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(54) **A LINKAGE STRUCTURE OF THE MOVING CONTACT OF THE MODULAR CIRCUIT BREAKER**

VERKNÜPFUNGSSTRUKTUR DES BEWEGLICHEN KONTAKTES EINES MODULAREN  
SCHUTZSCHALTERS

STRUCTURE DE LIAISON DU CONTACT MOBILE D'UN DISJONCTEUR MODULAIRE

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**EP 2 763 154 B1**

## Description

### BACKGROUND OF THE INVENTION

#### Field of the invention

**[0001]** The present invention relates to a contact module of circuit breaker, and more particularly, relates to a moving contact linkage structure in the operation mechanism of a modular circuit breaker.

#### The Related Art

**[0002]** Modularization of contacts is a development trend of molded case circuit breakers. As an important component of the molded case circuit breaker, contact module has drawn great attention. Modern molded case circuit breakers with high breaking capacity generally utilize modularized contacts. The structural styles of the modularized contacts are various. For the purpose of keeping synchronization on the switching of contacts in separate phases, various types of rotational moving contact linkage structures are provided in domestic or foreign products. The rotational moving contact linkage structures may guarantee motion synchronization of contacts of separate phases, and contact balance on bilateral contacts within a rotary dual breakpoint moving contact in a particular single phase. A typical linkage structure is a metal rod member assembled additionally and independently to a contact module. Such a structure has a risk of interphase short circuit. Multiple location fit of the structure may also deteriorate the contact situation of the moving contact, such as unbalanced contact pressure on bilateral contacts of a rotary dual breakpoint moving contact.

**[0003]** Document WO 03/050835 A1 discloses a multipole low-voltage power circuit breaker, comprising actuation means that have an actuation lever and an element for supporting and moving the moving contacts of the circuit breaker, a contoured insulating cover that has a first portion, which forms the lower part of the enclosure of the circuit breaker and delimits a containment volume, and a second portion, which forms the front wall and partially forms the side and upper walls of the circuit breaker, wherein it comprises multiple poles comprising an insulating enclosure with front and rear half-shells, operation mechanism side plate, contact rotor with movable contacts and linkage elements, arranged side by side and mutually assembled, and in that at least one portion of the side, upper and rear walls of the circuit breaker is constituted by the side, upper and rear walls of said assembled poles.

**[0004]** The document US 2001/048354 A1 relates to a pressure sensitive trip mechanism for a rotary breaker, wherein the circuit breaker operating mechanism is coupled with a center cassette and is connected with the outer cassettes by drive pin. All cassettes along with the circuit breaker operating mechanism are assembled into

base and retained therein by the mid-cover.

**[0005]** The document US 2007/063796 A1 relates to a modular switching device which includes a plurality of interconnected modules, the modules having a control device module and a pole cell module, the modules of the switching device being directly interconnected with a shaft adapted to transfer a torque required for operating the switching device from one module to another module.

### 10 SUMMARY

**[0006]** The present invention discloses a moving contact linkage structure for modular circuit breaker. The present invention guarantees reliable linkage of the moving contact and uniform contact pressure on separate contacts within the modularized contacts.

**[0007]** According to the present invention, a moving contact linkage structure for modular circuit breaker is disclosed. The moving contact linkage structure for modular circuit breaker comprises: a first case and a second case, a first shaft, an operation mechanism side plate, an operation mechanism lower connecting rod, a contact rotor, a first linkage member and a second linkage member. The first case has a first mounting hole and the second case has a second mounting hole, the position of the first mounting hole and the position of the second mounting hole correspond to each other. The operation mechanism side plate has a third through hole, the third through hole is positioned at a rotation center of a contact rotor. The operation mechanism lower connecting rod has a fourth through hole, the first shaft connects to the fourth through hole. The contact rotor is rotatable around a rotation center, the contact rotor has mating surfaces on both sides. The first linkage member connects to the mating surface on a first side of the contact rotor. The second linkage member connects to the mating surface on a second side of the contact rotor. The contact rotor, the first linkage member and the second linkage member are mounted in the first mounting hole and the second mounting hole.

**[0008]** According to an embodiment, the contact rotor has first recess holes. The first recess holes are positioned on the mating surfaces on both sides of the contact rotor. The first recess holes on the mating surface of a same side are symmetric along the rotation center of the contact rotor.

**[0009]** According to the invention, the first linkage member has a first linkage matching surface and a second linkage matching surface. The first linkage matching surface has a convex first axle at a position corresponding to the rotation center of the contact rotor. The first axle connects to the third through hole. The axial length of the first axle ensures that the first axle can at least go through the third through hole and extend to a first non-through hole on the second linkage member. The first linkage matching surface has a second non-through hole. The second non-through hole is parallel to the rotation axis of the contact rotor, the first shaft connects to the

second non-through hole. The second linkage matching surface has second lugs. The second lugs engage with the first recess holes on the contact rotor.

**[0010]** According to an embodiment, the second linkage member has a third linkage matching surface and a fourth linkage matching surface. The third linkage matching surface has first non-through hole at a position corresponding to the rotation center of the contact rotor, the first non-through hole connects to the first axle of the first linkage member. The third linkage matching surface has a third non-through hole, the third non-through hole is parallel to the rotation axis of the contact rotor, the first shaft connects to the third non-through hole. The third linkage matching surface has second recess holes. The fourth linkage matching surface has third lugs, the third lugs engage with the first recess holes on the contact rotor.

**[0011]** According to an embodiment, the first linkage member has a first arc surface on the outer circumference. The first arc surface rotates collaboratively with the first case and the second case. The second linkage member has a second arc surface on the outer circumference. The second arc surface rotates collaboratively with the first case and the second case.

**[0012]** According to an embodiment, the first linkage member has first lugs on the first linkage matching surface. The first lugs engage with the second recess holes on the third linkage matching surface of the second linkage member.

**[0013]** According to an embodiment, the first case has a fourth lug within the first mounting hole approximate to the outer surface. The fourth lug has a full circle shape. The fourth lug limits the protruding position of the first linkage member or the second linkage member projecting from the outer surface of the first case. The first mounting hole rotates collaboratively with the first arc surface of the first linkage member or the second arc surface of the second linkage member. The first mounting hole does not block the connection between the first lug of the first linkage member and the second recess hole of the second linkage member, nor the connection between first shaft and the first linkage member or the second linkage member.

**[0014]** According to an embodiment, the second case has a fifth lug within the second mounting hole approximate to the outer surface. The fifth lug has a full circle shape. The fifth lug limits the protruding position of the first linkage member or the second linkage member projecting from the outer surface of the second case. The second mounting hole rotates collaboratively with the first arc surface of the first linkage member or the second arc surface of the second linkage member. The second mounting hole does not block the connection between the first lug of the first linkage member and the second recess hole of the second linkage member, nor the connection between first shaft and the first linkage member or the second linkage member.

**[0015]** According to an embodiment, the second lugs

on the first linkage member and the third lugs on the second linkage member connect to the first recess holes on the mating surfaces on both sides of the contact rotor, the axis of the second non-through hole on the first linkage member and the axis of the third non-through hole on the second linkage member align with each other. The first linkage member, the contact rotor and the second linkage member are disposed in the first mounting hole on the first case and the second mounting hole on the second case, the first case and the second case are assembled to form a single phase contact module.

**[0016]** According to an embodiment, the third lugs on two second linkage members engage with the first recess holes on the mating surfaces on both sides of the contact rotor. The axes of the third non-through holes on the two second linkage members align with each other. The first linkage member, the contact rotor and the second linkage member are disposed in the first mounting hole on the first case and the second mounting hole on the second case. The first case and the second case are assembled to form a single phase contact module.

**[0017]** The rotational moving contact of the moving contact linkage structure of modular circuit breaker according to the present invention has a different structure with traditional rotational moving contacts. This structure removes the linkage structures independent to the contact module and links the contact modules by directly connection linkage. The linkage components are made of insulation materials so as to eliminate the risk of inter-phase short circuit. The present invention also considers the component manufacturability, the installation convenience and structural strength caused by the complexity of the linkage structure of rotational moving contacts. The moving contact linkage structure of modular circuit breaker of the present invention supports mass production and has a high reliability.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0018]** The above and other features, natures, and advantages of the invention will be apparent by the following description of the embodiments incorporating the drawings, wherein:

Figs. 1a, 1b and 1c illustrate schematic views of an overall assembly structure of the moving contact linkage structure for modular circuit breaker according to an embodiment of the present invention.

Figs. 2a, 2b and 2c illustrate schematic views of a single phase contact module within the moving contact linkage structure of modular circuit breaker according to an embodiment of the present invention. Figs. 3a, 3b and 3c illustrate schematic views of the engagement for linkage members within the moving contact linkage structure of modular circuit breaker according to an embodiment of the present invention.

Fig. 4 illustrates a schematic view of a contact rotor

within the moving contact linkage structure of modular circuit breaker according to an embodiment of the present invention.

Figs. 5a, 5b, 5c and 5d illustrate schematic views of a first linkage member within the moving contact linkage structure of modular circuit breaker according to an embodiment of the present invention.

Figs. 6a, 6b, 6c and 6d illustrate schematic views of a second linkage member within the moving contact linkage structure of modular circuit breaker according to an embodiment of the present invention.

Figs. 7a, 7b and 7c illustrates schematic views of the first case and the second case within the moving contact linkage structure of modular circuit breaker according to an embodiment of the present invention.

Figs. 8a and 8b illustrate schematic views of an operation mechanism side plate and an operation mechanism lower connecting rod within the moving contact linkage structure of modular circuit breaker according to an embodiment of the present invention.

#### DETAILED DESCRIPTION OF EMBODIMENTS

**[0019]** The present invention provides a moving contact linkage structure of modular circuit breaker. As shown in Figs.1 - Fig.8, an embodiment of the moving contact linkage structure of modular circuit breaker is illustrated. The moving contact linkage structure of modular circuit breaker comprises: a first case 101 and a second case 102, a first shaft 103, an operation mechanism side plate 104, an operation mechanism lower connecting rod 105, a contact rotor 106, a first linkage member 107 and a second linkage member 108.

**[0020]** The first case 101 has a first mounting hole 110 and the second case 102 has a second mounting hole 120. The position of the first mounting hole 110 and the position of the second mounting hole 120 correspond to each other. The operation mechanism side plate 104 has a third through hole 140. The third through hole 140 is positioned at a rotation center of a contact rotor 106. The operation mechanism lower connecting rod 105 has a fourth through hole. The first shaft 103 connects to the fourth through hole by inserting into the fourth through hole. The contact rotor 106 is rotatable around a rotation center. The contact rotor 106 has mating surfaces on both sides. The first linkage member 107 connects to the mating surface on a first side of the contact rotor 106. The second linkage member 108 connects to the mating surface on a second side of the contact rotor 106. The contact rotor 106, the first linkage member 107 and the second linkage member 108 are mounted in the first mounting hole 110 and the second mounting hole 120.

**[0021]** As shown in Fig. 4, the contact rotor 106 is rotatable around a rotation center. The contact rotor 106 has mating surfaces on both sides. The contact rotor 106 has first recess holes 160. The first recess holes 160 are

positioned on the mating surfaces on both sides of the contact rotor 106. The first recess holes 160 on the mating surface of a same side are symmetric along the rotation center of the contact rotor 106. According to the embodiment shown in Fig. 4, on the mating surface of the same side of the contact rotor 106, there are at least two first recess holes 160 disposed on each side of the rotation center. Recess hole is utilized in the contact rotor 106 according to the embodiment shown in Fig. 4. It should be noticed that other forms, such as a lug may be used as well. If lugs are used on the contact rotor 106, the lugs now utilized on the first linkage member 107 and the second linkage member 108 shall be replaced with recess grooves correspondingly, so that the contact rotor 106 may still engage with the first linkage member 107 and the second linkage member 108. Returning to the embodiment illustrated by the drawings, there are two first recess holes 160 on the mating surface of a same side. The two first recess holes 160 are disposed to be symmetric along the rotation center if there is enough room. The depth of the recess hole 160 is at least 1.5mm, so as to ensure a contact surface enough for bearing the pressure.

**[0022]** As shown in Figs. 5a, 5b, 5c and 5d, the first linkage member 107 has a first linkage matching surface and a second linkage matching surface. The first linkage matching surface has a convex first axle 170 at a position corresponding to the rotation center of the contact rotor 106. The first axle 170 connects to the third through hole 140 on the operation mechanism side plate 104, the connection is realized by insertion. The axial length of the first axle 170 ensures that the first axle 170 at least goes through the third through hole 140 on the operation mechanism side plate 104 and extends to a first non-through hole 180 on the second linkage member 108. The first linkage matching surface of the first linkage member 107 also has a second non-through hole 171. The second non-through hole 171 is parallel to the rotation axis of the contact rotor. The first shaft 103 connects to the second non-through hole 171 by insertion. The first linkage member 107 has at least two first lugs 172 on the first linkage matching surface, the first lugs 172 engage with second recess holes 182 disposed on the second linkage member 108. The first linkage member 107 has at least two second lugs 173 on the second linkage matching surface. The second lugs 173 engage with the first recess holes 160 on the contact rotor 106. The first linkage member 107 has a first arc surface 174 on the outer circumference. The first arc surface 174 rotates collaboratively with the first case 101 and the second case 102.

**[0023]** As shown in Figs. 6a, 6b, 6c and 6d, the second linkage member 108 has a third linkage matching surface and a fourth linkage matching surface. The third linkage matching surface of the second linkage member 108 has first non-through hole 180 at a position corresponding to the rotation center of the contact rotor 106. The first non-through hole 180 connects to the first axle 170 of the first linkage member 107. The third linkage matching surface

of the second linkage member 108 has a third non-through hole 181. The third non-through hole 181 is parallel to the rotation axis of the contact rotor 106. The first shaft 103 connects to the third non-through hole 181 by insertion. The third linkage matching surface of the second linkage member 108 has at least two second recess holes 182. The second recess holes 182 engage with the first lugs 172 on the first linkage member 107. The fourth linkage matching surface of the second linkage member 108 has at least two third lugs 183, the third lugs 183 engage with the first recess holes 160 on the contact rotor 106. The second linkage member 108 has a second arc surface 184 on the outer circumference. The second arc surface 184 rotates collaboratively with the first case 101 and the second case 102.

**[0024]** As shown in Figs. 7a, 7b and 7c, the first case 101 and the second case 102 are the housing of the contact module. The first case 101 has a first mounting hole 110 on a flat surface in the middle part. The first mounting hole 110 accommodates the contact rotor 106, the first linkage member 107 and the second linkage member 108. A fourth lug 111 is disposed within the first mounting hole 110 at a position approximate to the outer surface of the first case 101. The fourth lug 111 has a full circle shape. The first linkage 107 or the second linkage member 108 may insert into the first mounting hole 110 from the inner surface of the first case 101, but the first linkage member 107 or the second linkage member 108 will not completely project out of the outer surface of the first case 101 because of the obstruction of the fourth lug 111. The protruding positions of the first linkage member 107 or the second linkage member 108 out of the outer surface of the first case 101 are limited to their linkage matching surfaces. The fourth lug 111 limits the protruding position of the first linkage member 107 or the second linkage member 108 projecting from the outer surface of the first case. The first mounting hole 110 cooperates for rotation with the first arc surface 174 of the first linkage member 107 or the second arc surface 184 of the second linkage member 108. The first mounting hole 110 does not block the connection between the first lug 172 of the first linkage member 107 and the second recess hole 182 of the second linkage member 108. The first mounting hole 110 does not block the connection between first shaft 103 and the first linkage member 107, or the connection between first shaft 103 and the second linkage member 108.

**[0025]** Still refer to Figs. 7a, 7b and 7c, the second case 102 has a second mounting hole 120 on a flat surface in the middle part, the second mounting hole 120 also accommodates the contact rotor 106, the first linkage member 107 and the second linkage member 108. A fifth lug 121 is disposed within the second mounting hole 120 at a position approximate to the outer surface of the second case 102. The fifth lug 121 has a full circle shape. The first linkage 107 or the second linkage member 108 may insert into the second mounting hole 120 from the inner surface of the second case 102, but the

first linkage member 107 or the second linkage member 108 will not completely project out of the outer surface of the second case 102 because of the obstruction of the fifth lug 121. The protruding positions of the first linkage member 107 or the second linkage member 108 out of the outer surface of the second case 102 are limited to their linkage matching surfaces. The fifth lug 121 limits the protruding position of the first linkage member 107 or the second linkage member 108 projecting from the outer surface of the second case. The second mounting hole 120 rotates collaboratively with the first arc surface 174 of the first linkage member 107 or the second arc surface 184 of the second linkage member 108. The second mounting hole 120 does not block the connection between the first lug 172 of the first linkage member 107 and the second recess hole 182 of the second linkage member 108. The second mounting hole 110 does not block the connection between first shaft 103 and the first linkage member 107, or the connection between first shaft 103 and the second linkage member 108.

**[0026]** As shown in Figs. 8a and 8b, the operation mechanism side plate 104 has a third through hole 140 on a flat surface. The third through hole 140 is positioned at a rotation center of a contact rotor 106. The third through hole 140 connects with the first axle 170 of the first linkage member 107 by insertion. The operation mechanism lower connecting rod 105 has a fourth through hole on a flat surface. The first shaft 103 connects to the fourth through hole by insertion.

**[0027]** Figs. 1a, 1b and 1c illustrate schematic views of an overall assembly structure of the moving contact linkage structure of modular circuit breaker according to an embodiment of the present invention. Figs. 2a, 2b and 2c illustrate schematic views of a single phase contact module within the moving contact linkage structure of modular circuit breaker according to an embodiment of the present invention. Figs. 3a, 3b and 3c illustrate schematic views of the connection of linkage members within the moving contact linkage structure of modular circuit breaker according to an embodiment of the present invention. Figs. 1 - 3 illustrate a single phase contact module 100.

**[0028]** During the procedure of the engagement:

- 1) The second lugs 173 on the first linkage member 107 and the third lugs 183 on the second linkage member 108 are inserted and assembled in the recess holes 160 on the mating surfaces on both sides of the contact rotor 106. The axis of the second non-through hole 171 on the first linkage member 107 and the axis of the third non-through hole 181 on the second linkage member 108 align with each other. The first linkage member 107, the contact rotor 106 and the second linkage member 108 are disposed in the first mounting hole 110 on the first case 101 and the second mounting hole 120 on the second case 102. The first case 101 and the second case 102 are assembled to form a first single phase con-

tact module.

2) Counterchange the assembly position of the first linkage member 107 and the second linkage member 108, that is, counterchange the assembly position of the first linkage member 107 and the second linkage member 108 for connecting to the contact rotor 106, to form a second single phase contact module. The second single phase contact module and the first single phase contact module are symmetric with respect to structure.

3) The third lugs 183 on two second linkage members 108 are inserted and assembled in the recess holes 160 on the mating surfaces on both sides of the contact rotor 106. The axes of the two third non-through holes 181 on the two second linkage members 108 align with each other. The contact rotor 106 and the two second linkage members 108 are disposed in the first mounting hole 110 on the first case 101 and the second mounting hole 120 on the second case 102. The first case 101 and the second case 102 are assembled to form a third single phase contact module.

**[0029]** The moving contact linkage structure of modular circuit breaker according to the present invention may guarantee reliable linkage of the moving contact and keep consistence of the contact pressure of different contacts. According to the embodiments of the present invention, moving contact linkage may be realized by assembling the above three types of single phase contact modules in turn, no additional independent linkage element is needed.

**[0030]** The rotational moving contact of the moving contact linkage structure of modular circuit breaker according to the present invention has a different structure with traditional rotational moving contacts. This structure removes the linkage structures independent to the contact module and links the contact modules by directly connection linkage. The linkage components are made of insulation materials so as to eliminate the risk of inter-phase short circuit. The present invention also considers the component manufacturability, the installation convenience and structural strength caused by the complexity of the linkage structure of rotational moving contacts. The moving contact linkage structure of modular circuit breaker of the present invention supports mass production and has a high reliability.

## Claims

1. A moving contact linkage structure for modular circuit breaker, comprising:

a first case (101) or and a second case (102), the first case (101) or having a first mounting hole (110) and the second case (102) having a second mounting hole (120), a the position of

the first mounting hole (110) and the position of the second mounting hole (120) corresponding to each other;

a first shaft (103);

an operation mechanism side plate (104), the operation mechanism side plate (104) having a third through hole (140), the third through hole (140) being positioned at a rotation center of a contact rotor (106);

an operation mechanism lower connecting rod (105), the operation mechanism lower connecting rod (105) having a fourth through hole, the first shaft (103) connecting to the fourth through hole;

a contact rotor (106), the contact rotor (106) being rotatable around a rotation center, the contact rotor having mating surfaces on both sides; a first linkage member (107), the first linkage member (107) connecting to the mating surface on a first side of the contact rotor (106), the first linkage member (107) having a convex first axle (170) at a position corresponding to the rotation center of the contact rotor (106), the convex first axle (170) connecting to the third through hole (140);

a second linkage member (108), the second linkage member (108) connecting to the mating surface on a second side of the contact rotor (106); wherein the first linkage member (107), the contact rotor (106) and the second linkage member (108) are disposed in the first mounting hole (110) on the first case (101) and the second mounting hole (120) on the second case (102), the first case (101) and the second case (102) are assembled to form a single phase contact module (100);

the contact rotor (106) and two second linkage members (108) are disposed in the first mounting hole (110) on the first case (101) and the second mounting hole (120) on the second case (102), the first case (101) and the second case (102) are assembled to form a further single phase contact module (100); and

the single phase contact modules (100) are adapted to be linked by directly connection linkage without any linkage structures independent to the contact modules (100).

2. The moving contact linkage structure for modular circuit breaker according to claim 1, **characterized in that,**

the contact rotor has first recess holes, the first recess holes being positioned on the mating surfaces on both sides of the contact rotor, the first recess holes on the mating surface of a same side being symmetrical along the rotation center of the contact rotor.

3. The moving contact linkage structure for modular circuit breaker according to claim 2, **characterized in that**,  
the first linkage member has a first linkage matching surface and a second linkage matching surface;  
the convex first axle is on the first linkage matching surface at a position corresponding to the rotation center of the contact rotor, the axial length of the first axle ensures the first axle to at least go through the third through hole and extend to a first non-through hole on the second linkage member; the first linkage matching surface has a second non-through hole, the second non-through hole is parallel to the rotation axis of the contact rotor, the first shaft connects to the second non-through hole;  
the second linkage matching surface has second lugs, the second lugs engage with the first recess holes on the contact rotor.
4. The moving contact linkage structure for modular circuit breaker according to claim 3, **characterized in that**,  
the second linkage member has a third linkage matching surface and a fourth linkage matching surface;  
the third linkage matching surface has a first non-through hole at a position corresponding to the rotation center of the contact rotor, the first non-through hole connects to the first axle of the first linkage member; the third linkage matching surface has a third non-through hole, the third non-through hole is parallel to the rotation axis of the contact rotor, the first shaft connects to the third non-through hole; the third linkage matching surface has second recess holes; the fourth linkage matching surface has third lugs, the third lugs engage with the first recess holes on the contact rotor.
5. The moving contact linkage structure for modular circuit breaker according to claim 4, **characterized in that**,  
the first linkage member has a first arc surface on the outer circumference, when the contact rotor rotates, the first arc surface collaborates with the first case and the second case;  
the second linkage member has a second arc surface on the outer circumference, when the contact rotor rotates, the second arc surface collaborates with the first case and the second case.
6. The moving contact linkage structure for modular circuit breaker according to claim 5, **characterized in that**,  
the first linkage member has first lugs on the first linkage matching surface, the second linkage member having second recess holes on the third linkage matching surface, the first lugs engaging with the second recess holes.
7. The moving contact linkage structure for modular circuit breaker according to claim 6, **characterized in that**,  
the first case has a fourth lug within the first mounting hole adjacent to the outer surface, the fourth lug has a full circle shape, the fourth lug limits the protruding position of the first linkage member or the second linkage member projecting from the outer surface of the first case;  
when the contact rotor rotates, the first mounting hole collaborates with the first arc surface of the first linkage member or the second arc surface of the second linkage member;  
the first mounting hole does not block the connection between the first lug of the first linkage member and the second recess hole of the second linkage member, nor the connection between the first shaft and the first linkage member or the second linkage member.
8. The moving contact linkage structure for modular circuit breaker according to claim 6, **characterized in that**,  
the second case has a fifth lug within the second mounting hole adjacent to the outer surface, the fifth lug has a full circle shape, the fifth lug limits the protruding position of the first linkage member or the second linkage member projecting from the outer surface of the second case;  
when the contact rotor rotates, the second mounting hole collaborates with the first arc surface of the first linkage member or the second arc surface of the second linkage member;  
the second mounting hole does not block the connection between the first lug of the first linkage member and the second recess hole of the second linkage member, nor the connection between the first shaft and the first linkage member or the second linkage member.
9. The moving contact linkage structure for modular circuit breaker according to claim 7 or 8, **characterized in that**,  
the second lugs on the first linkage member and the third lugs on the second linkage member connect to the first recess holes on the mating surfaces on both sides of the contact rotor, the axis of the second non-through hole on the first linkage member and the axis of the third non-through hole on the second linkage member align with each other;  
the first linkage member, the contact rotor and the second linkage member are disposed in the first mounting hole on the first case and the second mounting hole on the second case, the first case and the second case are assembled to form a single phase contact module.
10. The moving contact linkage structure for modular circuit breaker according to claim 7 or 8, **characterized in that**,  
the first case has a fourth lug within the first mounting hole adjacent to the outer surface, the fourth lug has a full circle shape, the fourth lug limits the protruding position of the first linkage member or the second linkage member projecting from the outer surface of the first case;  
when the contact rotor rotates, the first mounting hole collaborates with the first arc surface of the first linkage member or the second arc surface of the second linkage member;  
the first mounting hole does not block the connection between the first lug of the first linkage member and the second recess hole of the second linkage member, nor the connection between the first shaft and the first linkage member or the second linkage member.

cuit breaker according to claim 7 or 8, **characterized in that,**

the third lugs on two second linkage members respectively engage with the first recess holes on the mating surfaces on both sides of the contact rotor; the axes of the two third non-through holes on the two second linkage members align with each other; the contact rotor and the two second linkage members are disposed in the first mounting hole on the first case and the second mounting hole on the second case, the first case and the second case are assembled to form a single phase contact module.

## Patentansprüche

### 1. Verknüpfungsstruktur eines beweglichen Kontaktes für einen modularen Schutzschalter, umfassend:

ein erstes Gehäuse (101) und ein zweites Gehäuse (102), das erste Gehäuse (101) mit einem ersten Montageloch (110) und das zweite Gehäuse (102) mit einem zweiten Montageloch (120), die Position des ersten Montagelochs (110) und die Position des zweiten Montagelochs (120) miteinander übereinstimmend; einen ersten Schaft (103);

eine Betriebsmechanismus-Seitenplatte (104), welche Betriebsmechanismus-Seitenplatte (104) ein drittes Durchgangsloch (140) aufweist, das dritte Durchgangsloch (140) positioniert an einem Rotationszentrum eines Kontaktrotors (106);

eine untere Betriebsmechanismus-Verbindungsstange (105), welche untere Betriebsmechanismus-Verbindungsstange (105) ein viertes Durchgangsloch aufweist, der erste Schaft (103) verbunden mit dem vierten Durchgangsloch;

einem Kontaktrotor (106), welcher Kontaktrotor (106) um ein Rotationszentrum drehbar ist, welcher Kontaktrotor zusammenpassende Oberflächen auf beiden Seiten hat;

ein erstes Verknüpfungsglied (107), welches erste Verknüpfungsglied (107) mit der zusammenpassenden Oberfläche auf einer ersten Seite des Kontaktrotors (106) verbunden ist, welches erste Verknüpfungsglied (107) eine konvexe erste Achse (170) an einer Position entsprechend dem Rotationszentrum des Kontaktrotors (106) hat, die konvexe erste Achse (170) verbunden mit dem dritten Durchgangsloch (140);

ein zweites Verknüpfungsglied (108), das zweite Verknüpfungsglied (108) verbunden mit der zusammenpassenden Oberfläche auf einer zweiten Seite des Kontaktrotors (106); wobei das erste Verknüpfungsglied (107), der

Kontaktrotor (106) und das zweite Verknüpfungsglied (108) in dem ersten Montageloch (110) auf dem ersten Gehäuse (101) und dem zweiten Montageloch (120) auf dem zweiten Gehäuse (102) angeordnet sind, das erste Gehäuse (101) und das zweite Gehäuse (102) zusammengebaut sind, um ein Einphasen-Kontaktmodul (100) zu bilden;

der Kontaktrotor (106) und zwei zweite Verknüpfungsglieder (108) in dem ersten Montageloch (110) auf dem ersten Gehäuse (101) und dem zweiten Montageloch (120) auf dem zweiten Gehäuse (102) angeordnet sind, das erste Gehäuse (101) und das zweite Gehäuse (102) zusammengebaut sind, um ein weiteres Einphasen-Kontaktmodul (100) zu bilden; und die Einphasen-Kontaktmodule (100) angepasst sind, um durch direkte Verbindungsverknüpfung ohne irgendwelche Verknüpfungsstrukturen unabhängig mit den Kontaktmodulen (100) verknüpft zu werden.

### 2. Verknüpfungsstruktur eines beweglichen Kontaktes für einen modularen Schutzschalter nach Anspruch 1, **dadurch gekennzeichnet, dass**

der Kontaktrotor erste Vertiefungslöcher hat, welche ersten Vertiefungslöcher an den zusammenpassenden Oberflächen auf beiden Seiten des Kontaktrotors positioniert sind, welche ersten Vertiefungslöcher an den zusammenpassenden Oberflächen auf einer selben Seite entlang des Rotationszentrums des Kontaktrotors symmetrisch sind.

### 3. Verknüpfungsstruktur eines beweglichen Kontaktes für einen modularen Schutzschalter nach Anspruch 2, **dadurch gekennzeichnet, dass**

das erste Verknüpfungsglied eine erste passende Verknüpfungsoberfläche und eine zweite passende Verknüpfungsoberfläche hat; die konvexe erste Achse auf der ersten passenden Verknüpfungsoberfläche ist, an einer Position entsprechend dem Rotationszentrum des Kontaktrotors, die Axiallänge der ersten Achse sicherstellt, dass die erste Achse mindestens durch das dritte Durchgangsloch geht und zu einem ersten Nichtdurchgangsloch auf dem zweiten Verknüpfungsglied verläuft; die erste passende Verknüpfungsoberfläche ein zweites Nichtdurchgangsloch hat, welches zweite Nichtdurchgangsloch parallel zu der Rotationsachse des Kontaktrotors ist, der erste Schaft verbunden mit dem zweiten Nichtdurchgangsloch; die zweite passende Verknüpfungsoberfläche zweite Ösen hat, welche zweiten Ösen in die ersten Vertiefungslöcher auf dem zweiten Kontaktrotor eingreifen.

### 4. Verknüpfungsstruktur eines beweglichen Kontaktes für einen modularen Schutzschalter nach Anspruch

### 3, dadurch gekennzeichnet, dass

das zweite Verknüpfungsglied eine dritte passende Verknüpfungsoberfläche und eine vierte passende Verknüpfungsoberfläche hat;

die dritte passende Verknüpfungsoberfläche ein erstes Nichtdurchgangsloch hat, an einer Position entsprechend dem Rotationszentrum des Kontaktrotors, das erste Nichtdurchgangsloch verbunden mit der ersten Achse des ersten Verknüpfungsglieds; die dritte passende Verknüpfungsoberfläche ein drittes Nichtdurchgangsloch hat, das dritte Nichtdurchgangsloch parallel zu der Rotationsachse des Kontaktrotors ist, der erste Schaft verbunden mit dem dritten Nichtdurchgangsloch; die dritte passende Verknüpfungsoberfläche zweite Vertiefungslöcher hat;

die vierte passende Verknüpfungsoberfläche dritte Ösen hat, welche dritten Ösen in die ersten Vertiefungslöcher auf dem Kontaktrotor eingreifen.

5. Verknüpfungsstruktur eines beweglichen Kontaktes für einen modularen Schutzschalter nach Anspruch 4, **dadurch gekennzeichnet, dass**

das erste Verknüpfungsglied eine erste Bogenoberfläche auf dem Außenumfang hat, wenn sich der Kontaktrotor dreht, welche erste Bogenoberfläche mit dem ersten Gehäuse und dem zweiten Gehäuse zusammenarbeitet;

das zweite Verknüpfungsglied eine zweite Bogenoberfläche auf dem Außenumfang hat, wenn sich der Kontaktrotor dreht, welche zweite Bogenoberfläche mit dem ersten Gehäuse und dem zweiten Gehäuse zusammenarbeitet.

6. Verknüpfungsstruktur eines beweglichen Kontaktes für einen modularen Schutzschalter nach Anspruch 5, **dadurch gekennzeichnet, dass**

das erste Verknüpfungsglied erste Ösen auf der ersten passenden Verknüpfungsoberfläche hat, das zweite Verknüpfungsglied versehen mit zweiten Vertiefungslöchern auf der dritten passenden Verknüpfungsoberfläche, die ersten Ösen eingreifend in die zweiten Vertiefungslöcher.

7. Verknüpfungsstruktur eines beweglichen Kontaktes für einen modularen Schutzschalter nach Anspruch 6, **dadurch gekennzeichnet, dass**

das erste Gehäuse eine vierte Öse innerhalb des ersten Montagelochs neben der Außenoberfläche hat, die vierte Öse eine volle Kreisform hat, die vierte Öse die hervorstehende Position des ersten Verknüpfungsgliedes oder das Hervorstehen des zweiten Verknüpfungsgliedes von der Außenoberfläche des ersten Gehäuses begrenzt;

wenn sich der Kontaktrotor dreht, das erste Montageloch mit der ersten Bogenoberfläche des ersten Verknüpfungsgliedes oder der zweiten Bogenoberfläche des zweiten Verknüpfungsgliedes zusammen-

menarbeitet;

das erste Montageloch weder die Verbindung zwischen der ersten Öse des ersten Verknüpfungsgliedes und dem zweiten Vertiefungsloch des zweiten Verknüpfungsgliedes noch die Verbindung zwischen dem ersten Schaft und dem ersten Verknüpfungsglied oder dem zweiten Verknüpfungsglied blockiert.

8. Verknüpfungsstruktur eines beweglichen Kontaktes für einen modularen Schutzschalter nach Anspruch 6, **dadurch gekennzeichnet, dass**

das zweite Gehäuse eine fünfte Öse innerhalb des zweiten Montagelochs neben der Außenoberfläche hat, die fünfte Öse eine volle Kreisform hat, die fünfte Öse die hervorstehende Position des ersten Verknüpfungsgliedes oder das Hervorstehen des zweiten Verknüpfungsgliedes von der Außenoberfläche des zweiten Gehäuses begrenzt;

wenn sich der Kontaktrotor dreht, das zweite Montageloch mit der ersten Bogenoberfläche des ersten Verknüpfungsgliedes oder der zweiten Bogenoberfläche des zweiten Verknüpfungsgliedes zusammen-

arbeitet;

das zweite Montageloch weder die Verbindung zwischen der ersten Öse des ersten Verknüpfungsgliedes und dem zweiten Vertiefungsloch des zweiten Verknüpfungsgliedes noch die Verbindung zwischen dem ersten Schaft und dem ersten Verknüpfungsglied oder dem zweiten Verknüpfungsglied blockiert.

9. Verknüpfungsstruktur eines beweglichen Kontaktes für einen modularen Schutzschalter nach Anspruch 7 oder 8, **dadurch gekennzeichnet, dass**

die zweiten Ösen auf dem ersten Verknüpfungsglied und die dritten Ösen auf dem zweiten Verknüpfungsglied verbunden sind mit den ersten Vertiefungslöchern auf den zusammenpassenden Oberflächen an beiden Seiten des Kontaktrotors, die Achse des zweiten Nichtdurchgangslochs auf dem ersten Verknüpfungsglied und die Achse des dritten Nichtdurchgangslochs auf dem zweiten Verknüpfungsglied zueinander ausgerichtet sind;

das erste Verknüpfungsglied, der Kontaktrotor und das zweite Verknüpfungsglied in dem ersten Montageloch auf dem ersten Gehäuse und dem zweiten Montageloch auf dem zweiten Gehäuse angeordnet sind, das erste Gehäuse und das zweite Gehäuse zusammengebaut sind, um ein Einphasen-Kontaktmodul zu bilden.

10. Verknüpfungsstruktur eines beweglichen Kontaktes für einen modularen Schutzschalter nach Anspruch 7 oder 8, **dadurch gekennzeichnet, dass**

die dritten Ösen auf zwei zweiten Verknüpfungsgliedern jeweils in die ersten Vertiefungslöcher auf den passenden Oberflächen an beiden Seiten des Kon-

taktrotors eingreifen;  
 die Achsen der zwei dritten Nichtdurchgangslöcher auf den zwei zweiten Verknüpfungsgliedern zueinander ausgerichtet sind;  
 der Kontaktrotor und die zwei zweiten Verknüpfungsglieder in dem ersten Montageloch auf dem ersten Gehäuse und dem zweiten Montageloch auf dem zweiten Gehäuse angeordnet sind, das erste Gehäuse und das zweite Gehäuse zusammengebaut sind, um ein Einphasen-Kontaktmodul zu bilden.

## Revendications

1. Structure de liaison de contact mobile pour un disjoncteur modulaire comprenant :

un premier boîtier (101) et un second boîtier (102), le premier boîtier (101) ayant un premier trou de montage (110), et le second boîtier (102) ayant un second trou de montage (120), la position du premier trou de montage (110) et la position du second trou de montage (120) étant correspondantes entre elles ;  
 un premier arbre (103) ;  
 une plaque latérale de mécanisme de commande (104), la plaque latérale de mécanisme de commande (104) ayant un troisième trou débouchant (140), le troisième trou débouchant (140) étant positionné à un centre de rotation d'un rotor de contact (106)  
 une tige de raccordement inférieure de mécanisme de commande (105), la tige de raccordement inférieure de mécanisme de commande (105) ayant un quatrième trou débouchant, le premier arbre (103) se raccordant au quatrième trou débouchant ;  
 un rotor de contact (106), le rotor de contact (106) pouvant tourner autour d'un centre de rotation, le rotor de contact ayant des surfaces de couplage des deux côtés ;  
 un premier élément de liaison (107), le premier élément de liaison (107) se raccordant à la surface de couplage sur un premier côté du rotor de contact (106), le premier élément de liaison (107) ayant un premier essieu convexe (170) dans une position correspondant au centre de rotation du rotor de contact (106), le premier essieu convexe (170) se raccordant au troisième trou débouchant (140) ;  
 un second élément de liaison (108), le second élément de liaison (108) se raccordant à la surface de couplage sur un second côté du rotor de contact (106) ;  
 dans laquelle le premier élément de liaison (107), le rotor de contact (106) et le second élément de liaison (108) sont disposés dans le pre-

mier trou de montage (110) sur le premier boîtier (101) et dans le deuxième trou de montage (120) sur le second boîtier (102), le premier boîtier (101) et le second boîtier (102) sont assemblés pour former un module de contact monophasé (100) ;  
 le rotor de contact (106) et les deux éléments de liaison (108) sont disposés dans le premier trou de montage (110) sur le premier boîtier (101) et dans le second trou de montage (120) sur le second boîtier (102), le premier boîtier (101) et le second boîtier (102) sont assemblés pour former un autre module de contact monophasé (100) ; et  
 les modules de contact monophasés (100) sont adaptés pour être reliés directement par liaison de raccordement sans aucune structure de liaison indépendante des modules de contact (100).

2. Structure de liaison de contact mobile pour un disjoncteur modulaire selon la revendication 1, **caractérisée en ce que** :

le rotor de contact a des premiers trous d'évidement, les premiers trous d'évidement étant positionnés sur les surfaces de couplage des deux côtés du rotor de contact, les premiers trous d'évidement sur la surface de couple d'un même côté étant symétriques le long du centre de rotation du rotor de contact.

3. Structure de liaison de contact mobile pour un disjoncteur modulaire selon la revendication 2, **caractérisée en ce que** :

le premier élément de liaison a une première surface de couplage de liaison et une deuxième surface de couplage de liaison ;  
 le premier essieu convexe est sur la première surface de couplage de liaison dans une position correspondant au centre de rotation du rotor de contact, la longueur axiale du premier essieu garantit au premier essieu de traverser au moins le troisième trou débouchant et de s'étendre jusqu'à un premier trou non débouchant sur le second élément de liaison ; la première surface de couplage de liaison a un deuxième trou non débouchant, le deuxième trou non débouchant est parallèle à l'axe de rotation du rotor de contact, le premier arbre se raccorde au deuxième trou non débouchant ;  
 la deuxième surface de couplage de liaison a des deuxième pattes, les deuxième pattes se mettent en prise avec les premiers trous d'évidement sur le rotor de contact.

4. Structure de liaison de contact mobile pour un dis-

joncteur modulaire selon la revendication 3, **caractérisée en ce que**

le second élément de liaison a une troisième surface de couplage de liaison et une quatrième surface de couplage de liaison ;

la troisième surface de couplage de liaison a un premier trou non débouchant dans une position correspondant au centre de rotation du rotor de contact, le premier trou non débouchant se raccorde au premier essieu du premier élément de liaison ; la troisième surface de couplage de liaison a un troisième trou non débouchant, le troisième trou non débouchant est parallèle à l'axe de rotation du rotor de contact, le premier arbre se raccorde au troisième trou non débouchant ; la troisième surface de couplage de liaison a des deuxième trous d'évidement ; la quatrième surface de couplage de liaison a des troisième pattes, les troisième pattes se mettent en prise avec les premiers trous d'évidement sur le rotor de contact.

5. Structure de liaison de contact mobile pour un disjoncteur modulaire selon la revendication 4, **caractérisée en ce que :**

le premier élément de liaison a une première surface d'arc sur la circonférence externe, lorsque le rotor de contact tourne, la première surface d'arc collabore avec le premier boîtier et le second boîtier ;

le second élément de liaison a une seconde surface d'arc sur la circonférence externe, lorsque le rotor de contact tourne, la seconde surface d'arc collabore avec le premier boîtier et le second boîtier.

6. Structure de liaison de contact mobile pour un disjoncteur modulaire selon la revendication 5, **caractérisée en ce que :**

le premier élément de liaison a des premières pattes sur la première surface de couplage de liaison, le second élément de liaison ayant des deuxième trous d'évidement sur la troisième surface de couplage de liaison, les premières pattes se mettant en prise avec les deuxième trous d'évidement.

7. Structure de liaison de contact mobile pour un disjoncteur modulaire selon la revendication 6, **caractérisée en ce que :**

le premier boîtier a une quatrième patte à l'intérieur du premier trou de montage adjacent à la surface externe, la quatrième patte a une forme de cercle complet, la quatrième patte limite la position en saillie du premier élément de liaison ou du second élément de liaison faisant saillie

de la surface externe du premier boîtier ;

lorsque le rotor de contact tourne, le premier trou de montage collabore avec la première surface d'arc du premier élément de liaison ou la seconde surface d'arc du second élément de liaison ; le premier trou de montage n'empêche pas le raccordement entre la première patte du premier élément de liaison et le second trou d'évidement du second élément de liaison, ni le raccordement entre le premier arbre et le premier élément de liaison ou le second élément de liaison.

8. Structure de liaison de contact mobile pour un disjoncteur modulaire selon la revendication 6, **caractérisée en ce que :**

le second boîtier a une cinquième patte à l'intérieur du second trou de montage adjacent à la surface externe, la cinquième patte a une forme de cercle complet, la cinquième patte limite la position en saillie du premier élément de liaison ou du second élément de liaison faisant saillie de la surface externe du second boîtier ;

lorsque le rotor de contact tourne, le second trou de montage collabore avec la première surface d'arc du premier élément de liaison ou de la seconde surface d'arc du second élément de liaison ;

le second trou de montage n'empêche pas le raccordement entre la première patte du premier élément de liaison et le second trou d'évidement du second élément de liaison, ni le raccordement entre le premier arbre et le premier élément de liaison ou le second élément de liaison.

9. Structure de liaison de contact mobile pour un disjoncteur modulaire selon la revendication 7 ou 8, **caractérisée en ce que :**

les deuxième pattes sur le premier élément de liaison et les troisième pattes sur le second élément de liaison se raccordent aux premiers trous d'évidement sur les surfaces de couplage des deux côtés du rotor de contact, l'axe du deuxième trou non débouchant sur le premier élément de liaison et l'axe du troisième trou non débouchant sur le second élément de liaison s'alignent entre eux ;

le premier élément de liaison, le rotor de contact et le second élément de liaison sont disposés dans le premier trou de montage sur le premier boîtier et le second trou de montage sur le second boîtier, le premier boîtier et le second boîtier sont assemblés pour former un module de contact monophasé.

**10. Structure de liaison de contact mobile pour un disjoncteur modulaire selon la revendication 7 ou 8, caractérisée en ce que :**

les troisièmes pattes sur deux seconds éléments de liaison se mettent respectivement en prise avec les premiers trous d'évidement sur les surfaces de couplage des deux côtés du rotor de contact ;  
les axes des deux troisièmes trous non débouchants sur les deux seconds éléments de liaison s'alignent entre eux ;  
le rotor de contact et les deux seconds éléments de liaison sont disposés dans le premier trou de montage sur le premier boîtier et le second trou de montage sur le second boîtier, le premier boîtier et le second boîtier sont assemblés pour former un module de contact monophasé.

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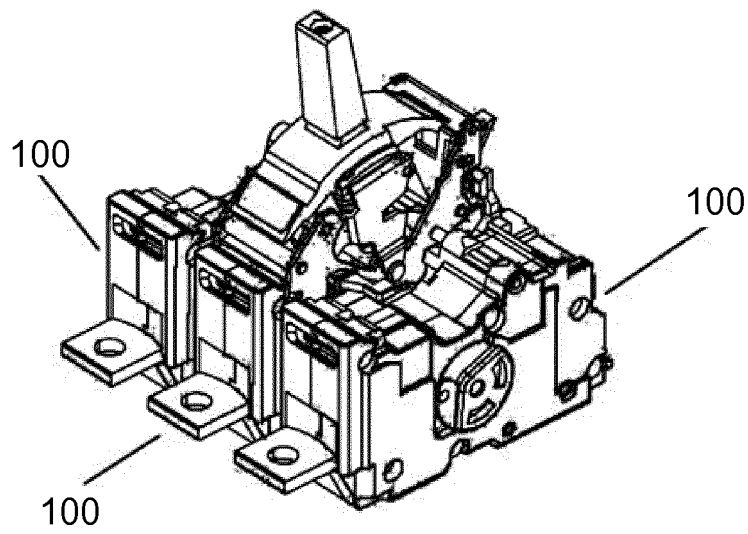


**Fig 1a**

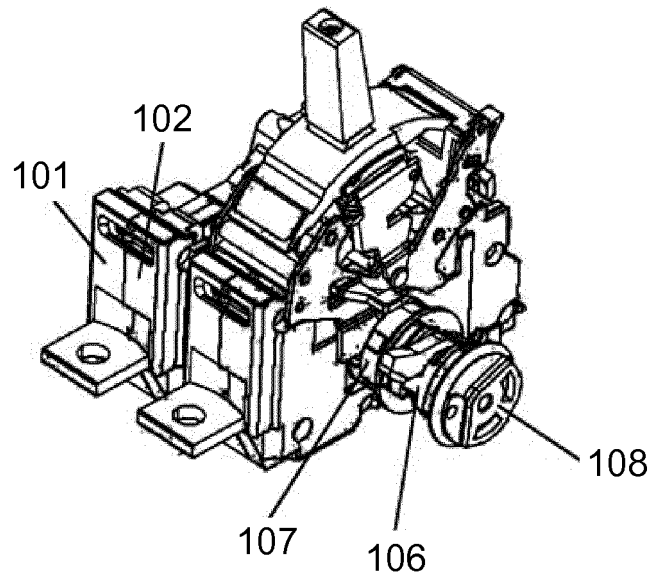


**Fig 1b**

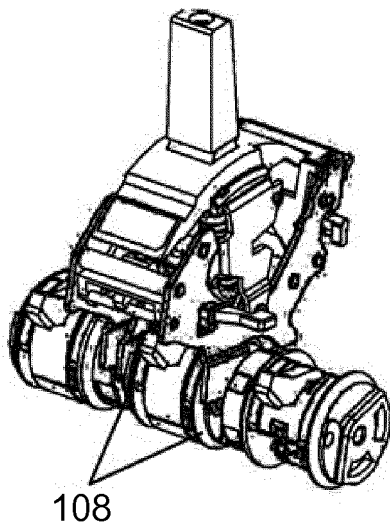


**Fig 1c**

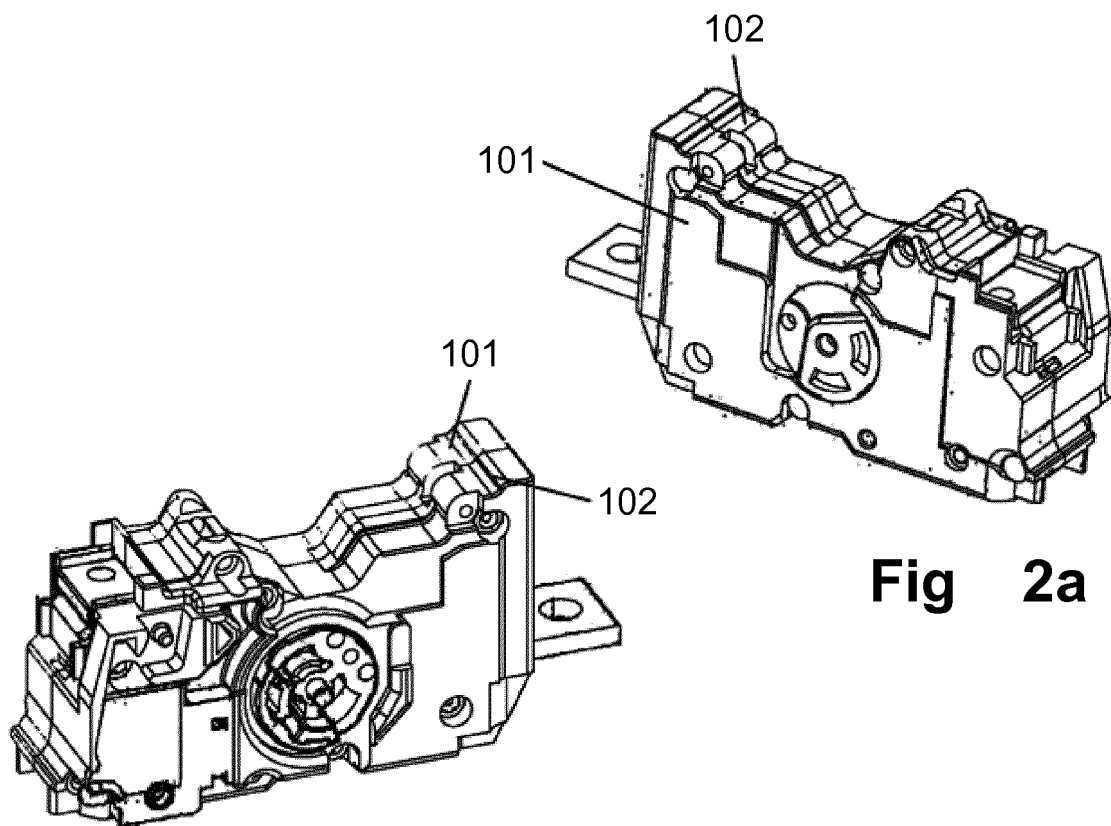


**Fig 2a**

**Fig 2b**

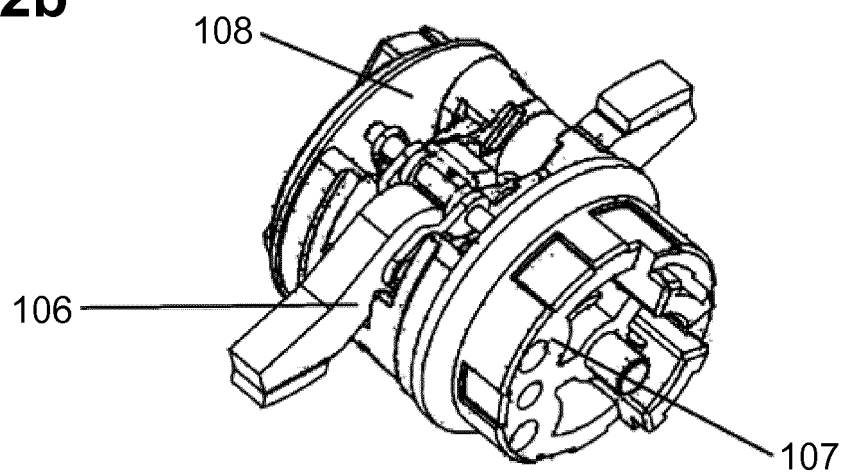


**Fig 2c**

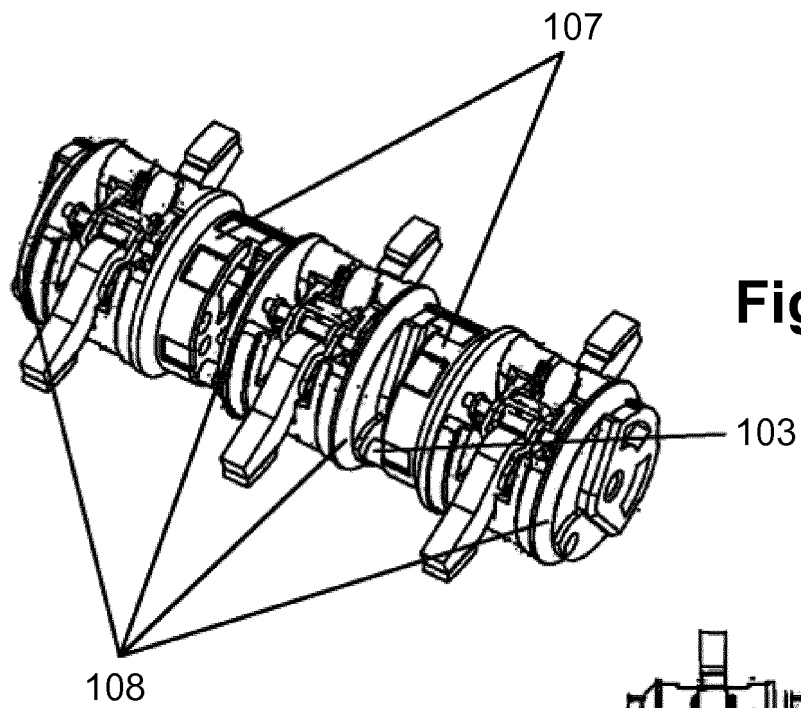


**Fig 3a**

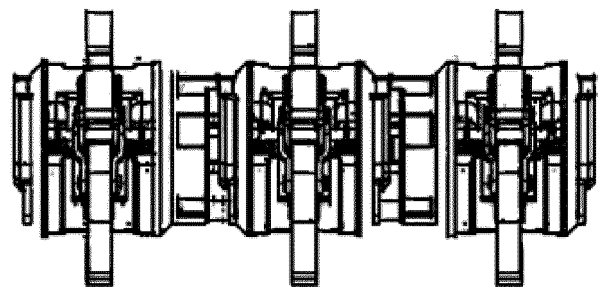


**Fig 3b**

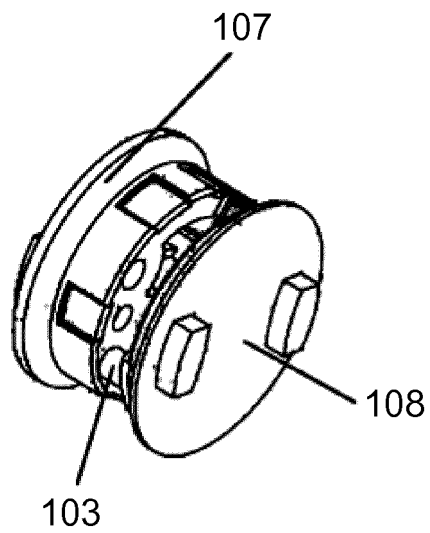


**Fig 3c**

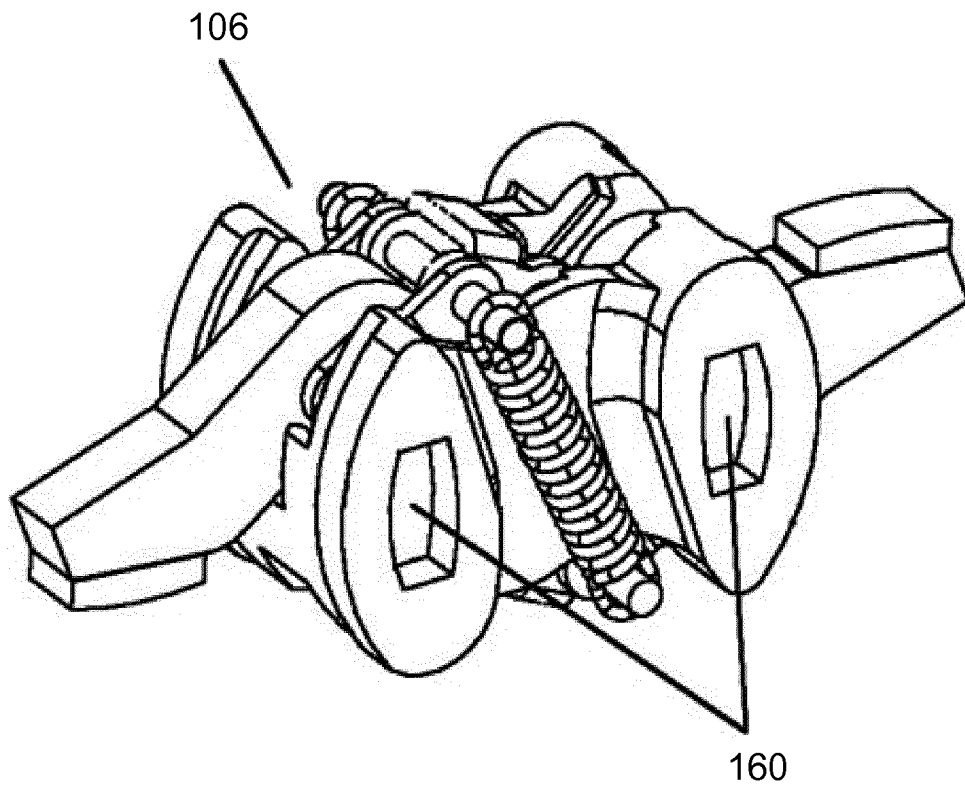


**Fig 4**

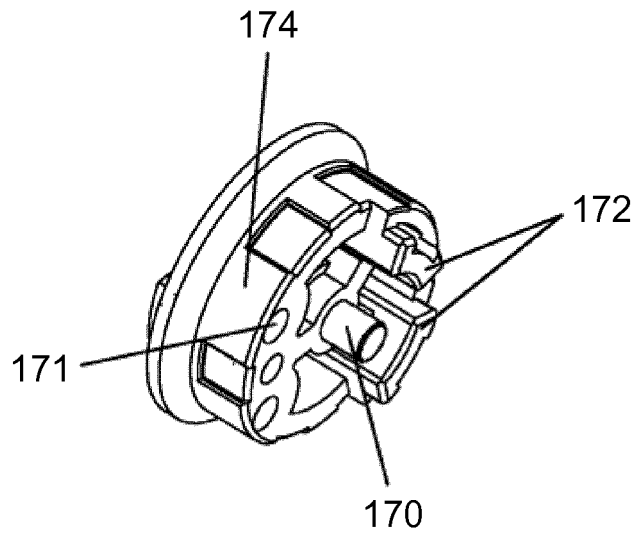


**Fig 5a**

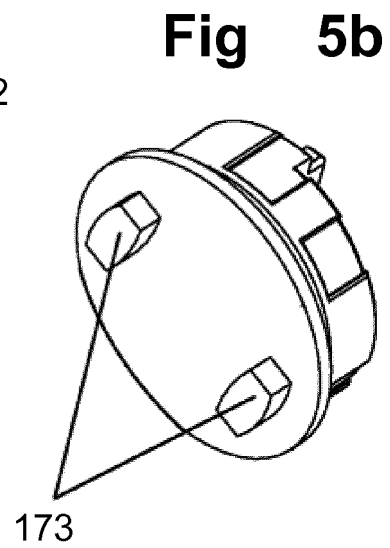


**Fig 5b**

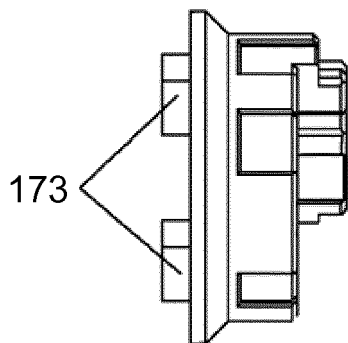


**Fig 5c**

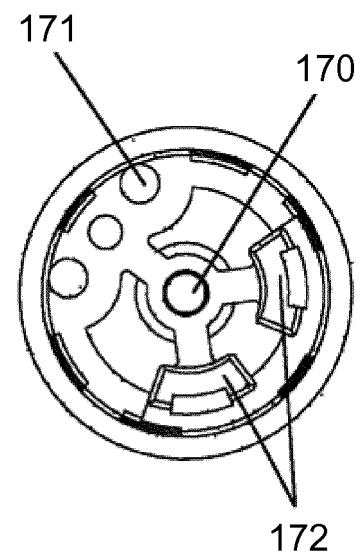


**Fig 5d**

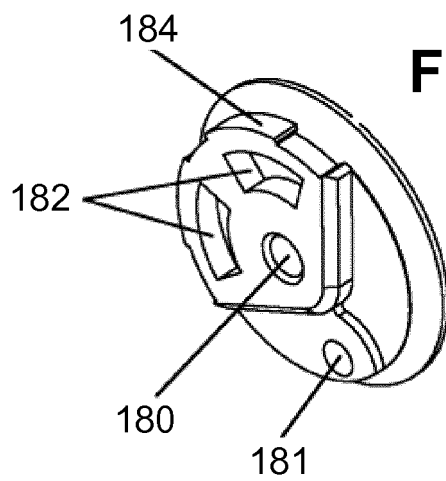


**Fig 6a**

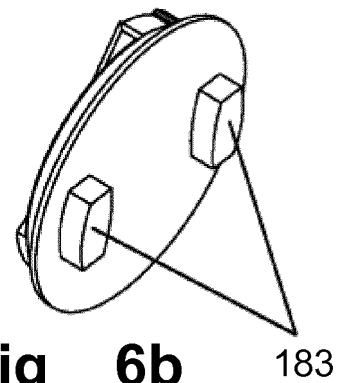


**Fig 6b**

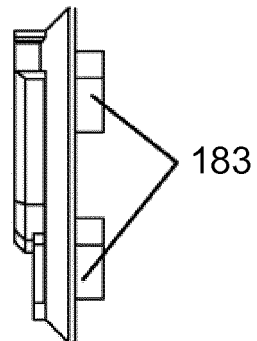


**Fig 6c**

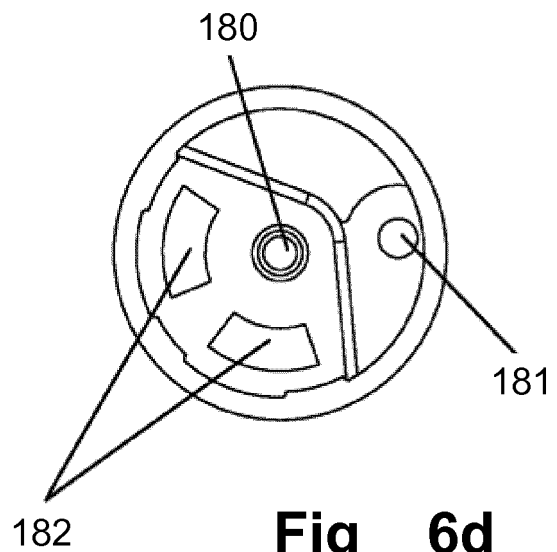


**Fig 6d**

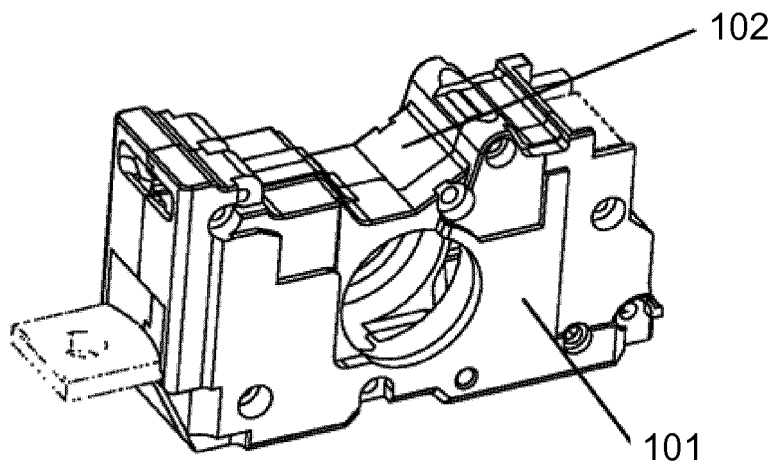


**Fig 7a**

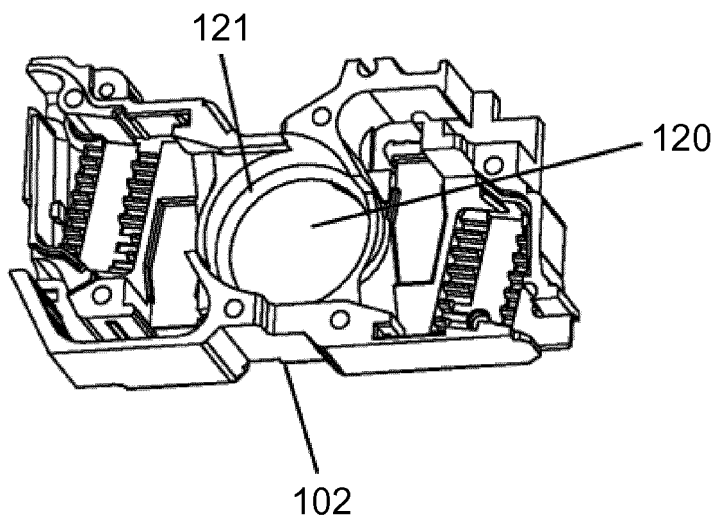


**Fig 7b**

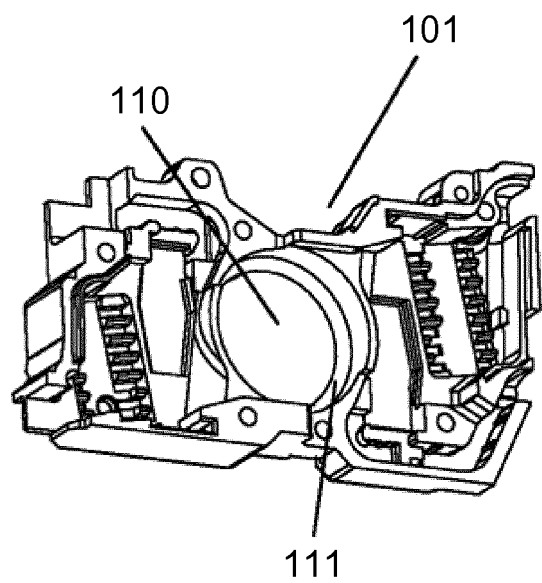


**Fig 7c**

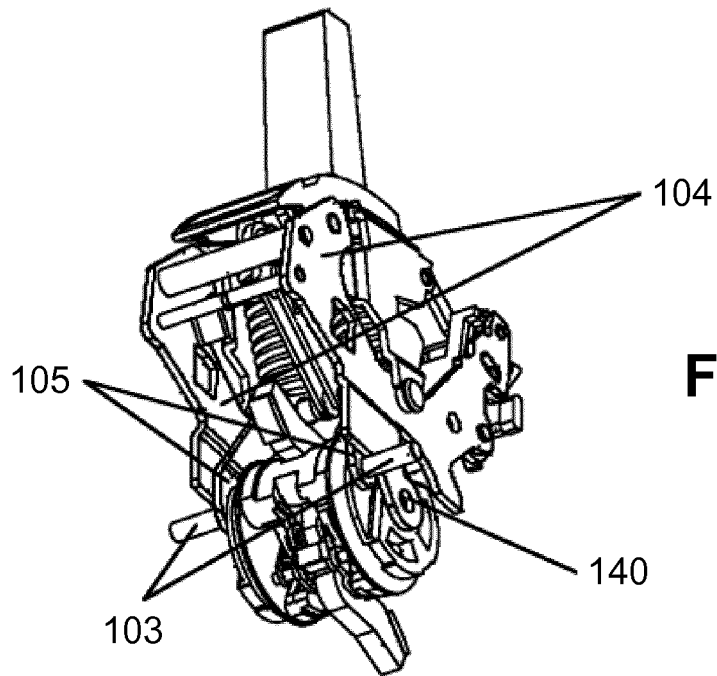


**Fig 8a**

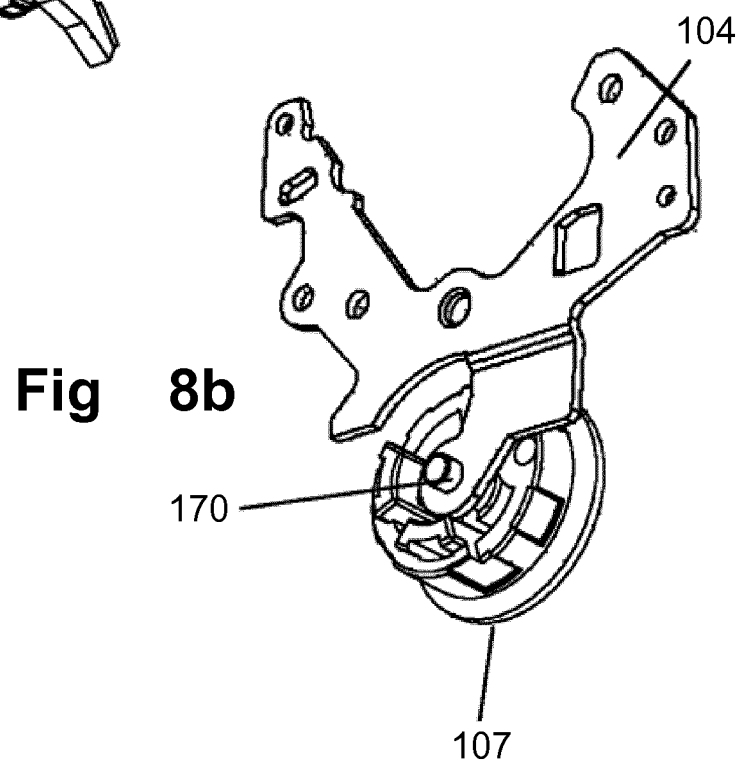


**Fig 8b**

**REFERENCES CITED IN THE DESCRIPTION**

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