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(71) Applicant: **mitsubishi denki kabushiki
kaisha**
Chiyoda-ku, Tokyo 100-8310 (JP)

(72) Inventors:
• **MAKITA, Yo**
c/o Mitsubishi Denki Kabushiki Kaisha
Tokyo 100-8310 (JP)
• **FUKUYA, Kazunori**
Mitsubishi Denki Kabushiki K.K.
Chiyoda-Ku, Tokyo 100-8310 (JP)
• **TAKEUCHI, Toshie**
Mitsubishi Denki Kabushiki K.K.
Chiyoda-Ku, Tokyo 100-8310 (JP)

• **mitsubishi, Takao**
Mitsubishi Denki Kabushiki K.K.
Chiyoda-Ku, Tokyo 100-8310 (JP)
• **tsukishima, Chihito**
c/o Mitsubishi Denki K.K.
Tokyo 100-8310 (JP)
• **okashita, Hiroshi**
c/o Mitsubishi Denki K.K.
Chiyoda-Ku, Tokyo 100-8310 (JP)
• **koayama, Kenichi**
c/o Mitsubishi Denki K.K.
Chiyoda-Ku, Tokyo 100-8310 (JP)

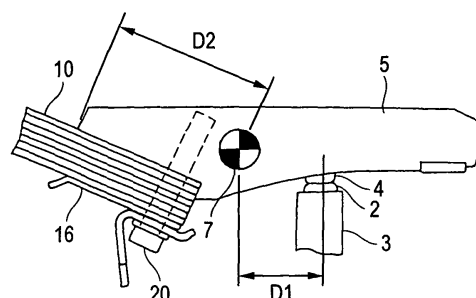
(74) Representative: **Sajda, Wolf E. et al**
Meissner, Bolte & Partner GbR
Postfach 86 06 24
D-81633 München (DE)

(54) **BREAKER**

(57) The present invention provides a circuit breaker including a fixed element 3 having a fixed contact point 2, a movable element 5 tilting in a state of being supported by a shaft 7 and having a movable contact point 4 which comes into and out of contact with the fixed contact point 2, and a shunt conductor 10 fixed at one end to a rear end side of the movable element 5 which is opposite from the movable contact point 4 with respect to the shaft 7 and connected at the other end with a terminal 9, and being configured in such a manner that an electromag-

netic force generated by a current flowing in the shunt conductor 10 and a magnetic flux excited by the current acts on the movable element 5 so as to cause the movable contact point 4 toward the fixed contact point 2, wherein the length of the movable element 5 on the rear end side is set to a length at least twice a distance between the shaft 7 and the movable contact point 4 in the horizontal direction, and the one end of the shunt conductor 10 is fixed in contact with the rear end side of the movable element 5.

FIG. 3



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Description

Technical Field

[0001] The present invention relates to a structure of a circuit breaker.

Background Art

[0002] Various proposals are provided for improving a power conducting performance between contact points when a short circuit current is occurred in the circuit breaker. For example, JP-A-6-89650 discloses is a circuit breaker including a power conducting portion having a fixed element with a fixed contact point, a movable element with a movable contact point, and a shunt conductor extending between the movable element and a terminal, so that a magnetic flux excited by a current flowing in the shunt conductor and an electromagnetic force generated by the current causes the movable contact point to move toward the fixed contact point, wherein a member having high magnetic permeability is arranged in a magnetic path of the magnetic flux, so that the magnetic flux passed through the member having the magnetic permeability is interlinked with the current. Accordingly, the magnetic flux is concentrated to the member having high magnetic permeability and the short circuit current is interlinked with the magnetic flux concentrated on the member having high magnetic permeability, so that the amount of interlinked magnetic flux is increased, and a force of pressing the contact points to each other is increased, thereby improving the power conducting performance.

[0003] However, according to the structure in the related art described above, it has advantages such that the electromagnetic force applied between the contact points increases, a force to press the movable and fixed contact points against each other is increased, and hence the power conducting performance can be improved. On the other hand, it has disadvantages such that the number of components increases, and a certain amount of space is required for installing the member having high magnetic permeability.

Disclosure of Invention

[0004] In view of such circumstances, it is an object of the present invention to enhance a force of pressing between movable and fixed contact points without increasing the number of components and in a compact state without occupying a large space, so as to improve a short-time current carrying capacity of a circuit breaker in case of occurrence of short circuit currency.

[0005] In order to achieve the above-described object, a circuit breaker according to the present invention is a circuit breaker including a fixed element having a fixed contact point, a movable element tilting in a state of being supported by a shaft and having a movable contact point which comes into and out of contact with the fixed contact

point, and a shunt conductor fixed at one end to a rear end side of the movable element which is opposite from the movable contact point with respect to the shaft and connected at the other end with a terminal, and being configured in such a manner that an electromagnetic force generated by a magnetic flux excited by a current flowing in the shunt conductor and the current in question acts on the movable element so as to cause the movable contact point to move toward the fixed contact point, wherein the length of the movable element on the rear end side is set to a length at least twice a distance between the shaft and the movable contact point in the horizontal direction, and the one end of the shunt conductor is fixed in contact with the rear end side of the movable element.

[0006] The invention also provides a circuit breaker in which each pole includes a fixed element having a fixed contact point, three or more movable elements tilting in a state of being supported by the shaft and having movable contact points that come into and out of contact with the fixed contact point and being arranged in parallel, and shunt conductors each fixed at one end to the rear end side of the movable element which is opposite from the movable contact point with respect to the shaft and connected at the other end to a terminal, and being configured in such a manner that an electromagnetic force generated by a magnetic flux excited by a current flowing in the shunt conductor and the current in question acts on the movable element so as to cause the movable contact point to move toward the fixed contact point, wherein the width of the movable elements adjacent to different poles are narrowed in plan view in comparison with the widths of the remaining movable elements.

[0007] The invention also provides a circuit breaker in which each pole includes a fixed element tilting in a state of being supported by the shaft and having a fixed contact point, three or more movable elements having movable contact points that come into and out of contact with the fixed contact point and being arranged in parallel, and shunt conductors each fixed at one end to the rear end side of the movable element which is opposite from the movable contact point with respect to the shaft and connected at the other end to a terminal, and being configured in such a manner that an electromagnetic force generated by a magnetic flux excited by a current flowing in the shunt conductor and the current in question acts on the movable element so as to cause the movable contact point to move toward the fixed contact point, wherein the movable elements adjacent to different poles are shifted toward the center of a group of movable elements with respect to the fixed contact points corresponding to the movable contact points thereof.

Advantages of the Invention

[0008] Since a force that the movable contact points presses against the fixed contact point is increased, a compact circuit breaker having a large short-time current

carrying capacity is achieved.

Brief Description of the Drawings

[0009]

Fig. 1 is a side view of a circuit breaker according to the present invention.

Fig. 2 is a conceptual drawing showing a portion of a fixed element and a movable element of the circuit breaker according to a first embodiment of the present invention.

Fig. 3 is an enlarged drawing showing a principal portion of the fixed element and the movable element of the circuit breaker according to the first embodiment of the present invention.

Fig. 4 is a graph for explaining an operation in the first embodiment of the present invention.

Fig. 5 is a conceptual drawing showing a portion of the fixed element and the movable element of the circuit breaker according to a second embodiment of the present invention.

Fig. 6 is an enlarged drawing of a principal portion of the fixed element and the movable element of the circuit breaker according to the second embodiment of the present invention.

Fig. 7 shows a plan view (a) and a side view (b) of a portion of the fixed element of the circuit breaker according to a third embodiment of the present invention.

Fig. 8 is a graph for explaining an operation in the third embodiment.

Fig. 9 shows a plan view (a) and a side view (b) of a portion of the movable element of the circuit breaker according to a fourth embodiment of the present invention.

Best Mode for Carrying Out the Invention

First Embodiment

[0010] Referring now to the drawings, embodiments of the present invention will be described below. Fig. 1 is a cross-sectional side view of a circuit breaker according to the present invention; Fig. 2 is a conceptual drawing showing a portion of a fixed element and a movable element; and Fig. 3 is an enlarged drawing of a principal portion in Fig. 2. The circuit breaker according to the present invention includes a housing 1. In the housing 1, a fixed element (conductor) 3 having a fixed contact point 2, a movable element 5 having a movable contact point 4 which comes into and out of contact with the fixed contact point 2, a contact arm 6 supported by a shaft 8, a movable shaft 7 which rotatably supports the movable element 5, a terminal 9, a shunt conductor 10 that electrically connects the terminal 9 and the movable shaft 7, a compressing spring 11 provided between the movable element 5 and the housing 1 for applying an urging force

to the movable element 5 in the direction of closing the contact point 5, an opening and closing mechanism 12, a shaft 13, a separating relay unit 14, and an arc extinguish chamber 15.

[0011] Fig. 2 is a conceptual drawing showing specifically a portion of the fixed element 3 and the movable element 5, and Fig. 3 is an enlarged drawing showing a principal portion of Fig. 2. These drawings show a state in which the movable contact point 4 is in contact with the fixed contact point 2. The shunt conductor 10 for connecting the terminal 9 and the movable element 5 is a flexible conductor having a number of laminated thin copper plates. One end of the shunt conductor 10 is fixed to the terminal 9 with a screw or the like, and the other end is fixed to the movable element 5 by a fixing member A. The fixing member A is normally a fixing screw 20 as described later. The movable element 5 is a substantially rod-shaped member which tilts about the shaft 7 as a fulcrum point, and includes the fixed contact point 2 on a distal end side (right side in Fig. 2) with respect to the shaft 7. A rear end side with respect to the shaft 7 (left side in Fig. 2) is connected and fixed to the shunt conductor 10.

[0012] Connecting and fixed portion between the shunt conductor 10 and the movable element 5 will be described in detail. A distal end portion of the shunt conductor 10 formed of a laminated conductor abuts along a lower surface of the movable element 5 on the rear end side, that is, along the plane of the movable element 5 where the movable contact point 4 is provided, and is fixed by screwing a screw 20 into the movable element with a reinforcing plate 16 abutted thereto from the lower side. The distal end portion of the shunt conductor 10 is firmly fixed between the reinforcing plate 16 and the movable element 5 on the rear end side with respect to the shaft 7, and has a tight contact electrically with the movable element 5. The reinforcing plate 16 has a length substantially the same as the length of the distal end portion of the shunt conductor 10 that is in contact with the movable element 5.

[0013] A characteristic of the present invention described in a first embodiment is that in the configuration as described above, the distance between a rear end of the movable element 5 and the shaft 7 is set to a larger value than the distance between the shaft 7 and the movable contact point 4. More specifically, assuming that D1 represents the distance between a center of the shaft 7 and the movable contact point 4 in the horizontal direction and D2 represents the distance between a center of the shaft 7 and the rear end of the movable element 5, the distance D2 is equal to or larger than twice the distance D1.

[0014] When a short circuit current flows from the terminal 9 through the shunt conductor 10, the movable element 5, the movable contact point 4, the fixed contact point 2 to the fixed element 3, a magnetic flux is excited by this current, and an electromagnetic repulsive force is generated between the shunt conductor 10 and the

terminal 9 by the magnetic flux and the above-described current. This electromagnetic repulsive force acts on the movable element 5 so as to press the movable contact point 4 against the fixed contact point 2 about the shaft 7 as a center of rotation. On the other hand, a repulsive force generated by an electromagnetic force (hereinafter, it is referred to as contact point repulsive force in order to differentiate the same from the electromagnetic repulsive force which acts between the terminal 9 and the shunt conductor 10) acts between the movable contact point 4 and the fixed contact point 2, and a force to weaken a press contact between the movable contact point 4 and the fixed contact point 2 is applied thereto. However, by setting the value of D2 to a distance equal to or larger than twice the distance D1, a moment about the shaft 7 generated by the distance D2 significantly exceeds a moment about the axis 7 generated by the distance D1, and hence the press contact force of between the movable contact point 4 and the fixed contact point 2 significantly exceeds the contact point repulsive force, whereby the short-time current carrying capacity is increased.

[0015] This condition will be described using a graph obtained by the result of an experiment. Fig. 4 (a) shows representative examples of current waveforms in two phases, that is, Phase A and Phase B, of a three-phase circuit breaker when a short circuit current is occurred. Fig. 4 shows, representing the time in the lateral axis and the current value in the vertical axis, and a first half a wavelength of the short circuit current where the current of Phase A is represented by S and the current of Pole B is represented by T. In this case, a rising force R of the movable element generated at the contact point (caused by the contact point repulsive force) and a pressing force P (caused by the electromagnetic repulsive force, the contact pressure spring force, and the like) will be as shown in Figs. 4 (b) and (c) (the lateral axis represents the time the vertical axis represents the force) from the analysis of the electromagnetic force by a finite element method or the like. In the structure in the related art in which the distance D2 does not reach twice the distance D1, as shown in Fig. 4(b), there is a case in which a point where the rising force and the pressing force are balanced is generated, and hence the contact points cannot be held sufficiently with each other, whereby satisfactorily short-time current carrying capacity cannot be achieved. In contrast, when the dimension D2 of the movable element 5 is set to a distance twice the distance D1, as shown in Fig. 4(c), the pressing force P exceeds the rising force R, and hence the holding force is improved.

Second Embodiment

[0016] Fig. 5 and Fig. 6 show a portion of the movable element and the fixed element of the circuit breaker according to a second embodiment of the present invention. The second embodiment is characterized in that the fixing member A for fixing the end portion of the shunt conductor 10 which is in press contact along the rear end

side of the movable element 5 to the movable element 5 is provided in the vicinity of the rear end of the movable element 5. The fixing member A has the same structure as that in the first embodiment, and normally the fixing screw 20 is screwed and fixed to the movable element 5 in a state in which the end portion of the shunt conductor 10 which is in abutment with the rear end side of the movable element 5 is sandwiched between the movable element 5 and the reinforcing plate 16. In this case, assuming that D1 represents the distance between the shaft 7 and the movable contact point 4 in the horizontal direction, and D3 represents the distance between the shaft 7 and the fixing screw 20, the distance D3 is set to a distance 1.3 times or more the distance D1. Other configurations are the same as those in the first embodiment.

[0017] As described in conjunction with the first embodiment, when the distance D2 between the rear end of the movable element 5 and the shaft 7 is set to the distance equal to or larger than twice the distance D1 between the rear end of the movable contact point 4 and the shaft 7, a force to press the movable contact point 4 against the fixed contact point 2 about the shaft 7 as the center of rotation by the action of the electromagnetic repulsive force generated between the shunt conductor 10 and the terminal 9 is enhanced. However, as in this embodiment, when the fixed position between the movable element 5 and the shunt conductor 10 by the fixing screw 20 is close to the shaft 7 and hence the distance D3 is equal to or smaller than 1.2 times the distance D1, a resultant force of the electromagnetic repulsive force which acted upon the movable element 5 may be diminished by play or delay of transmitting time caused by resiliency or the like of the shunt conductor 10. However, by placing the end portion of the shunt conductor 10 along the rear end side of the movable element 5 and fixing the same to a position near the rear end of the movable element 5 by the fixing screw 20 at the distance D3, which is equal to or larger than 1.3 times the distance D1, the play width between the shunt conductor 10 and the movable element 5 was restrained, and hence a force that causes the movable contact point 4 to move toward the fixed contact point 2 was generated without the time delay or the play width, and hence the short-time current carrying capacity was improved.

Third Embodiment

[0018] Fig. 7 shows a plan view (a) and a side view (b) showing a group of movable elements of the circuit breaker according to a third embodiment of the present invention, and the drawings show an example in which one pole of three phases is composed of six movable elements arranged in parallel. The number of movable elements may be increased or decreased according to the capacity or the like of the circuit breaker, and is not limited to six. The respective movable elements 51-56 are rotatably supported by the shaft 7, and fixed to the shunt conductors 10 with the fixing screws 20. The respective

movable elements 51-56 are provided with the movable contact points 4 respectively. On the other hand, the fixed contact points that come into contact with the movable contact points 4 are such that a laterally elongated fixed contact point 2a commonly opposes the movable contact points 4 of the adjacent three movable elements 51-53 and a laterally elongated fixed contact point 2b commonly opposes the movable contact points 4 of the remaining three movable elements 54-56. The form of the fixed contact point is not limited to this example, and a form in which one fixed contact point opposes one movable contact point or a form in which a common one fixed contact point opposes six movable contact points are also applicable. In this case, for example, the ratio between the width of the fixed contact point and the width of the movable contact point is set to 1.5 : 1.0.

[0019] A characteristic of the third embodiment relates to the intervals of adjacency of the respective movable elements 51-56 having the same shape and the same dimensions and arranged in parallel (Fig. 7 shows Pole B arranged between the three-phase Pole A and Pole C), and is that assuming that n_2 represents distances between the movable elements 51 and 56 that are adjacent to another poles and the movable elements 52 and 55 which are adjacent thereto respectively, and n_1 represents distances between other movable elements 52 and 53, 53 and 54, and 54 and 55, respectively, the distance n_2 is smaller than the distance n_1 . In other words, while the positions of the fixed contact points 2 are provided on the assumption that all the movable elements are provided at regular intervals, the movable elements 51 and 56 which are located at both sides are arranged at positions closer to the center of the group of the movable elements. In the case in which the fixed contact points (width: 1.5) are provided for the movable contact points 4 (width: 1.0) independently on one-by-one basis, the movable contact points 4 of the movable elements 52-55 are provided so that the centers thereof are opposed to the centers of the fixed contact points with respect to each other. In contrast, the movable elements 51 and 56 are arranged so that the centerlines of the movable contact points 4 of the movable elements 51 and 56 are shifted by 0.5 from the centerlines of the fixed contact points toward the center of the group of movable elements.

[0020] Fig. 8 is a graph showing a surface current distribution of first to sixth movable elements at Phase B out of three phases including, for example, Phase A, Phase B and Phase C. As shown in Fig. 8, the surface current of large magnitude concentrates on the first movable element and the sixth movable element which are located at both ends. This is because of an eddy current occurred by the influence of the adjacent movable elements or of the adjacent poles. Therefore, a contact point repulsive force and an electromagnetic force directed toward other poles (laterally outward directions) acting on the movable elements adjacent to the different poles are remarkable in comparison with those of other movable elements in

the group of the movable elements of each pole due to the eddy current. Various electromagnetic forces act on the respective movable elements according to the magnitude of current flowing therein. In particular, a resultant force of the lateral electromagnetic force directed outward and a contact point repulsive force which is a repulsive force between the fixed contact points and the movable contact points is exerted to the movable elements on the side adjacent to the different poles. Consequently, the movable contact points do not come into contact with the fixed contact points at original contact surfaces, that is, so called slipping up occurs, and hence the short-time current carrying capacity is reduced. However, by arranging the positions of the movable elements 51 and 56 which are adjacent to the different poles inwardly at intervals of n_2 which is smaller than n_1 as in the present embodiment, margins that allows the movable contact points 4 to move on the fixed contact points 2 before resulting in slipping up is secured to prevent slipping up, so that a sufficient short-time current carrying capacity is secured.

Fourth Embodiment

[0021] Fig. 9 is a plan view of movable elements of the circuit breaker according to a fourth embodiment of the present invention showing, for example, an example in which one pole of three phases is composed of six movable elements arranged in parallel. The number of movable elements are increased or decreased by the capacity of the circuit breaker, and is not limited to six. The respective movable elements 51 to 56 are rotatably supported by the shaft 7 and fixed to the shunt conductors 10 with the fixing screws 20. The structure of the fixed contact points are the same as those in the third embodiment.

[0022] A characteristic of the fourth embodiment is that the widths of the movable elements 51 and 56 adjacent to the different poles out of the group of the movable elements 51-56 is narrowed in comparison with the widths of remaining movable elements 52-55 in plan view. In Fig. 9, assuming that t_1 represents the width of the movable elements 52-55, the widths of the movable elements 51 and 56 adjacent to the different pole is set to the width t_2 which is smaller than t_1 , so that the cross-sectional areas of the current paths in these portions are reduced to increase impedances. Although the widths of the movable elements 51 and 56 from a joint portion with the shunt conductors 10 to the distal ends thereof are set to t_2 which is smaller than t_1 from the reason of machining in Fig. 9, in principle, the widths of portions at least from the joint portions with the shunt conductors 10 and the movable contact points 4 must be reduced.

[0023] The current distributions of the respective movable elements when the widths of the movable elements 51-56 are all the same are as shown in Fig. 8. Because of this current distribution, there is a tendency such that a large magnitude of surface current flows in the movable

elements adjacent to the different poles and a large electromagnetic force acts thereon as described in conjunction with the third embodiment, and hence the contact point repulsive force between the fixed contact point and the movable contact point caused by the electromagnetic force and the electromagnetic force in the lateral directions toward the different poles are remarkably exerted to the movable elements 51, 56 on both sides, and hence the force that the movable contact points are pressed against the fixed contact points are reduced. Simultaneously, the movable contact points do not come into contact with the fixed contact points at original contact surfaces, that is, so called slipping up occurs, and hence the short-time current carrying capacity is reduced.

[0024] However, by narrowing the widths of the movable elements 51 and 56 adjacent to the different poles in comparison with the remaining movable elements 52-55 as in this embodiment, the current carrying cross-sectional areas of the movable elements 51 and 56 are reduced, and the impedance is increased, which acts in the direction for cancelling bias of the current distribution shown in Fig. 8. Accordingly, the surface currents flowing through the movable elements 51 and 56 adjacent to the different poles are reduced, whereby the lateral electromagnetic force that these movable elements receive is reduced. Consequently, the slipping up of the contact point is prevented, and the contact point repulsive force is reduced, whereby the short-time current carrying capacity is improved.

Industrial Applicability

[0025] The present invention can be applied to a circuit breaker having a large breaking capacity.

Claims

1. A circuit breaker comprising: a fixed element having a fixed contact point; a movable element tilting in a state of being supported by a shaft and having a movable contact point which comes into and out of contact with the fixed contact point; and a shunt conductor fixed at one end to a rear end side of the movable element which is opposite from the movable contact point with respect to the shaft and connected at the other end with a terminal, in which an electromagnetic force generated by a magnetic flux excited by a current flowing in the shunt conductor and the current in question acts on the movable element so as to cause the movable contact point to move toward the fixed contact point, **characterized in that** the length of the movable element on the rear end side is set to a length at least twice a distance between the shaft and the movable contact point in the horizontal direction, and the one end of the shunt conductor is fixed in contact with the rear end side of the movable element.
2. The circuit breaker according to Claim 1, **characterized in that** the shunt conductor and the movable element are fixed with joint screw, and the distance between the shaft and the joint screw is set to a distance 1.3 times or more the distance between the shaft and the movable contact point in the horizontal direction.
3. A circuit breaker in which each pole comprises: a fixed element having a fixed contact point; three or more movable elements tilting in a state of being supported by the shaft and having movable contact points that come into and out of contact with the fixed contact point and being arranged in parallel; and shunt conductors each fixed at one end to the rear end side of the movable element which is opposite from the movable contact point with respect to the shaft and connected at the other end to a terminal, and an electromagnetic force generated by a current flowing in the shunt conductor and a magnetic flux excited by the current acts on the movable element so as to cause the movable contact point to move toward the fixed contact point, **characterized in that** the movable elements adjacent to different poles are shifted toward the center of a group of movable elements with respect to the fixed contact points corresponding to the movable contact points thereof.
4. A circuit breaker in which each pole comprises: a fixed element having a fixed contact point; three or more movable elements tilting in a state of being supported by the shaft and having movable contact points that come into and out of contact with the fixed contact point and being arranged in parallel; and shunt conductors each fixed at one end to the rear end side of the movable element which is opposite from the movable contact point with respect to the shaft and connected at the other end to a terminal, and an electromagnetic force generated by a magnetic flux excited by a current flowing in the shunt conductor and the current in question acts on the movable element so as to cause the movable contact point to move toward the fixed contact point, **characterized in that** the width of the movable elements adjacent to different poles in plan view are narrowed in comparison with the widths of the remaining movable elements.

FIG. 1

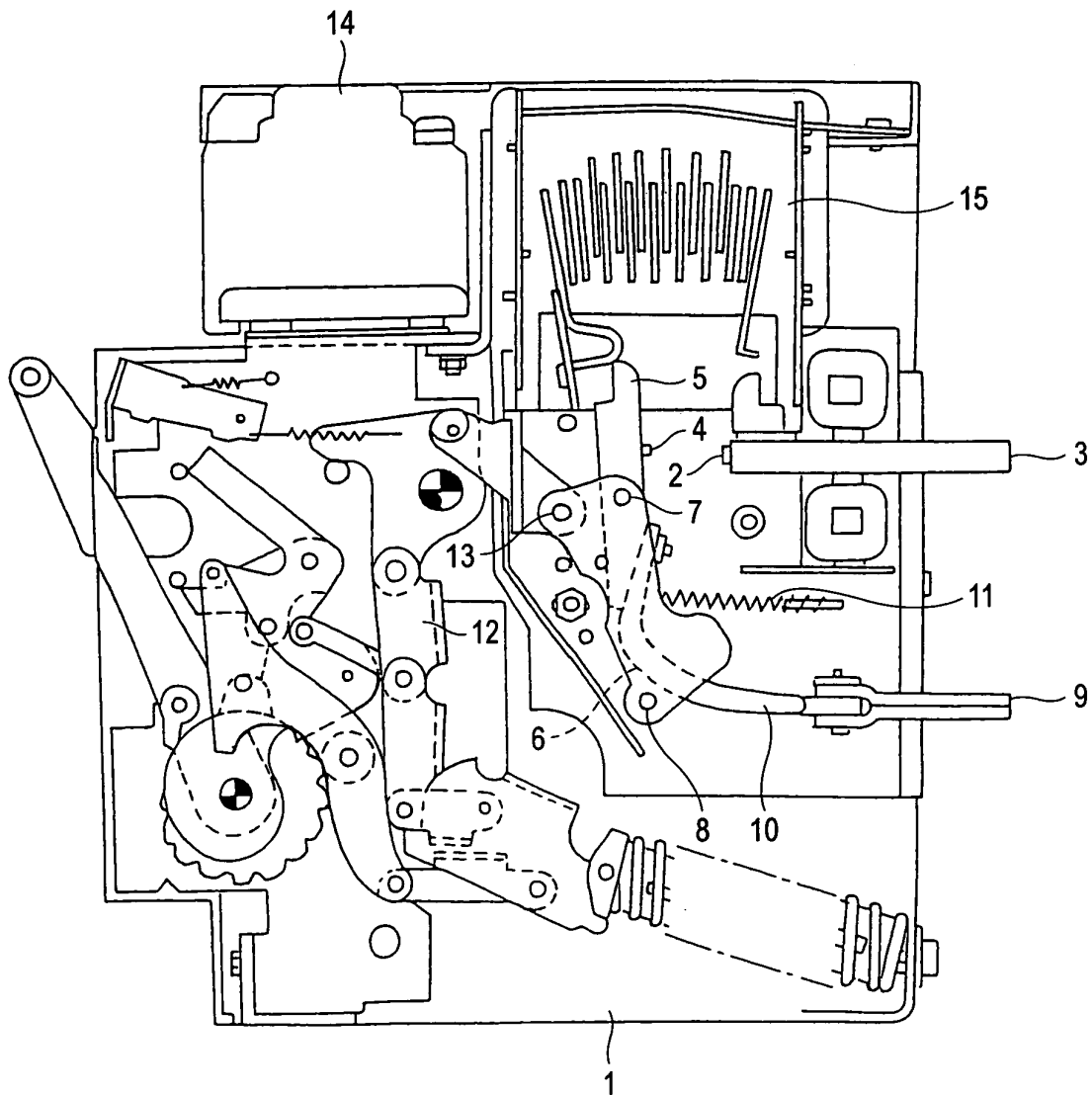


FIG. 2

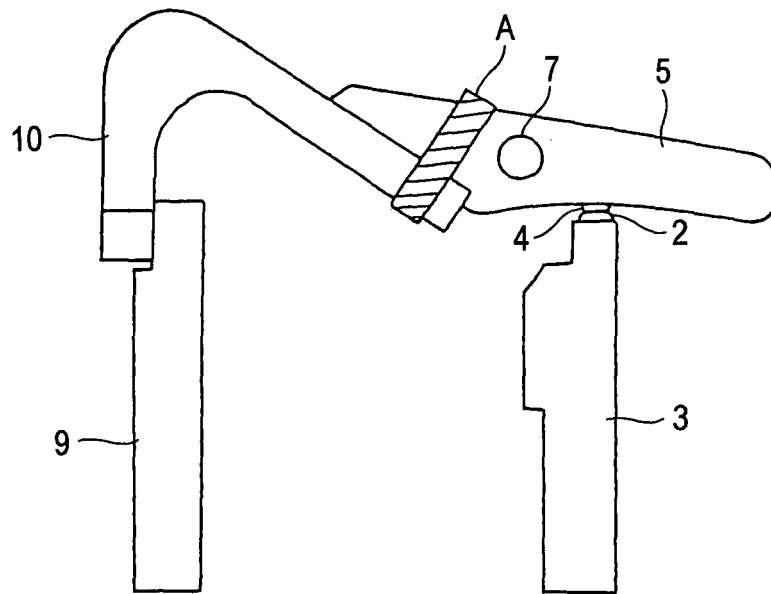


FIG. 3

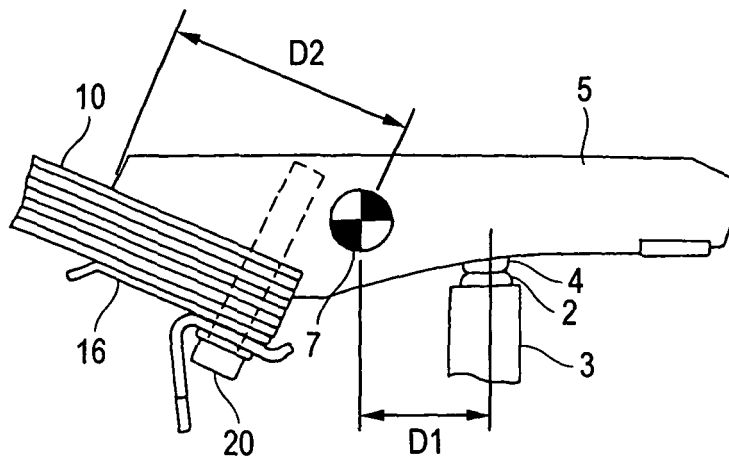


FIG. 4 (a)

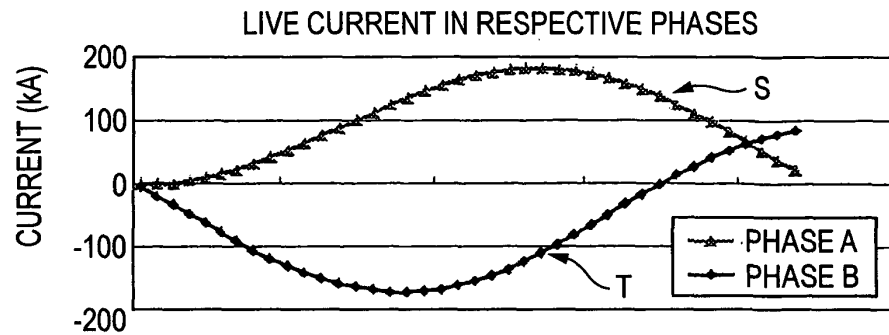


FIG. 4 (b)

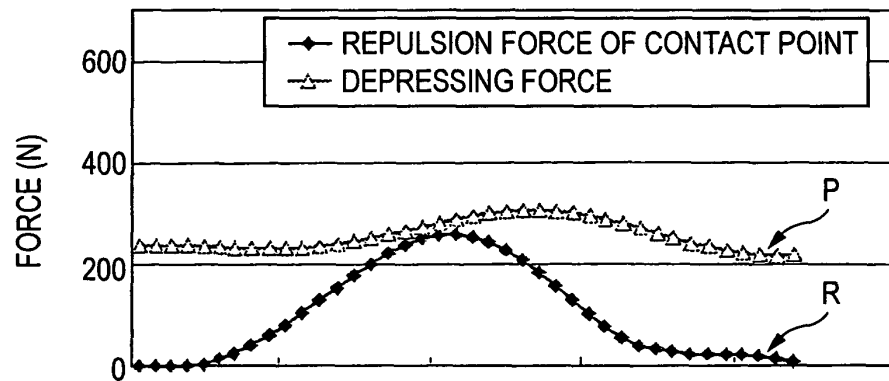


FIG. 4 (c)

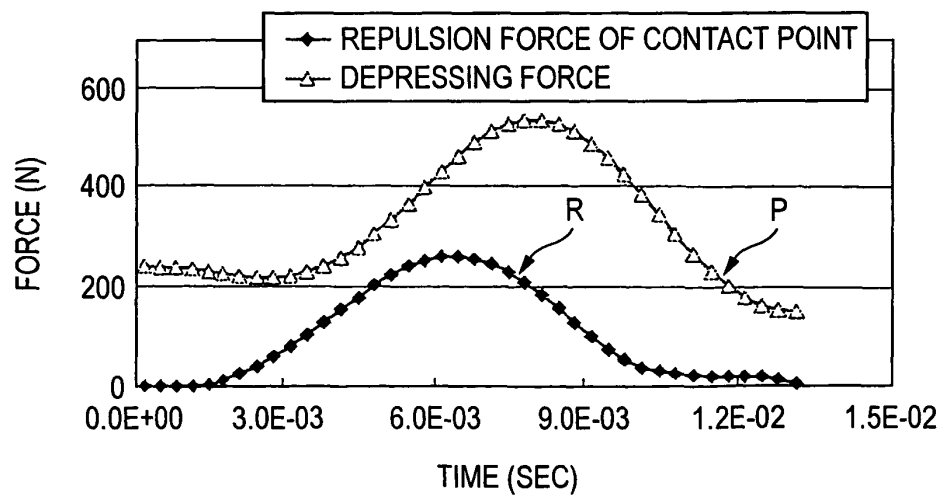


FIG. 5

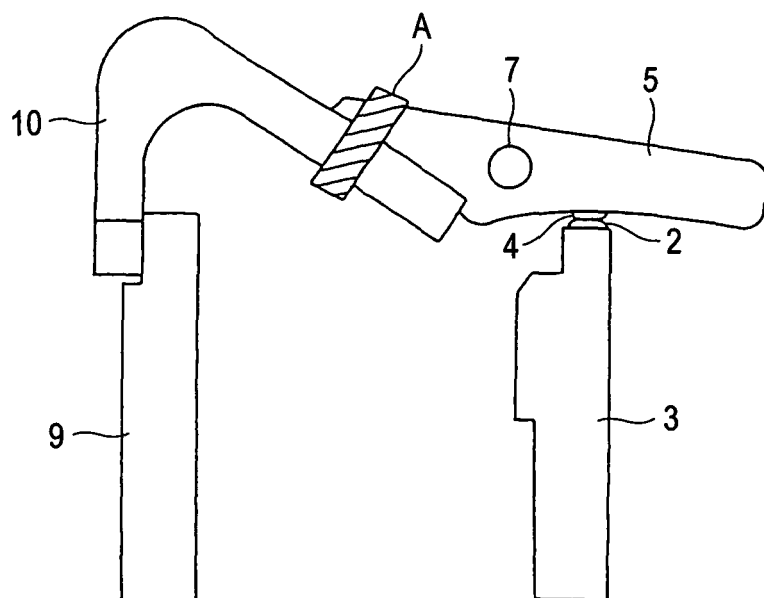


FIG. 6

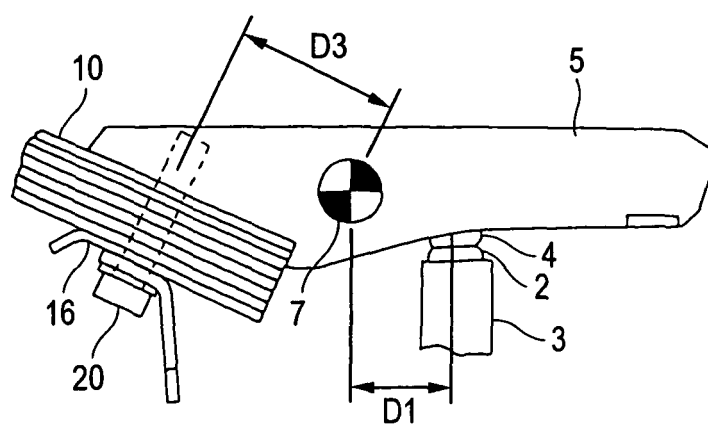


FIG. 7 (a)

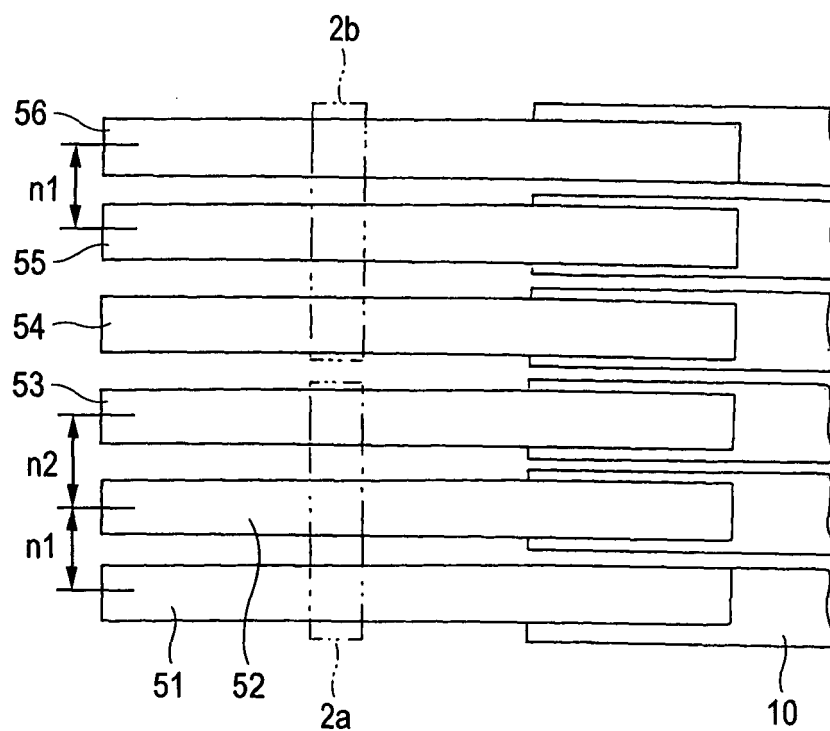


FIG. 7 (b)

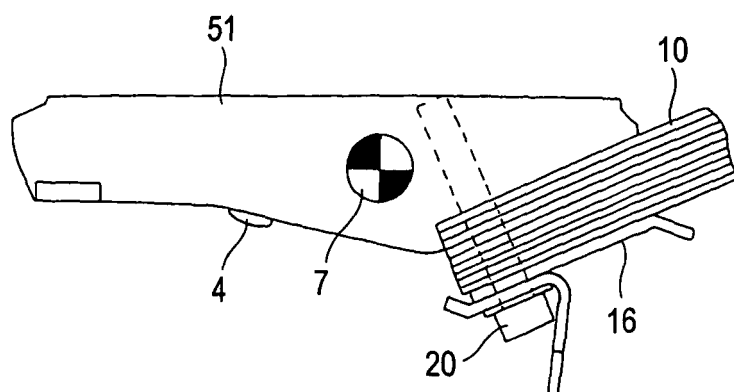


FIG. 8

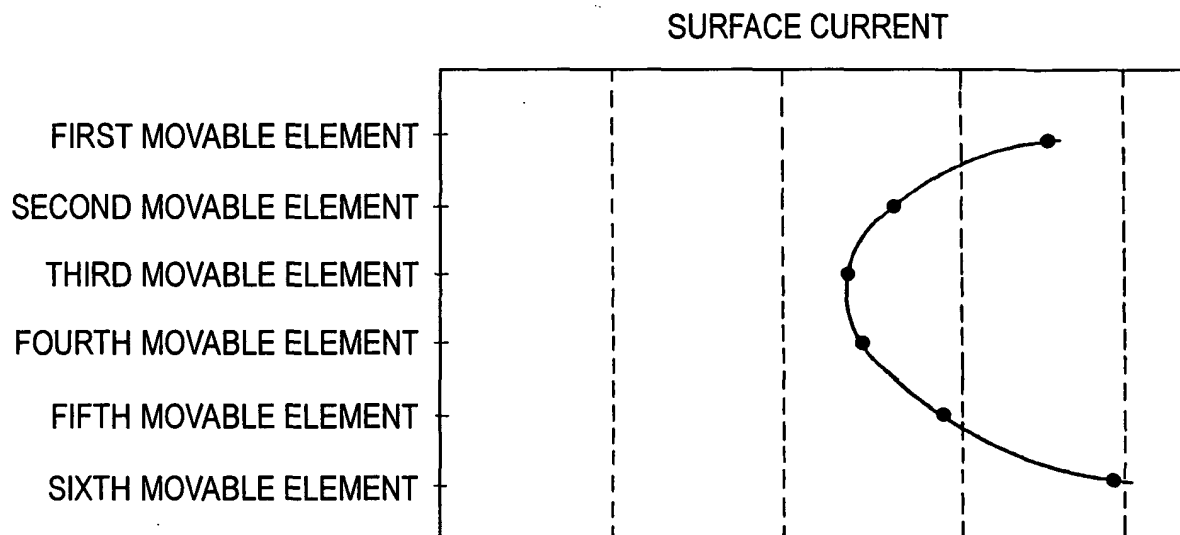


FIG. 9 (a)

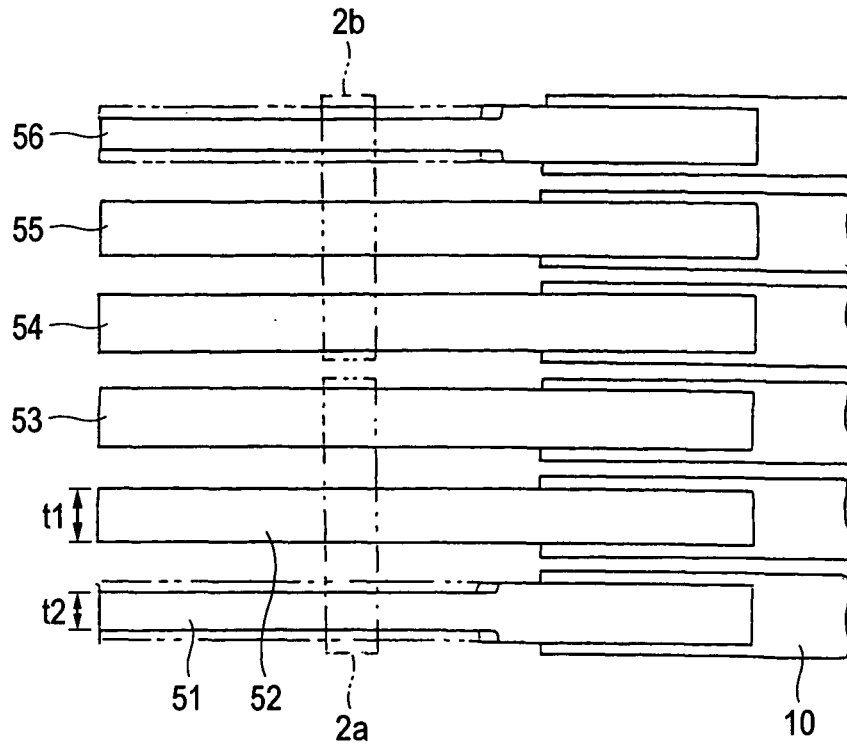
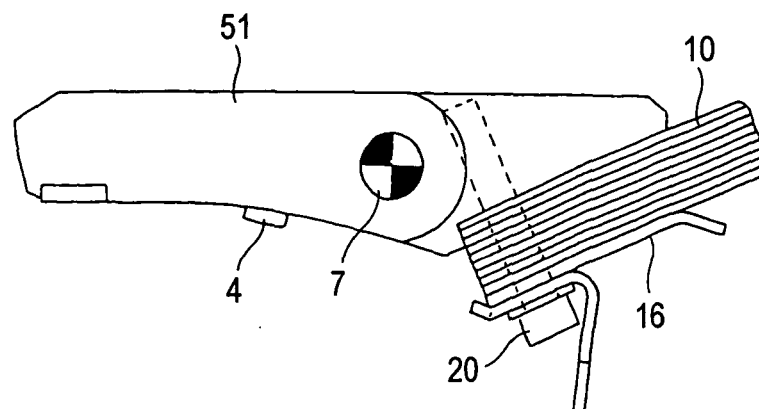


FIG. 9 (b)



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/000759

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ H01H31/02		
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) Int.Cl. ⁷ H01H31/02, H01H1/22, H01H1/58, H01H33/08, H01H33/42, H01H73/02		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1940-1996 Toroku Jitsuyo Shinan Koho 1994-2004 Kokai Jitsuyo Shinan Koho 1971-2004 Jitsuyo Shinan Toroku Koho 1996-2004		
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.
X	WO 01/052289 A (Mitsubishi Electric Corp.),	1
Y	19 July, 2001 (19.07.01),	2
A	Full text; Figs. 1 to 8 & EP 1168391 A	3, 4
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☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 01 March, 2004 (01.03.04)		Date of mailing of the international search report 23 March, 2004 (23.03.04)
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/000759

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 103575/1986 (Laid-open No. 9737/1988) (Mitsubishi Electric Corp.), 22 January, 1988 (22.01.88), Full text; Figs. 1 to 5 (Family: none)	1-4
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REFERENCES CITED IN THE DESCRIPTION

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