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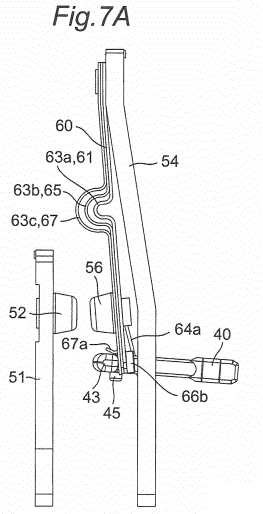
(54) CONTACT POINT MECHANISM PART, AND ELECTROMAGNETIC RELAY PROVIDED WITH SAME

(57) Provided is a contact mechanism for engaging driving projections 43, 44 provided on one end of a slidable card 40 with a distal end of a movable contact plate 60 and sliding the card to rotate the movable contact plate, causing movable contacts 56,57 on the movable contact plate to connect with and disconnect from stationary contacts 52, 53. The mechanism comprises a pair of driving projections on one end of the card and projected in opposite directions from neighborhood corners of the one end of the card, and a pair of returning elastic tongues 67b, 67c disposed so that they can make contacts with the driving projections. When the movable contacts are in contact with the stationary contacts, a distance between one of the driving projections 44 and one of the returning elastic tongues 67b is smaller than that between the other of the driving projections 43 and the other of the returning elastic tongues 67c.

Fig.7A



EP 3 021 342 A1

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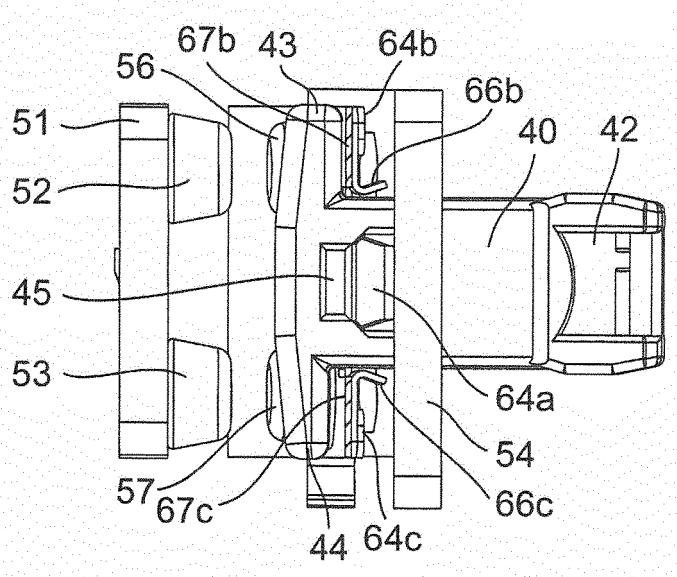
Fig.7B


67b
43
64b
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66b
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52
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53
64a
54
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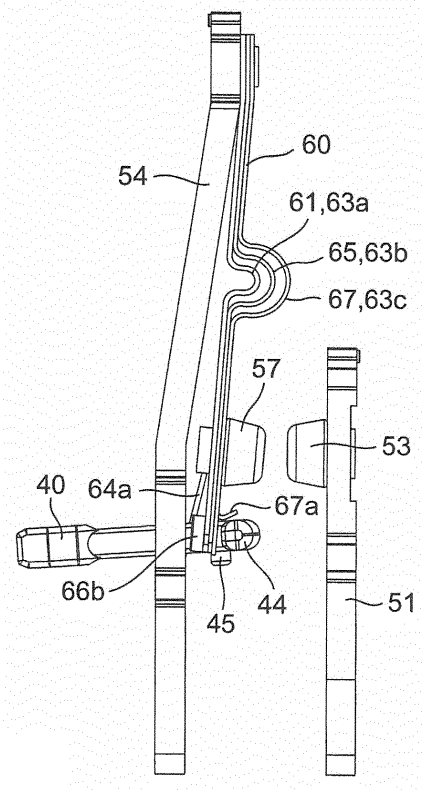
67c
66c
44
64c

Fig.7C


60
54
61,63a
65,63b
67,63c
57
53
40
64a
67a
66b
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44
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Description

TECHNICAL FIELD

[0001] The present invention relates to a contact mechanism and, more particularly, to a contact mechanism to be assembled in a switching device such as an electromagnetic relay.

BACKGROUND

[0002] Conventionally, there has been disclosed, in Fig. 1 of Patent Document 1, a switching device such as an electromagnetic relay in which an armature 10 rotates back and forth in response to applications of voltage and thereby to an electromagnetic coil 8 to slidingly move an actuator 13 up and down, which in turn moves a contact spring 4 to make and break contacts between a contact button 6 and a second relay contact 3.

[0003] Patent Document 1: US Patent No. 6,661,319

[0004] According to the contact mechanism, the actuator 13 has a projection 15 in the form of bracket at its lower end to engage the contact spring 4 so that a breaking force is loaded evenly on substantially the entire transverse length of the contact spring. Then, when breaking the contacts, the movable contact plate 4 receives force acting only in a substantially vertical direction thereof, causing an increased load in the separation of the contacts, which needs the armature 10 to generate a greater driving force and, to this end, results in greater power consumption.

[0005] Considering those problems, an object of the present invention is to provide a contact mechanism which uses less power and driving force for making and breaking the contacts, and an electromagnetic relay with the contact mechanism.

SUMMARY OF THE INVENTION

[0006] According to one aspect of the invention, a contact mechanism for engaging driving projections provided on one end of a slidable card with a distal end of a movable contact plate and sliding the card to rotate the movable contact plate, causing movable contacts on the movable contact plate to connect with and disconnect from stationary contacts, the contact mechanism comprises a pair of driving projections disposed on one end of the card and projected in opposite directions from neighborhood corners of the one end of the card, and a pair of returning elastic tongues disposed so that they can make contacts with the driving projections, wherein, in condition that the movable contacts are in contact with the stationary contacts, a distance between one of the driving projections and one of the returning elastic tongues is smaller than that between the other of the driving projections and the other of the returning elastic tongues.

[0007] According to the invention, in the operation of disconnection, one of the driving projections of the card makes a contact with one of the returning elastic tongues of the movable plate and then the other of the driving projections of the card makes a contact with the other of the returning elastic tongues of the movable plate. Therefore, this results in a transitional condition in which only one of the driving projections is in contact with one of the returning elastic tongues, causing a torsional force or moment in the movable plate, which needs less force and less energy consumption in the disconnection of the contacts.

[0008] Also, only an adjustment of the distance between the driving projections of the card and the returning elastic tongues of the movable plate causes a desired disconnecting force and torsional moment, which in turn facilitates a design of the contact mechanism and ensures a precise and reliable control of the force and moment.

[0009] In another aspect of the invention, the contact mechanism takes a state in which one of the driving projections is in contact with one of the returning elastic tongues and the other of the driving projections is out of contact with the other of the returning elastic tongues while the while the movable contact moves away from the stationary contact.

[0010] According to this aspect of the invention, additionally another advantage is obtained that the returning elastic tongues move in a stable manner and the contact mechanism is minimized.

[0011] In another aspect of the invention, the pair of driving projections of the card takes different shapes from each other and the pair of returning elastic tongues of the moving contact plate takes the same shape.

[0012] According to this aspect of the invention, like previously described contact mechanisms, the returning elastic tongues are brought into contacts with the driving projections of the card at different times, which ensures a less energy consumption and a reliable contact in the contact mechanism.

[0013] In another aspect of the invention, the pair of driving projections of the card takes the same shape and the pair of returning elastic tongues of the moving contact plate takes different shapes from each other.

[0014] This aspect of the invention increases a design flexibility and facilitates the design of the contact mechanism.

[0015] In another aspect of the invention, a pair of moving contacts are arranged on the free end of the moving contact plate so that they are spaced apart from each other in a widthwise direction of the contact plate, and a pair of stationary contacts are arranged so that they are spaced away from each other.

[0016] This aspect of the invention allows an employment of a double contact structure in the contact mechanism, which enhances a contact reliability in the contact mechanism.

[0017] In another aspect of the invention, in order to overcome the problems, an electromagnetic relay com-

prises any one of the contact mechanisms described above.

[0018] According to the invention, in the operation of disconnection, one of the driving projections of the card makes a contact with one of the returning elastic tongues of the movable plate and then the other of the driving projections of the card makes a contact with the other of the returning elastic tongues of the movable plate. Therefore, this results in a transitional condition in which only one of the driving projections is in contact with one of the returning elastic tongues, causing a torsional force or moment in the movable plate, which needs less force and less energy consumption in the disconnection of the contacts.

[0019] Also, only an adjustment of the distance between the driving projections of the card and the returning elastic tongues of the movable plate causes a desired disconnecting force and torsional moment, which in turn facilitates a design of the contact mechanism and ensures a precise and reliable control of the force and moment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1A is a general perspective view showing an electromagnetic relay to which a first embodiment according to the present invention is applied and Fig. 1B is a perspective view showing a state in which a cover is removed from the first embodiment in Fig. 1A.

Figs. 2A and 2B are plan views showing states brought before and after an operation.

Fig. 3 is an exploded perspective view showing the first embodiment illustrated in Fig. 1A.

Fig. 4 is an exploded perspective view seen at a different angle from Fig. 3.

Fig. 5 is a perspective view showing a box-shaped base illustrated in Fig. 1B.

Fig. 6 is an exploded perspective view showing a main part according to the first embodiment illustrated in Fig. 1B.

Figs. 7A, 7B and 7C are front, bottom and rear views showing a contact mechanism illustrated in Fig. 3, respectively.

Figs. 8A and 8B are plan and sectional views showing a card illustrated in Fig. 3.

Figs. 9A and 9B are partial enlarged perspective and bottom views in which a moving contact terminal is removed from a driving mechanism portion illustrated in Fig. 1B.

Figs. 10A and 10B are front and rear views showing a contact mechanism according to a second embodiment of the present invention.

Figs. 11A and 11B are a bottom view of a contact mechanism and a perspective view of a third conductive thin plate spring illustrated in Fig. 10.

EMBODIMENTS OF THE INVENTION

[0021] With reference to Figs. 1A to 10B, an electromagnetic relay according to an embodiment of the invention will be described.

[0022] An electromagnetic relay according to a first embodiment of the invention includes a box-shaped base 10, an electromagnet block 20, a rotating block 30, a card 40, a contact mechanism 50, a support plate 70 and a cover 80.

[0023] As shown in Fig. 5, the base 10, which is configured to be a rectangular thin box, has an interior separated by an insulating wall 11 into first and second cavities 12 and 13. The insulating wall 11 has a cutout 11a defined therein. The rectangular base 1 has vertical shallow grooves 14a formed in its external side surfaces. The grooves 14a accept engaging portions 14b formed in and projected from the bottom surfaces thereof.

[0024] The first cavity 12 has a bearing 16 provided on a bottom surface thereof for supporting a rotating shaft 34a of the rotating block 30 which will be described below. Positioning concaves 17a and 17b are provided on opposite sides of the bearing 16 for positioning the electromagnet block 20 which will be described below. A concave cutout 18 is provided on an opening edge of the first cavity 12 for positioning a spool 21 of the electromagnet block 20 which will be descried below.

[0025] Terminal grooves 15a and 15b are formed on an open edge of the second cavity 13 for receiving stationary and movable contact terminals 51 and 54 of the contact mechanism 50 which will be described below.

[0026] As shown in Fig. 6, the electromagnet block 20 has a spool 21 with opposite flanges 22a and 22b, a coil 23 wound around the spool 21, an iron core 24 inserted in a through-hole 22c formed in the spool 21, and yokes 25 and 27 fixed on the opposite ends of the iron core 24 projecting from the opposite flanges. Each of the yokes 25 and 27 is made of a T-shaped, punched magnetic plate with transversely extended wide portions 26 and 28, which is then right angled to have an L-shaped configuration. A pair of coil terminals 29 are press inserted in the terminal holes formed in the flange 22a of the spool 21. The opposite ends of the coil 23 are engaged around the respective coil terminals 29 and then soldered.

[0027] Five terminal holes may be formed in parallel in the flange 22a, allowing more coil terminals 29 and/or various arrangements of the coil terminals 29 to be selected as necessary. The coil terminals 29 are not limited to a straight rod-like terminal, and it may be have another configuration such as T-shape.

[0028] The rotating block 30 has a rotating block body 33. The rotating block body 33, which has a permanent magnet (not shown) and a pair of movable iron plates 31 and 32 provided on opposite sides of the permanent magnet, is made by insert molding. The rotating block body 33 has a pair of rotating shafts 34a and 34b coaxially projecting from the opposite upper and lower surfaces of the block body 33 and a driving arm 35 integrally mounted

on a side surface of the block body 33. The driving arm 35 has an engaging nail 36 formed on a distal end thereof.

[0029] As shown in Fig. 8, the card 40 has a driving hole 41 provided on one side and an engaging hole 42 provided on the other side. The card 40 also has driving projections provided on one end thereof and projected in the opposite directions so that it has a substantially T-shape. The card 40 further has a fail-safe projection provided adjacent the peripheral edge of the driving hole 41. One driving projection 43 has a greater thickness than the other driving projection 44 so as to prevent the movable contact plate 60 does not contact them simultaneously.

[0030] As shown in Figs. 6 and 7, the contact mechanism 50 has a stationary contact terminal 51 and a movable contact terminal 54. For convenience of description, in Fig. 7 distal ends of the returning elastic tongue 67b and 67c provided on the distal end of the second conductive thin plate spring 65 are removed in part. The stationary contact terminal 51 has a pair of stationary contacts 52 and 53 spaced apart from each other in the widthwise direction and fixed to one end thereof.

[0031] The movable contact terminal 54 supports the movable contact plate 60 fixed to one side thereof and has an operating hole 55 provided on the other side. The movable contact plate 60, which is made of three - first, second and third - conductive thin plate springs 61, 65 and 67 stacked one on top the other, has a pair of movable contacts 56 and 57 spaced apart from each other in the widthwise direction and integrally fixed to the distal end portion of the plate.

[0032] The first conductive thin plate spring 61 has a spring constant adjusting slit 62a extending in a longitudinal direction from the proximal to distal end thereof and a substantially U-shaped fold 63a provided in its mid-portion so as to accommodate its deformation and then ensure a desired operating characteristic thereof. The distal end of the spring 61 is forked into three prongs including a central driving elastic tongue 64a and two reinforcing elastic tongues 64b and 64c provided on opposite sides of the central tongue.

[0033] The second conductive thin plate spring 65 has a spring constant adjusting slit 62b extending in a longitudinal direction from the proximal to distal end thereof and a substantially U-shaped fold 63a provided in its mid-portion so as to accommodate its deformation and then ensure a desired operating characteristic thereof. The second conductive thin plate spring 65 has an engaging cutout 66a formed in a distal, central portion thereof and two prongs provided on opposite sides of the cutout 66a. The prongs have opposing inner edges thereof which are right angled in the same direction to form position regulating elastic tongues 66b and 66c.

[0034] The third conductive thin plate spring 67 has a substantially U-shaped fold 63c provided in its mid-portion so as to accommodate its deformation and then ensure a desired operating characteristic thereof. The distal end of the spring 67 is forked into three prongs including a central driving elastic tongue 64a and two reinforcing elastic tongues which are right angled to form a position regulating elastic tongue 67a and a pair of returning elastic tongues 67b and 67c.

[0035] The spring constants of the first and second conductive thin plate springs 61 and 65 can be adjusted by changing the widths and/or lengths of the slits 62a and 62b. This facilitates the adjustment of the spring loads at making and breaking operations of the contacts, enhancing the design flexibility of the relay.

[0036] As shown in Fig. 3, the support plate 70 has both ends engaged and supported on the opposing opening edges of the base 10. The rotating shaft 34b of the rotating block 30 is fitted in the bearing hole 71 formed at the center of the plate 70. Also, the ends 26b and 28b of the wide portions 26 and 28 of the yoke 25 and 27 are fitted in the positioning rectangular holes 72. This causes that the electromagnet block 20 and the rotating block 30 are positioned precisely.

[0037] The cover 80 takes a rectangular configuration capable of covering the opening of the base 10, and has an elastic engaging portions 81 extending from respective outer peripheral edges thereof.

[0038] Description will be made to an assembling of the electromagnetic relay.

[0039] As shown in Figs. 3 and 5, the electromagnet block 20 is positioned in the first cavity 12 of the base 10 (Fig. 6) with one ends 26a and 28a of the wide portions 26 and 28 of the yokes 25 and 27 fitted in the positioning concaves 17a and 17b on the bottom surface of the first cavity 12 and also with the flange 22a engaged in the cutout 18 of the base 10. According to the embodiment, the electromagnet block 20 is positioned in the base 10 at several portions, which is advantageous that it is precisely assembled in the base. Then, the stationary contact terminal 51 is fitted and positioned in the groove 15a of the second cavity 13.

[0040] As shown in Figs. 3 and 9, the card 40 is inserted in the operating hole 55 of the movable contact terminal 54 and is thus assembled into the movable contact plate 60 fixed to the movable contact terminal 54. For convenience of description, the movable contact terminal 54 is not shown in Fig. 5B.

[0041] Specifically, as shown in Fig. 9, the driving elastic tongue 64a of the first conductive thin plate spring 61 is inserted in the driving hole 41 of the card 40. The card 40 is positioned or held by engaging the position regulating elastic tongues 66b and 66c of the second conductive thin plate spring 65 on the opposite side surfaces of the card 40. Also, the position regulating elastic tongue 67a of the third conductive thin plate spring 67 is engaged on one end of the card 40, and the returning elastic tongues 67b and 67c are engaged on the driving projections 43 and 44 of the card 40 for the vertical positioning of the card.' Further, the engaging nail 36 of the rotating block 30 is engaged in the engaging hole 42 of the card 40 and then the card 40 is inserted in the base 10. Thereafter, the card 40 is inserted in the operating cutout 11a

of the insulating wall 11 of the base 10, and the movable contact terminal 54 is press fitted and thereby positioned in the terminal groove 15b. Subsequently, the rotating shaft 34a of the rotating block 30 is fitted in the bearing 16 of the base 10 to rotatably support the rotating block 30.

[0042] Furthermore, the opposite ends of the support plate 70 are engaged and supported on the opening edges of the base 10, and the rotating shaft 34b of the rotating block 30 is fitted in the bearing hole 71. Also, the other ends 26b and 28b of the wide portions 26 and 28 in the yokes 25 and 27 are fitted and positioned in the positioning rectangular holes 72 and 72g. Therefore, the electromagnet block 20 and the rotating block 30 are precisely positioned in the base 10, which results in a stable operating characteristic.

[0043] Finally, the cover 80 is positioned to cover the opening portion of the base 10, and the elastic engaging portion 81 of the cover 80 is engaged with the engaging portion of the base 10, which completes the assembling of the relay.

[0044] An operation of this present embodiment will be described below.

[0045] As shown in Fig. 2A, in the rotating block 30, the end 32a of the movable iron plate 32 is attracted to the wide portion 26 of the yoke 25 and the other end 31b of the movable iron plate 31 is attracted to the wide portion 28 of the yoke 27 by the magnetic force of the permanent magnet (not shown). This causes that the movable contact plate 60 is attracted toward the movable contact terminal 54 against a spring force thereof through the card 40, which results in that the movable contact 56 is disconnected from the stationary contact 52. For convenience of description, the support plate 70 is not shown in Figs. 2A and 2B.

[0046] A voltage is applied to the coil 23 to generate a magnetic force in a direction which overcomes the magnetic force of the permanent magnet in the rotating block 30. This allows that one end 31a of the movable iron plate 31 of the rotating block 30 is attracted to the wide portion 26 of the yoke 25 and the other end 32b of the movable iron plate 32 of the rotating block 30 is attracted to the wide portion 28 of the yoke 27 so that the rotating block 30 is rotated. This allows the driving arm 35 to force the card 40, causing the spring force of the movable contact plate 60 to act on the card 40 through the driving elastic tongue 64a, which slidingly moves the card 40 toward the stationary contact terminal 51. As a result, the movable contact plate 60 is moved away from the movable contact terminal 54 by its spring force so that the movable contacts 56 and 57 are brought into contacts with the stationary contacts 52 and 53. Subsequently, the one end 31a of the movable iron plate 31 of the rotating block 30 is attracted to the wide portion 26 of the yoke 25, and the other end 32b of the movable iron plate 32 is attracted to the wide portion 28 of the yoke 27. This allows that, even if the application of the voltage to the coil 23 is halted, the card 40 is immovably fixed so that the connections between the movable contacts 56 and 57 and the stationary contacts 52 and 53 are maintained. In this state, a distance between the driving projection 43 and the returning elastic tongue 67b is smaller than that between the driving projection 44 and the returning elastic tongue 67c.

[0047] When a voltage is applied to the coil 23 in the opposite direction, the end 32a of the movable iron plate 32 is attracted to the wide portion 26 of the yoke 25, and the other end 31b of the movable iron plate 31 is attracted to the wide portion 28 of the yoke 27, causing the rotating block 30 to rotate in the opposite direction, which results in that the card 40 is pulled by the engaging nail 36 of the rotating block 30 to slidingly move away from the stationary contact terminal 51. The driving projection 43 makes a contact with the returning elastic tongue 67b of the third conductive thin plate spring 67, and then the driving projection 44 makes a contact with the returning elastic tongue 67c. This means that during the breakings of the contacts between the movable and the stationary contacts 56 and 52 and the movable and the stationary contacts 57 and 53 , the card 40 makes a contact with one side of the movable contact plate 60, acting not only a separating force but also a torsional force or moment on the third conductive thin plate spring 67 so that the movable contact 56 is disconnected from the stationary contact 52 and then the movable contact 57 is disconnected from the stationary contact 53. This eases the disconnections between fused, be that as they may, movable and stationary contacts 56, 57 and 52, 53.

[0048] As shown in Figs. 10 to 10A-11B, the second embodiment of the invention is substantially the same as the first embodiment except that, the driving projections 43 and 44 of the T-shaped card 40 have the same configuration and the pair of returning elastic tongues 67b and 67c provided on the distal ends of the third conductive thin plate spring 67 have different bending angles (Fig. 11B).

[0049] Therefore, the driving projection 43 is out of contact with the returning elastic tongue 67b of the third conductive thin plate spring 67 during the contact disconnection or when the driving projection 44 of the card is in contact with the returning elastic tongue 67c of the third conductive thin plate spring 67.

[0050] An operation according to the second embodiment is substantially the same as that in the first embodiment. When an electromagnet block 20 is activated to rotate a rotating block 30 and thereby sliding a card 40, the movable contacts 56 and 57 simultaneously contact the stationary contacts 52 and 53 through the first conductive thin plate spring 61. Even if the voltage application to the coil 23 of the electromagnet block 20 is halted, the card 40 is held in its active position due to the magnetic force of the permanent magnet and then the connection between the movable contacts 56 and 57 and the stationary contacts 52 and 53 is maintained.

[0051] When the voltage is applied to the coil 23 of the electromagnet block 20 in the opposite direction, the ro-

tating block 30 is rotated in the opposite direction so that the card 40 is slidingly moved in the opposite direction through the engaging nail 36 of the rotating block 30. This results in that the driving projection 43 of the card 40 contacts the returning elastic tongue 67c of the third conductive thin plate spring 67 and then the driving projection 44 contacts the returning elastic tongue 67b of the third conductive thin plate spring 67, which generates a torsional moment in the movable contact plate 60. This results in that the card 40 makes a contact with one side of the movable contact plate 60, and then not only the separation force but also the torsional force is applied to the third conductive thin plate spring 67. As a result, the movable contact 57 is disconnected from the stationary contact 53 and then the movable contact 56 is disconnected from the stationary contact 52, which eases the disconnection between fused, be that as they may, movable and stationary contacts 56, 57 and 52, 53.

[0052] The electromagnetic relay according to the invention is not limited to that described above, and the invention can be applied to various electromagnetic relays and electronic devices.

PARTS LIST

[0053]

10 box-shaped base
11 insulating wall
11a cutout
12 first cavity
13 second cavity
15a, 15b terminal groove
16 bearing
17a, 17b positioning concave
18 cutout
20 electromagnet block
21 spool
22a, 22b flange
23 coil
24 iron core
25, 27 yoke
26, 28 wide portion
29 coil terminal
30 rotating block
31, 32 movable iron plate
33 block body
34a, 34b rotating shaft
35 driving arm
36 engaging nail
40 card
41 driving hole
42 engaging hole
43 driving projection
45 fail safe projection
50 contact mechanism
51 stationary contact terminal
52, 53 stationary contact
54 movable contact terminal
55 operating hole
56, 57 movable contact
60 movable contact plate
61 first conductive thin plate spring
62a, 62b spring constant adjusting slit
63a, 63b, 63c fold
64a driving elastic tongue
64b, 64c reinforcing elastic tongue
65 second conductive thin plate spring
66b, 66c position regulating elastic tongue
67 third conductive thin plate spring
67a position regulating elastic tongue
67b, 67c returning elastic tongue
70 support plate
71 bearing hole
72 positioning rectangular hole
80 cover
81 elastic engaging portion

Claims

1. A contact mechanism for engaging driving projections provided on one end of a slidable card with a distal end of a movable contact plate and sliding the card to rotate the movable contact plate, causing movable contacts on the movable contact plate to connect with and disconnect from stationary contacts, the contact mechanism comprising:

   a pair of driving projections disposed on one end of the card and projected in opposite directions from neighborhood corners of the one end of the card; and
   a pair of returning elastic tongues disposed so that they can make contacts with the driving projections;
   wherein, in condition that the movable contacts are in contact with the stationary contacts, a distance between one of the driving projections and one of the returning elastic tongues is smaller than that between the other of the driving projections and the other of the returning elastic tongues.

2. The contact mechanism according to claim 1, wherein the contact mechanism takes a state in which one of the driving projections is in contact with one of the returning elastic tongues and the other of the driving projections is out of contact with the other of the returning elastic tongues while the while the movable contact moves away from the stationary contact.

3. The contact mechanism according to claim 1 or 2, wherein the pair of driving projections of the card takes different shapes from each other and the pair of returning elastic tongues of the moving contact

plate takes the same shape.

4. The contact mechanism according to claim 1 or 2, wherein the pair of driving projections of the card takes the same shape and the pair of returning elastic tongues of the moving contact plate takes different shapes from each other.

5. The contact mechanism according to any of claims 1 to 4, wherein a pair of moving contacts are arranged on the free end of the moving contact plate so that they are spaced apart from each other in a widthwise direction of the contact plate, and a pair of stationary contacts are arranged so that they are spaced away from each other.

6. An electromagnetic relay comprising the contact mechanism according to any of claims 1 to 5.

Fig.1A

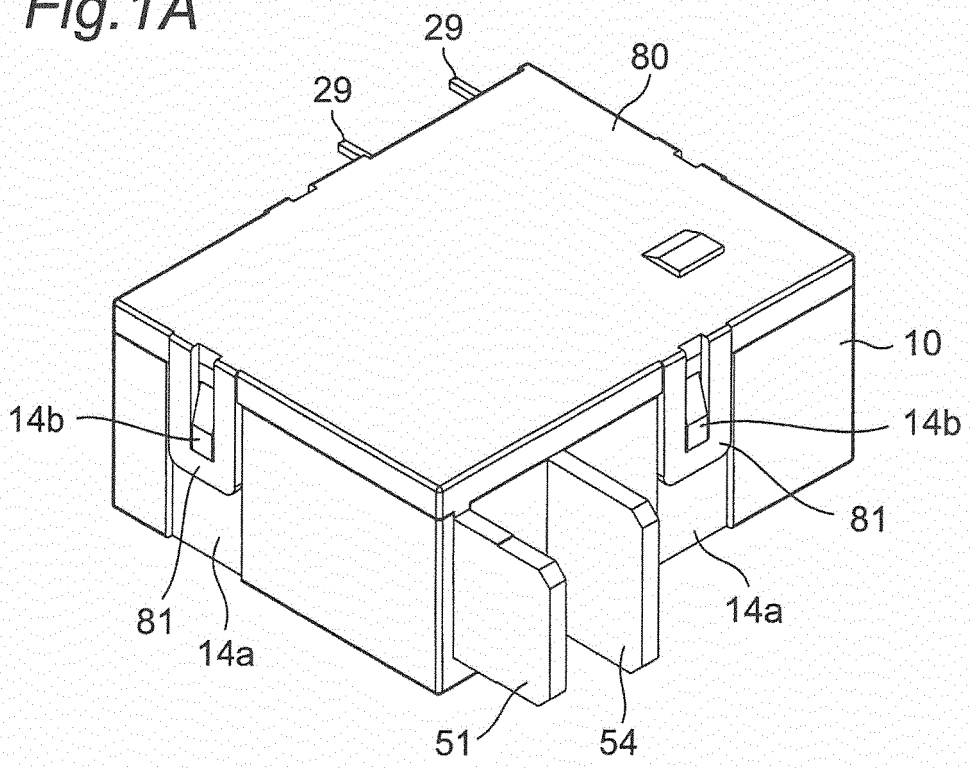
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Fig.1B

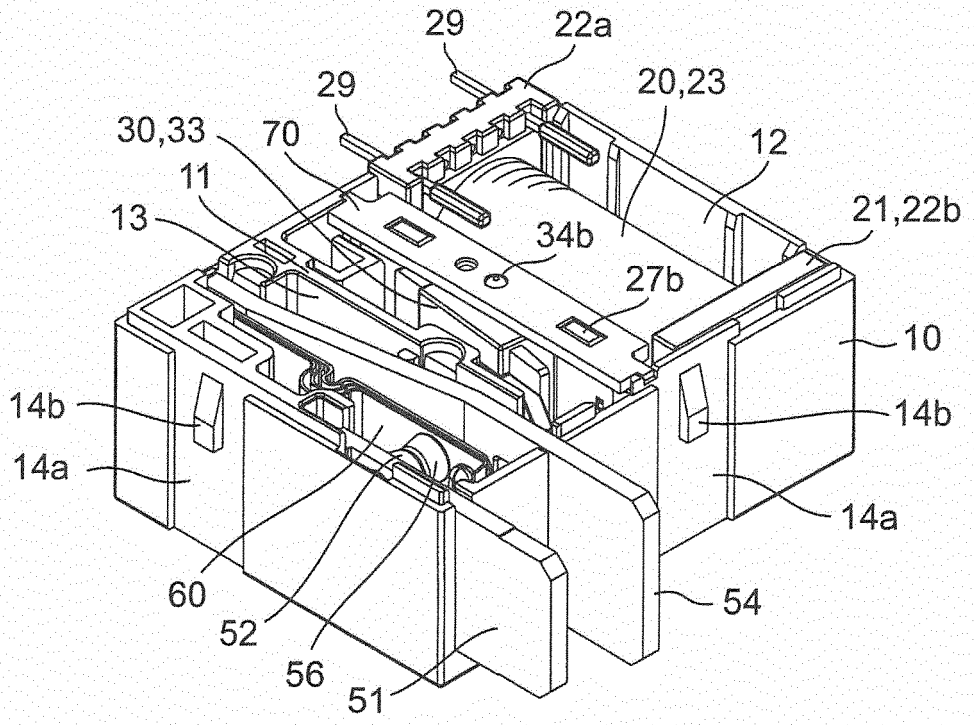
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Fig.2A

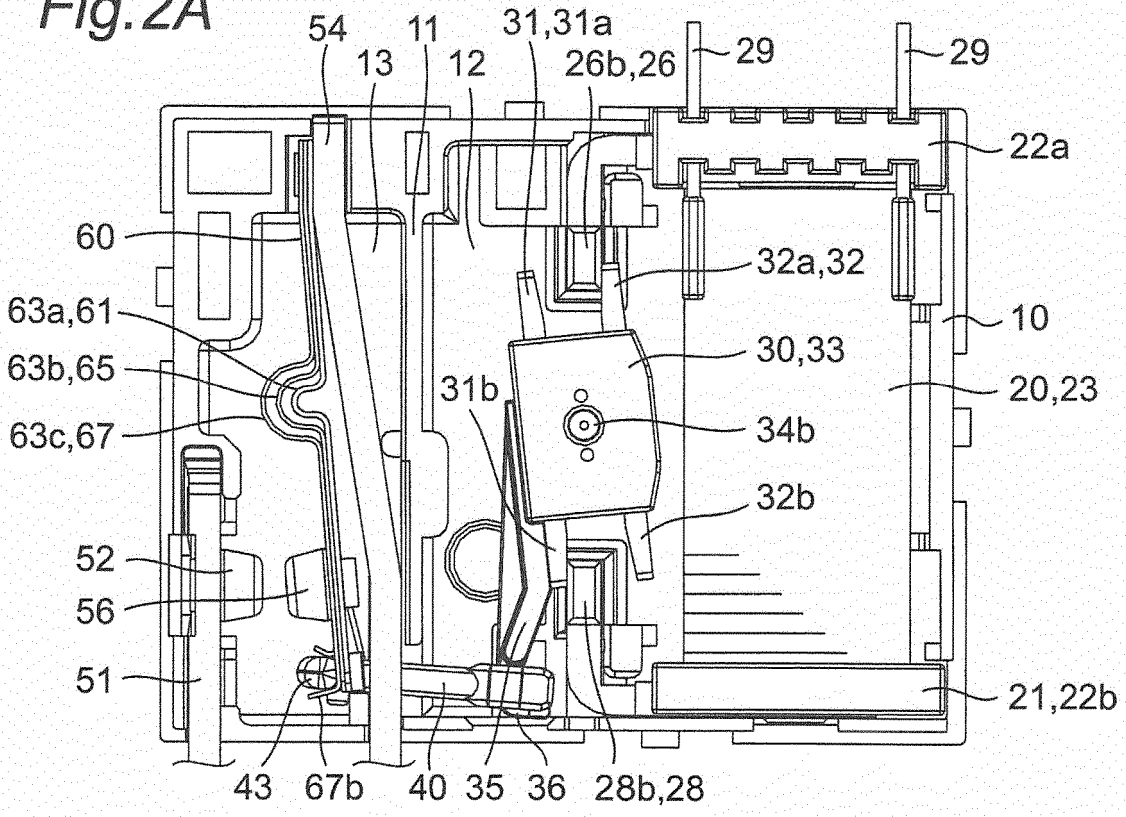
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Fig.2B

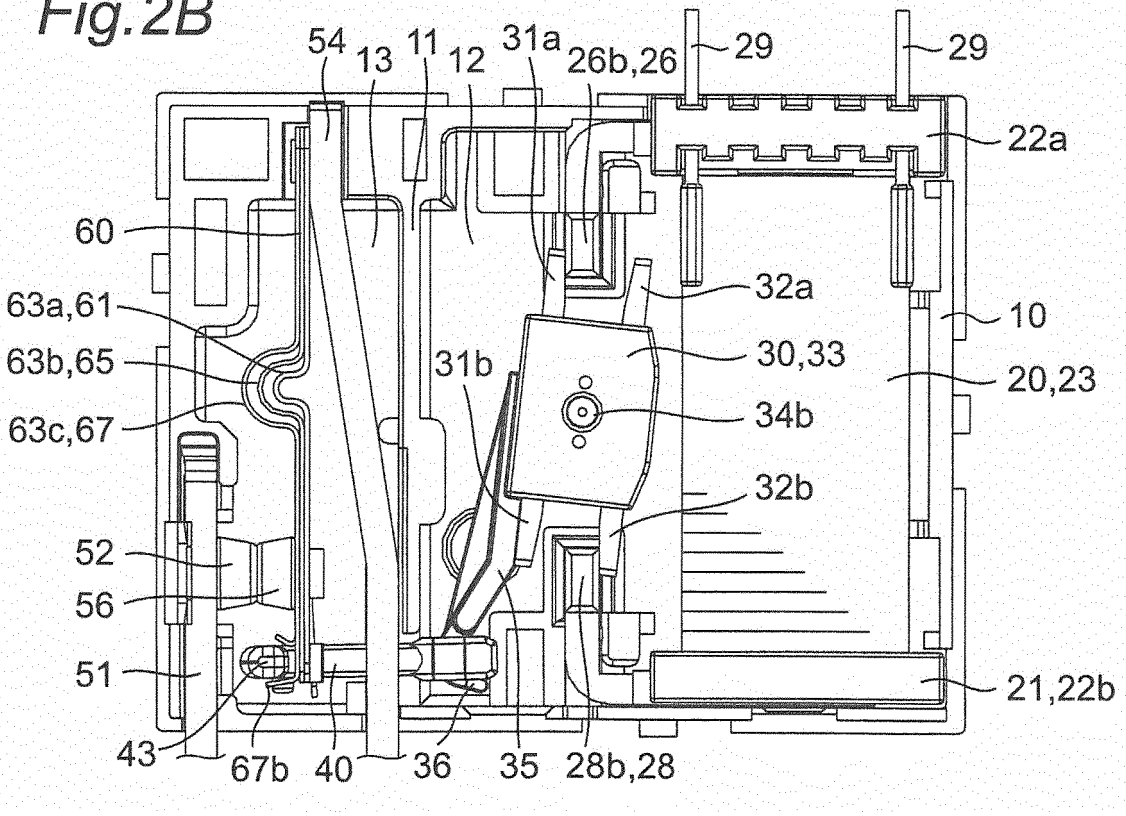
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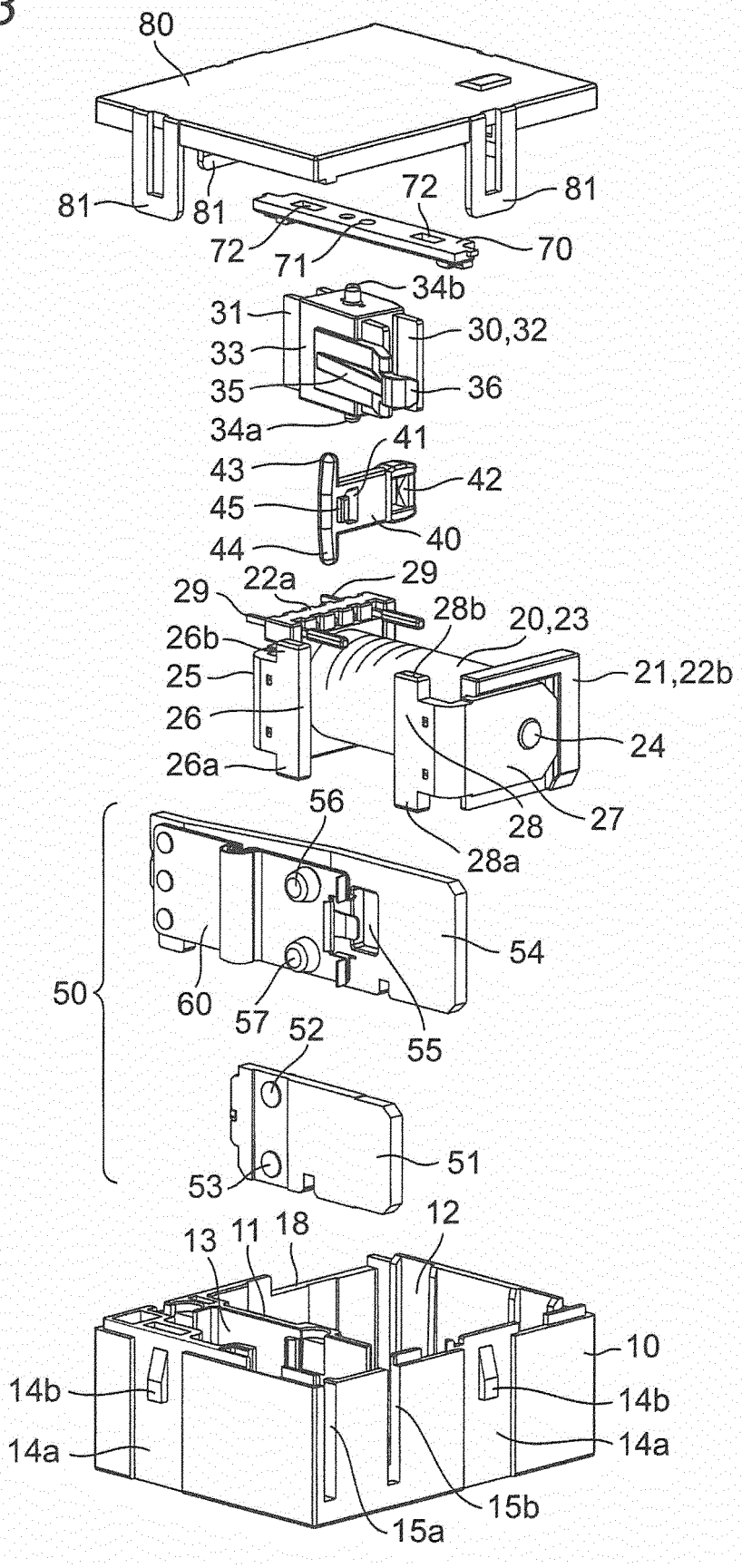
Fig.3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26b
25
21,22b
26
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26a
28
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28a
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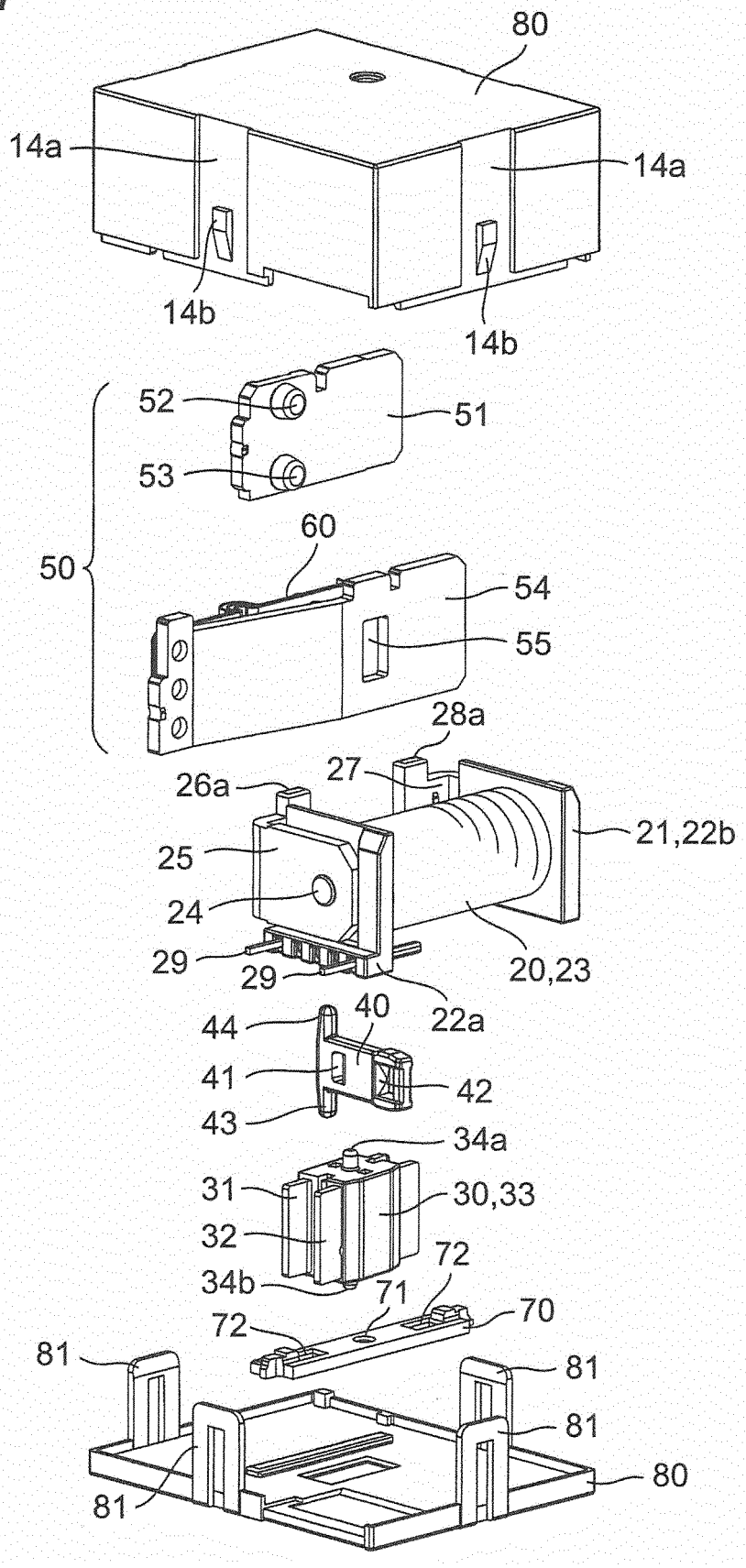
14b
14a
14a
15b
15a

Fig.4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14b
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20,23
22a
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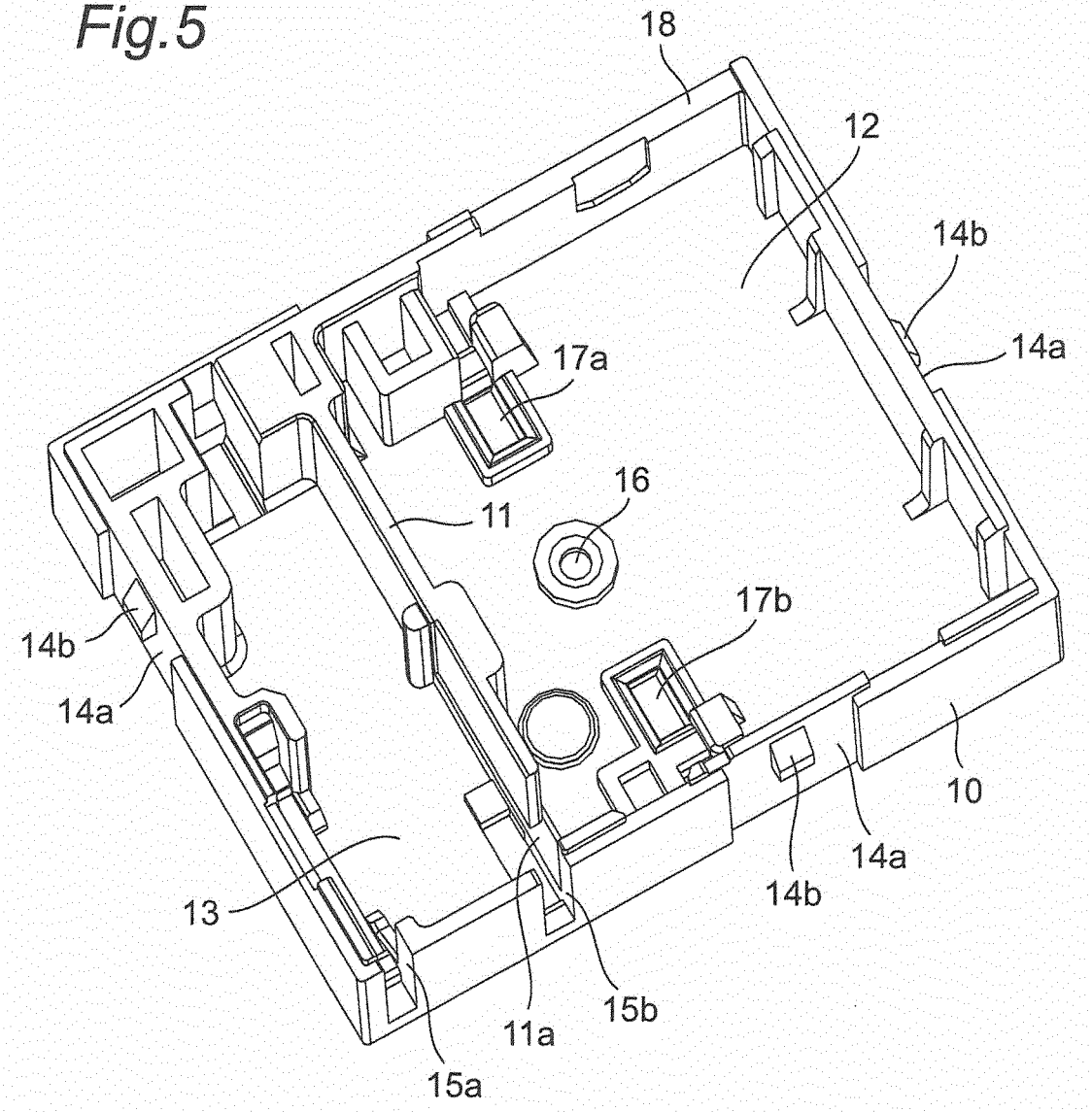
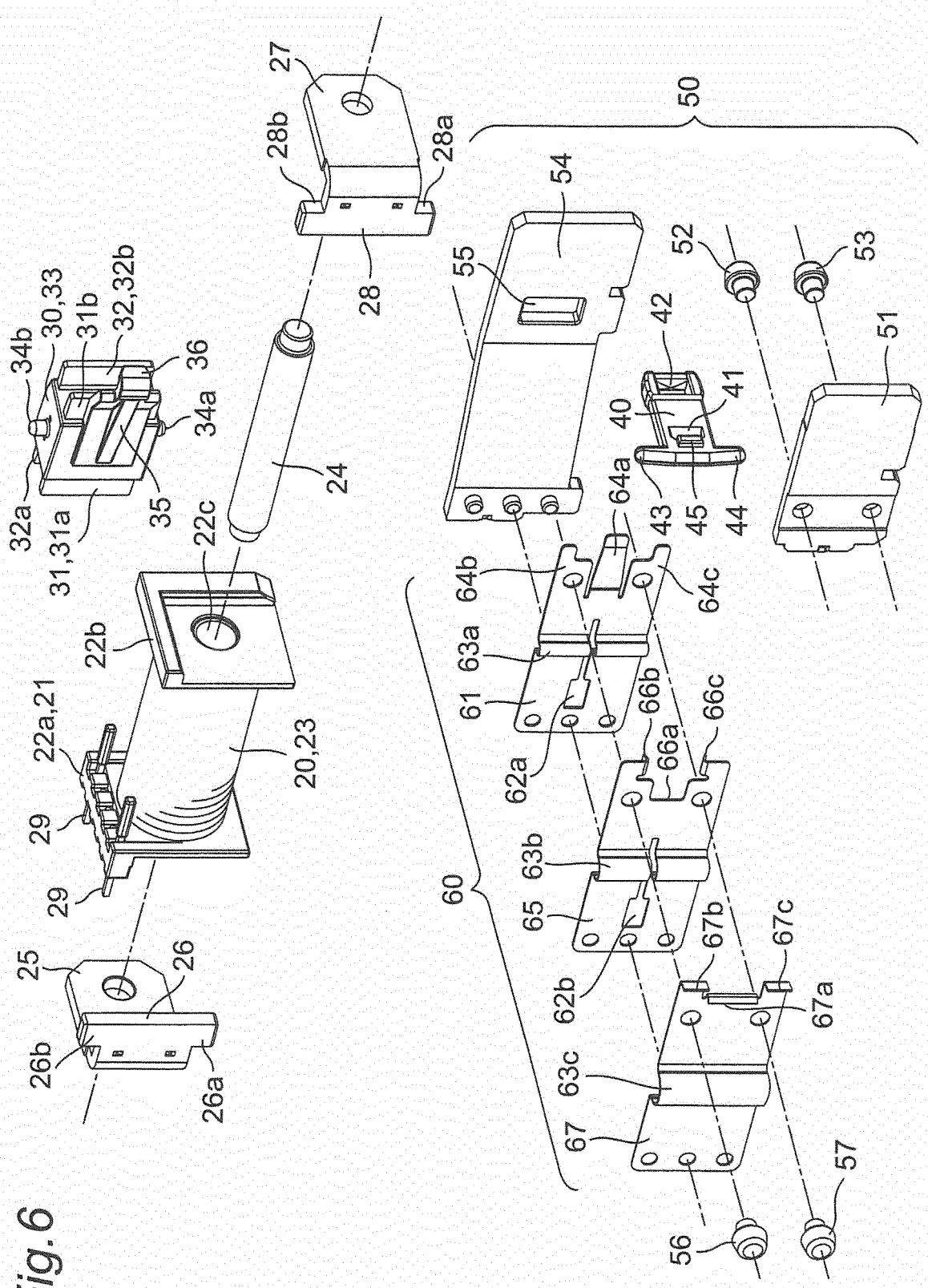
81
80

Fig.5

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34a
32a
31,31a
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22c
64a
43
45
44
64b
64c
22b
63a
61
66b
66c
22a,21
62a
66a
20,23
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29
63b
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67a
63c
26b
26a
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56

Fig.6

Fig.7A

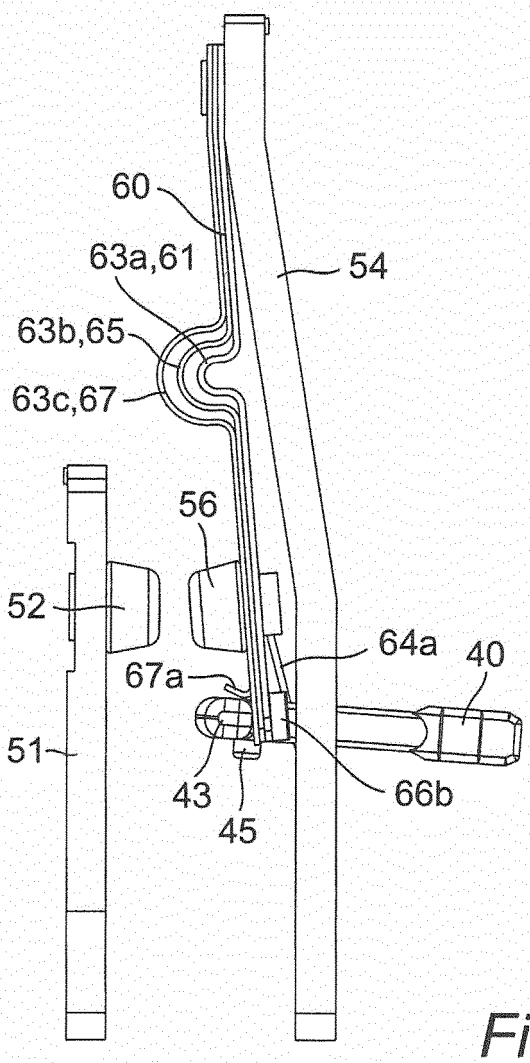


Fig.7C

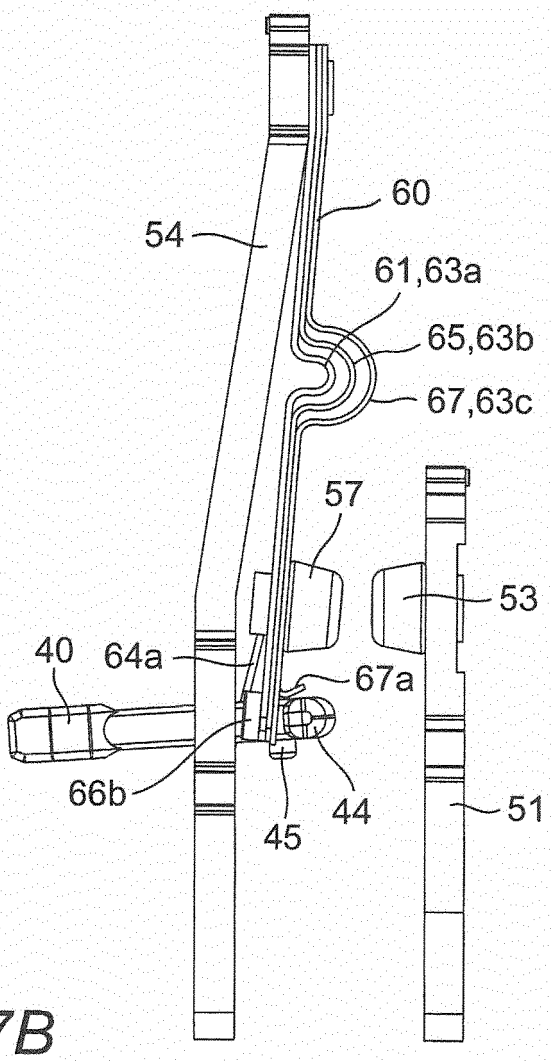


Fig.7B

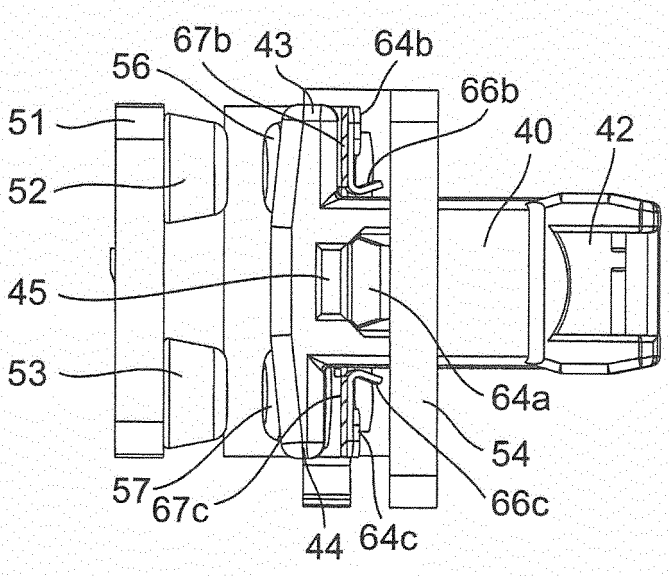


Fig.8A

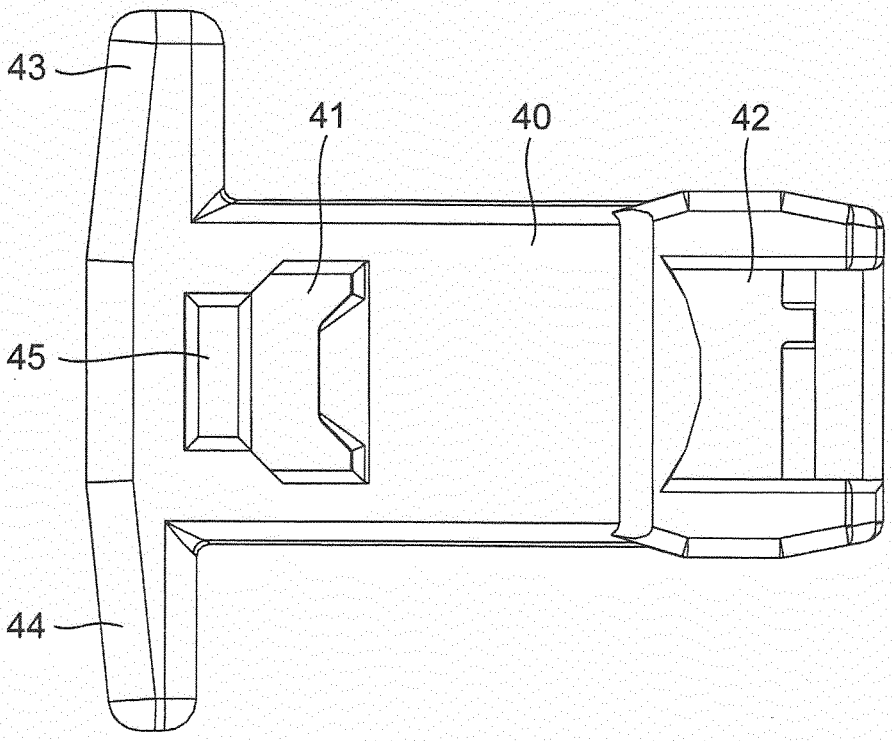


Fig.8B

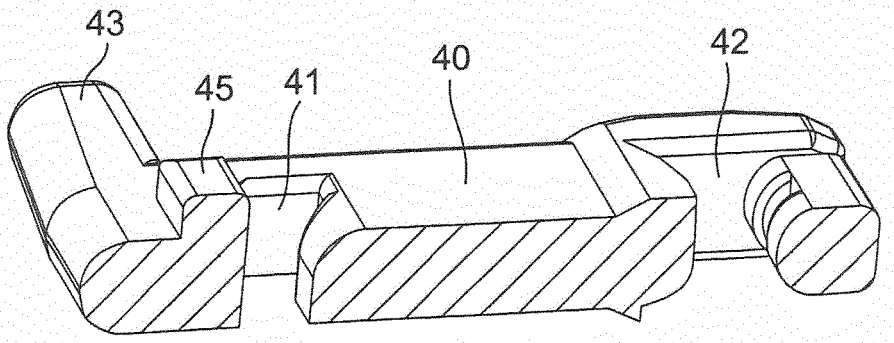
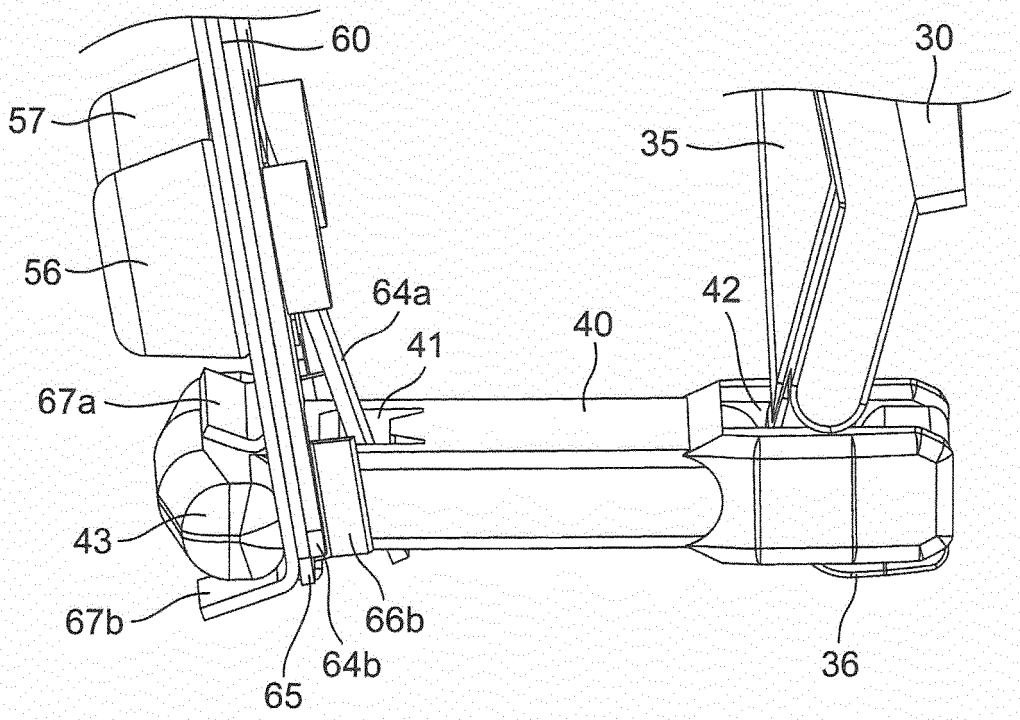


Fig.9A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67a
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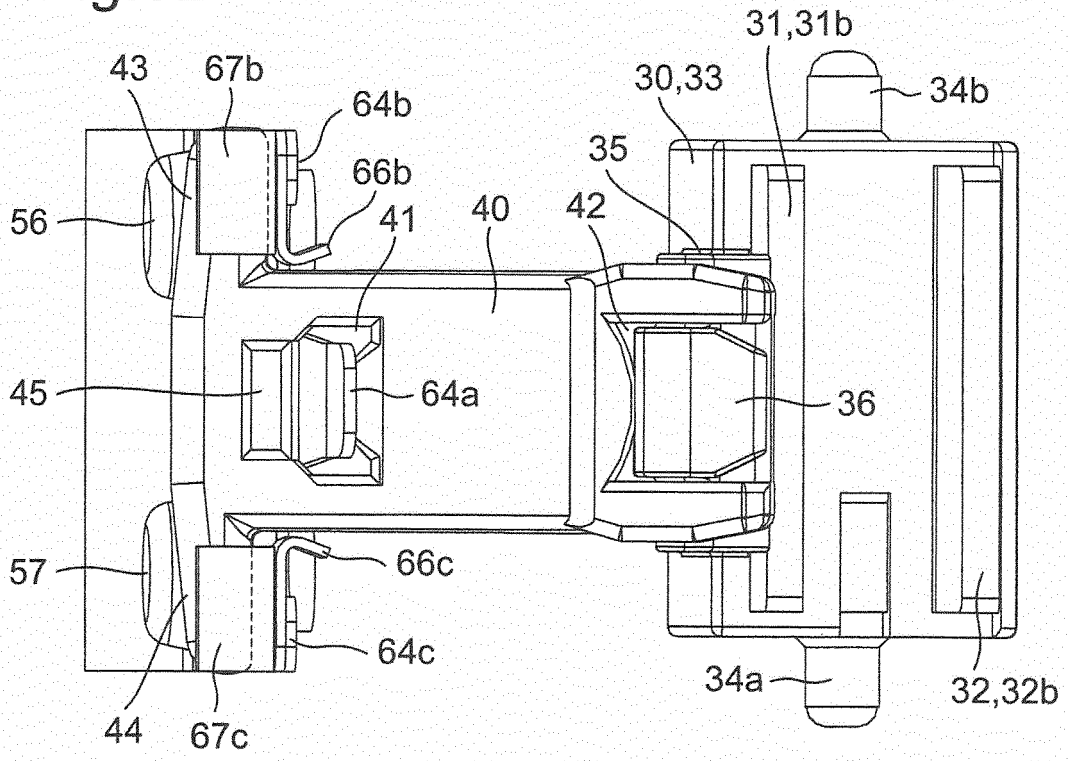
67b
66b
64b
65
36

Fig.9B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67b
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34b
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66b
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66c
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64c
34a
32,32b
44
67c

Fig.10A

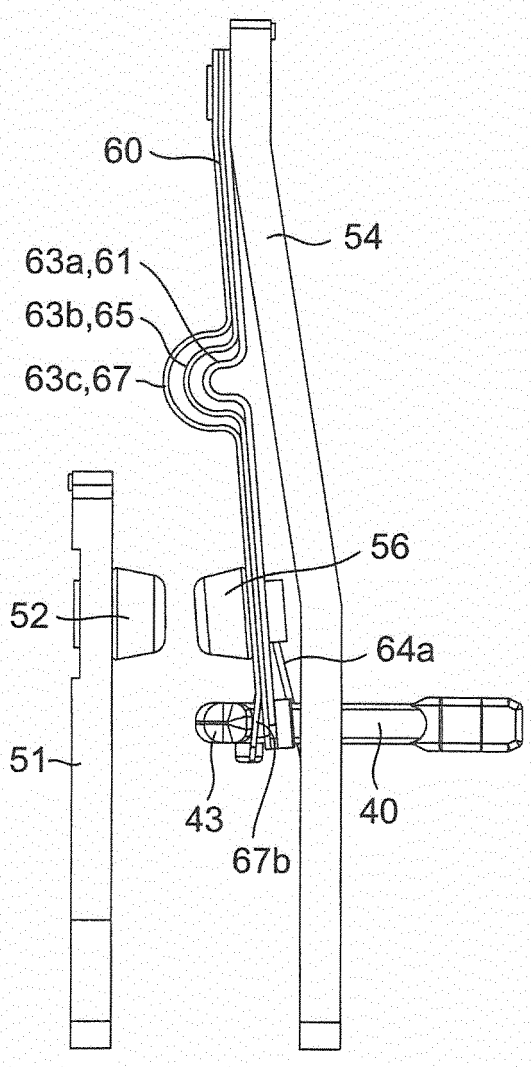


Fig.10B

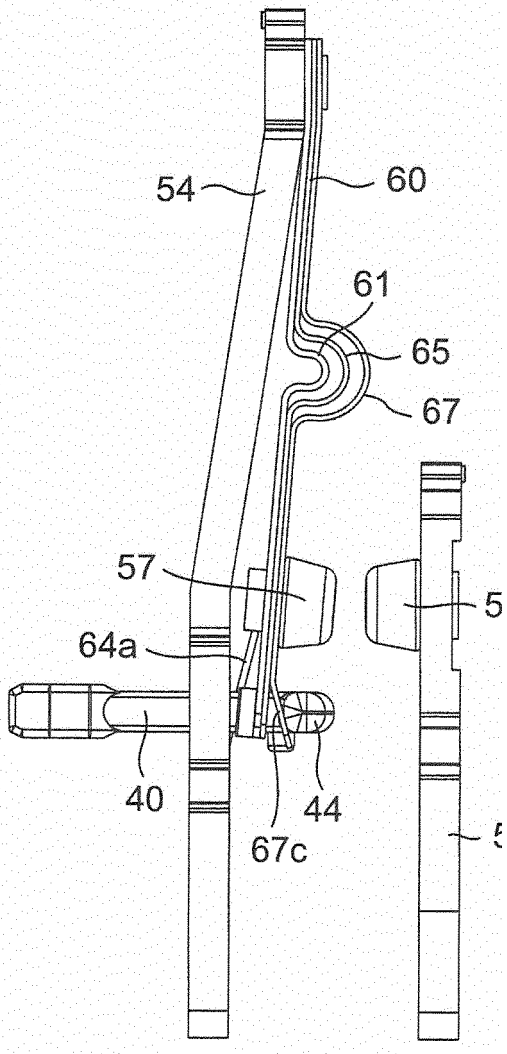


Fig.11A

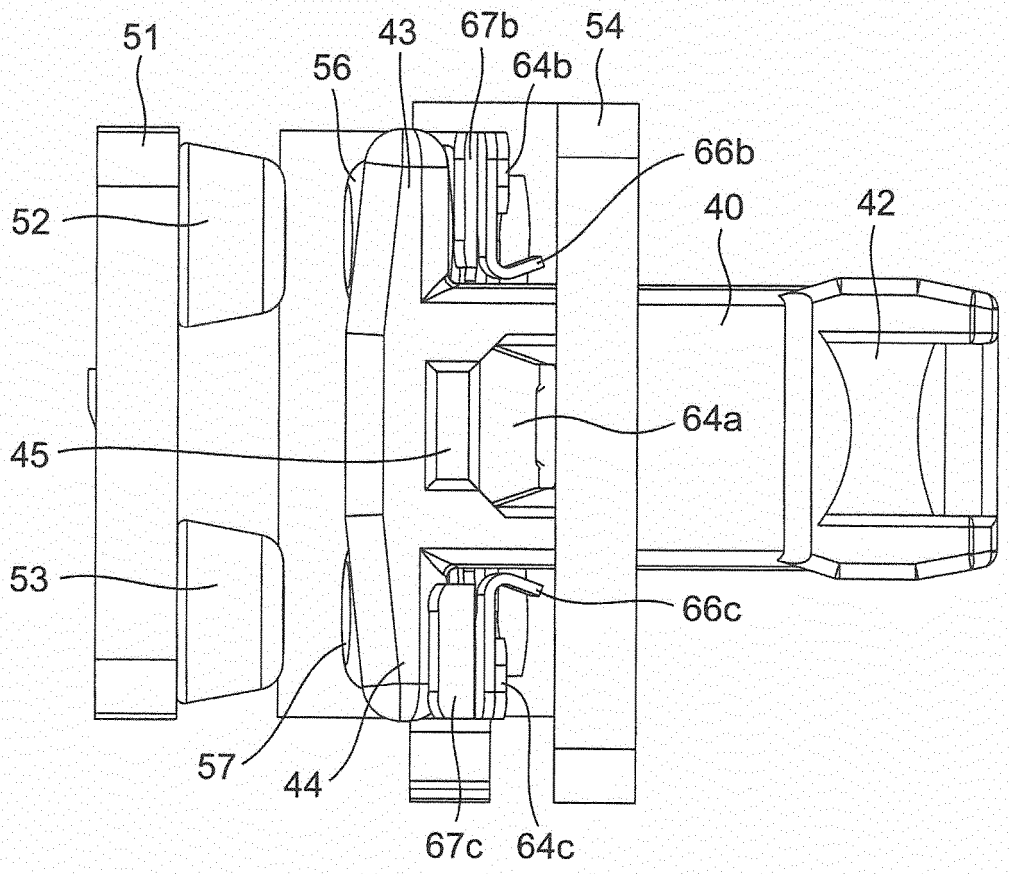
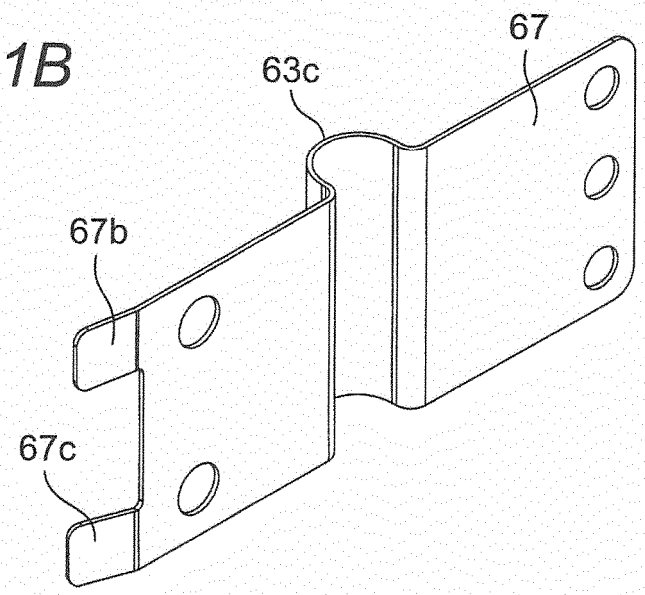


Fig.11B



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/068132

A. CLASSIFICATION OF SUBJECT MATTER
H01H50/64(2006.01)i, *H01H50/56*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01H50/64, H01H50/56

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014
Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2013-30308 A (Panasonic Corp.), 07 February 2013 (07.02.2013), entire text; all drawings (Family: none)	1-6
Y	JP 2003-45309 A (Tyco Electronics Austria GmbH), 14 February 2003 (14.02.2003), paragraphs [0020], [0021] & US 2003/0016104 A1 & EP 1271593 A2 & CN 1393902 A	1-6

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 September, 2014 (02.09.14)	16 September, 2014 (16.09.14)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/068132

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 26709/1987(Laid-open No. 134409/1988) (Matsushita Electric Works, Ltd.), 02 September 1988 (02.09.1988), page 9, line 10 to page 10, line 12; fig. 6 (Family: none)	1-6

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Patent documents cited in the description

- US 6661319 B **[0003]**