position. Moreover, the positioning projection 107 of the stopper main body 101 is fitted into the positioning hole 79a in the erroneous operation preventing wall 72. Thus, the stopper 100 is set at the restriction position.

[0063] In order to move the slide lever 80 to the actuation position, the stopper 100 is turned to the position illustrated in Fig. 2 (release position) to open the operation hole 71. Thus, the stopper 100 releases the restriction to the sliding operation of the slide lever 80. Herein, the positioning projection 107 of the stopper main body 101 is fitted into the positioning hole 79b in the erroneous operation preventing wall 72. Thus, the stopper 100 is set at the release position. The stopper 100 does not disturb the sliding operation of the slide lever 80, and therefore can ensure the favorable sliding operation of the slide lever 80.

[0064] As illustrated in Figs. 4 and 5, next, 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.

[0065] 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.

[0066] 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.

[0067] 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 normally-opened first fixed contact 32b. Thus, the actuation state illustrated in Fig. 5 is established.

[0068] 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.

[0069] 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 Fig. 4. 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 Fig. 5 to the return state illustrated in Fig. 4 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.

[0070] The electromagnetic relay 1 includes the stopper 100 capable of restricting the slide lever 80 to the return position for bringing the contact mechanism 30 into the return state. The stopper 100 can prevent erroneous operation of the slide lever 80, and also can prevent an unintentional change in open and close states of the movable contact 31 b.

[0071] In the electromagnetic relay 1, the stopper 100 can be set at the restriction position and the release position. Therefore, the user can clearly determine whether or not the slide lever 80 is located at the return position. Thus, the stopper 100 can prevent the user from erroneously operating the slide lever 80.

[0072] The electromagnetic relay 1 may employ any other contact mechanisms in addition to the contact mechanism 30.

[0073] The electromagnetic relay 1 is not limited to the configuration employing the slide switch 2, but may include a slide switch 202 illustrated in Fig. 12. The slide switch 202 includes a cover 270, a slide lever 280, and a stopper 300. The slide lever 280 is disposed to be slidable via an operation hole formed in one of longitudinal ends of the cover 270. As illustrated in Fig. 13, the stopper 300 is formed into a substantially lateral "U" shape, and includes a holding part 301 and fitting projections 302 and 302.

[0074] The slide switch 202 has fitting grooves 271 and 271 formed on side surfaces of the cover 270 at ends where the slide lever 280 is formed. The stopper 300 is attached to the cover 270 in such a manner that the fitting projections 302 and 302 of the stopper 300 are fitted into the fitting grooves 271 and 271. Thus, the stopper 300 can restrict the position of the slide lever 280.

[0075] As described above, the slide lever can be restricted to an arbitrary position in such a manner that the shapes of the slide lever and stopper are changed in accordance with the design and the like of the slide switch.

[0076] In the electromagnetic relay 1, 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 72 may be formed on at least one of the two edges of the operation hole 71.

[0077] In the electromagnetic relay 1, the return position of the slide lever 80 corresponds to position of the slide lever 80 in the state in which the normally-closed second fixed contact 33b and the movable contact 31 b are in contact with each other in the contact mechanism 30; however, the disclosure is not limited thereto. For example, the electromagnetic relay 1 does not necessarily include the second fixed contact (normally-closed fixed contact). The return position of the slide lever may be a position of the slide lever in a state in which the movable contact and the first fixed contact (normally-opened fixed contact) are not in contact with each other.

[0078] 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 lever which is slidable via an operation hole, and a stopper which is disposed to restrict the position of the slide lever.

Claims

1. An electromagnetic relay (1) comprising a case (40) and a contact mechanism (30) housed in the case (40),
   the electromagnetic relay (1) 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 and configured to be slidable via an operation hole (71) formed in the cover
   an elastic test button (90) housed in the cover and actuated in a direction crossing one surface of the case (40) in accordance with the sliding operation of the slide lever and
   a stopper (100) mounted on the cover and disposed to restrict a position of the slide lever

   the slide switch 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) according to the sliding operation of the slide lever wherein the stopper is adapted to restrict the slide lever to a return position to maintain the contact mechanism (30) at a return state, **characterized in that** the stopper is mounted on the cover in a turnable manner so as to block a part of the operation hole (71) and restrict the slide lever to the return position.

2. The electromagnetic relay (1) according to claim 1, **characterized in that**
   the stopper is settable at a restriction position for restricting the slide lever to the return position and a release position indicating that the restriction of the slide lever to the return position is released.

3. The electromagnetic relay (1) according to claim 1 or 2, **characterized in that**
   a sliding direction of the slide lever from the return position to an actuation position for bringing the contact mechanism (30) into an actuation state agrees with a turning direction of the stopper from the restriction position to the release position, and
   a sliding direction of the slide lever from the actuation position to the return position agrees with a turning direction of the stopper from the release position to the restriction position.

4. The electromagnetic relay (1) according to claim 3, **characterized in that**
   the cover 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.

Patentansprüche

1. Elektromagnetisches Relais (1), das ein Gehäuse (40) und einen Kontaktmechanismus (30) aufweist, der in dem Gehäuse (40) untergebracht ist,
   wobei das elektromagnetische Relais (1) enthält:

   einen Schiebeschalter (2), der aufweist:

   eine Abdeckung (70), die auf einer Seite des Gehäuses (40) angebracht ist;
   einen Gleithebel (80), der in der Abdeckung untergebracht ist und dazu eingerichtet ist, sich gleitend über ein Betätigungsloch (71)

bewegen zu lassen, das in der Abdeckung ausgebildet ist,
eine elastische Testtaste (90), die in der Abdeckung untergebracht ist und in einer Richtung quer über eine Fläche des Gehäuses (40) in Entsprechung zu der gleitenden Betätigung des Gleithebels betätigt wird, und
einen Anschlag (100), der an der Abdeckung befestigt ist und angeordnet ist, um eine Stellung des Gleithebels zu beschränken,

wobei der Schiebeschalter dazu eingerichtet ist, einen Kontakt (31b, 32b, 33b) des Kontaktmechanismus (30) in Verbindung mit der Betätigung der elastischen Testtaste (90) in Entsprechung zu der gleitenden Betätigung des Gleithebels zu öffnen und zu schließen, wobei
der Anschlag dazu eingerichtet ist, den Gleithebel auf eine Rückkehrstellung zu beschränken, um den Kontaktmechanismus (30) in einem Rückkehrzustand aufrecht zu erhalten,
dadurch gekennzeichnet, dass der Anschlag an der Abdeckung drehbar angebracht ist, so dass ein Teil des Betätigungslochs (71) versperrt wird und der Gleithebel auf die Rückkehrstellung beschränkt wird.

2. Elektromagnetisches Relais (1) nach Anspruch 1, **dadurch gekennzeichnet, dass**
der Anschlag in eine Beschränkungsstellung zur Beschränkung des Gleithebels auf die Rückkehrstellung und in eine Freigabestellung einstellbar ist, die anzeigt, dass die Beschränkung des Gleithebels auf die Rückkehrstellung aufgehoben ist.

3. Elektromagnetisches Relais (1) nach Anspruch 1 oder 2,
dadurch gekennzeichnet, dass
eine Gleitrichtung des Gleithebels von der Rückkehrstellung in eine Betätigungsstellung, um den Kontaktmechanismus (30) in einen Betätigungszustand zu versetzen, einer Drehrichtung des Anschlags von der Beschränkungsstellung in die Freigabestellung entspricht, und
eine Gleitrichtung des Gleithebels von der Betätigungsstellung in die Rückkehrstellung einer Drehrichtung des Anschlags von der Freigabestellung in die Beschränkungsstellung entspricht.

4. Elektromagnetisches Relais (1) nach Anspruch 3, **dadurch gekennzeichnet, dass**
die Abdeckung eine Wand (72) zur Verhinderung einer irrtümlichen Betätigung aufweist, die von wenigstens einem Rand des Betätigungslochs (71) vorspringt, um eine irrtümliche Betätigung des Gleithebels zu verhindern.

Revendications

1. Relais électromagnétique (1) comprenant un boîtier (40) et un mécanisme de contact (30) logé dans le boîtier (40),
le relais électromagnétique (1) comprenant :

un commutateur à glissière (2) incluait :

un couvercle (70) monté sur une surface du boîtier (40) ;
un levier à glissière (80) logé dans le couvercle et configuré pour pouvoir glisser par le biais d'un trou d'actionnement (71) formé dans le couvercle ;
un bouton de test élastique (90) logé dans le couvercle et actionné dans une direction croisant une surface du boîtier (40) conformément à l'opération de glissement du levier à glissière ; et
une butée (100) montée sur le couvercle et disposée pour limiter une position du levier à glissière ,

le commutateur à glissière étant configuré pour ouvrir et fermer un contact (31b, 32b, 33b) du mécanisme de contact (30) conjointement avec l'actionnement du bouton d'essai élastique (90) selon l'opération de glissement du levier à glissière, dans lequel
la butée est adaptée pour limiter le levier à glissière vers une position de retour afin de maintenir le mécanisme de contact (30) dans un état de retour,
caractérisé en ce que la butée est montée sur le couvercle de façon rotative de manière à bloquer une partie du trou d'actionnement (71) et à limiter le levier à glissière vers la position de retour.

2. Relais électromagnétique (1) selon la revendication 1, **caractérisé en ce que**
la butée peut être installée dans une position de restriction pour restreindre le levier à glissière vers la position de retour et une position de relâchement indiquant que la restriction du levier à glissière vers la position de retour est relâchée.

3. Relais électromagnétique (1) selon la revendication 1 ou 2, **caractérisé en ce que**
une direction de glissement du levier à glissière depuis la position de retour vers une position d'actionnement pour amener le mécanisme de contact (30) dans un état d'actionnement concorde avec une direction de rotation de la butée depuis la position de restriction vers la position de relâchement, et
une direction de glissement du levier à glissière depuis la position d'actionnement vers la position de

retour concorde avec une direction de rotation de la butée depuis la position de relâchement vers la position de restriction.

4. Relais électromagnétique (1) selon la revendication 3, **caractérisé en ce que**
le couvercle comporte une paroi de prévention contre un actionnement erroné (72) faisant saillie depuis au moines un des bords du trou d'actionnement (71) afin d'empêcher un actionnement erroné du levier à glissière.

FIG. 1

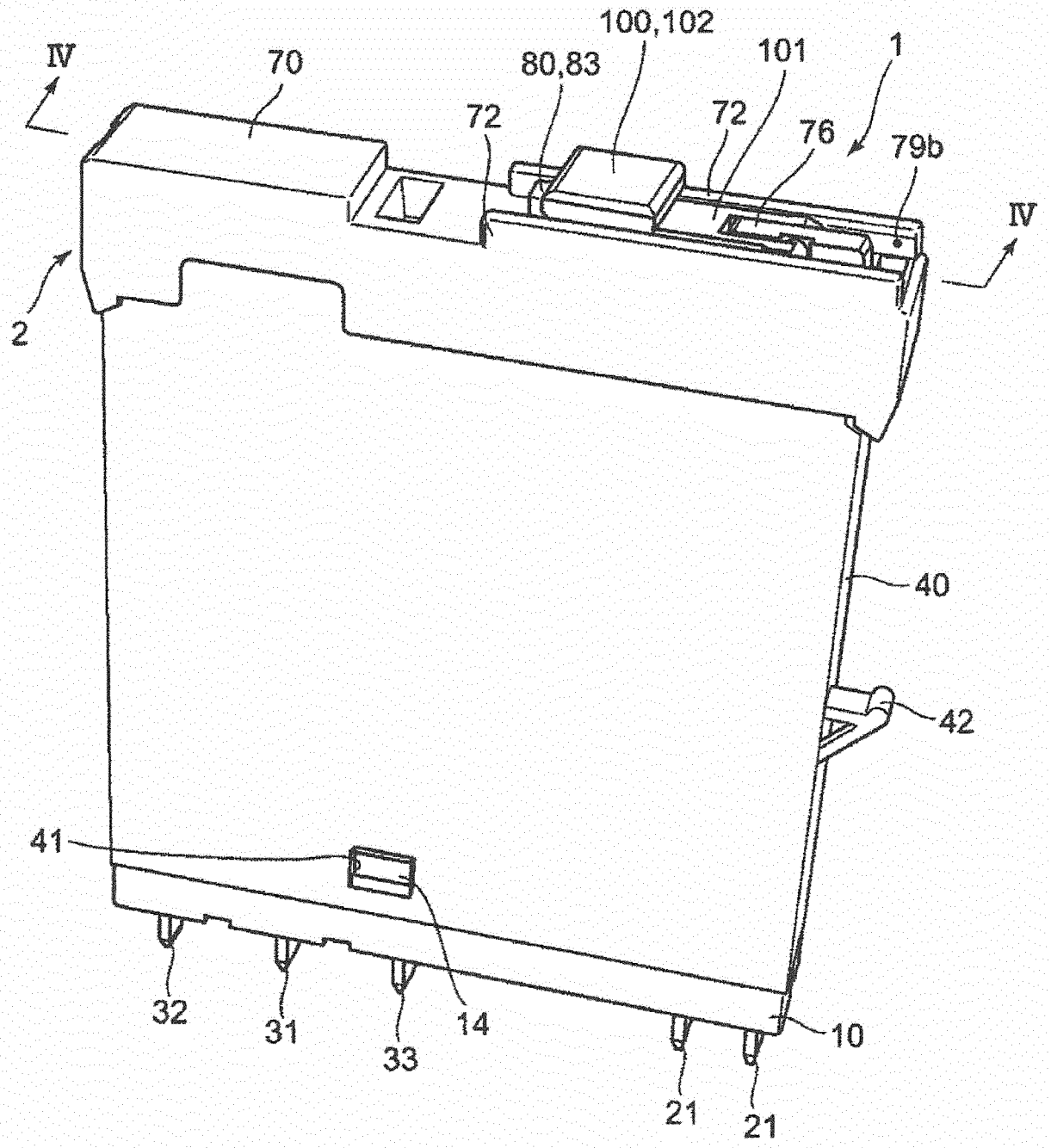

IV
70
100,102
80,83
101
1
72
72
76
79b
IV
2
40
42
41
32
31
33
14
10
21
21

FIG. 2

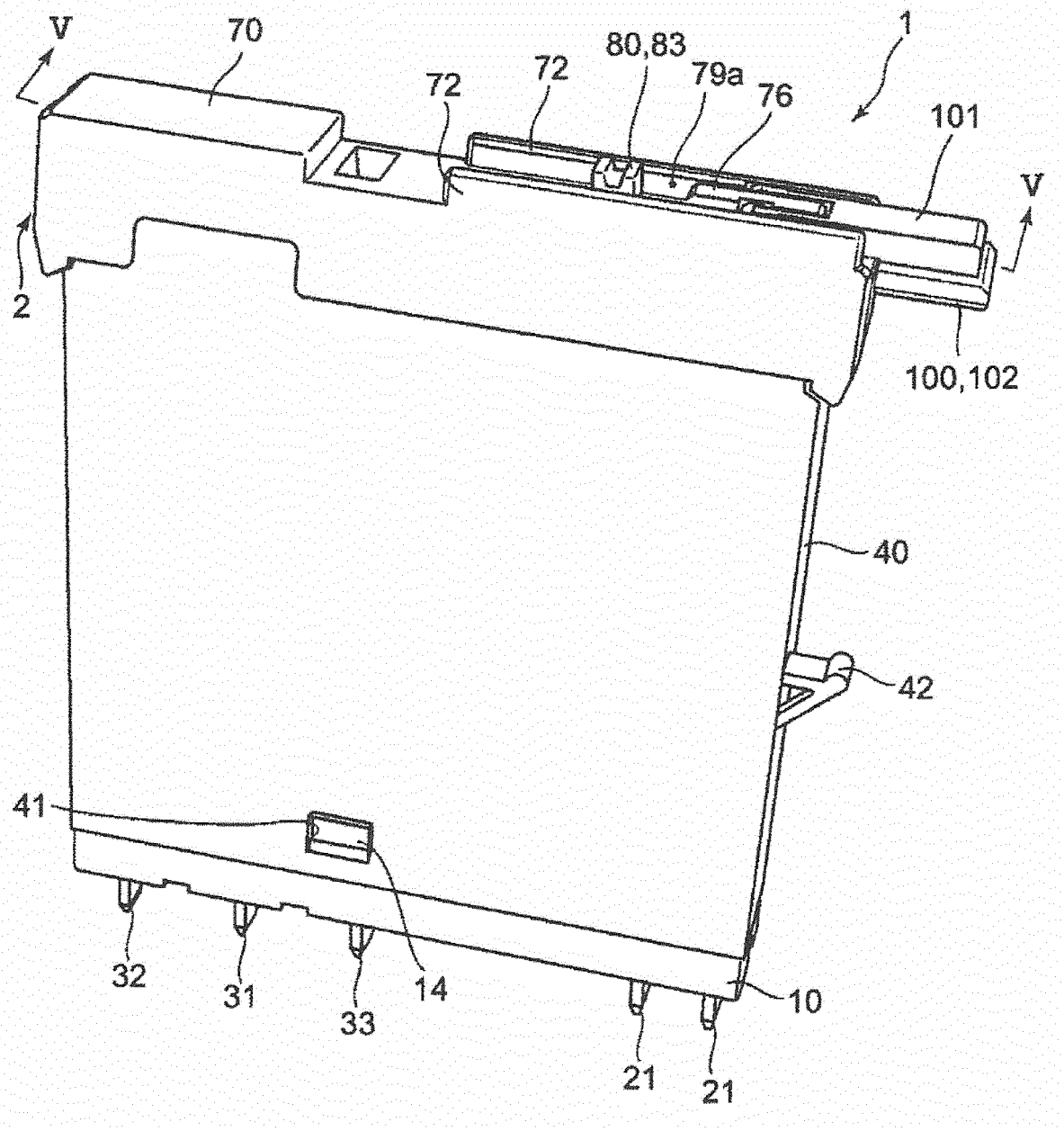


FIG. 3

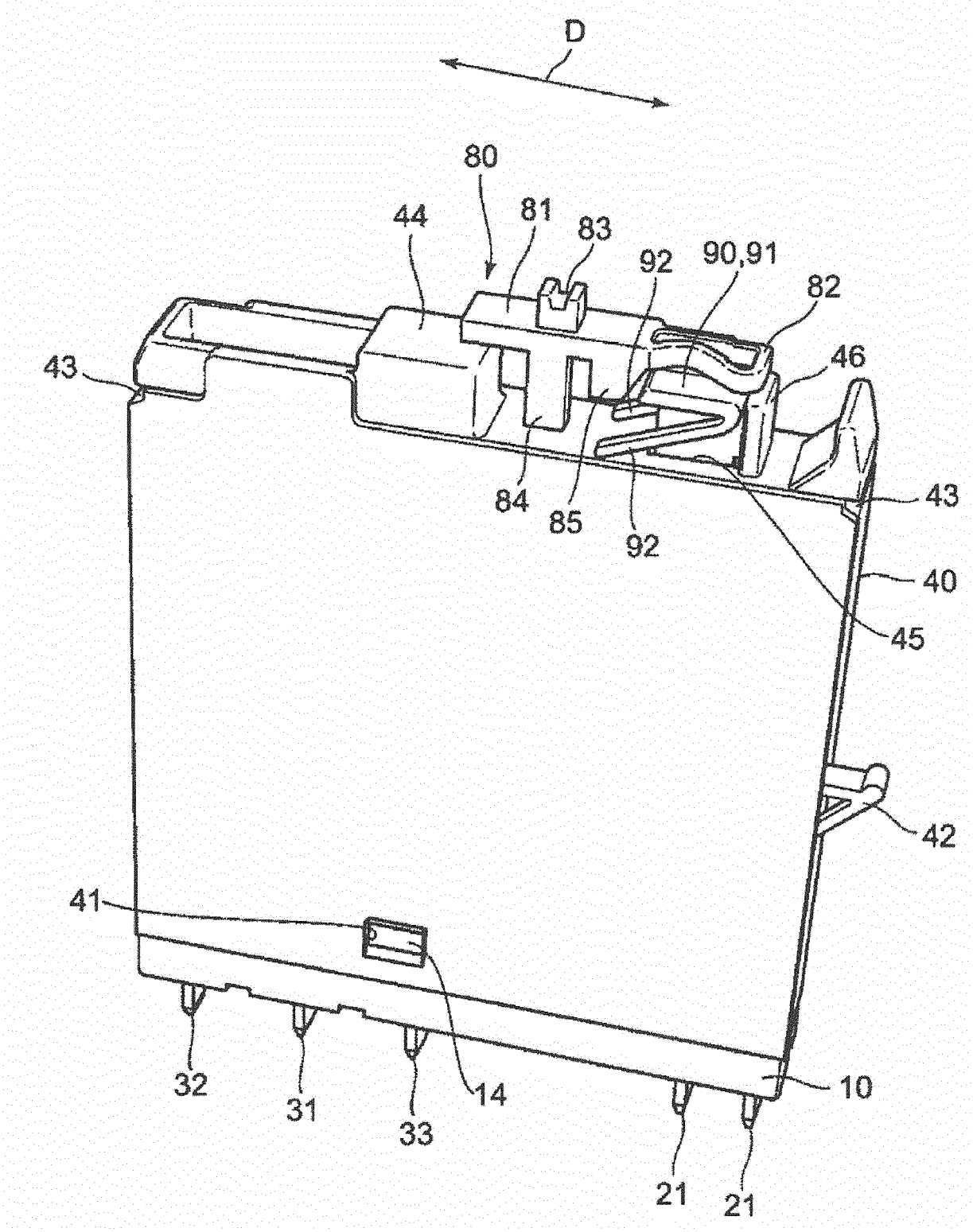

D
80
44
81
83
92
90,91
82
46
43
84
85
92
43
40
45
42
41
32
31
33
14
10
21
21

FIG. 4

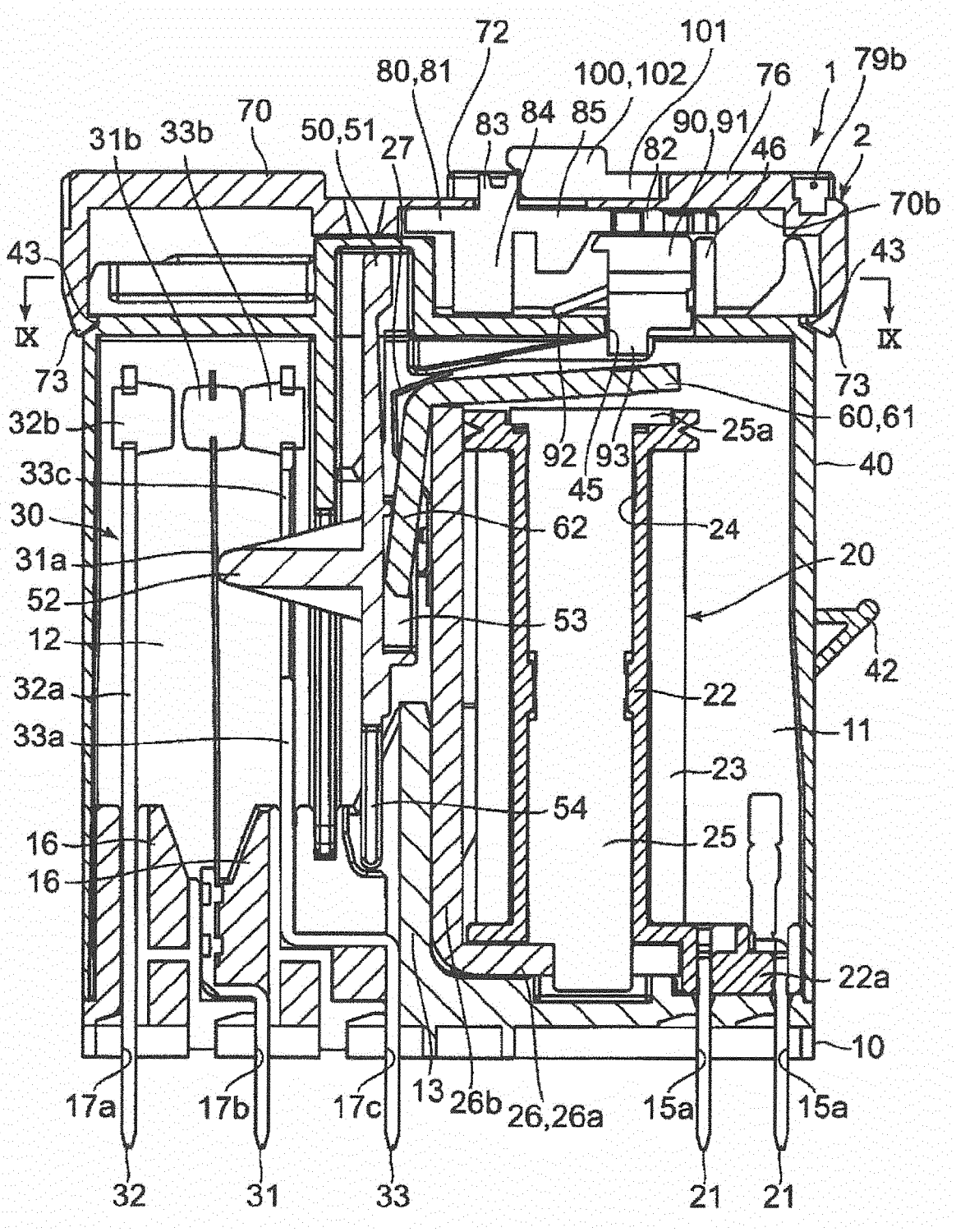

72
101
80,81
100,102
76
1
79b
70
31b
33b
50,51
27
83
84
85
90,91
82
46
2
70b
43
IX
43
IX
73
73
60,61
32b
25a
92
93
45
40
33c
30
62
24
20
31a
52
53
12
42
32a
22
11
33a
23
54
25
16
16
22a
10
17a
17b
17c
13
26b
26,26a
15a
15a
32
31
33
21
21

FIG. 5

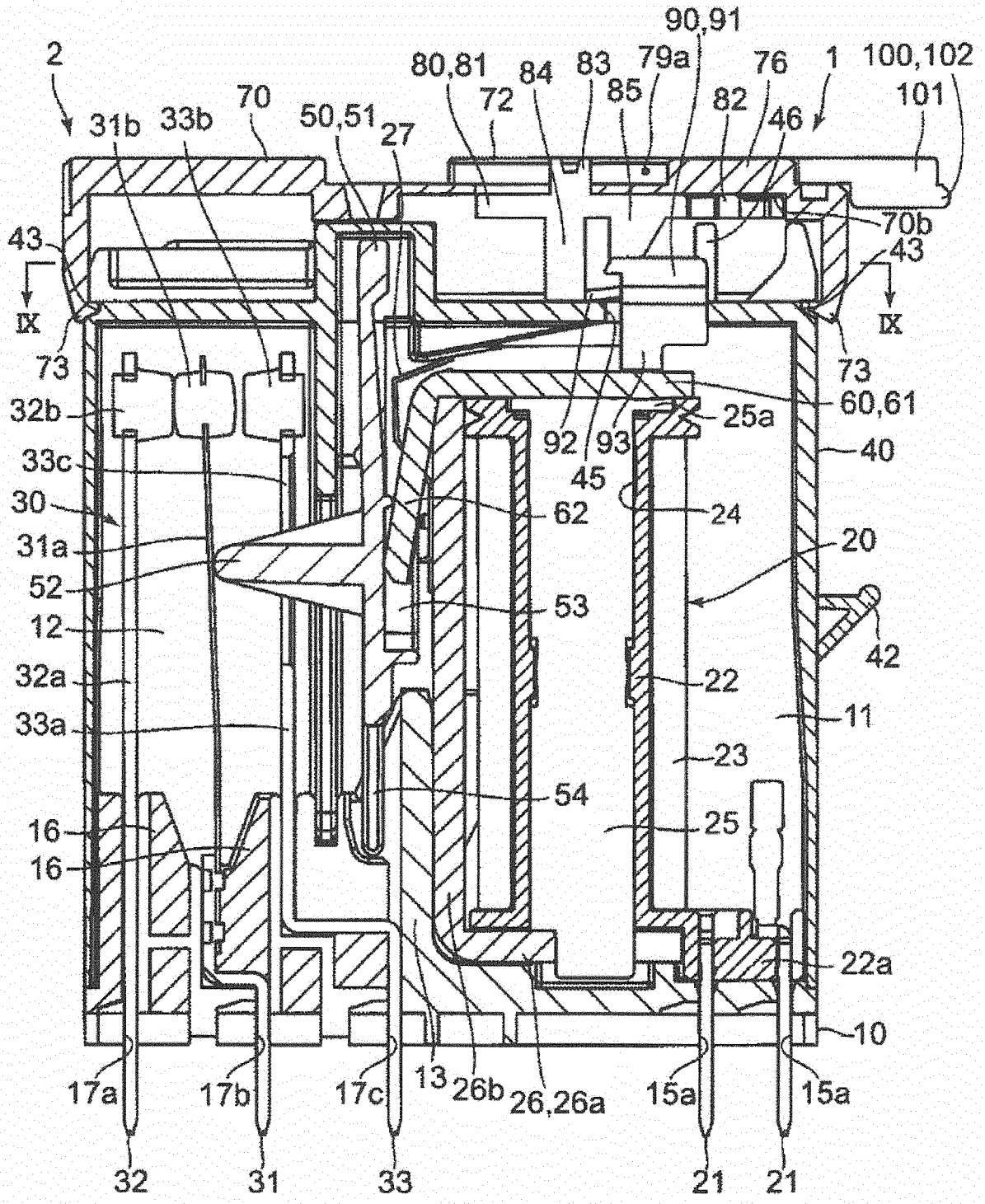

2
31b
33b
70
50,51
27
80,81
72
84
83
85
79a
90,91
82
76
46
1
100,102
101
70b
43
IX
73
32b
33c
30
31a
52
12
32a
33a
16
16
17a
17b
17c
13
26b
26,26a
15a
15a
32
31
33
21
21
22a
10
11
23
25
54
22
53
42
20
24
62
45
92
93
25a
60,61
40

FIG. 6

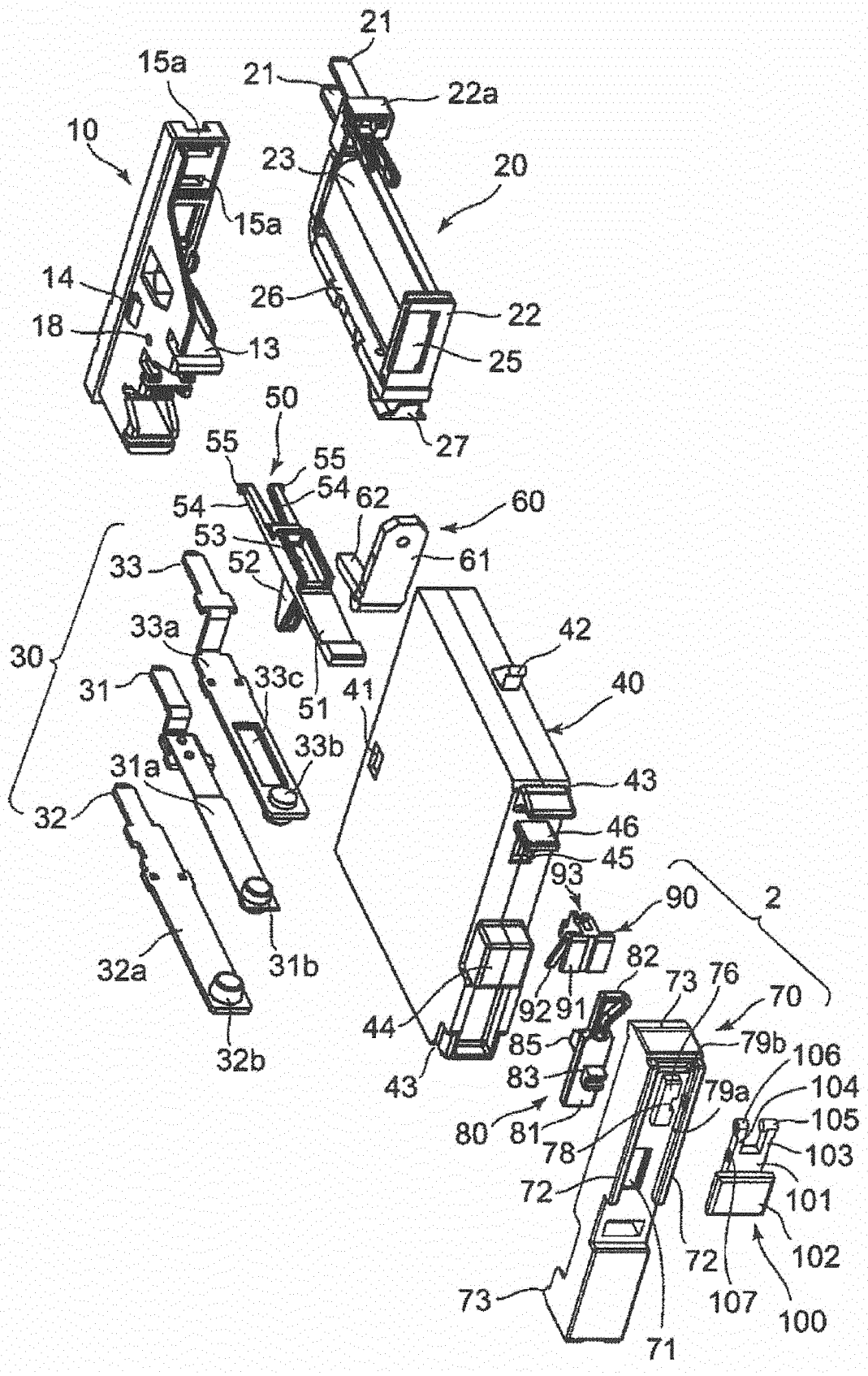

21
15a
21
22a
10
23
20
15a
14
26
22
18
13
25
50
27
55
55
54
54
62
60
53
61
33
52
42
33a
40
30
33c
31
51
41
33b
43
31a
46
45
32
93
90
2
82
73
76
70
32a
31b
44
92
91
85
79b
106
83
79a
104
43
80
81
78
105
103
72
101
72
102
32b
73
107
100
71

FIG. 7

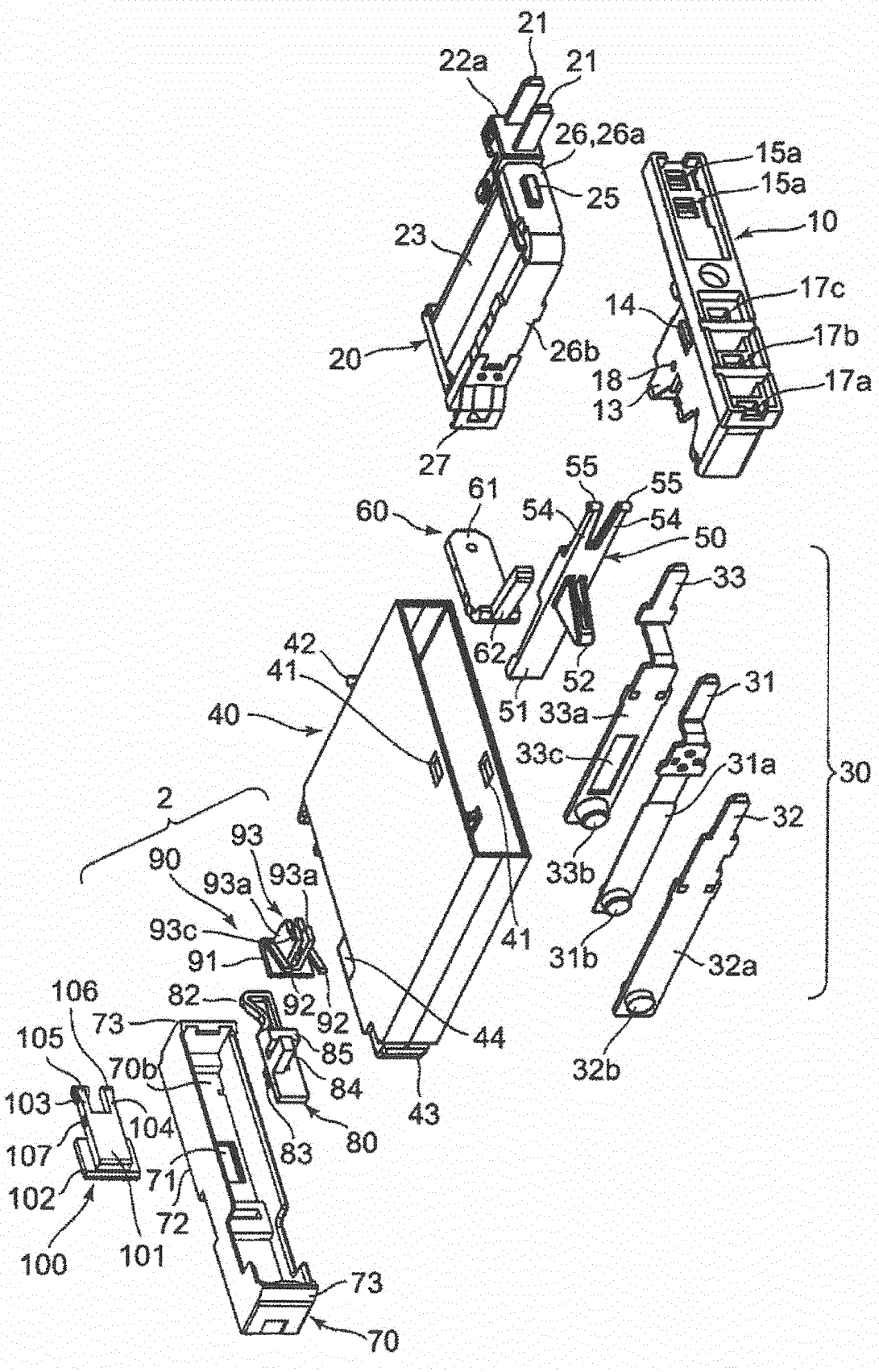

21
22a
21
26,26a
15a
15a
25
10
23
17c
14
17b
20
26b
18
17a
13
27
55
61
55
60
54
54
50
33
42
62
52
31
41
51
33a
40
33c
31a
30
2
32
93
90
93a
93a
33b
93c
41
91
31b
32a
106
82
92
92
73
44
105
85
70b
84
32b
103
104
43
80
107
83
71
102
72
100
101
73
70

FIG. 8

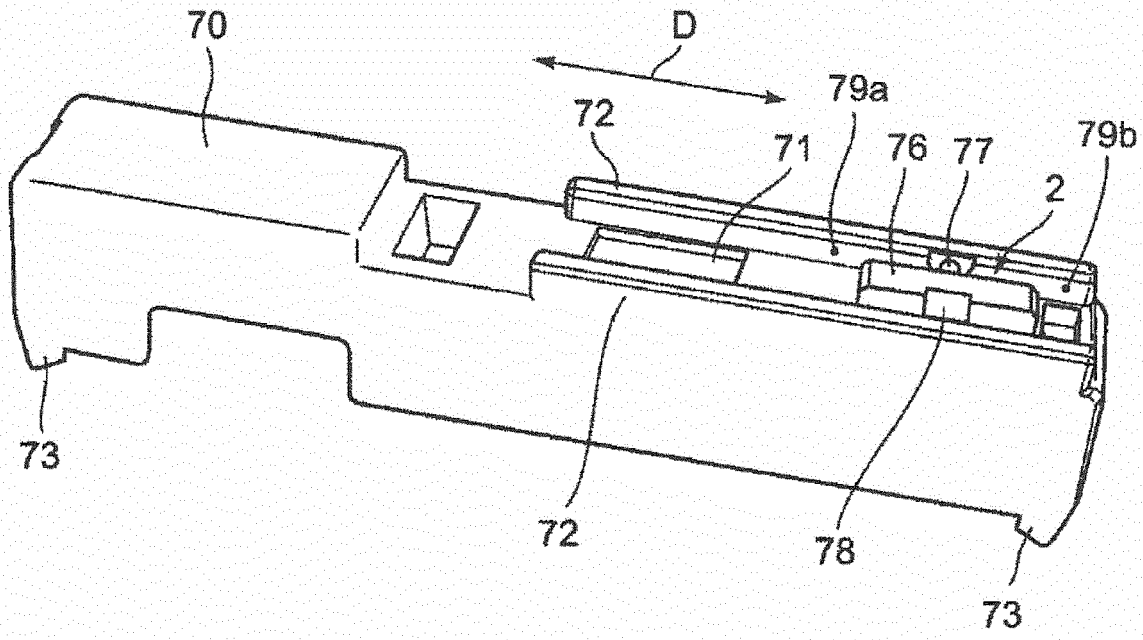


FIG. 9

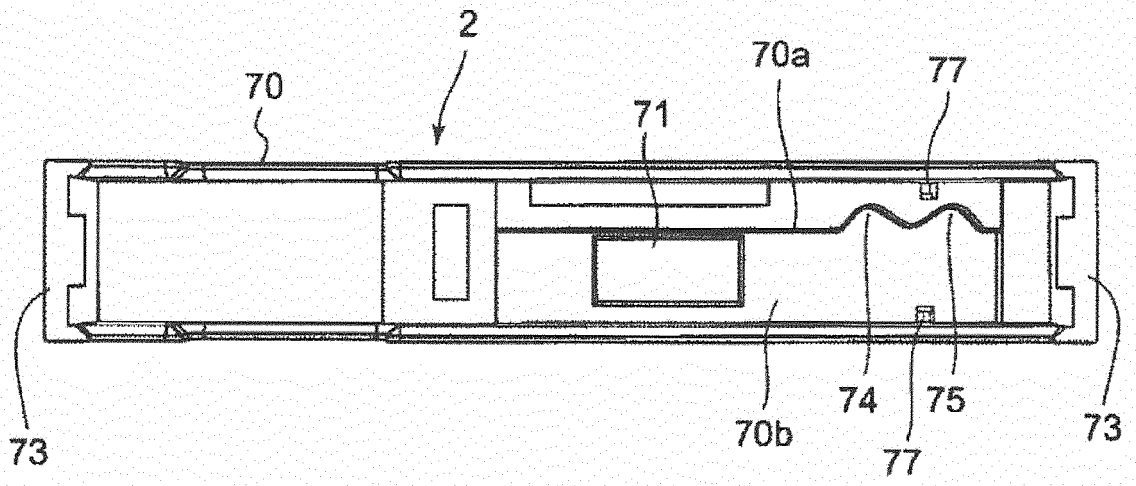


FIG. 10C

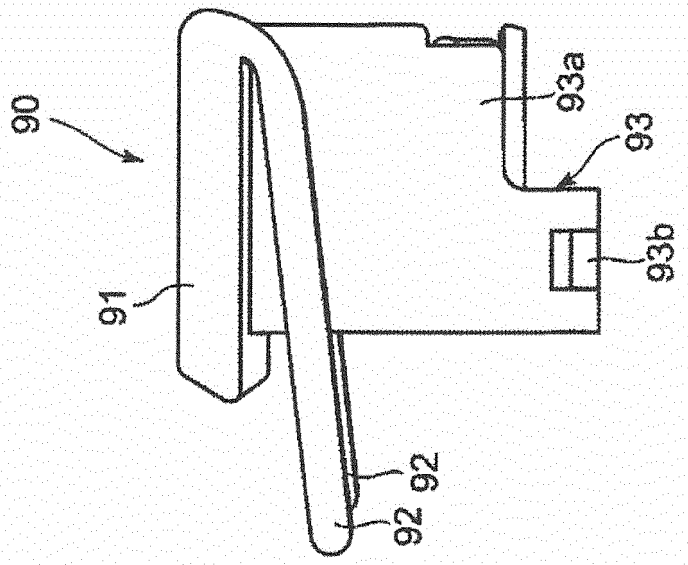


FIG. 10B

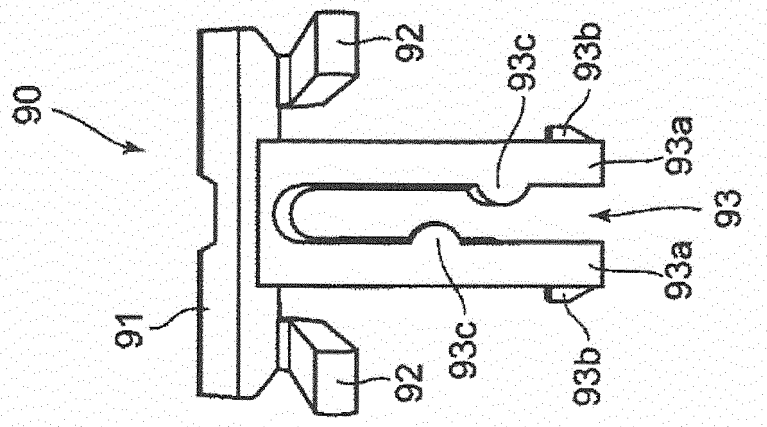


FIG. 10A

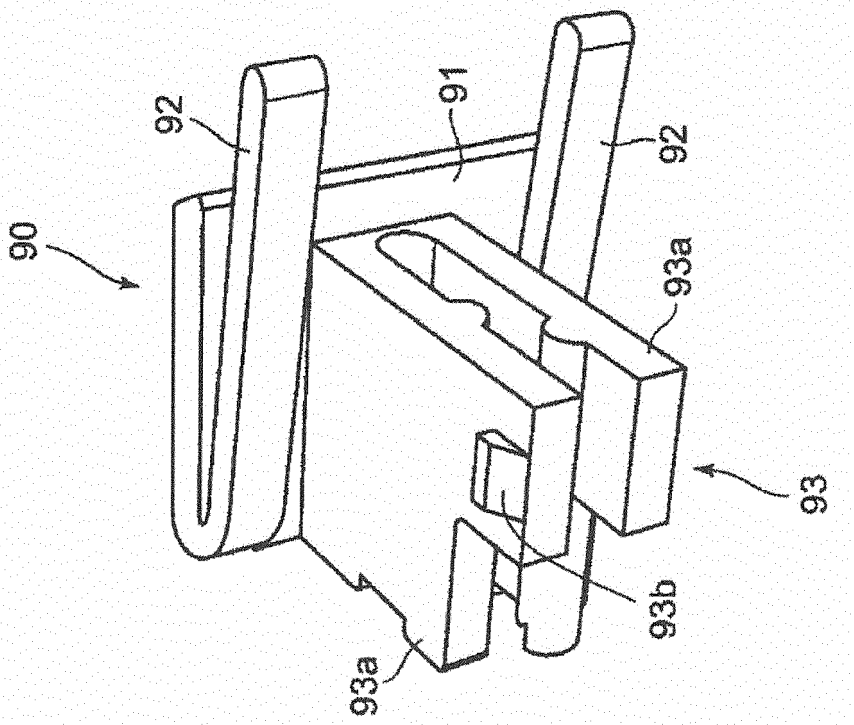


FIG. 11A

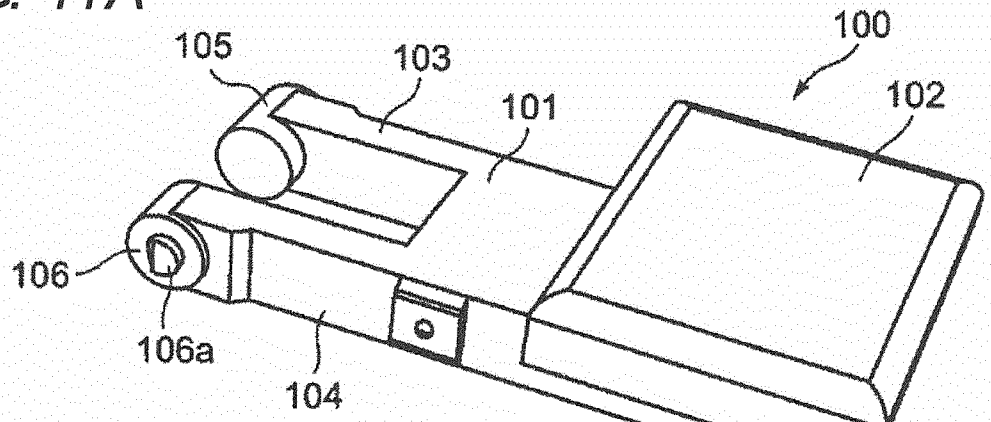


FIG. 11B

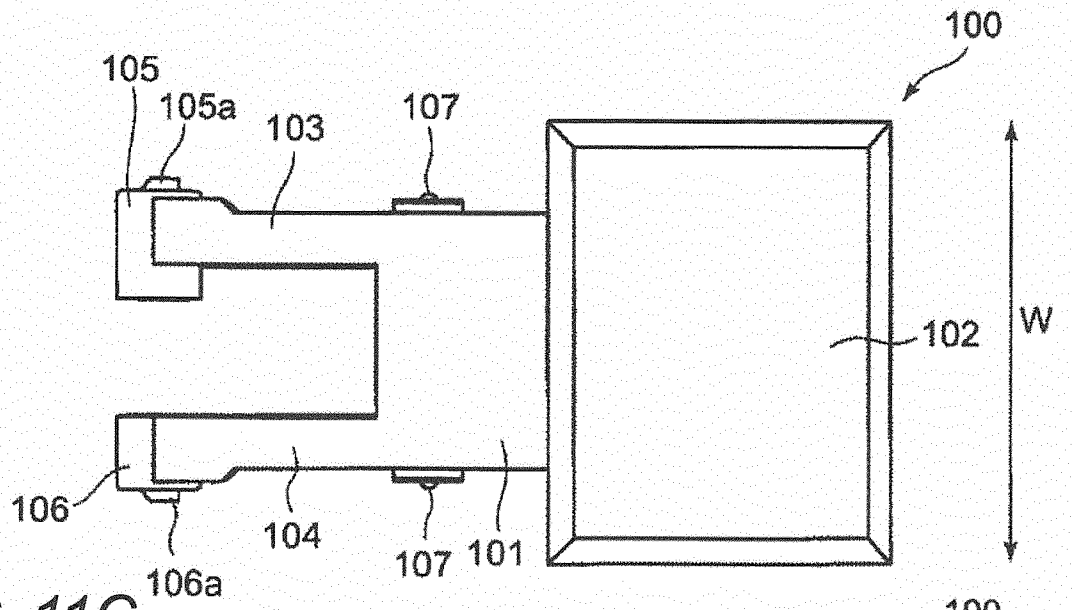


FIG. 11C

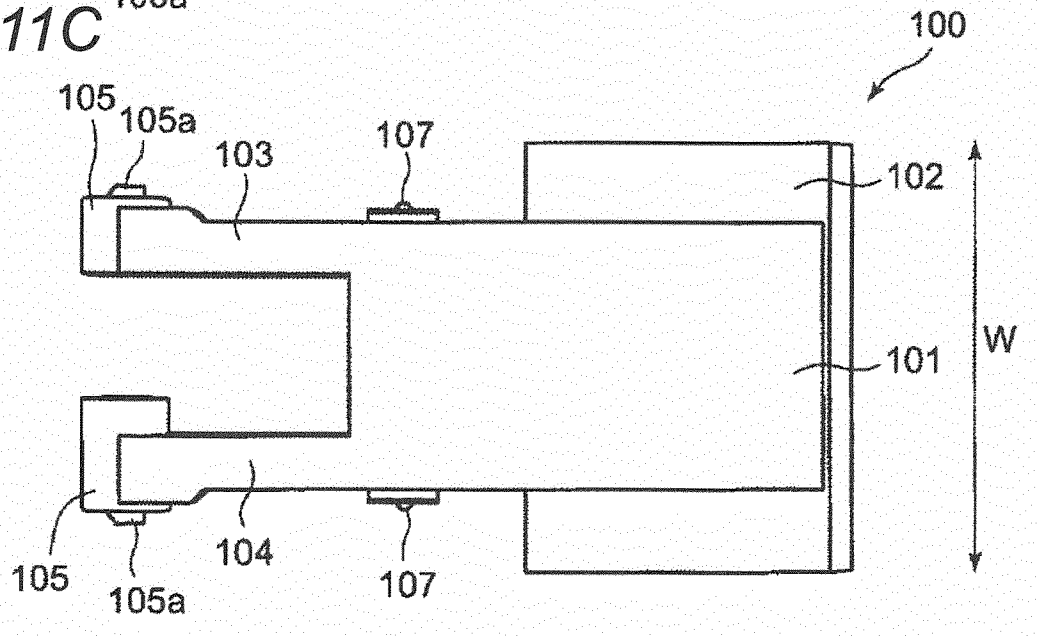


FIG. 12

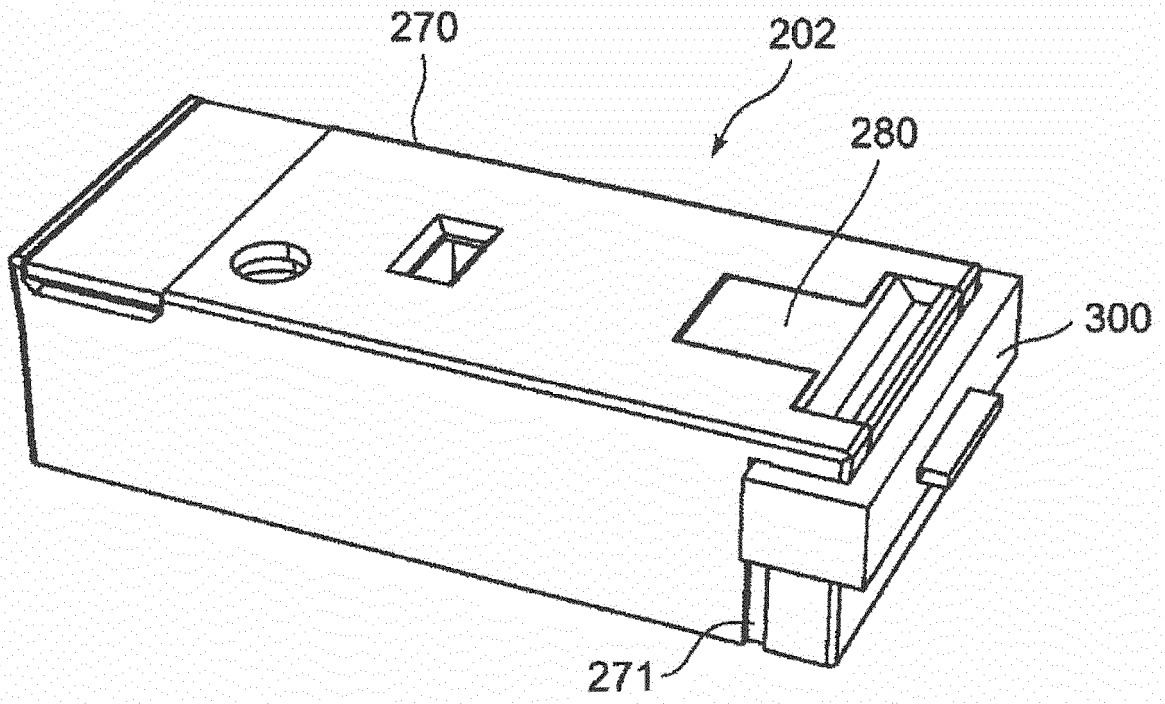
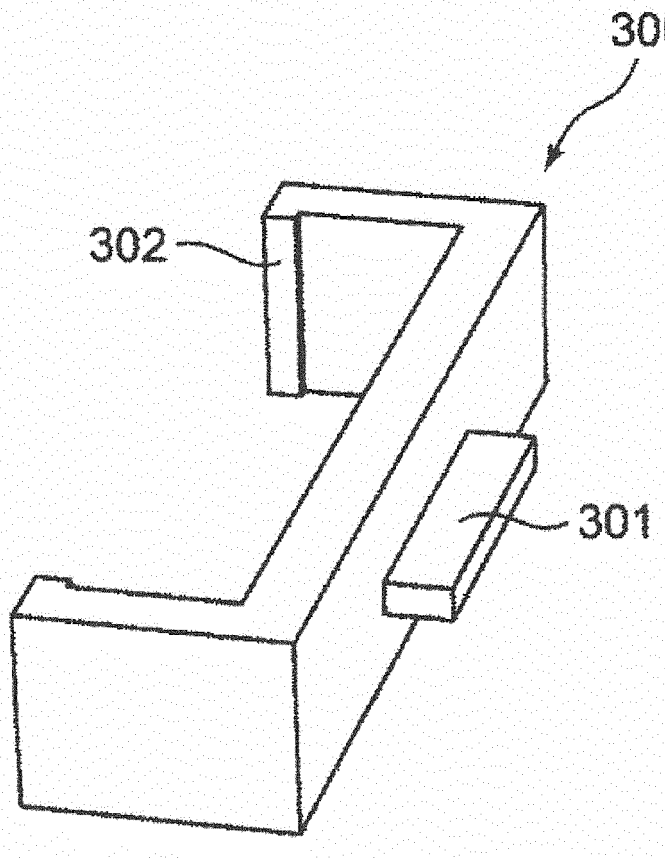


FIG. 13



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 11096875 A **[0002]**
- GB 2230384 A **[0003]**