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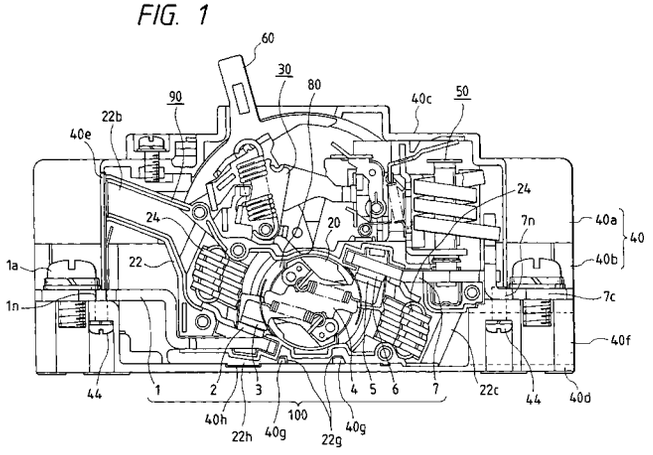
(54) Circuit breaker

(57) It is an object of the present invention to provide a circuit breaker excellent in safety by electrically insulating the trip unit from the main circuit, and capable of performing a proper wiping of the movable contact carrier, resulting in reduction of electrical resistance at the contacts. Further, a circuit breaker excellent in workability in assembling processes is also provided.

In the circuit breaker of the present invention, a housing means (22) contains a main circuit (100) including a power supply side stationary contact carrier (1) with a stationary contact (2), a movable contact carrier (4) with a power supply side movable contact (3) and a load side movable contact (5), and a load side stationary contact carrier (7) with a load side stationary contact (6). The housing means is made of insulating material and disposed in the casing (40) also made of insulating material. The circuit breaker includes a make-and-break mechanism (30), a tripping mechanism (50). The tripping mechanism (50) is unitedly connected to the load side stationary contact carrier (7) and to the load side terminal (7c) therebetween. The tripping means (50) includes a converting mechanism (51) for converting electromagnetic force to mechanical force for tripping, which is supported on the housing means (22) and is electrically insulated from the main circuit (100). The make-and-break mechanism (30) is mounted on the housing means (22) and is electrically insulated from the main circuit (100).

FIG. 1



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Description

[0001] This invention relates to a circuit breaker, more particularly to a circuit breaker provided with a contact suitable for performing proper wiping when the circuit breaker is turned on.

[0002] A circuit breaker is connected between a power source and a load in a circuit of a power distribution line or a bus line of a transforming station, and sometimes in a circuit connected to a machine, etc. for breaking the circuit automatically when a defect, such as short circuit or overcurrent, occurs therein. In addition, when the current is within a rated value or a predetermined value, the circuit breaker is used to manually turning on and off the circuit as a switch.

[0003] A circuit breaker in the related art, as disclosed in Japanese Patent Application Laid-open No.Hei-6-52777 (Priority: FR 92 03142), has a movable contact provided at each end of a rotational contact bridge (movable contact carrier) and a pair of stationary contact provided so as to face each of those movable contacts. Consequently, a set of movable contact and stationary contact pair is provided at each end of the movable contact carrier. The set of those movable contact and the stationary contact pair are disposed symmetrically from a point (the rotational center) of the movable contact carrier so as to turn on or turn off the circuit at the same time practically.

[0004] In addition, as disclosed in Japanese Patent Application Laid-open No. Hei-6-325680 (Priority: FR 93 04296), a contact unit including a power side contact and a tripping unit including a tripping mechanism are formed separately and connected to each other with screws thereby to form a circuit breaker.

[0005] Further, as disclosed in Japanese Published Patent No. Hei-7-123021, a converting portion for converting an electromagnetic force of the tripping mechanism to a mechanical output is an electrically charged portion.

[0006] In the related art, the movable contact and the stationary contact pair are designed in such a manner that the movement of the movable contact carrier is stopped at a position where the movable contact comes in contact with the stationary contact, which prevents those contacts from sliding on their surfaces resulting in formation of an oxide film on the surface of the contacts. In addition, in the related art, since the power side contact unit and the tripping unit are formed separately and they are connected together at an assembly step within a casing, an additional process is required for fastening the units, and an operation check is possible only when the assembling is over. Further, the tripping unit in the related art employs a converting mechanism, where an electromagnetic force is converted to a mechanical output, is electrically connected to an electrically charged portion within the circuit breaker, i.e., the tripping unit is also a charged portion, which brings about an accidental electrical shock by careless touch during maintenance or inspection. Furthermore, in such a circuit breaker as disclosed in the last related art, the make-and-breaker mechanism is an electrically charged portion, though not written explicitly. The make-and-break mechanism, is screwed through screw holes formed at the bottom of the cabinet case. The screws are insulated with a cover made of an insulating material and provided at the bottom of the case. The bottom of the case is thus double-structured, resulting in expansion of the size, increase of the weight and the number of assembling processes.

[0007] It is an object of the present invention to provide a circuit breaker excellent in safety by electrically insulating the trip unit from the main circuit.

[0008] It is another object of the present invention to provide a circuit breaker capable of performing a proper wiping of the movable contact carrier, resulting in reduction of electrical resistance at the contacts.

[0009] It is the third object of the present invention to provide a circuit breaker excellent in workability in assembling processes.

[0010] In view of the objective of solving the problems explained above, the construction of the circuit breaker comprises

a casing (40) made of electrically insulating material;

a main circuit (100) provided with a power supply side stationary contact carrier (1), a power supply side stationary contact (2), a power supply side movable contact (3), a movable contact carrier (4), a load side movable contact (5), a load side stationary contact (6), and a load side stationary contact carrier (7);

housing means (22) disposed in the casing (40) for housing the power supply side stationary contact (2), the power supply side movable contact (3), the movable contact carrier (4), the load side movable contact (5), and the load side stationary contact (6) therein, the housing means (22) being made of electrically insulating material;

a make-and-break mechanism (30) disposed in the casing (40) for making and breaking the main circuit (100) by moving the movable contact carrier (4);

a tripping mechanism (50) disposed in the casing (40) for tripping the make-and-break mechanism (30) when an abnormal current flows in the main circuit (100);

a movable contact carrier holder (20) disposed in the housing means (22) for supporting the movable contact carrier (4), the movable contact carrier holder (20) being made of electrically insulating material;

holding means (80) disposed in the housing means (22) for supporting the movable contact carrier holder (4) rotatably; and

transmitting means (25) for transmitting the make/break operation of the make-and-break mechanism (30) to the movable contact carrier holder (20),

wherein

the power supply side stationary contact carrier (1) and the load side stationary contact carrier (7) is partially exposed outside of the housing means (22) so as to be electrically connected to a power supply side terminal (1a) and a load side terminal (7c) respectively,

characterized in that

the tripping mechanism (50) is united to the load side stationary contact carrier (7) and to the load side terminal (7c), the tripping means (50) includes a converting mechanism (51) for converting electromagnetic force to mechanical force for tripping, the converting mechanism is supported on the housing means (22) and is electrically insulated from the main circuit (100), the transmitting means (25) is made of electrically insulating material, the make-and-break mechanism (30) is mounted on the housing means and is electrically insulated from the main circuit (100).

[0011] In another embodiment of the circuit breaker, the power supply side stationary contact carrier (1) and the load side stationary contact carrier (7) are composed in such a manner that an amount of wipe between the power supply side stationary contact (2) and the power supply side movable contact (3) differs from that between the load side movable contact (5) and the load side stationary contact (6) when the main circuit (100) makes.

[0012] In the second embodiment of the circuit breaker, the power supply side stationary contact carrier (1) and the load side stationary contact carrier (7) are composed in such a manner that a gap between contacts is formed at either one of the power supply side stationary contact (2) and the power supply side movable contact (3) pair or the load side movable contact (5) and the load side stationary contact (6) pair when the other contact pair makes.

[0013] In the third embodiment of the circuit breaker, the power supply side stationary contact carrier (1) and the load side stationary contact carrier (7) are composed in such a manner that the gap is formed between the power supply side stationary contact (2) and the power supply side movable contact (3) when the load side movable contact (5) and the load side stationary contact (6) pair makes.

[0014] In the fourth embodiment of the circuit breaker, the circuit breaker has a plurality of poles, and comprises,

a casing (40) made of electrically insulating material;

a plurality of main circuits (100) disposed at each of the poles, each of the main circuit (100) provided with a power supply side stationary contact carrier (1), a power supply side stationary contact (2), a power supply side movable contact (3), a movable contact carrier (4), a load side movable contact (5), a load side stationary contact (6), and a load side stationary contact carrier (7);

a plurality of housing means (22) disposed in the casing (40), each of the housing means for housing the power supply side stationary contact (2), the power supply side movable contact (3), the movable contact carrier (4), the load side movable contact (5), and the load side stationary contact (6) therein for each pole, the housing means (22) being made of electrically insulating material;

a make-and-break mechanism (30) disposed in the casing (40) for making and breaking the plurality of main circuit (100) by moving the movable contact carrier (4) at each pole;

a plurality of tripping mechanisms (50) disposed in the casing (40), each of the tripping mechanisms (50) for tripping the make-and-break mechanism (30) when an abnormal current flows in at least one of the plurality of main circuits (100);

a movable contact carrier holder (20) disposed in the housing means (22) for supporting the movable contact carrier (4), the movable contact carrier holder (20) being made of electrically insulating material;

holding means (80) disposed in the housing means (22) for supporting the movable contact carrier holder (4) rotatably; and

transmitting means (25) for transmitting the make/break operation of the make-and-break mechanism (30) to all of the movable contact carrier holders (20) simultaneously, wherein

the power supply side stationary contact carrier (1) and the load side stationary contact carrier (7) is partially exposed outside of the housing means (22) so as to be electrically connected to a power supply side terminal (la) and a load side terminal (7c) respectively,

characterized in that

the tripping mechanism (50) is united to the load side stationary contact carrier (7) and to the load side terminal (7c), the tripping means (50) includes a converting mechanism (51) for converting electromagnetic force to mechanical force for tripping, the converting mechanism is supported on the housing means (22) and is electrically insulated from the main circuit (100), the transmitting means (25) is made of electrically insulating material, the make-and-break mechanism (30) is mounted on one of the housing means (22) and is electrically insulated from the plurality of main circuits (100).

[0015] In the fifth embodiment of the circuit breaker, the power supply side stationary contact carrier (1) and the load side stationary contact carrier (7) are composed in such a manner that an amount of wipe between the power supply side stationary contact (2) and the power supply side movable contact (3) differs from that between the load side movable contact (5) and the load side stationary contact (6) when the main circuit (100)

makes in at least one of the plurality of poles.

[0016] In the sixth embodiment of the circuit breaker, the power supply side stationary contact carrier (1) and the load side stationary contact carrier (7) are composed in such a manner that a gap between contacts is formed at either one of the power supply side stationary contact (2) and the power supply side movable contact (3) pair or the load side movable contact (5) and the load side stationary contact (6) pair when the other contact pair makes in at least one of the plurality of poles.

[0017] In the seventh embodiment of the circuit breaker, the power supply side stationary contact carrier (1) and the load side stationary contact carrier (7) are composed in such a manner that the gap is formed between the power supply side stationary contact (2) and the power supply side movable contact (3) when the load side movable contact (5) and the load side stationary contact (6) pair makes in at least one of the plurality of poles.

[0018] In the eighth embodiment of the circuit breaker, the circuit breaker has,

a casing (40) made of electrically insulating material;

a main circuit (100) provided with a power supply side stationary contact carrier (1), a power supply side stationary contact (2), a power supply side movable contact (3), a movable contact carrier (4), a load side movable contact (5), a load side stationary contact (6), and a load side stationary contact carrier (7);

housing means (22) disposed in the casing (40) for housing the power supply side stationary contact (2), the power supply side movable contact (3), the movable contact carrier (4), the load side movable contact (5), and the load side stationary contact (6) therein, the housing means (22) being made of electrically insulating material;

a make-and-break mechanism (30) disposed in the casing (40) for making and breaking the main circuit (100) by moving the movable contact carrier (4);

a tripping mechanism (50) disposed in the casing (40) for tripping the make-and-break mechanism (30) when an abnormal current flows in the main circuit (100);

a movable contact carrier holder (20) disposed in the housing means (22) for supporting the movable contact carrier (4), the movable contact carrier holder (20) being made of electrically insulating material;

holding means (80) disposed in the housing means (22) for supporting the movable contact carrier holder (4) rotatably; and

transmitting means (25) for transmitting the make/break operation of the make-and-break mechanism (30) to the movable contact carrier holder (20), wherein

the power supply side stationary contact carrier (1) and the load side stationary contact carrier (7) is partially exposed outside of the housing means (22) so as to be electrically connected to a power supply side terminal (1a) and a load side terminal (7c) respectively,

characterized in that

the power supply side stationary contact carrier (1) and the load side stationary contact carrier (7) are composed in such a manner that an amount of wipe between the power supply side stationary contact (2) and the power supply side movable contact (3) differs from that between the load side movable contact (5) and the load side stationary contact (6) when the main circuit (100) makes.

[0019] In the ninth embodiment of the circuit breaker, the power supply side stationary contact carrier (1) and the load side stationary contact carrier (7) are composed in such a manner that a gap between contacts is formed at either one of the power supply side stationary contact (2) and the power supply side movable contact (3) pair or the load side movable contact (5) and the load side stationary contact (6) pair when the other contact pair makes.

[0020] In the tenth embodiment of the circuit breaker, the power supply side stationary contact carrier (1) and the load side stationary contact carrier (7) are composed in such a manner that the gap is formed between the power supply side stationary contact (2) and the power supply side movable contact (3) when the load side movable contact (5) and the load side stationary contact (6) pair makes.

[0021] Embodiments of the invention will now be described in detail, by way of example, with reference to the accompanying drawings in which:

[0022] Fig. 1 is a front cross sectional view showing a configuration of a circuit breaker in an embodiment of the present invention.

[0023] Fig. 2 is a plan view of the circuit breaker in this embodiment of the present invention with its cover opened.

[0024] Fig. 3 is a plan view showing the circuit breaker in this embodiment of the present invention.

[0025] Fig. 4 is a plan view showing how the units are connected to each other in the circuit breaker in this embodiment of the present invention.

[0026] Fig. 5 is a front cross sectional view showing a unit in the circuit breaker in this embodiment of the present invention before a load side stationary contact carrier is attached.

[0027] Fig. 6 is a front view of a partial assembly a tripping mechanism including an oil dash pot, a yoke, a coil and the load side stationary contact carrier in this embodiment of the present invention.

[0028] Fig. 7 is a plan view of the partial assembly of the tripping mechanism in this embodiment of the present invention.

[0029] Fig. 8 is a bottom view of the partial assembly

of the tripping mechanism in this embodiment of the present invention.

[0030] Fig. 9 is a front view of a complete assembly of a tripping mechanism further including a movable core and a spring in this embodiment of the present invention.

[0031] Fig. 10 is a front cross sectional view of a complete assembly of the unit including a main circuit and the tripping mechanism in this embodiment of the present invention.

[0032] Fig. 11 is a front view showing a configuration of the contacts for performing a wipe in this embodiment of the present invention. Fig. 11(a) is a front view of the major portion showing a formation of a gap between the movable contact and the stationary contact. Fig. 11(b) is a front view showing the state of the contacts after the wipe is performed.

[0033] Fig. 12 is a front view showing a first variation of the configuration of the contacts for performing a wipe in this embodiment of the present invention. Fig. 12(a) is a front view of the major portion showing a formation of a gap between the movable contact and the stationary contact. Fig. 12(b) is a front view showing the state of the contacts after the wipe is performed.

[0034] Fig. 13 is a front view showing a second variation of the configuration of the contacts for performing a wipe in this embodiment of the present invention. Fig. 13(a) is a front view of the major portion indicating a formation of a gap between the movable contact and the stationary contact. Fig. 13(b) is a front view showing the state of the contacts after the wipe is performed.

[0035] Fig. 14 is a front cross sectional view showing a configuration of a make-and-break mechanism of the circuit breaker in this embodiment of the present invention.

[0036] Fig. 15 is a side view showing a common tripping shaft attached to the make-and-break mechanism of the circuit breaker in this embodiment of the present invention.

[0037] Fig. 16 is a front view showing an external shape of a movable contact carrier holder in this embodiment of the present invention.

[0038] Fig. 17 is a front cross sectional view showing an internal configuration of the movable contact carrier holder in this embodiment of the present invention.

[0039] Fig. 18 is an exploded perspective view showing a configuration of a stopper frame in this embodiment of the present invention.

[0040] Fig. 19 is a front cross sectional view showing an internal configuration of the movable contact carrier holder at its locked position after repulsion in this embodiment of the present invention.

[0041] Before beginning a detailed description of the subject invention, mention of the following is in order. When appropriate, like reference numerals and characters are used to designate identical, corresponding or similar components in differing figure drawings. Further, in the detailed description to follow, exemplary sizes/models/values/ranges are given, although the present invention is not limited to the same.

[0042] An embodiment of the present invention will be described with reference to Figs. 1 through 18. In this embodiment, the present invention is applied to a circuit breaker having three-poles.

[0043] The circuit breaker in this embodiment, as shown in Figs. 1 and 2, is provided with a main circuit 100 that includes a power supply side stationary contact carrier 1, a power supply side stationary contact 2, a power supply side movable contact 3, a movable contact carrier 4, a load side movable contact 5, a load side stationary contact 6, and a load side stationary contact carrier 7; and a power supply side terminal 1a and a load side terminal 7c connected electrically to the main circuit 100 respectively in a casing 40 provided with a cover 40a and a case 40b. The main circuit 100, the power supply side terminal 1a, and the load side terminal 7c are provided for each of the three poles.

[0044] As shown in Figs. 1, 5, and 10, the power supply side stationary contact carrier 1 and the load side stationary contact carrier 7 are disposed so as to be substantially symmetrical from a point (the rotational center) of the movable contact carrier 4 held rotatably. The power supply side stationary contact carrier 1 has the power supply side stationary contact 2 at a position facing the power supply side movable contact 3 and the load side stationary contact carrier 7 has the load side stationary contact 6 at a position facing the load side movable contact 5.

[0045] The movable contact carrier 4 has the power supply side movable contact 3 and the load side movable contact 5 disposed symmetrically from its rotation center. The movable contact carrier 4 is supported rotatably by a pair of springs 8 within the movable contact carrier holder 20. The movable contact carrier holder 20 is supported rotatably by the holding means 80. The main circuit case 22 contains at least a section of the main circuit 100, which extended from the power supply side stationary contact 2 to the load side stationary contact 6 via the movable contact carrier 4, and the movable contact carrier holder 20 and the holding means 80, so as to compose a unit 90. In this embodiment, the holding means 80 made of an insulating material is formed unitedly with the main circuit case 22. In this embodiment, the tripping mechanism 50 is actuated for generating a mechanical output when an abnormal current such as overcurrent or short circuit current flows in the main circuit 100. The tripping mechanism 50 is fixed unitedly with the load side terminal 7c at the end portion 7b opposite to the end portion 7a where the load side stationary contact 6 is fixed as shown in Fig. 9.

[0046] The main circuit case 22 has a part 22a for mounting the tripping mechanism 50 outside itself. Units 90 are disposed side by side so that the rotational axis of the movable contact carrier holders 20 for the three poles are aligned practically on a line as shown in Fig. 2 while the power supply side terminal 1a, the load side

terminal 7c, and the tripping mechanism 50 are disposed outside the main circuit case 22. Here, the word "practically" means that items whose positions and angles are shifted within the allowable ranges respectively are also included in this embodiment. In Fig. 2, when it is looked at with the power supply side terminals la positioned upward, the leftmost pole shows the main circuit 100 in the unit 90 where the main circuit case 22 and the tripping mechanism 50 are not illustrated.

[0047] As shown in Fig. 9, the tripping mechanism 50 in this embodiment includes a coil 52 connected to between the load side contact carrier 7 and the load side terminal 7c; a cylindrical oil dash pot 53, which works as a fixed core, provided within the coil 52; an L-shaped yoke 54 to which this oil dash pot 53 is fixed at a horizontal side of the L-shaped portion; a movable core 55 attached rotationally to an end of the vertical side of the L-shaped portion; and a spring 56 for forcing the movable core 55 to be separated from the oil dash pot 53. The movable core 55 forms a closed loop of a magnetic circuit together with the L-shaped yoke 54 and the oil dash pot 53 when it is attracted by the oil dash pot 53 due to the excitation of the coil 52. Thus, the converting mechanism 51 converts an electromagnetic force generated in the oil dash pot 52 to a mechanical force for tripping when an abnormal current flows in the main circuit 100. i.e., the converting mechanism 51 is composed of the oil dash pot 53; a yoke 54; a movable core 55; and a spring 56 in this embodiment.

[0048] As shown in Fig. 6, at the load side stationary contact carrier 7 is formed a rising part 7d longer than the length of the coil 52 in the axial direction. In this embodiment, the diameter of the top portion 53a of the oil dash pot 53 is formed larger than the inner diameter of the coil 52, so the coil 52 is inserted in the oil dash pot 53 beforehand, then the yoke 54 is fixed by means of brazing, etc. at the end 53b of the oil dash pot 53. In this state, the coil 52 is connected to both the rising part 7d of the load side stationary contact carrier 7 and the rising part 7e of the load side terminal 7c while the oil dash pot 53 is kept set in the coil 52. At the top end of this rising part 7d is connected one end of the coil 52, that is, either of the end or the start of the winding electrically by means of brazing, etc. On the other hand, the rising part 7e is formed at the load side terminal 7c and at the top of this rising part 7e is connected the other end of the coil, that is, the end or start of the winding of the coil 52 electrically by means of brazing, etc. Consequently, the load side stationary contact carrier 7 and the load side terminal 7c are connected to each other via the coil 52. The movable core 55 and the spring 56 are fixed to this yoke 54 so as to be put together as shown in Fig. 9. The assembly shown in Figs. 6 and 9 is obtained by putting this load side stationary contact carrier 7, the coil 52, and the load side terminal 7c together. The shape of the assembly is thus stable and the positional relationships among the load side stationary contact carrier 7, the coil 52, and the load side terminal 7c are fixed. Consequently, this assembly enables an easy assembling with the case 40b using an industrial robot, etc. Fig. 7 shows the assembly shown in Fig. 6, which is viewed from the top portion 53a of the oil dash pot 53. Fig. 8 shows the assembly shown in Fig. 6, which is viewed from the bottom portion 53c of the oil dash pot 53.

[0049] As shown in Fig. 8, at the load side stationary contact carrier 7 is formed with a hole 7f through which the bottom 53c of the oil dash pot 53 passes. This hole 7f is formed largely enough with respect to the diameter of the oil dash pot 53. This "largely enough" means that a proper difference is secured between the diameters of the hole 7f and the oil dash pot 53 thereby to keep the oil dash pot 53 and the load side stationary contact carrier 7 separated and maintain an electrically insulating distance between them even when the attached oil dash pot 53 is shifted slightly. In addition, an insulating material 58 is wound on the outer peripheral surface of the oil dash pot 53, which is facing the coil 52, so that the oil dash pot 53 is insulated electrically from the main circuit 100.

[0050] The oil dash pot 53 is composed so that its end 53b is fixed to the L- shaped yoke 54 by means of brazing, etc. and the movable core 55 is attached rotatably to the yoke 54. The movable core 55 is urged by the spring 56 to be usually separated from the top portion 53a of the oil dash pot 53. When the coil 52 is excited, the magnetic force of the oil dash pot 53 overcomes the force of the spring 56, thereby the movable core 55 is attracted and comes in contact with the top portion 53a of the oil dash pot 53. Consequently, a magnetic circuit loop is formed from the oil dash pot 53 - the end 53b of the oil dash pot 53 - the yoke 54 - the movable core 55 to the top portion 53a of the oil dash pot 53. The yoke 54 is mounted at the mounting part 22a for the tripping mechanism 50, which is formed outside the main circuit case 22, and is kept insulated from the main circuit 100 electrically. Consequently, a part of the tripping mechanism 50, i.e., the converting mechanism 51 for generating a mechanical output for tripping the make-and-break mechanism 30, is mounted at the mounting part 22a of the housing means or the main circuit case 22 so as to be insulated electrically from both of the coil 52 and the main circuit 100 as shown in Fig. 10. Thus, the converting mechanism 51, which is insulated from the main circuit 100, is interposed between the coil 52, which is a electrically charged portion, and the make-and-break mechanism 30 as shown in Fig. 1. In addition, as shown in Figs. 9 and 10, since the movable core 55 of the converting mechanism 51 is placed at longer distance from the load side stationary contact carrier 7 than the coil 52, the movable core 55 and the vertical side of the L-shaped portion of the yoke 54 functions as a cover of the coil 52, i.e. electrically charged portion, which reduces accidents of electrical shock by touching the coil 52 carelessly during inspection or maintenance. Further, since the arc outlet 22b at the power supply side of the main circuit case 22 is extended over the portion of the

power supply side stationary contact carrier 1 which projects from the main circuit case 22, the arc outlet 22b also functions as a cover of the electrically charged portion. This also prevents the electrically charged portion from being touched carelessly during inspection or maintenance. In other words, the converting mechanism 51 and the arc outlet 22b intervenes between the electrically charged portion and a worker at the time of inspection or maintenance, and they have a function of protector against electrical shock in addition to their original functions. The safety of the circuit breaker can thus be improved in the maintenance work or in the inspection work. In addition, since the unit 90 for each of the three poles is composed by putting the main circuit 100 extending from the power supply side terminal la to the load side terminal 7c and a portion including the tripping mechanism 50 together, only combining the units 90 according to the number of necessary poles (three poles in this embodiment) is required to obtain a circuit breaker provided with a plurality of poles. It is thus possible to improve the workability in assembling processes significantly, as well as to obtain an excellent productivity.

[0051] The make-and-break mechanism 30 is mounted outside the unit 90 at the center pole. The make-and-break mechanism 30, as shown in Figs. 14 and 15, is composed of a lever 30t to which a handle 60 is attached; an upper link 30c and a lower link 30b combined to compose a toggle link; a hook 30d for keeping the toggle link linearly in the normal ON/OFF state (hereafter, to be described as normally) within a rated current range; a tripping latch 30h for attaching the hook 30d normally; a pin 30g for supporting the shaft of the tripping latch 30h rotatably; a common tripping shaft 30a for transmitting the action of the tripping mechanism 50 to the tripping member 30e; a tripping member 30e for transmitting the action of the common tripping shaft 30a to the tripping latch 30h; a pin 30f for supporting the shaft of the tripping hardware 30e rotationally; a spring 30s for urging the lever 30t and the toggle links 30 and 30c when in a normal ON/OFF operation and a tripping operation, which are all mounted in a frame 30w. The common tripping shaft 30a in this embodiment is extended over the units 90 provided for the three poles almost in parallel to the top surfaces thereof so that the operation of any of the tripping mechanisms 50 for the three poles, when started, is transmitted to the tripping member 30e. The movable contact carrier 4 is connected mechanically to the lower link 30b of the make-and-break mechanism 30 via the movable contact holder 20 and a connecting member 25. The main circuit 100 is turned on or off according to the rotation of the movable contact carrier 4. Usually, the handle 60 is used to turn on/off the make-and-break mechanism 30 to turn on/off the main circuit manually. If the make-and-break mechanism 30 is turned on, the contact holder 20 is rotated up to a position where the power supply side stationary contact carrier 1 and the load side stationary contact carrier 7 are connected electrically to each other according to the movement of the lower link 30b. The main circuit 100 thus makes. Among the units 90 for the three poles is provided a connecting member 25 respectively for making/breaking each pole contact simultaneously by rotating the movable contact carrier holder 20 thereof simultaneously. The "simultaneously" mentioned here means not only completely the same timing, but also timings that vary within an allowable time difference. On the other hand, if the make-and-break mechanism 30 is turned off, the contact holders 20 for the three poles are rotated together up to a position where the power supply side stationary contact carrier 1 and the load side stationary contact carrier 7 are disconnected electrically from each other according to the movement of the lower link 30b. The main circuit 100 thus breaks.

[0052] When an abnormal current larger than a rated one flows in the main circuit due to a short circuit, overload, or the like, the tripping mechanism 50 is driven to trip (release) the make-and-break mechanism 30. The tripping mechanism 30 for each pole is disposed at a position where its operation is transmitted to the make-and-break mechanism 30 via the common tripping shaft 30a, so that the make-and-break mechanism 30 is released when an abnormal current flows in the main circuit for at least one of a plurality of poles. When the make-and-break mechanism 30 is released, the movable contact carrier holders 20 for the three poles are rotated together up to a position where the power supply side stationary contact carrier 1 and the load side stationary contact carrier 7 are disconnected electrically from each other to open the main circuit 100. Thus, a circuit connected to the load side of the main circuit 100 is disconnected from the power supply side of the main circuit 100.

[0053] As shown in Fig. 10, each unit 90 is provided with a recess 22g and a projection 22h formed respectively on the bottom surface of the main circuit case 22 for positioning the unit 90 within the casing 40. On the other hand, as shown in Fig. 1, a projection 40g to be engaged with the recess 22g and a recess 40h to be engaged with the projection 22h are formed on the inner surface of the bottom of the case 40b. The power supply side terminal la and the load side terminal 7c are provided with screw holes 1n and 7n respectively. The units 90 for all the poles (three poles in this embodiment) are connected to each other via a connecting member 25 respectively while a make-and-break mechanism 30 is attached to one of those poles. The units 90 in such a state are inserted in the case 40b from the opening side of the case 40b. When the units 90 are inserted in the case 40b in such a way, the recess 22g and the projection 22h for positioning of the each unit are engaged with the projection 40g and the recess 40h formed at the inside surface of the bottom of the case 40b respectively. The movement or displacement of the main circuit 100 is thus restricted in the extending direction (from the power supply side terminal to the load side terminal or vice versa) of the main circuit 100. On the other hand,

as shown in Fig. 2, both side walls 40s of the case 40b, as well as the partition wall 40k formed between poles also restrict the movement or displacement of the main circuit 100 in the direction perpendicular to the extending direction of the main circuit 100. Consequently, easy positioning of the units 90 within the case 40b in assembling processes is available, which improves workability in the assembling process as well. Furthermore, as shown in Fig. 1, the unit 90 for each pole is fixed in the case 40b with screws 44 through the screw holes 1n and 7n from the bottom side of the case 40b. Consequently, the units 90 can be restricted or prevented from the movement toward the opening side from the bottom of the case 40b. At the same time, each unit 90 can be prevented from displacement in the extending direction of the main circuit 100 and in the direction perpendicular to the extension of the main circuit 100. In this embodiment, the unit 90 of each pole can be fixed with two screws in the case 40b. It is thus possible to reduce the number of assembling processes significantly. In addition, since those assembling processes can be replaced with drop-in processes, it is possible to assemble the components of the circuit breaker automatically using industrial robots, etc.

[0054] In this embodiment, the circuit breaker comprises a main circuit 100 extending from the power supply side terminal 1a to the load side terminal 7c via contact portions which include the power supply side stationary contact 2, the power supply side movable contact 3, the load side movable contact 5, and the load side stationary contact 6; the make-and-break mechanism 30 for making/breaking the contact portions 2, 3, 5, and 6; the tripping mechanism 50 for generating a mechanical output used to release the make-and-break mechanism 30 when an abnormal current flows in the main circuit 100; the main circuit case 22, as housing means, formed with an insulating material and used for housing at least the contact portions 2, 3, 5, and 6 of the main circuit 100 therein; and the casing 40 formed with an insulating material and used for housing the main circuit 100, the make-and-break mechanism 30, the tripping mechanism 50, and the main circuit case 22. At each pole, the tripping mechanism 50 is united with the main circuit case 22 for composing a unit 90. The unit 90 for the center pole is further provided with another make-and-break mechanism 30. The power supply side terminal 1a and the load side terminal 7c are disposed so as to protrude from the main circuit case 22 respectively. The power supply side terminal 1a and the load side terminal 7c are screwed at the terminal fixing part provided at an end of the case 40b of the casing 40, thereby the unit 90 is fixed in the casing 40.

[0055] In this embodiment, since each unit 90 is fixed only with screws at the terminal portion in the case 40b, it is not necessary to form screw holes at the bottom of the case nor have the bottom of the case double-structured. This enables to reduce both size and weight of the casing 40. In addition, each unit 90 can be fixed with less screws, so the number of assembling processes can be reduced. Furthermore, no through-holes such as screw holes, etc. are formed at the bottom of the case 40b in which each unit 90 is to be housed in this embodiment. In addition, the bottom of the unit 90 is covered with the insulating material layer of the bottom of the case 40b, so the unit 90 in the case 40b can be dust-proof and moisture-proof, thereby improving the reliability of the circuit breaker more significantly. In addition, since the bottom of the casing 40 is composed only of the insulating material layer of the case 40b, the heat generated in the case 40b can be released through the bottom of the casing 40, thereby preventing the temperature in the case 40b from rising.

[0056] In each unit 90, a direction of the current flowing through both of the power supply side stationary contact carrier 1 and the load side stationary contact carrier 7 is opposite to that flowing through the movable contact carrier 4 in the main circuit 100, thereby electromagnetic repulsive forces are generated at the power supply side contacts 2, 3 and the load side contacts 5, 6. More concretely, as shown in Figs. 6 through 10, the power supply side stationary contact carrier 1 and the load side stationary contact carrier 7 are provided with raised tongue portions (hereinafter tongues) 1k and 7k respectively. These tongues 1k and 7k are formed in the direction toward the power supply side terminal la and the load side terminal 7c respectively so as to reverse the direction of the current flowing through the power supply side stationary contact carrier 1 and the load side stationary contact carrier 7. And, the power supply stationary contact 2 and the load side stationary contact 6 are fixed at the tips of those tongues 1k and 7k respectively. Consequently, in the tongues 1k and 7k, the direction of the current is in the opposite to that in the movable contact carrier 4, thereby an electromagnetic repulsive force is generated between the stationary contact carriers 1, 7 and the movable contact carrier 4 when an abnormally large current such as a short-circuit current, etc. (more than 10 times the rated current) flows in the main circuit.

[0057] The circuit breaker in this embodiment is composed so that the amount of wipe between the contacts 2, 3 on the power supply side is different from that between the contacts 5, 6 on the load side in a normal ON/OFF operation. Generally, in the case of a circuit breaker, when the make-and-break mechanism is turned on, the make-and-break mechanism begins to move the movable contact carrier beyond a position where the movable contact comes in contact with the stationary contact. This is to obtain a proper contact pressure or to remove the oxide film from the surface of the contact thereby keeping good contacting condition between those contacts. The "wipe" is defined as the distance between the position where the movable contact reaches when neither the stationary contact nor the stationary contact carrier are mounted and the position where the movable contact comes in contact with the stationary contact when both of the stationary contact and station-

ary contact are mounted. In this embodiment, the circuit breaker is composed as shown in Fig. 11 so that the amount of wipe between the contacts 2, 3 at the power supply side becomes smaller than that between contacts 5, 6 at the load side when the main circuit 100 makes. More concretely, the angle of the tongue 7k of the load side stationary contact carrier 7 and the angle of the tongue 1k of the power supply side stationary contact carrier 1 are set respectively so that the angle between the load side stationary contact 6 and the load side movable contact 5 becomes larger than the angle between the power supply side stationary contact 2 and the power supply side movable contact 3 as shown in Figs. 11(a) and (b). Consequently, the power supply side stationary contact carrier 1 and the load side stationary contact carrier 7 are formed so that the surface of the power supply side stationary contact 2, facing to the power supply side movable contact 3, is included in the plane making a predetermined angle with the plane, which is in parallel to the plane that includes the surface of the load side stationary contact facing to the load side movable contact 5. Therefore, as shown in Fig. 11(b), a gap G is formed between the pair of contacts 2, 3 at the power supply side when the pair of contacts 5, 6 at the load side makes (when both contacts 5, 6 come in contact with each other). From this state up to when both pairs of the contacts make and the main circuit is turned on, the movable contact carrier 4 is further rotated and the load side movable contact 5 slides on the surface of the load side stationary contact 6 keeping in contact with each other. On the other hand, after the power supply side stationary contact 2 and the power supply side movable contact 3 come in contact with each other, the contacts 2 and 3 are slid by the force of a spring 8 respectively, thereby the contacts on both power supply and load sides are turned on. Thus the main circuit is shifted from OFF to ON. The amount of wipe between the load side movable contact 5 and the load side stationary contact 6 thus becomes larger than that between the power supply side stationary contact 2 and the power supply side movable contact 3, thereby the contact resistance between contacts 5, 6 at the load side can be reduced.

[0058] Especially in this embodiment, since a coil 52 is provided between the load side stationary contact carrier 7 and the load side terminal 7c, the heat generated at the load side stationary contact 6 is harder to be released than at the power supply side stationary contact 2 due to high thermal resistance within the coil 52. On the other hand, since the power supply side stationary contact 2 is connected to the power supply side terminal la via the power supply side stationary contact carrier 1, the heat generated at the contact 2 is released easily due to low thermal resistance within the power supply side stationary contact carrier 1. Consequently, since the amount of wipe between the load side movable contact 5 and the load side stationary contact 6 is set larger than that between the power supply side stationary contact 2 and the power supply side movable contact 3, thereby reducing the contact resistance between the contacts at the load side as described above, it enables to reduce the temperature rising at each contact, thereby obtaining a circuit breaker with less heat generation and excellent in safety and reliability.

[0059] Variations of structures for performing a proper wipe are explained referring to Figs. 12 and 13. Fig. 12 shows the first variation for composing the circuit breaker where the bending angles of the power supply side stationary contact carrier 1 is different from that of the load side stationary contact carrier 7. The power supply side stationary contact carrier 1 and the load side stationary contact carrier 7 are without the tongues, and the power supply side movable contact 3 and the load side movable contact 5 of the movable contact carrier 4 are composed so as to have a predetermined angle respectively to the parallel line as shown in Fig. 12 (b). In this variation, when the state of the main circuit 100 is shifted from OFF to ON and when the set of the load side movable contact 5 and the load side stationary contact 6 makes (comes in contact with each other), a gap G is formed between the contacts of the set of the power supply side stationary contact 2 and the power supply side movable contact 3 as shown in Fig. 12 (a). Consequently, just like the embodiment shown in Fig. 11, the amount of wipe between the power supply side stationary contact 2 and the power supply side movable contact 3 becomes smaller than that between the load side movable contact 6 and the load side stationary contact 5.

[0060] Fig. 13 shows the second variation for composing the circuit breaker where the bending angles of the power supply side stationary contact carrier 1 is different from that of the load side stationary contact carrier 7 similarly to the first variation. The power supply side stationary contact carrier 1 and the load side stationary contact carrier 7 are without the tongues, and the power supply side movable contact 3 and the load side movable contact 5 of the movable contact carrier 4 are composed so as to have a predetermined angle respectively to the parallel line as shown in Fig. 13 (b). In this variation, a gap G is formed between the contacts of the set of the load side stationary contact 6 and the load side movable contact 5. Consequently, the amount of wipe between the load side movable contact 5 and the load side stationary contact 6 becomes smaller than that between the power supply side stationary contact 2 and the power supply side movable contact 3, which results in a reduction of the contact resistance at the power supply side. This variation is effective when the heat generation is large at the power supply side.

[0061] It is thus possible to reduce the contact resistance at the load side or at the power supply side, thereby reducing the heat generation at each contact in this embodiment.

[0062] An arc chute (arc extinguisher) 24 is provided near each contact of the power supply side stationary

contact carrier 1, the load side stationary contact carrier 7, and the movable contact carrier 4 in the main circuit case. The arc chute is used to absorb and cool down the arc generated when the main circuit breaks. In order to lead such an arc to the arc chute 24 more effectively, an arc horn 26 is provided for each of the power supply side stationary contact carrier 1 and the load side stationary contact carrier 7 in this embodiment. In addition, arc outlets 22b and 22c are provided at both power supply side and load side of the main circuit case 22 in this embodiment so that the cooled arc gas is discharged. The arc exhaust port 22b at the power supply side is extended toward the surface 40c side (where an operation handle 60 is provided) of the circuit breaker casing 40 and communicated with the arc exhaust port 40e at the power supply side opened near the surface of the end of the casing at the power supply side. On the other hand, the arc exhaust port 22c at the load side is provided near the bottom 40d of an end face of the main circuit case 22 and communicated with the load side arc exhaust port 40f at the bottom of the casing load side. Consequently, when the circuit breaker breaks, the arc gas at the power supply side is jet out to the surface 40c side. Thus, metallic melts included within the arc gas are prevented from sticking between the power supply side terminal la and a circuit breaker mounting plate (not illustrated). (In a distribution board, this circuit breaker mounting plate is usually grounded electrically.) Consequently, ground faults can be prevented after the main circuit breaks. (An electrical potential is kept applied to the power supply side terminal 1a even after the main circuit 100 breaks.) On the other hand, at the load side, the arc gas jets out toward the bottom of the load side end face of the casing 40 via the load side arc exhaust port 40f at the bottom of the casing 40d. The metallic melts included within the arc gas are prevented from sticking on the tripping mechanism 50, thereby improving the reliability of the circuit breaker more significantly.

[0063] In this embodiment, the circuit breaker 100 is composed so that the movable contact carrier 4 is moved up to a position, where the arc is shut off, by an electromagnetic repulsive force working between the contacts when an abnormally large current flows in the main circuit 100, such as a short circuit current. At this time, the movable contact carrier holder 20 is provided with a locking mechanism for preventing the movable contact carrier 4 from a rebound, i.e., a phenomenon that the movable contact carrier 4, once repulsed and separated, comes close to the power supply side stationary contact carrier 1 and the load side stationary contact carrier 7 again, which restarts the arc and makes the electric current to flow again. The locking mechanism employed in this embodiment is the one disclosed in the applicant's Japanese Patent Application No.Hei-10-118110. I.e., as disclosed in Fig. 17, the movable contact carrier holder 20 is provided with a stopper frame 10 supported rotationally on a shaft by the first pin 16 and the second pin 14 supported rotationally on a shaft by this stopper frame 10. The movable contact carrier 4, mounted on the movable contact carrier holder 20, is provided with an engaging part 4A to be engaged with the second pin 14. When the movable contact carrier 4 repulses, the second pin 14 engages with the engaging part 4A so as to lock and hold the movable contact carrier 4 at a repulsive position. The first pin 16 is inserted in the hole 20b opened at the movable contact carrier holder 20 as shown in Fig. 16. The first pin 16 also passes through the hole 10d of the stopper frame 10 so as to support the stopper frame 10 rotatably in the movable contact carrier holder 20. As shown in Fig. 18, the first pin 16 is provided with a groove 16a, so that an E-ring 17 is fit in this groove 16a to prevent the stopper frame 10 from dropping while the stopper frame 10 is supported rotatably in the movable contact carrier holder 20. The stopper frame 10 has U-shaped cross section and each of its rising parts 10a is provided with holes 10d and 10e. The first pin 16 is fit in the hole 10d and the second pin 14 is fit in the hole 10e rotationally. And, a long hole 10b and a semicircular notch 10c for mounting one end of the spring 8 are provided at the bottom of the U-shaped part. The other end of the spring 8 is fit in the recess 4B of the movable contact carrier 4 as shown in Fig. 5.

[0064] When a large current, such as short circuit current, flows in the main circuit in this state, the movable contact carrier 4 repulses and opens(breaks) the circuit. After the repulsion, the movable contact carrier 4 is engaged with the pin 14 and held as shown in Fig. 19, thereby preventing the rebounding of the movable contact carrier 4. Consequently, in this embodiment, the second pin 14 can lock the engaging part 4A more strongly in the engaging state after the repulsion just as disclosed in the Japanese Patent Application No.Hei-10-118110, which enables to obtain a circuit breaker excellent in the shutting-off performance and to surely prevent the rebounding of the movable contact carrier 4.

[0065] According to the present invention, a circuit breaker capable of performing a proper amount of wipe at the movable contact carrier for a stable make/break performance is obtained.

[0066] In addition, a circuit breaker excellent in workability in assembling processes is obtained according to the present invention.

[0067] Furthermore, according to the present invention, a circuit breaker capable of preventing electrical shock by electrically insulating the converting mechanism, which converts the electromagnetic force to a mechanical output for tripping, from the main circuit is obtained.

Claims

1. A circuit breaker, comprising,

a casing (40) made of electrically insulating ma-

terial;
a main circuit (100) provided with a power supply side stationary contact carrier (1), a power supply side stationary contact (2), a power supply side movable contact (3), a movable contact carrier (4), a load side movable contact (5), a load side stationary contact (6), and a load side stationary contact carrier (7);
housing means (22) disposed in said casing (40) for housing said power supply side stationary contact (2), said power supply side movable contact (3), said movable contact carrier (4), said load side movable contact (5), and said load side stationary contact (6) therein, said housing means (22) being made of electrically insulating material;
a make-and-break mechanism (30) disposed in said casing (40) for making and breaking said main circuit (100) by moving said movable contact carrier (4);
a tripping mechanism (50) disposed in said casing (40) for tripping said make-and-break mechanism (30) when an abnormal current flows in said main circuit (100);
a movable contact carrier holder (20) disposed in said housing means (22) for supporting said movable contact carrier (4), said movable contact carrier holder (20) being made of electrically insulating material;
holding means (80) disposed in said housing means (22) for supporting said movable contact carrier holder (20) rotatably; and
transmitting means (25) for transmitting the make/break operation of said make-and-break mechanism (30) to said movable contact carrier holder (20), wherein
said power supply side stationary contact carrier (1) and said load side stationary contact carrier (7) is partially exposed outside of said housing means (22) so as to be electrically connected to a power supply side terminal (1a) and a load side terminal (7c) respectively,

characterized in that

said tripping mechanism (50) is united to said load side stationary contact carrier (7) and to said load side terminal (7c), said tripping means (50) includes a converting mechanism (51) for converting electromagnetic force to mechanical force for tripping, said converting mechanism (51) is supported on said housing means (22) and is electrically insulated from said main circuit (100), said transmitting means (25) is made of electrically insulating material, said make-and-break mechanism (30) is mounted on said housing means and is electrically insulated from said main circuit (100).

2. A circuit breaker according to claim 1, wherein said power supply side stationary contact carrier (1) and said load side stationary contact carrier (7) are composed in such a manner that an amount of wipe between said power supply side stationary contact (2) and said power supply side movable contact (3) differs from that between said load side movable contact (5) and said load side stationary contact (6) when said main circuit (100) makes.

3. A circuit breaker according to claim 2, wherein said power supply side stationary contact carrier (1) and said load side stationary contact carrier (7) are composed in such a manner that a gap between contacts is formed at either one of said power supply side stationary contact (2) and said power supply side movable contact (3) pair or said load side movable contact (5) and said load side stationary contact (6) pair when the other contact pair makes.

4. A circuit breaker according to claim 3, wherein said power supply side stationary contact carrier (1) and said load side stationary contact carrier (7) are composed in such a manner that said gap is formed between said power supply side stationary contact (2) and said power supply side movable contact (3) when said load side movable contact (5) and said load side stationary contact (6) pair makes.

5. A circuit breaker having a plurality of poles, comprising,

a casing (40) made of electrically insulating material;
a plurality of main circuits (100) disposed at each of said poles, each of said main circuit (100) provided with a power supply side stationary contact carrier (1), a power supply side stationary contact (2), a power supply side movable contact (3), a movable contact carrier (4), a load side movable contact (5), a load side stationary contact (6), and a load side stationary contact carrier (7);
a plurality of housing means (22) disposed in said casing (40), each of said housing means for housing said power supply side stationary contact (2), said power supply side movable contact (3), said movable contact carrier (4), said load side movable contact (5), and said load side stationary contact (6) therein for each pole, said housing means (22) being made of electrically insulating material;
a make-and-break mechanism (30) disposed in said casing (40) for making and breaking said plurality of main circuits (100) by moving said movable contact carrier (4) at each pole;
a plurality of tripping mechanisms (50) disposed in said casing (40), each of said tripping mechanisms (50) for tripping said make-and-

break mechanism (30) when an abnormal current flows in at least one of said plurality of main circuits (100);
a movable contact carrier holder (20) disposed in said housing means (22) for supporting said movable contact carrier (4), said movable contact carrier holder (20) being made of electrically insulating material;
holding means (80) disposed in said housing means (22) for supporting said movable contact carrier holder (20) rotatably; and
transmitting means (25) for transmitting the make/break operation of said make-and-break mechanism (30) to all of said movable contact carrier holders (20) simultaneously, wherein said power supply side stationary contact carrier (1) and said load side stationary contact carrier (7) is partially exposed outside of said housing means (22) so as to be electrically connected to a power supply side terminal (1a) and a load side terminal (7c) respectively,

characterized in that

said tripping mechanism (50) is united to said load side stationary contact carrier (7) and to said load side terminal (7c), said tripping means (50) includes a converting mechanism (51) for converting electromagnetic force to mechanical force for tripping, said converting mechanism is supported on said housing means (22) and is electrically insulated from said main circuit (100), said transmitting means (25) is made of electrically insulating material, said make-and-break mechanism (30) is mounted on one of said housing means (22) and is electrically insulated from said plurality of main circuits (100).

6. A circuit breaker according to claim 5, wherein said power supply side stationary contact carrier (1) and said load side stationary contact carrier (7) are composed in such a manner that an amount of wipe between said power supply side stationary contact (2) and said power supply side movable contact (3) differs from that between said load side movable contact (5) and said load side stationary contact (6) when said main circuit (100) makes in at least one of said plurality of poles.

7. A circuit breaker according to claim 6, wherein said power supply side stationary contact carrier (1) and said load side stationary contact carrier (7) are composed in such a manner that a gap between contacts is formed at either one of said power supply side stationary contact (2) and said power supply side movable contact (3) pair or said load side movable contact (5) and said load side stationary contact (6) pair when the other contact pair makes in at least one of said plurality of poles.

8. A circuit breaker according to claim 7, wherein said power supply side stationary contact carrier (1) and said load side stationary contact carrier (7) are composed in such a manner that said gap is formed between said power supply side stationary contact (2) and said power supply side movable contact (3) when said load side movable contact (5) and said load side stationary contact (6) pair makes in at least one of said plurality of poles.

9. A circuit breaker, comprising,

a casing (40) made of electrically insulating material;
a main circuit (100) provided with a power supply side stationary contact carrier (1), a power supply side stationary contact (2), a power supply side movable contact (3), a movable contact carrier (4), a load side movable contact (5), a load side stationary contact (6), and a load side stationary contact carrier (7);
housing means (22) disposed in said casing (40) for housing said power supply side stationary contact (2), said power supply side movable contact (3), said movable contact carrier (4), said load side movable contact (5), and said load side stationary contact (6) therein, said housing means (22) being made of electrically insulating material;
a make-and-break mechanism (30) disposed in said casing (40) for making and breaking said main circuit (100) by moving said movable contact carrier (4);
a tripping mechanism (50) disposed in said casing (40) for tripping said make-and-break mechanism (30) when an abnormal current flows in said main circuit (100);
a movable contact carrier holder (20) disposed in said housing means (22) for supporting said movable contact carrier (4), said movable contact carrier holder (20) being made of electrically insulating material;
holding means (80) disposed in said housing means (22) for supporting said movable contact carrier holder (20) rotatably; and
transmitting means (25) for transmitting the make/break operation of said make-and-break mechanism (30) to said movable contact carrier holder (20), wherein
said power supply side stationary contact carrier (1) and said load side stationary contact carrier (7) is partially exposed outside of said housing means (22) so as to be electrically connected to a power supply side terminal (1a) and a load side terminal (7c) respectively,

characterized in that

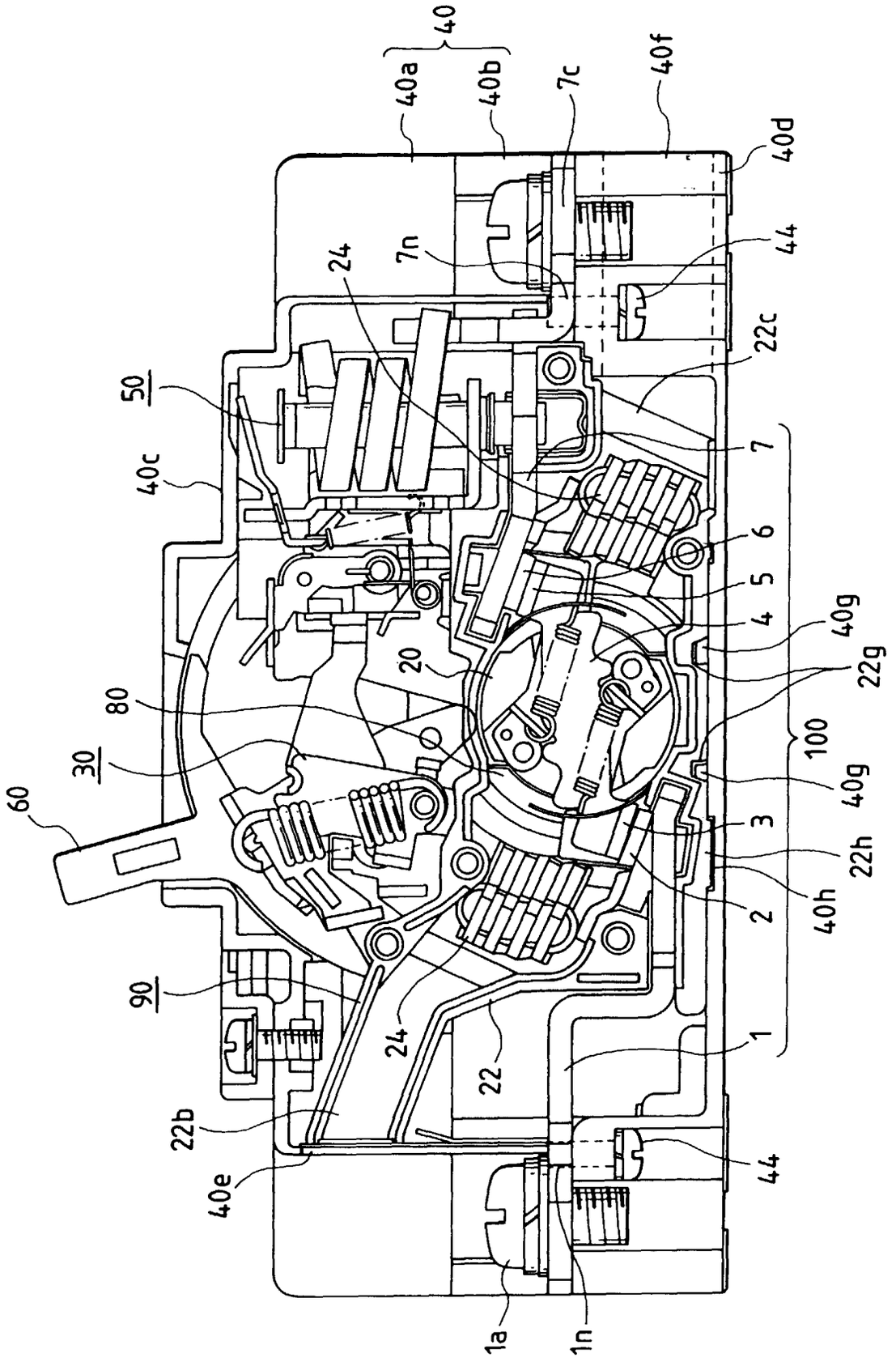
said power supply side stationary contact car-

rier (1) and said load side stationary contact carrier (7) are composed in such a manner that an amount of wipe between said power supply side stationary contact (2) and said power supply side movable contact (3) differs from that between said load side movable contact (5) and said load side stationary contact (6) when said main circuit (100) makes.

10. A circuit breaker according to claim 9, wherein said power supply side stationary contact carrier (1) and said load side stationary contact carrier (7) are composed in such a manner that a gap between contacts is formed at either one of said power supply side stationary contact (2) and said power supply side movable contact (3) pair or said load side movable contact (5) and said load side stationary contact (6) pair when the other contact pair makes.

11. A circuit breaker according to claim 10, wherein said power supply side stationary contact carrier (1) and said load side stationary contact carrier (7) are composed in such a manner that said gap is formed between said power supply side stationary contact (2) and said power supply side movable contact (3) when said load side movable contact (5) and said load side stationary contact (6) pair makes.

FIG. 1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40a
40b
7c
40f
40d
44
22c
24
7n
50
40c
7
6
5
4
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22g
20
80
30
60
100
3
22h
2
40h
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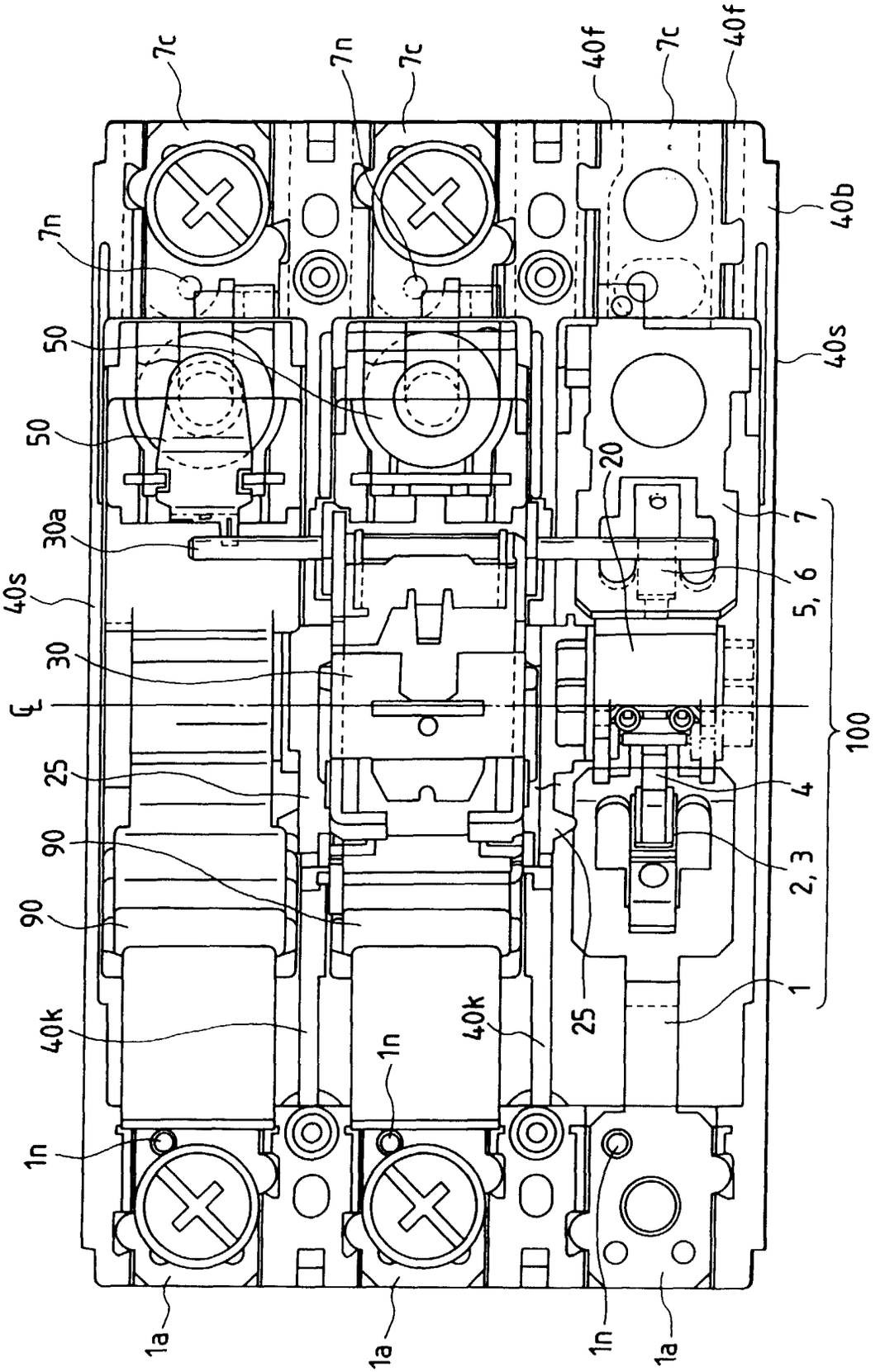
1
22
24
22b
40e
44
1a
1n

FIG. 2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7c
40f
7c
40f
40b
7n
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40s
50
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7
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1n
1a

FIG. 3

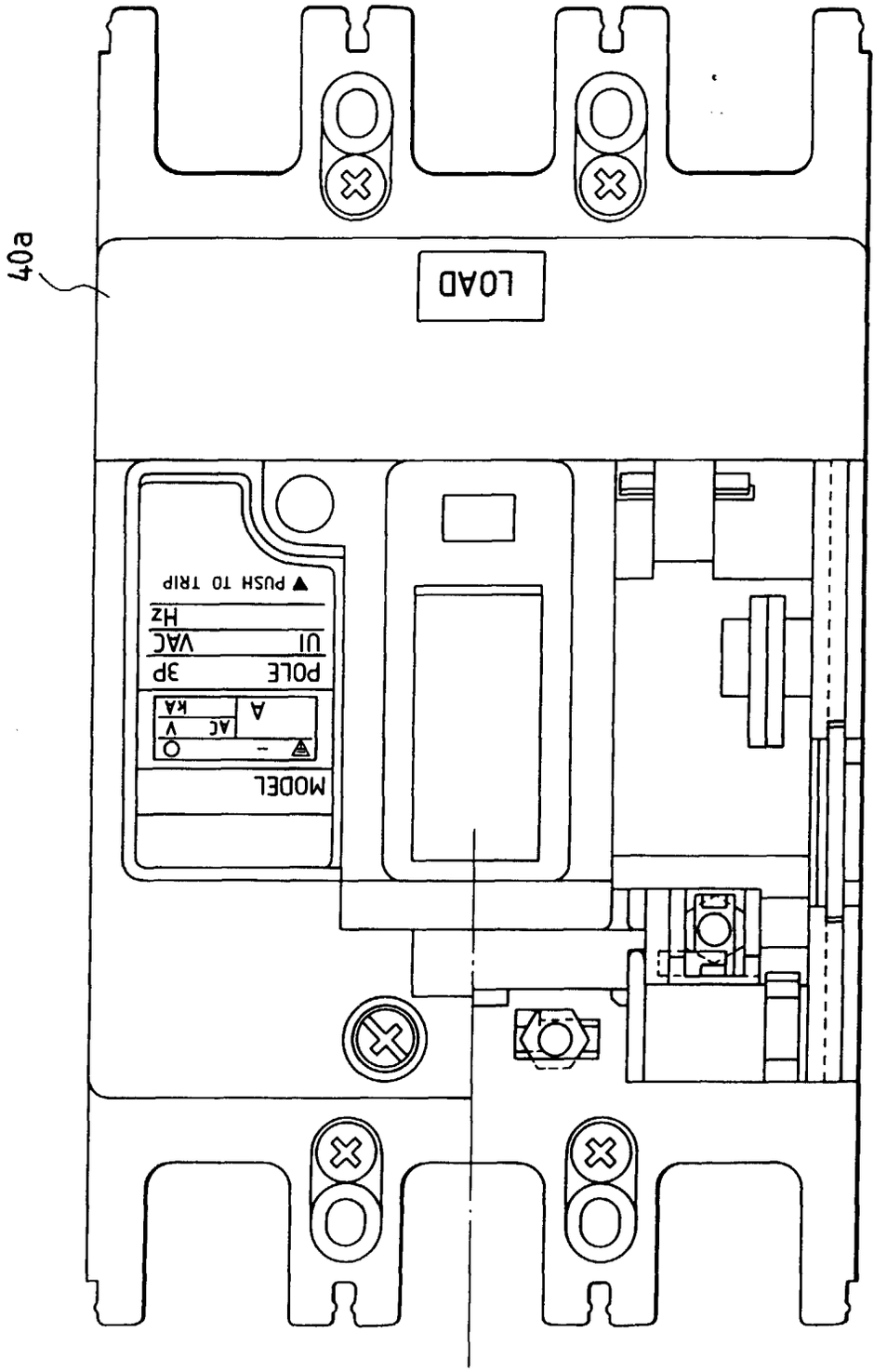

FIG. 4

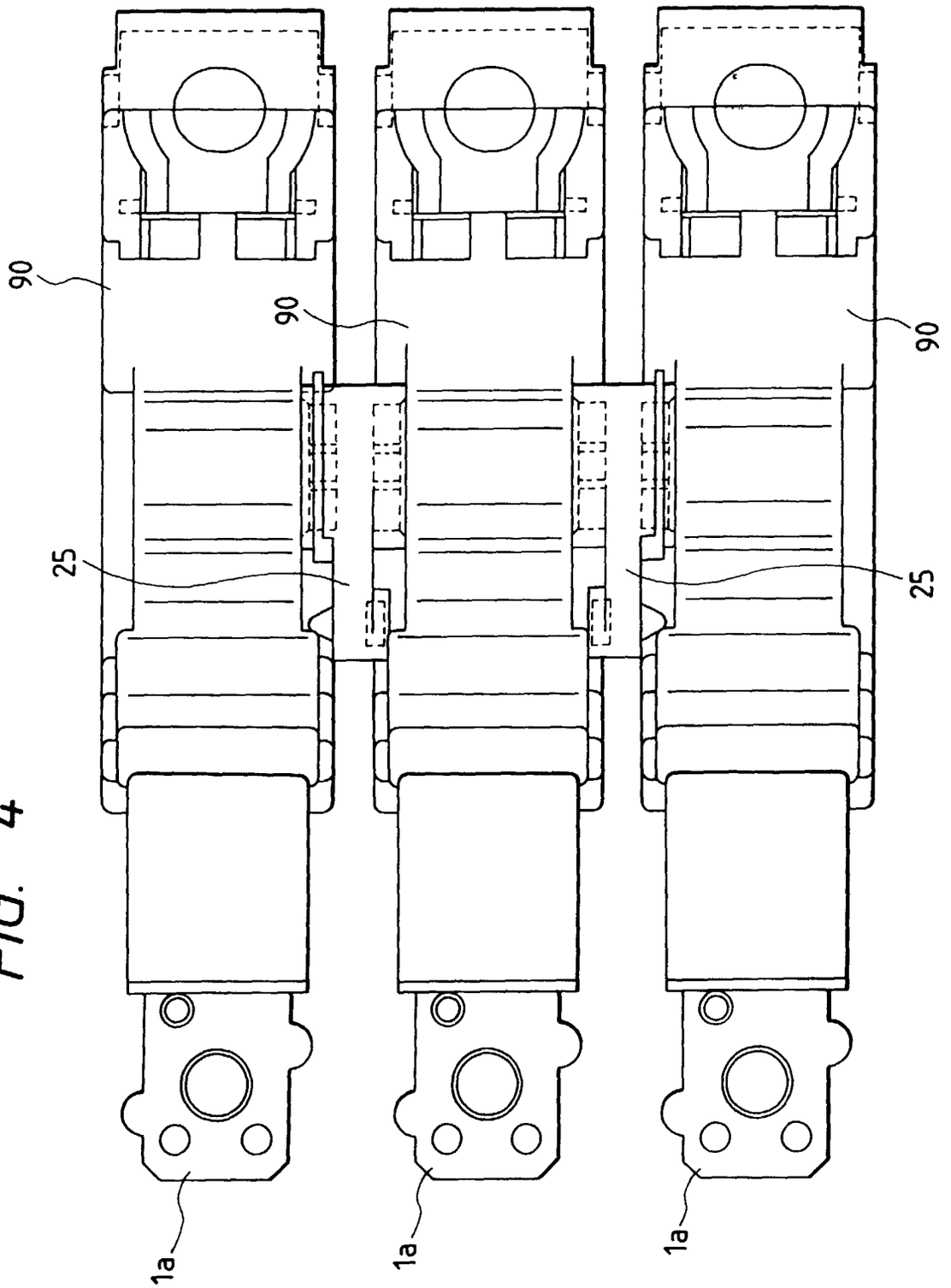

FIG. 5

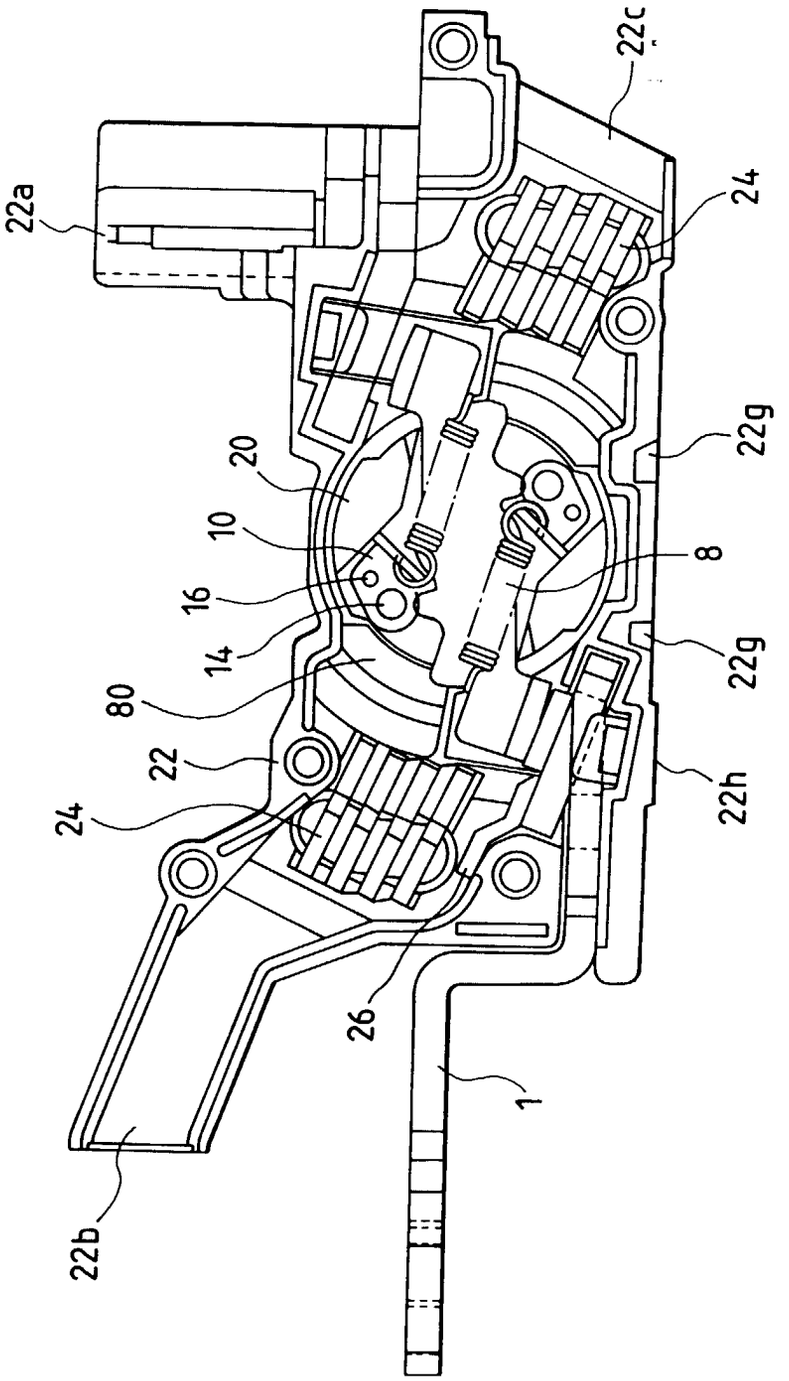

FIG. 6

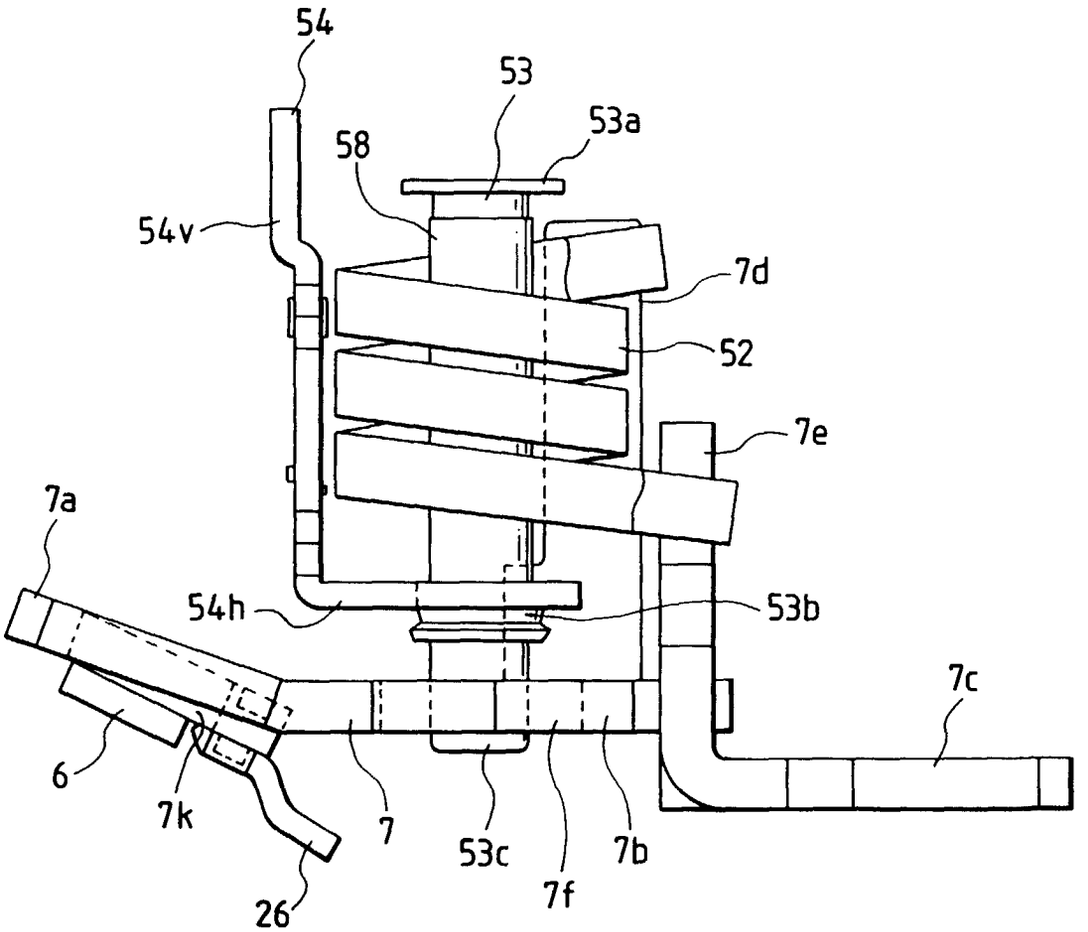

FIG. 7

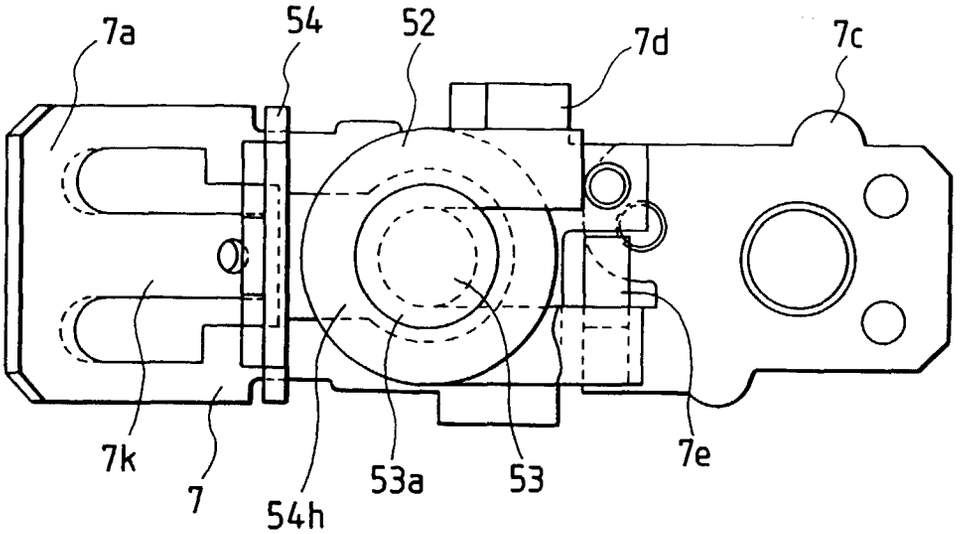

FIG. 8

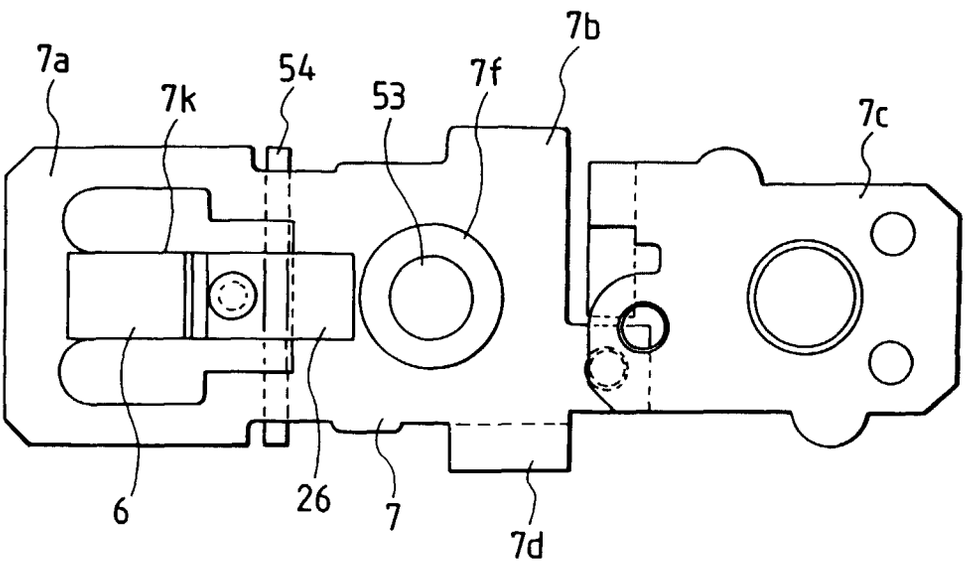

FIG. 9

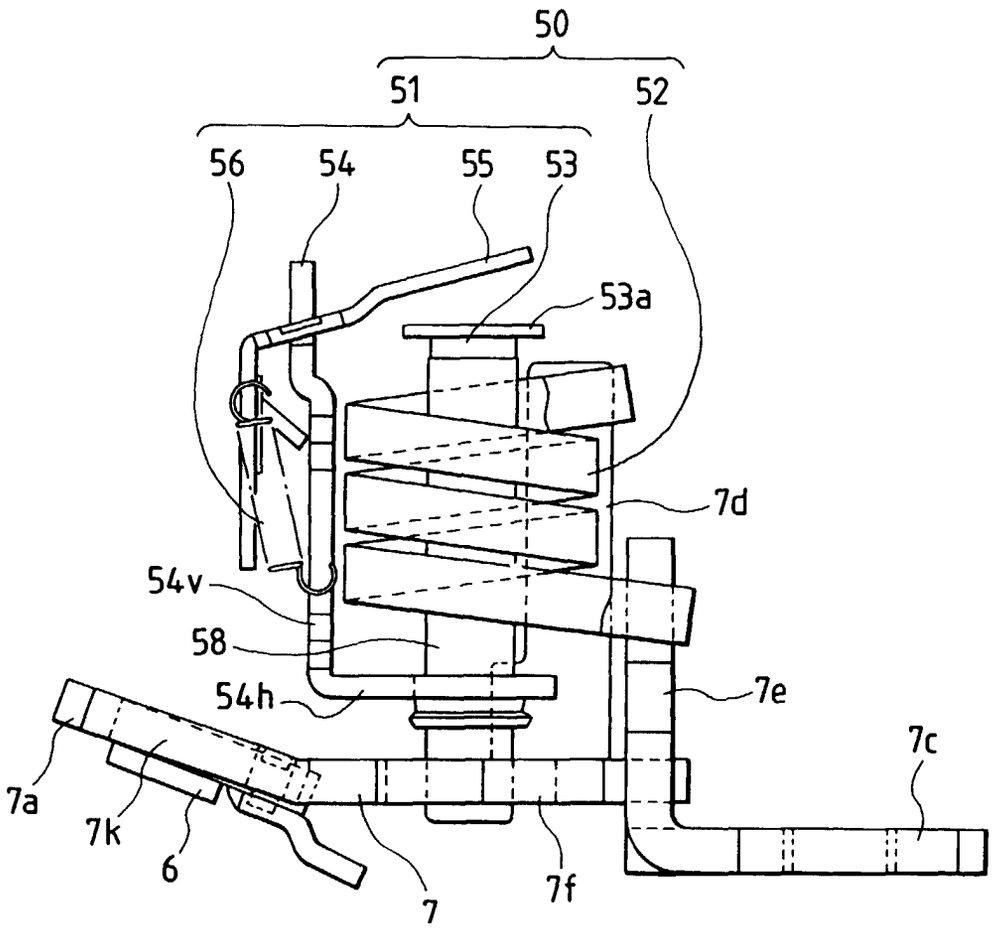

FIG. 10

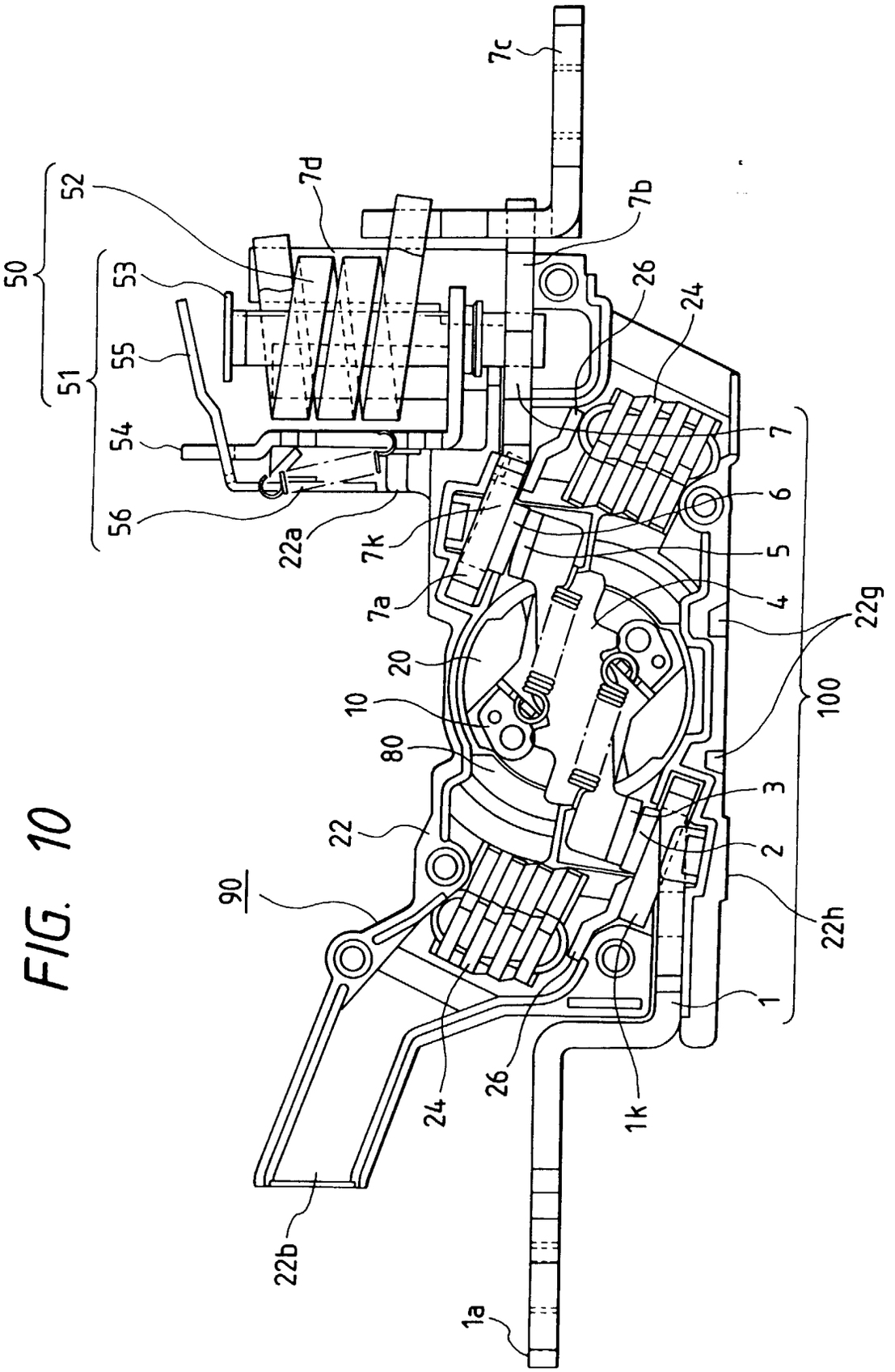
7c
7d
7b
52
50
53
51
55
54
56
22a
7k
26
24
7
6
5
4
7a
20
10
80
22
90
3
2
22g
100
22h
1
1k
26
24
22b
1a

FIG. 11(a)

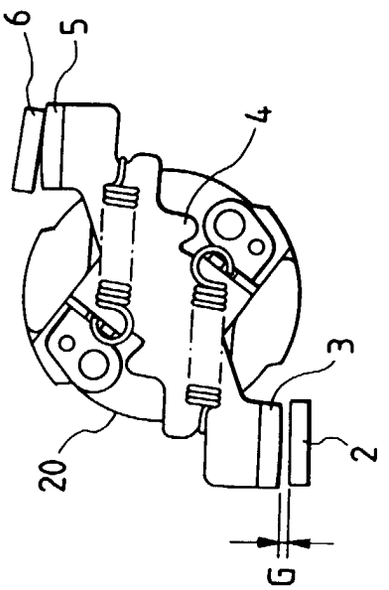

FIG. 11(b)

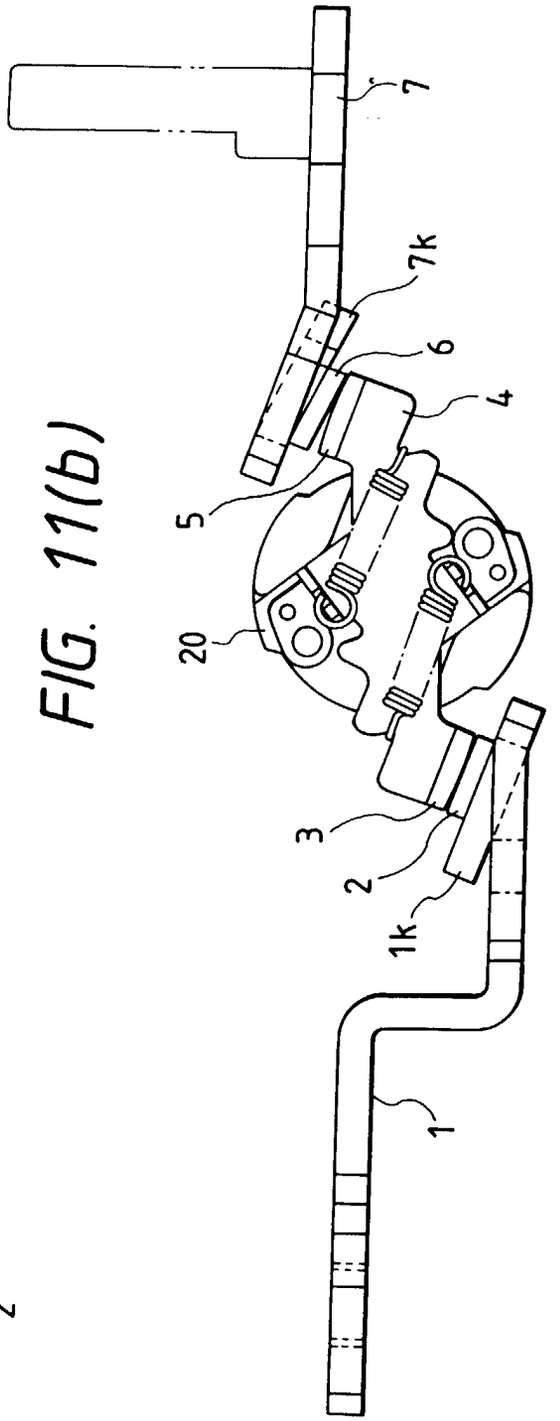

FIG. 12(a)

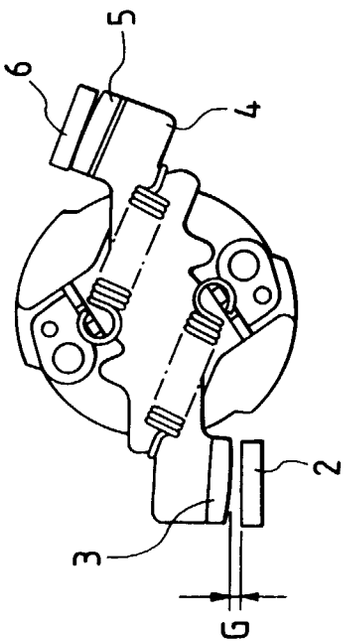

FIG. 12(b)

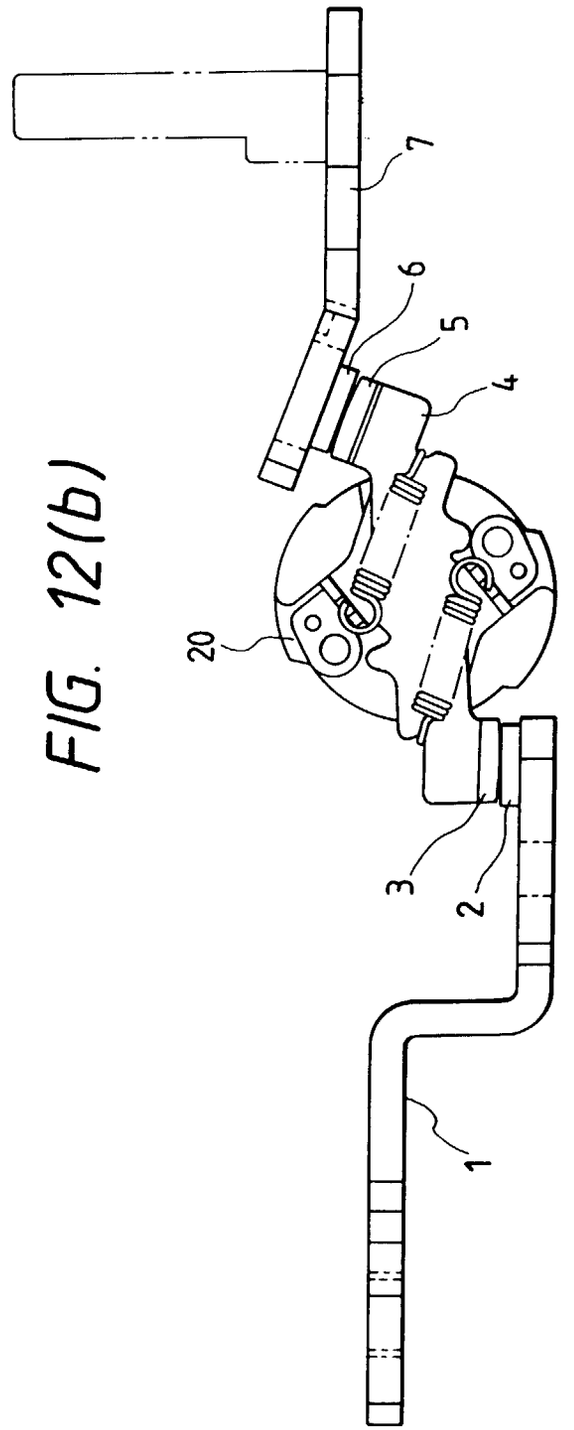

FIG. 13(a)

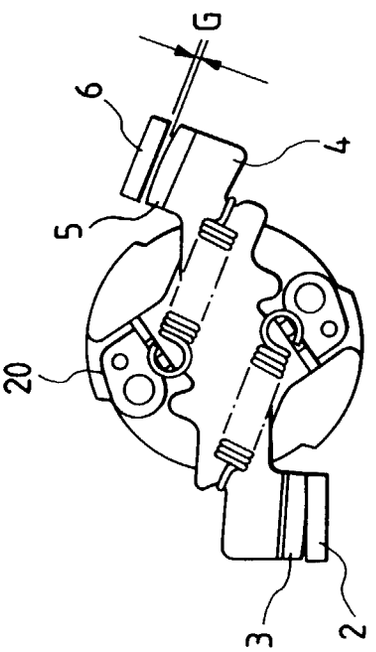

FIG. 13(b)

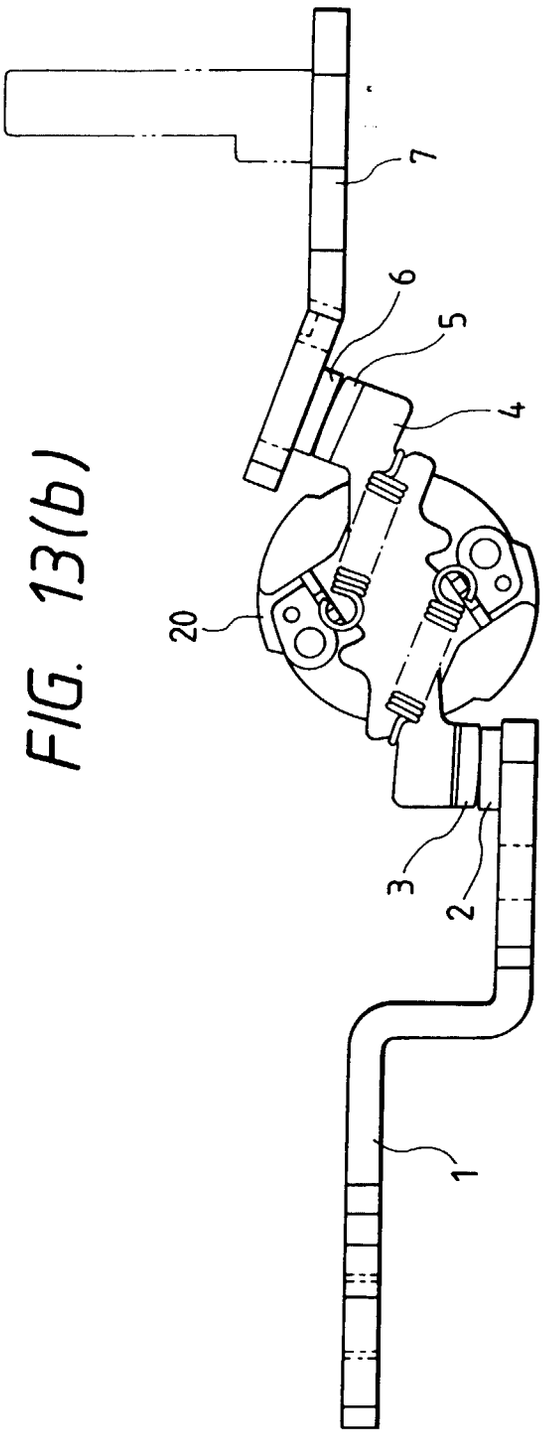

FIG. 14

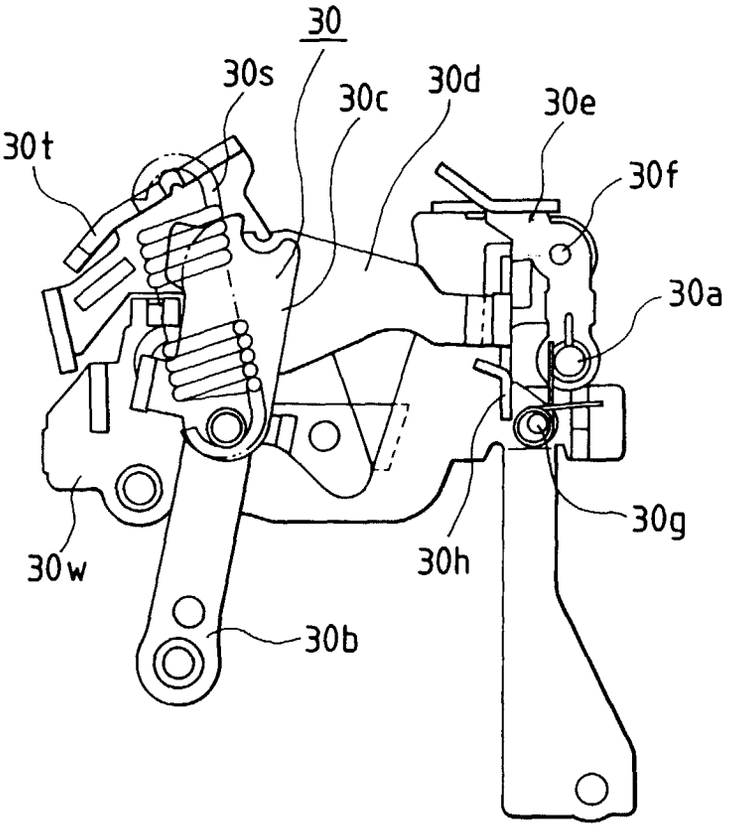

FIG. 15

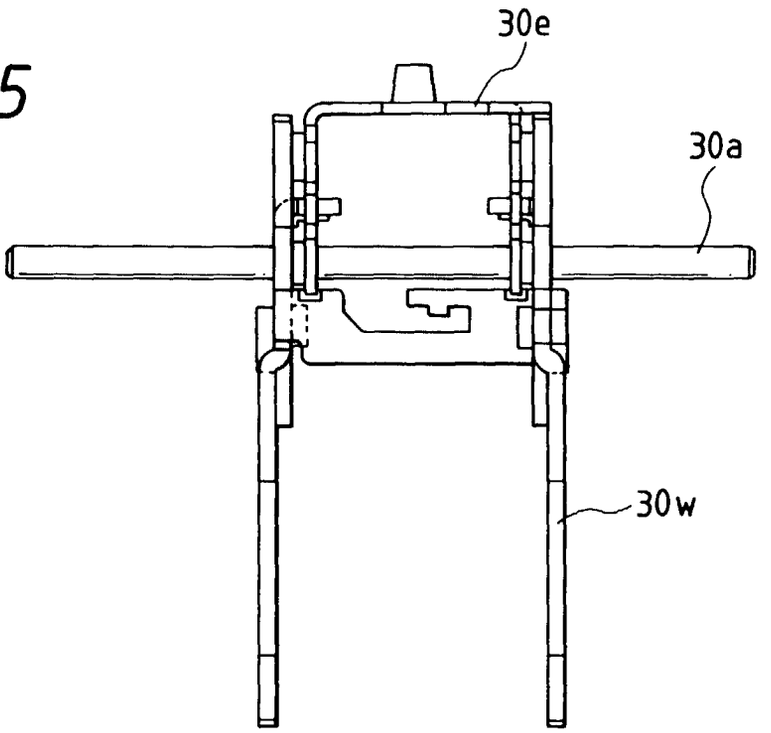

FIG. 16

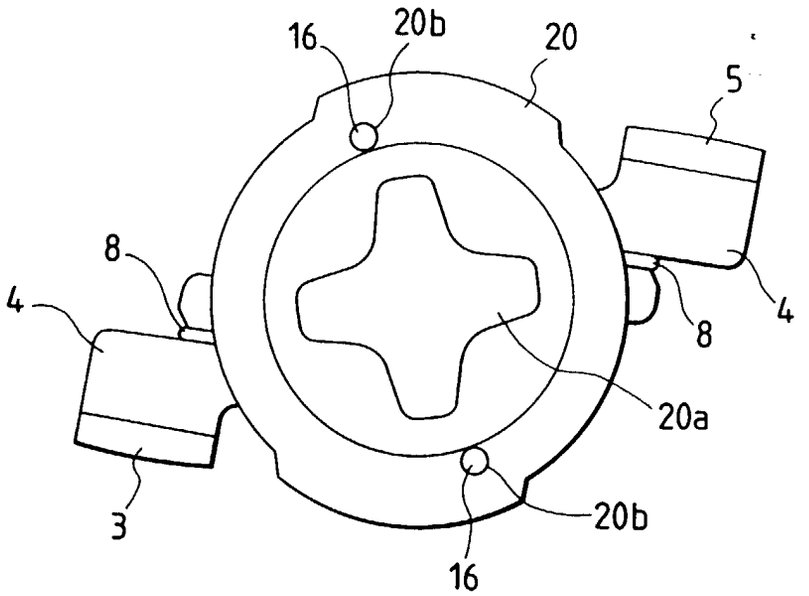
16
20b
20
5
8
4
4
8
20a
3
20b
16

FIG. 17

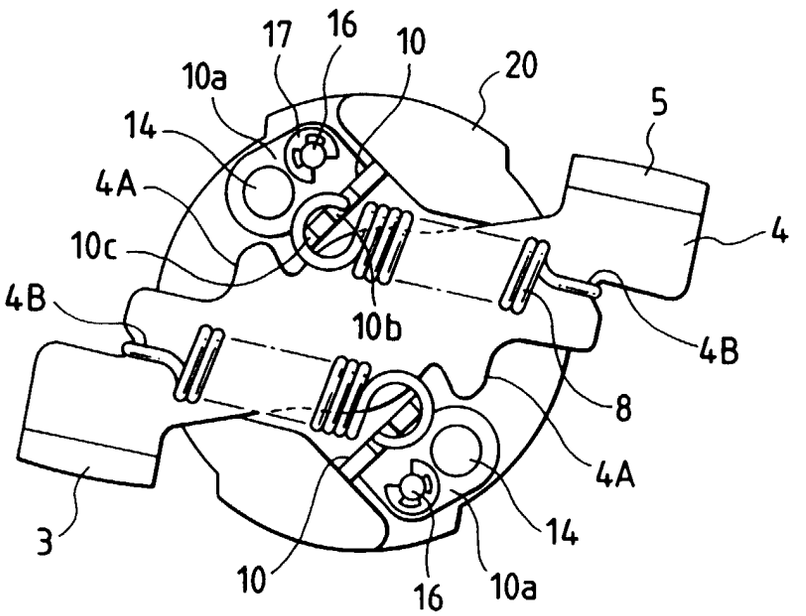
17
16
10
10a
20
5
14
4A
4
10c
4B
10b
4B
8
4A
14
3
10
16
10a

FIG. 18

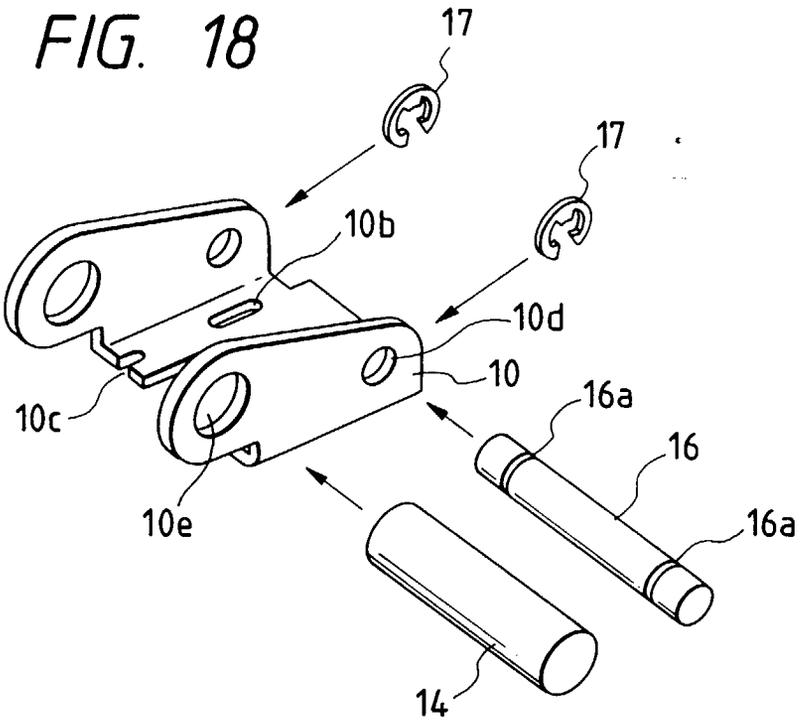

FIG. 19