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

(11) EP 2 763 154 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
06.08.2014 Bulletin 2014/32

(21) Application number: **12834733.3**

(22) Date of filing: **24.09.2012**

(51) Int Cl.:
H01H 71/10 *(2006.01)*

(86) International application number:
PCT/CN2012/081803

(87) International publication number:
WO 2013/044765 (04.04.2013 Gazette 2013/14)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **26.09.2011 CN 201110287701**

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

(57) The present invention discloses a moving contact linkage structure of modular circuit breaker. The moving contact linkage structure of modular circuit breaker comprises: a first case having a first mounting hole and the second case having a second mounting hole, the first mounting hole and the second mounting hole corresponding to each other on position; a first shaft; an operation mechanism side plate having a third through hole, the third through hole being positioned at a rotation center of a contact rotor; an operation mechanism lower connecting rod having a fourth through hole, the first shaft connecting to the fourth through hole; a contact rotor being rotatable around a rotation center, the contact rotor having mating surfaces on both sides; a first linkage member connecting to the mating surface on a first side of the contact rotor; a second linkage member connecting to the mating surface on a second side of the contact rotor; the contact rotor, the first linkage member and the second linkage member being mounted in the first mounting hole and the second mounting hole.

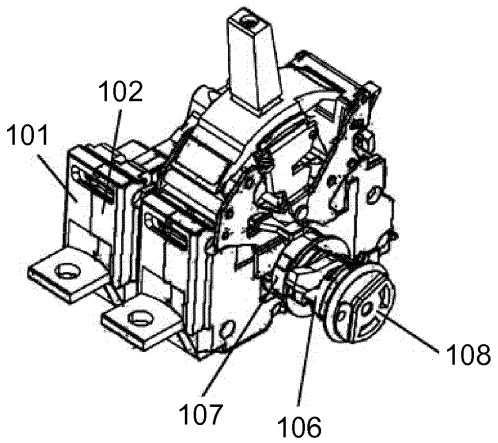

Fig 1b

EP 2 763 154 A1

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.

SUMMARY

[0003] 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.

[0004] 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.

[0005] 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.

[0006] According to an embodiment, 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.

[0007] 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.

[0008] 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.

[0009] 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.

[0010] 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.

[0011] 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.

[0012] 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.

[0013] 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.

[0014] 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 interphase 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

[0015] 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

[0016] 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 sec-

ond 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.

[0017] 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.

[0018] 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.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] 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 contact 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 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 third single phase contact module.

[0026] 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 ele-

ment is needed.

[0027] 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 interphase 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.

[0028] The above embodiments are provided to those skilled in the art to realize or use the invention, under the condition that various modifications or changes being made by those skilled in the art without departing the spirit and principle of the invention, the above embodiments may be modified and changed variously, therefore the protection scope of the invention is not limited by the above embodiments, rather, it should conform to the maximum scope of the innovative features mentioned in the claims.

Claims

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

a first case and a second case, the first case having a first mounting hole and the second case having a second mounting hole, the position of the first mounting hole and the position of the second mounting hole corresponding to each other;
a first shaft;
an operation mechanism side plate, the operation mechanism side plate having a third through hole, the third through hole being positioned at a rotation center of a contact rotor;
an operation mechanism lower connecting rod, the operation mechanism lower connecting rod having a fourth through hole, the first shaft connecting to the fourth through hole;
a contact rotor, the contact rotor being rotatable around a rotation center, the contact rotor having mating surfaces on both sides;
a first linkage member, the first linkage member connecting to the mating surface on a first side of the contact rotor;
a second linkage member, the second linkage member connecting to the mating surface on a second side of the contact rotor;
wherein the contact rotor, the first linkage member and the second linkage member are mounted in the first mounting hole and the second mounting hole.

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 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 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, 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.

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;
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 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;
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 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 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 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.

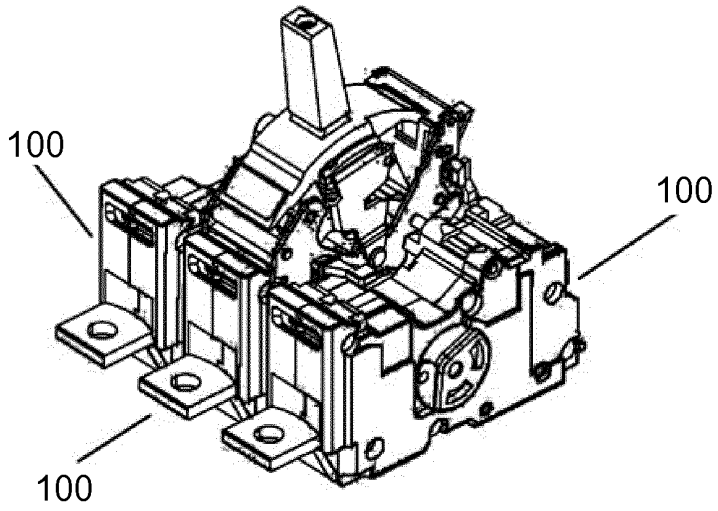

Fig 1a

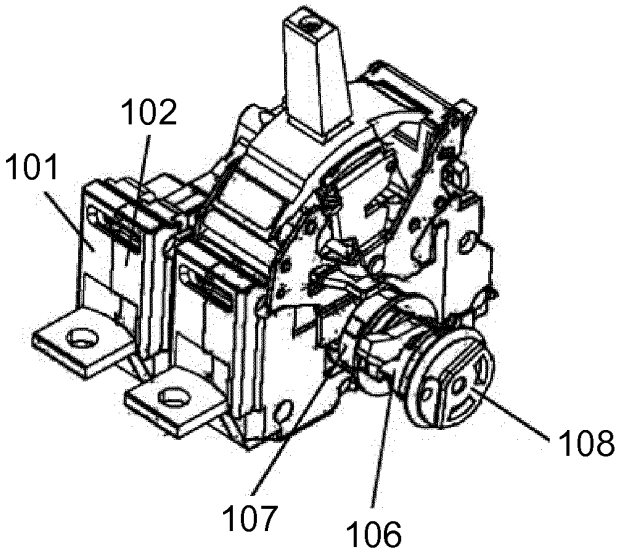

Fig 1b

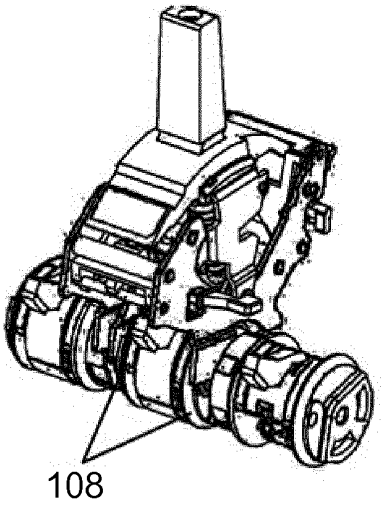

Fig 1c

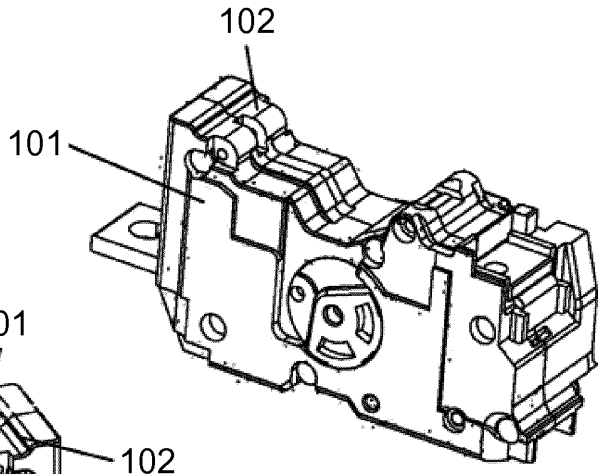

Fig 2a

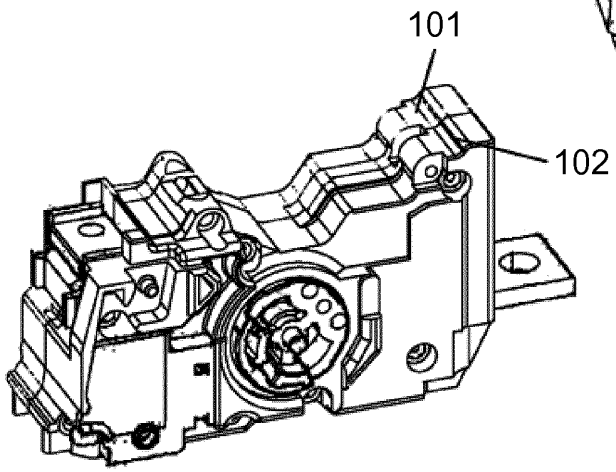

Fig 2b

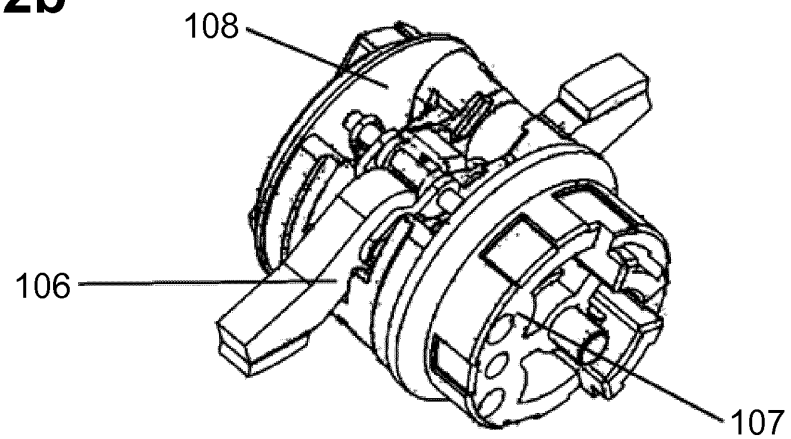

Fig 2c

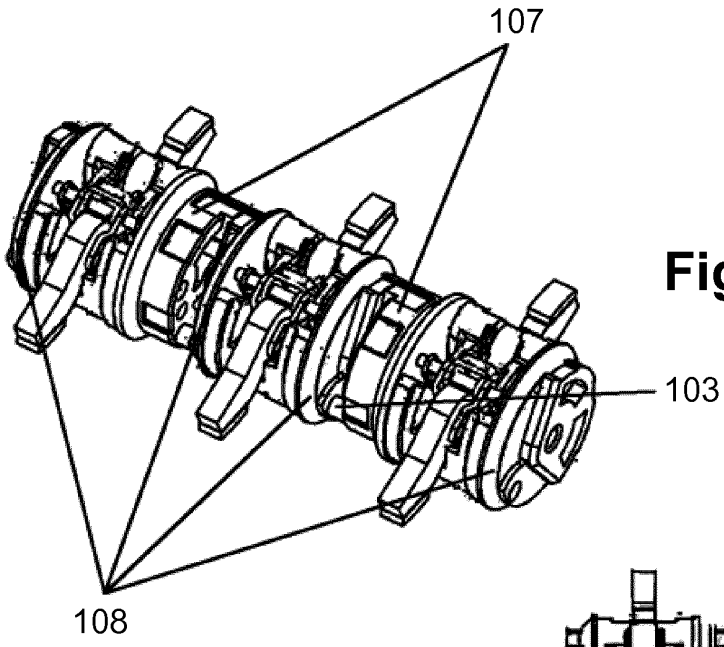

Fig 3a

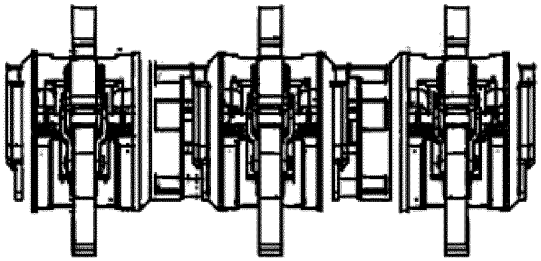

Fig 3b

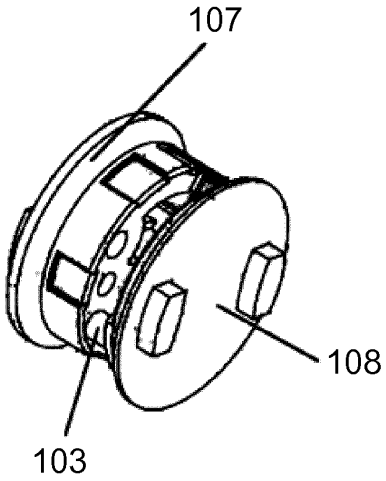

Fig 3c

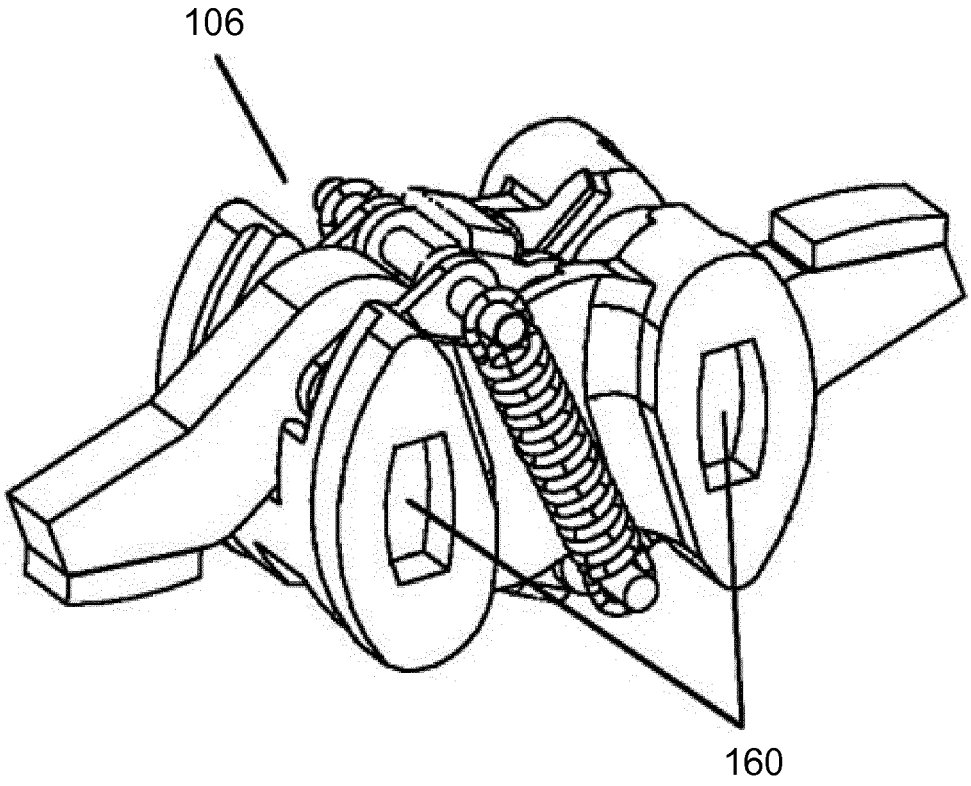

Fig 4

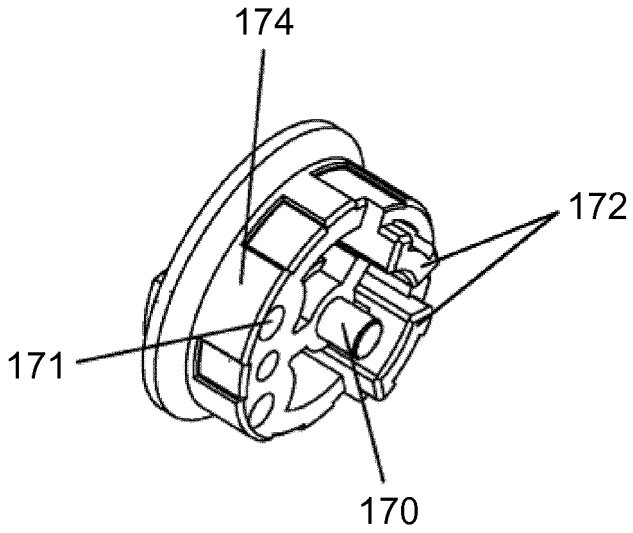

Fig 5a

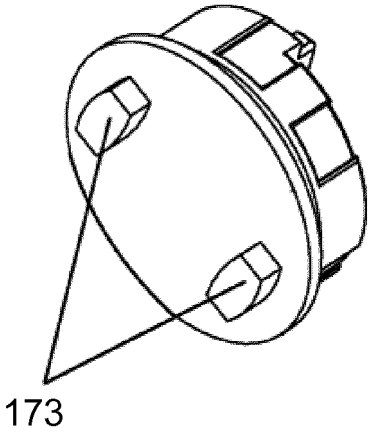

Fig 5b

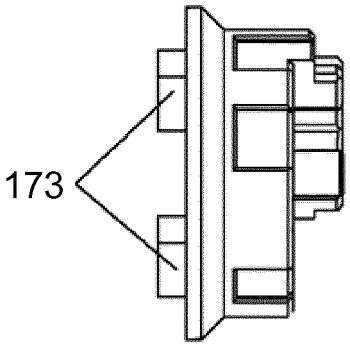

Fig 5c

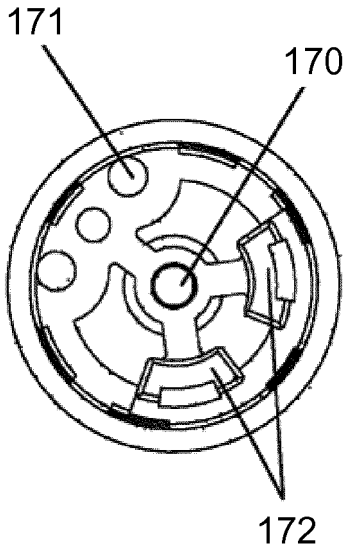

Fig 5d

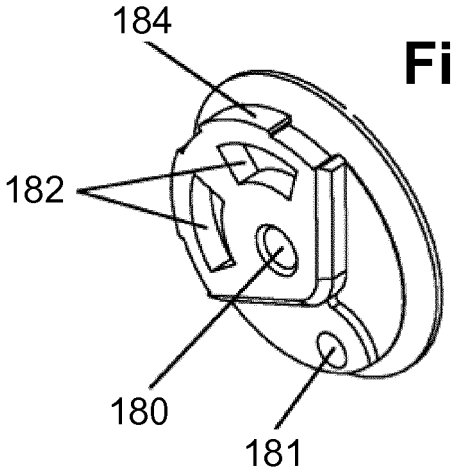

Fig 6a

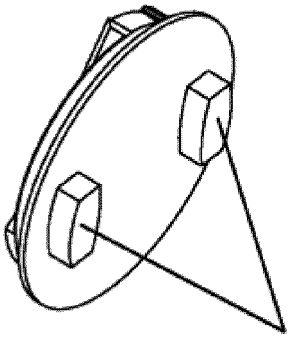

Fig 6b

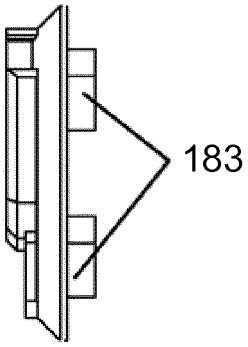

Fig 6c

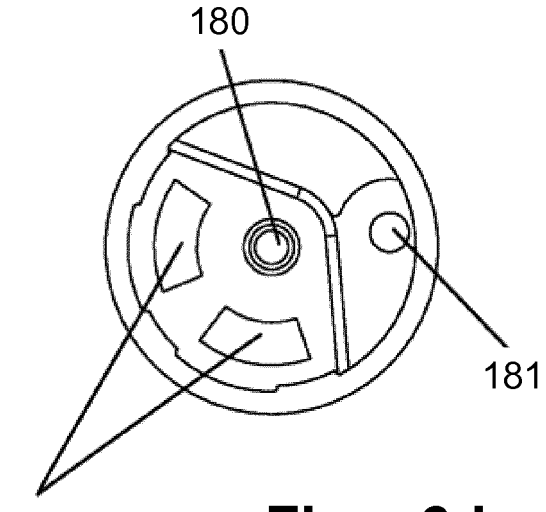

Fig 6d

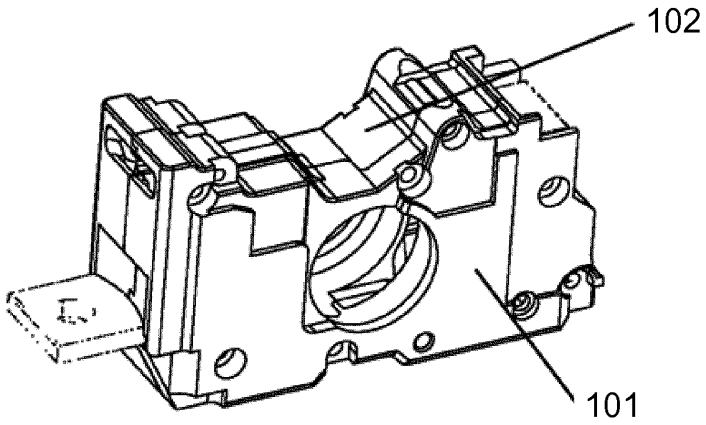

Fig 7a

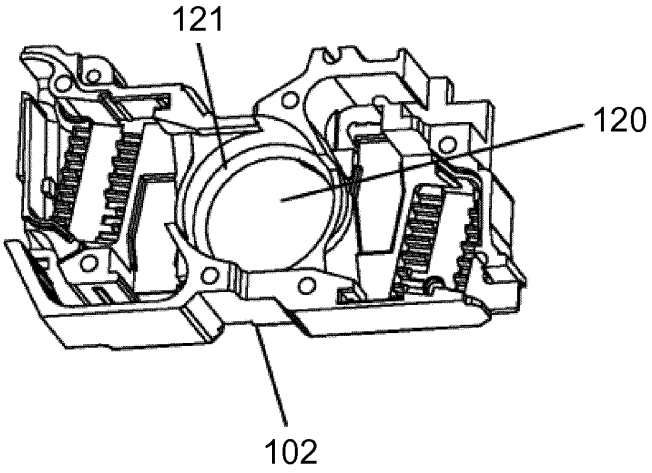

Fig 7b

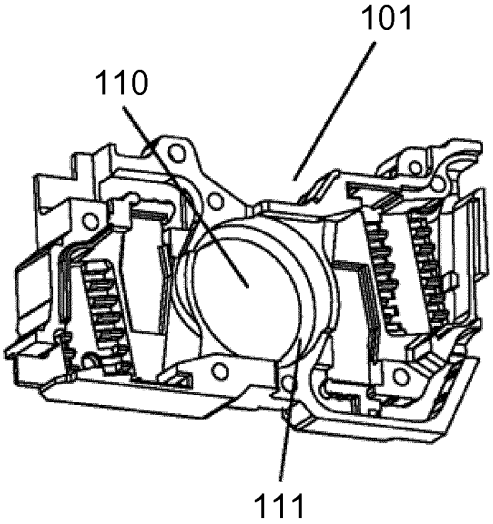

Fig 7c

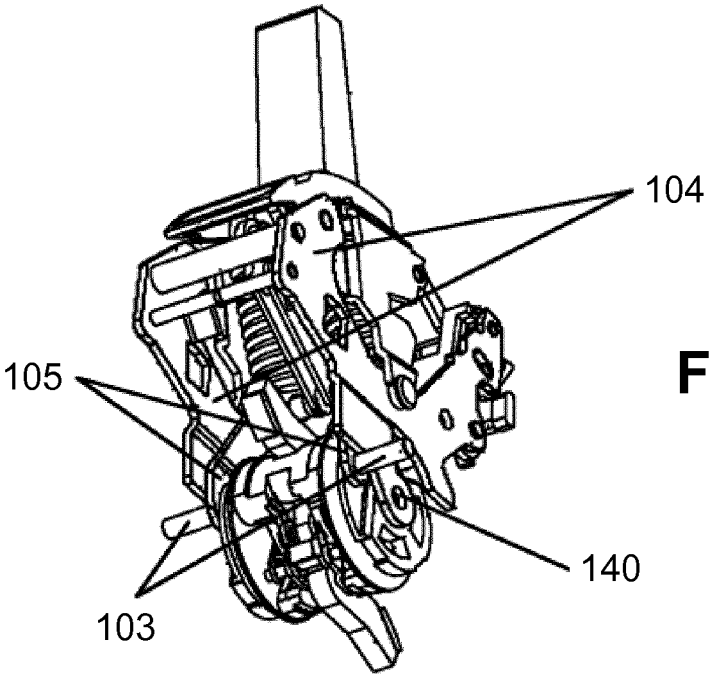

Fig 8a

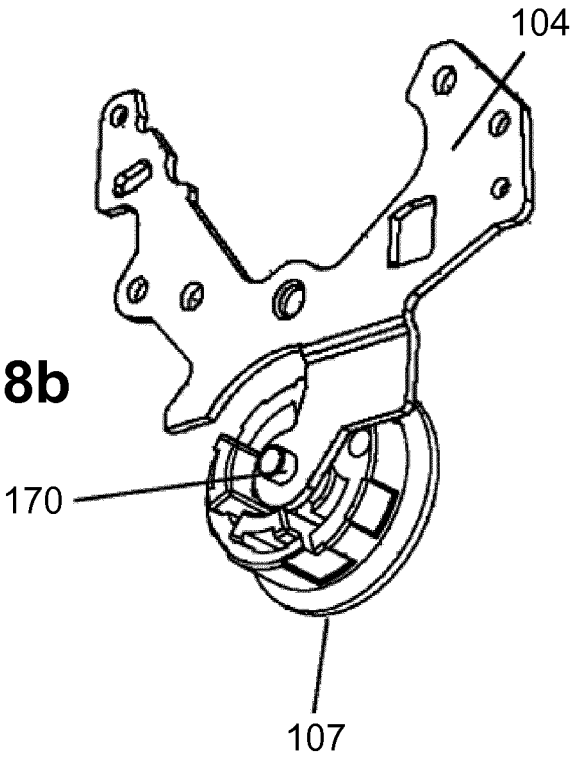

Fig 8b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2012/081803

A. CLASSIFICATION OF SUBJECT MATTER

H01H 71/10 (2006.01) i

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC:H01H71

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

WPI; EPODOC; CNPAT; CNKI: circuit,break+,module,link+,block,sheet,rod,lever,hole?,rotor,shell,hous+,contact+,side+,plate,active+

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.
A	CN 201417722 Y (Changshu Switch Manufacturing Co., Ltd.) 03 Mar. 2010 (03.03.2010) the detail embodiment part, figures1-13	1-10
A	US 2004/0021536 A1 (HARMON, Jason Edward et al.) 05 Feb. 2004 (05.02.2004) description, paragraphs [0011]-[0021], figures1-3	1-10
A	CN 2845154 Y (Shanghai Electrical Apparatus Research Institute Co., Ltd.) 06 Dec. 2006 (06.12.2006) the detail embodiment part of description, figures1-4	1-10
A	CN 201804806 U (Shanghai Nader Electric Co., Ltd.) 20 Apr. 2011 (20.04.2011) the detail embodiment partfigures1-6	1-10

☐ 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 application or patent 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	Date of mailing of the international search report
03 Dec. 2012 (03.12.2012)	03 Jan. 2013 (03.01.2013)
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10)62019451	Authorized officer FENG, Yan Telephone No. (86-10)62412857

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2012/081803

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 201417722 Y	03.03.2010	None	
US 2004/0021536 A1	05.02.2004	None	
CN 2845154 Y	06.12.2006	None	
CN 201804806 U	20.04.2011	None	

Form PCT/ISA /210 (patent family annex) (July 2009)