



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

(43) Date of publication:
15.05.2019 Bulletin 2019/20

(51) Int Cl.:
H01H 71/08 (2006.01) H01H 73/04 (2006.01)

(21) Application number: **17823580.0**

(86) International application number:
PCT/CN2017/091415

(22) Date of filing: **03.07.2017**

(87) International publication number:
WO 2018/006768 (11.01.2018 Gazette 2018/02)

(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**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

• **Zhejiang Chint Electrics Co., Ltd.**
Yueqing, Zhejiang 325603 (CN)

(72) Inventors:
• **GU, Xiang**
Shanghai 200063 (CN)
• **JIANG, Guping**
Shanghai 200063 (CN)
• **JIANG, Zhili**
Shanghai 200063 (CN)
• **HE, Wennan**
Shanghai 200063 (CN)

(30) Priority: **06.07.2016 CN 201610525091**

(71) Applicants:
• **Seari Electric Technology Co., Ltd.**
Shanghai 200063 (CN)
• **Shanghai Noark Electric Co., Ltd.**
Shanghai 201614 (CN)

(74) Representative: **Osha Liang**
2, rue de la Paix
75002 Paris (FR)

(54) **ELECTRICALLY CONDUCTIVE LOOP OF CIRCUIT BREAKER**

(57) An electrical path for a circuit breaker, comprising: an inlet contact group (121, 122); an outlet contact group (131, 132); and a conductive assembly (115, 111, 112). The inlet contact group (121, 122) is connected to an inlet terminal (123), and the outlet contact group (131, 132) is connected to an outlet terminal (133). The conductive assembly (115, 111, 112) comprises a soft connection assembly (115) and a hard connection assembly (111, 112). The hard connection assembly (111, 112) is fixed to a base of the circuit breaker; the soft connection assembly (115) is connected to the inlet contact group (121, 122) and the outlet contact group (131, 132); the soft connection assembly (115) and the hard connection assembly (111, 112) are connected to provide an electrical path between the inlet contact group (121, 122) and the outlet contact group (131, 132). The inlet contact group (121, 122) and the outlet contact group (131, 132) are mounted coaxially. By combining a soft connection and a hard connection, the electrical path utilizes the flexibility of the soft connection to make the mounting of the contact groups more flexible and convenient and utilizes the hard connection to obtain a reliable and stable electrical path, thus achieving a balance between assembly efficiency and assembly quality.

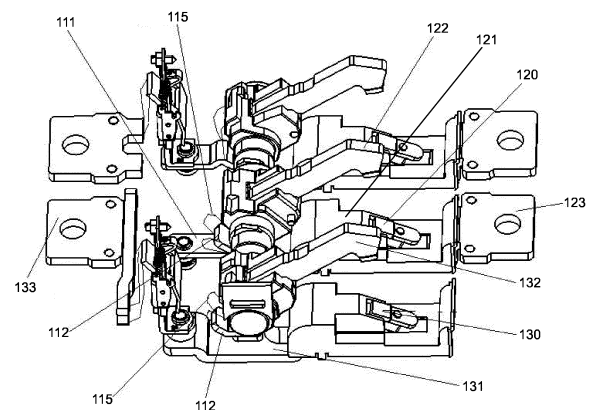


FIG 1a

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] Embodiments of the present invention relate to the field of low voltage electrical appliances and, more particularly, to an electrical path for a circuit breaker.

2. The Related Art

[0002] As the photovoltaic power generation industry controls costs more and more strictly, the cost control on equipment by combiner box and inverter manufacturers is becoming more and more rigorous. The current development trend of the market is to increase the system voltage to reduce the cost of equipment. A consensus is that the voltage of photovoltaic systems will increase from the existing DC1000V to DC1500V in the future. Therefore, DC1500V will become the mainstream voltage of the photovoltaic industry in the future. The rated voltage of the matching switch devices also needs to be increased accordingly.

[0003] Circuit breakers are the main switch devices in various circuit equipment. Therefore, photovoltaic dedicated direct current molded-case circuit breakers with DC1500V rated voltage will become the mainstream product of the future photovoltaic industry demand. In order to achieve the short-circuit breaking capacity at high voltage, in order to improve the rated working voltage of the DC circuit breaker, internal or external cascade connection is usually adopted to achieve a higher rated working voltage by providing multiple break points of a plurality of contact groups.

[0004] However, the plurality of contact groups that are cascade-connected need to occupy more space, which will increase the product volume, and in the case of increasingly higher requirements for the product volume, it is required to install a plurality of contact groups in a small space. This poses a challenge to the reliability of the cascade connection of the contact groups and the difficulty of installation.

SUMMARY

[0005] Embodiments of the present invention disclose an electrical path for a circuit breaker, comprising: an inlet contact group; an outlet contact group; and a conductive assembly. The inlet contact group is connected to an inlet terminal, and the outlet contact group is connected to an outlet terminal. The conductive assembly comprises a soft connection assembly and a hard connection assembly. The hard connection assembly is fixed to a base of the circuit breaker; the soft connection assembly is connected to the inlet contact group and the outlet contact group; the soft connection assembly and the hard connection assembly are connected to provide

an electrical path between the inlet contact group and the outlet contact group. The inlet contact group and the outlet contact group are coaxially mounted.

[0006] In one embodiment, the hard connection assembly includes a connecting member and a conductive strip. The connecting member is fixed to the base of the circuit breaker and extends from a position near the inlet contact group to a position near the outlet contact group. The conductive strip is fixed to the connecting member and is adjacent to the inlet contact group and the outlet contact group.

[0007] In one embodiment, the connecting member is provided with fixing holes and connecting holes. The connecting member is fixed by fasteners to the base of the circuit breaker through the fixing holes, and the conductive strip is fixed by fasteners to the connecting member through the connecting holes.

[0008] In one embodiment, the soft connection comprises an inlet side soft connection and an outlet side soft connection. The conductive strip comprises an inlet side conductive strip and an outlet side conductive strip. An end of the inlet side soft connection is connected to the inlet side conductive strip, and another end of the inlet side soft connection is connected to the inlet contact group. An end of the outlet side soft connection is connected to the outlet side conductive strip, and another end of the outlet side soft connection is connected to the outlet contact group.

[0009] In one embodiment, the inlet contact group comprises: an inlet static contact and an inlet moving contact. The inlet static contact is connected to the inlet terminal. The inlet side soft connection is connected to the inlet moving contact.

[0010] In one embodiment, the outlet contact group comprises: an outlet static contact and an outlet moving contact. The outlet static contact is connected to the outlet terminal. The outlet side soft connection is connected to the outlet moving contact.

[0011] In one embodiment, the inlet moving contact is mounted coaxially with the outlet moving contact.

[0012] In one embodiment, a plurality of inlet contact groups are provided, and the inlet moving contacts of the plurality of inlet contact groups are coaxially mounted.

[0013] The electrical path according to one or more embodiments of the present invention, by combining a soft connection and a hard connection, utilizes the flexibility of the soft connection to make the mounting of the contact groups more flexible and convenient, and utilizes the hard connection to obtain a reliable and stable electrical path, thereby achieving a balance between assembly efficiency and assembly quality.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The above and other features, natures, and advantages of the present invention will be more apparent from the following description of the embodiments with reference to the accompanying drawings, wherein,

FIG. 1a and FIG. 1b show structural diagrams of an electrical path for a circuit breaker in accordance with an embodiment of the present invention.

FIG. 2 shows a schematic diagram of the connection of a conductive assembly in an electrical path for a circuit breaker in accordance with an embodiment of the present invention.

FIG. 3 shows a structural diagram of a connecting member in an electrical path for a circuit breaker in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0015] FIG. 1a and FIG. 1b show structural diagrams of an electrical path for a circuit breaker in accordance with an embodiment of the present invention. Referring to FIG. 1a and FIG. 1b, the electrical path for the circuit breaker comprises: an inlet contact group; an outlet contact group; and a conductive assembly. The inlet contact group, the outlet contact group, and the conductive assembly are all mounted within a housing of the circuit breaker. The inlet contact group is connected to an inlet terminal. The outlet contact group is connected to an outlet terminal. The conductive assembly comprises a soft connection assembly and a hard connection assembly. The hard connection assembly is fixed to a base of the circuit breaker; the soft connection assembly is connected to the inlet contact group and the outlet contact group; the soft connection assembly and the hard connection assembly are connected to provide an electrical path between the inlet contact group and the outlet contact group. The inlet contact group and the outlet contact group are coaxially mounted.

[0016] Specifically, the inlet contact group includes an inlet static contact 121 and an inlet moving contact 122. The inlet static contact 121 is connected to the inlet terminal 123, and the inlet terminal 123 is a wiring strip. The inlet moving contact 122 is rotatably mounted on a rotation shaft. The inlet moving contact 122 rotates about the rotation shaft, and an end portion of the inlet moving contact contacts or separates from a contact 120 on the inlet static contact 121 to form a switching circuit. The root portion of the inlet moving contact 122 is connected to the conductive assembly. The outlet contact group includes an outlet static contact 131 and an outlet moving contact 132. The outlet static contact 131 is connected to an outlet terminal 133, and the outlet terminal 133 is an outlet conductive strip. The outlet moving contact 132 is rotatably mounted on a rotation shaft. The outlet moving contact 132 rotates about the rotation shaft, and an end portion of the outlet moving contact contacts or separates from a contact 130 on the outlet static contact 131 to form a switching circuit. The root portion of the outlet moving contact 132 is connected to the conductive assembly. As shown, the inlet moving contact 122 and the

outlet moving contact 132 are coaxially mounted. In other words, the inlet moving contact 122 and the outlet moving contact 132 are mounted on the same rotation shaft 141 and rotate about the rotation shaft 141. It should be noted that although coaxial mounting is performed, the inlet moving contact 122 and the outlet moving contact 132 are independently operated, and the two are not synchronized. The purpose of coaxial mounting is to simplify the structure and to save space. The number of inlet contact groups may be multiple, and the inlet moving contacts of the multiple inlet contact groups are coaxially mounted. For example, in the illustrated embodiment, two inlet contact groups are provided, and the inlet moving contacts of the two inlet contact groups are mounted coaxially. Thus, in the illustrated embodiment, the two inlet moving contacts and the one outlet moving contact are all coaxially mounted.

[0017] From the perspective of mechanical connection, the inlet and outlet moving contacts are coaxially mounted. From an electrical perspective, the conductive assembly electrically connects the inlet contact group and the outlet contact group. The conductive assembly includes a soft connection assembly and a hard connection assembly. The hard connection assembly includes a connecting member 111 and a conductive strip 112. FIG. 3 shows a structural diagram of a connecting member in an electrical path for a circuit breaker in accordance with an embodiment of the present invention. As shown in FIG. 3, the connecting member 111 is substantially L-shaped. A connecting hole 119 is provided at each end of the main portion of the connecting member 111. The position of the connecting hole 119 is set close to the position of the inlet moving contact or the outlet moving contact. Fixing holes 118 are disposed at unoccupied positions on the connecting member 111. In the illustrated embodiment, a fixing hole 118 is disposed between the two connecting holes 119 on the main portion. Since the conductive strip 112 needs to be fixed through the connecting holes 119, the size of the conductive strip 112 needs to be considered when providing the fixing holes 118 so that the situation where the conductive strip 112 obscures the fixing holes 118 is avoided. The main portion of the connecting member 111 is disposed along the direction between the inlet contact group and the outlet contact group, extending and substantially covering the distance between the inlet contact group and the outlet contact group. In the illustrated embodiment, in order to reinforce the strength of the connecting member 111 and the connection strength of the connecting member 111 to the base of the circuit breaker, an extended portion extends in a direction perpendicular to the main body portion, forming an L shape. A fixing hole 118 is also provided on the extended portion, and the fixing hole 118 can be operated more conveniently because there is no interference from the conductive strip. The connecting member is fixed to the base of the circuit breaker by fasteners, such as screws or bolts, through the mounting holes 118. Similarly, the conductive strip 112 is fixed to

the connecting member 111 by fasteners, such as bolts, passing through the connecting holes 119.

[0018] Referring to FIG. 2, FIG. 2 shows a schematic diagram of the connection of a conductive assembly in an electrical path for a circuit breaker in accordance with an embodiment of the present invention. In FIG. 2, the inlet moving contact of the inlet contact group is taken as an example for description. It should be understood that the connection manner of the outlet moving contact in the outlet contact group is similar. The soft connection in the conductive assembly includes an inlet side soft connection and an outlet side soft connection, and the conductive strip includes an inlet side conductive strip and an outlet side conductive strip. The inlet side soft connection and the outlet side soft connection are the same components, and the inlet side conductive strip and the outlet side conductive strip are the same components. Different names are used as they are applied to the inlet side and the outlet side. As shown in FIG. 2, the inlet side conductive strip 112 is fixed to the connecting member 111 by a fastener 113. The position of the inlet side conductive strip 112 is close to the inlet moving contact 122. The inlet side soft connection 115 is a set of wires. An end of the inlet side soft connection 115 is connected to the inlet side conductive strip 112, and another end of the inlet side soft connection 115 is connected to the inlet moving contact 122 of the inlet contact group. In one embodiment, both ends of the inlet side soft connection 115 are soldered to the conductive strip and the moving contact, respectively. Similarly, the outlet side conductive strip is fixed to the connecting member 111 by a fastener. The position of the outlet side conductive strip is close to the outlet moving contact. The outlet side soft connection is a set of wires. An end of the outlet side soft connection is connected to the outlet side conductive strip, and another end of the outlet side soft connection is connected to the outlet moving contact 132 of the outlet contact group. In one embodiment, both ends of the outlet side soft connection are soldered to the conductive strip and the moving contact, respectively. In FIG. 1b, the conductive assembly, the inlet moving contact and the outlet moving contact can be observed simultaneously after mounting is completed.

[0019] The conductive assembly provides an electrical path between the inlet contact group and the outlet contact group. The inlet side soft connection and the inlet side conductive strip are connected to the inlet contact group, and the outlet side soft connection and the outlet side conductive strip are connected to the outlet contact group. In one embodiment, the connecting member of the conductive assembly is itself made of a conductive material, such as a metal material, so that the inlet side conductive strip and the outlet side conductive strip are electrically connected by the connecting member. In other embodiments, other wiring paths, such as wires disposed along the connecting member, may also be disposed between the inlet side conductive strip and the outlet side conductive strip to effect conduction of the

circuit. The hard connection assembly of the conductive assembly is fixed to the base of the circuit breaker, so that the entire conductive path can be stably and firmly fixed to achieve a stable connection of the electrical path.

[0020] Referring to FIG. 1a, the electrical path between the inlet terminal 123 and the outlet terminal 133 is as follows: The inlet terminal is connected to the inlet static contact. The inlet static contact and the inlet moving contact contact to be closed. The inlet moving contact is connected to the outlet moving contact through the inlet side soft connection, the inlet side conductive strip, the connecting member, the outlet side conductive strip, and the outlet side soft connection. The outlet moving contact and the outlet static contact contact to be closed. The outlet terminal is connected to the outlet static contact to realize a complete conductive loop.

[0021] The electrical path according to one or more embodiments of the present invention, by combining a soft connection and a hard connection, utilizes the flexibility of the soft connection to make the mounting of the contact groups more flexible and convenient, and utilizes the hard connection to obtain a reliable and stable electrical path, thereby achieving a balance between assembly efficiency and assembly quality.

[0022] The above embodiments are provided to those skilled in the art to implement or use the present invention, and those skilled in the art can make various modifications or changes to the above embodiments without departing from the inventive concept of the present invention. The scope of protection of the present invention is therefore not limited by the above embodiments but should conform to the maximum scope of the innovative features mentioned in the claims.

Claims

1. An electrical path for a circuit breaker, comprising:
 - an inlet contact group connected to an inlet terminal;
 - an outlet contact group connected to an outlet terminal; and
 - a conductive assembly comprising a soft connection assembly and a hard connection assembly, wherein the hard connection assembly is fixed to a base of the circuit breaker; the soft connection assembly is connected to the inlet contact group and the outlet contact group; the soft connection assembly and the hard connection assembly are connected to provide an electrical path between the inlet contact group and the outlet contact group, wherein the inlet contact group and the outlet contact group are coaxially mounted.
2. The electrical path for a circuit breaker according to claim 1, wherein

the hard connection assembly comprises a connecting member and a conductive strip;
 the connecting member is fixed to the base of the circuit breaker and extends from a position near the inlet contact group to a position near the outlet contact group;
 the conductive strip is fixed to the connecting member and is adjacent to the inlet contact group and the outlet contact group.

plurality of inlet contact groups are coaxially mounted.

3. The electrical path for a circuit breaker according to claim 2, wherein the connecting member is provided with a fixing hole and a connecting hole, the connecting member is fixed by a fastener to the base of the circuit breaker through the fixing hole, and the conductive strip is fixed by a fastener to the connecting member through the connecting hole.
4. The electrical path for a circuit breaker according to claim 2, wherein
 the soft connection comprises an inlet side soft connection and an outlet side soft connection;
 the conductive strip comprises an inlet side conductive strip and an outlet side conductive strip;
 an end of the inlet side soft connection is connected to the inlet side conductive strip, and another end of the inlet side soft connection is connected to the inlet contact group;
 an end of the outlet side soft connection is connected to the outlet side conductive strip, and another end of the outlet side soft connection is connected to the outlet contact group.
5. The electrical path for a circuit breaker according to claim 4, wherein the inlet contact group comprises:
 an inlet static contact connected to the inlet terminal;
 an inlet moving contact, wherein the inlet side soft connection is connected to the inlet moving contact.
6. The electrical path for a circuit breaker according to claim 5, wherein the outlet contact group comprises:
 an outlet static contact connected to the outlet terminal;
 an outlet moving contact, wherein the outlet side soft connection is connected to the outlet moving contact.
7. The electrical path for a circuit breaker according to claim 6, wherein the inlet moving contact and the outlet moving contact are coaxially mounted.
8. The electrical path for a circuit breaker according to claim 7, wherein a plurality of inlet contact groups are provided, and the inlet moving contacts of the

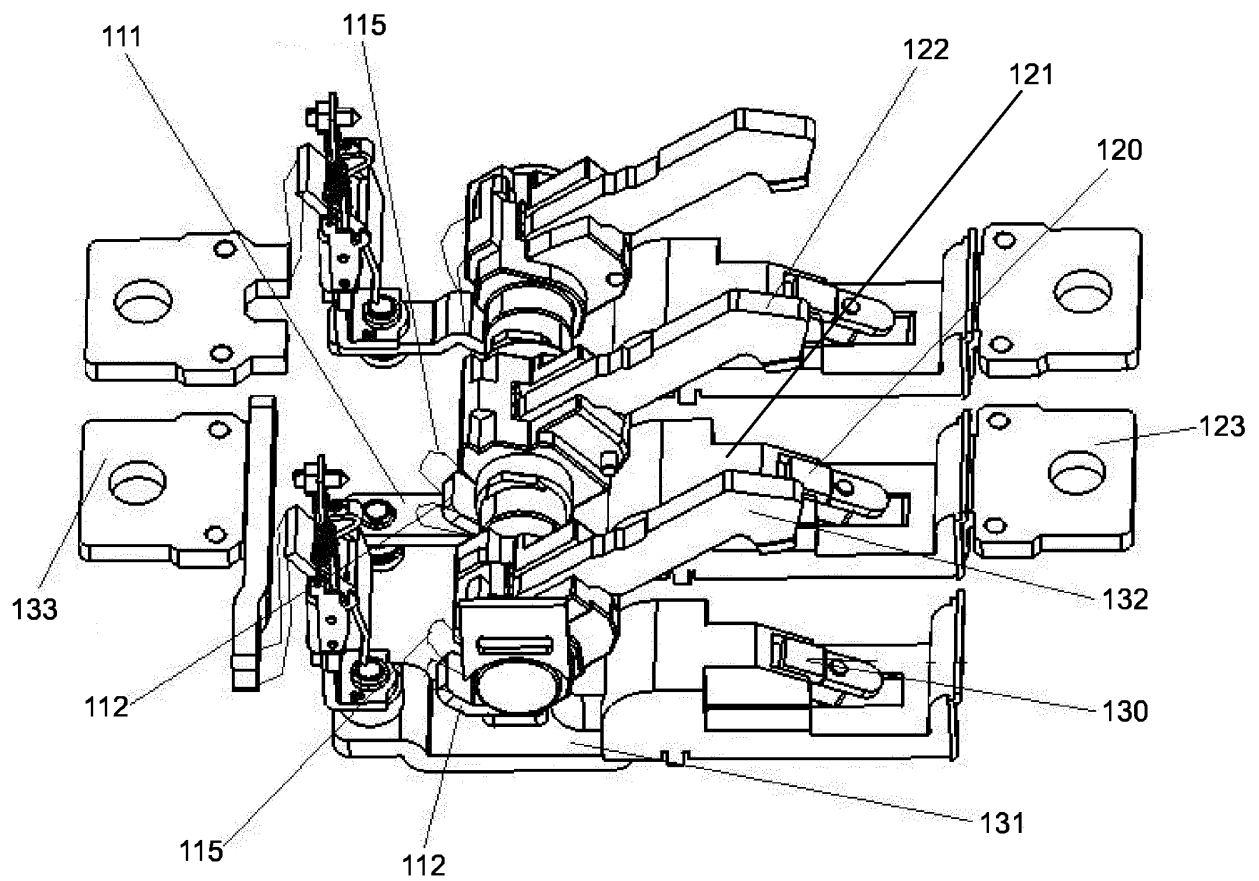


FIG 1a

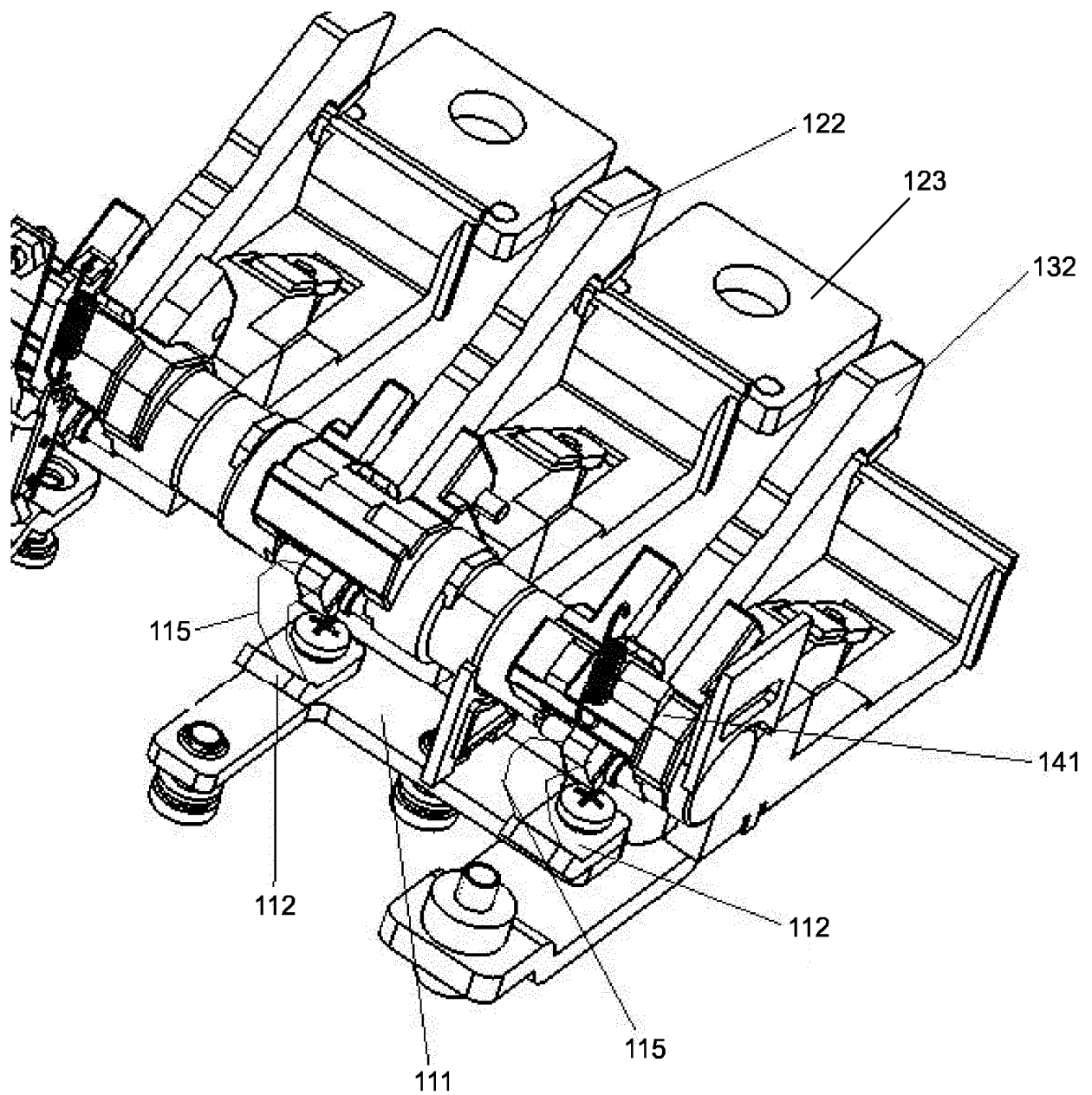


FIG 1b

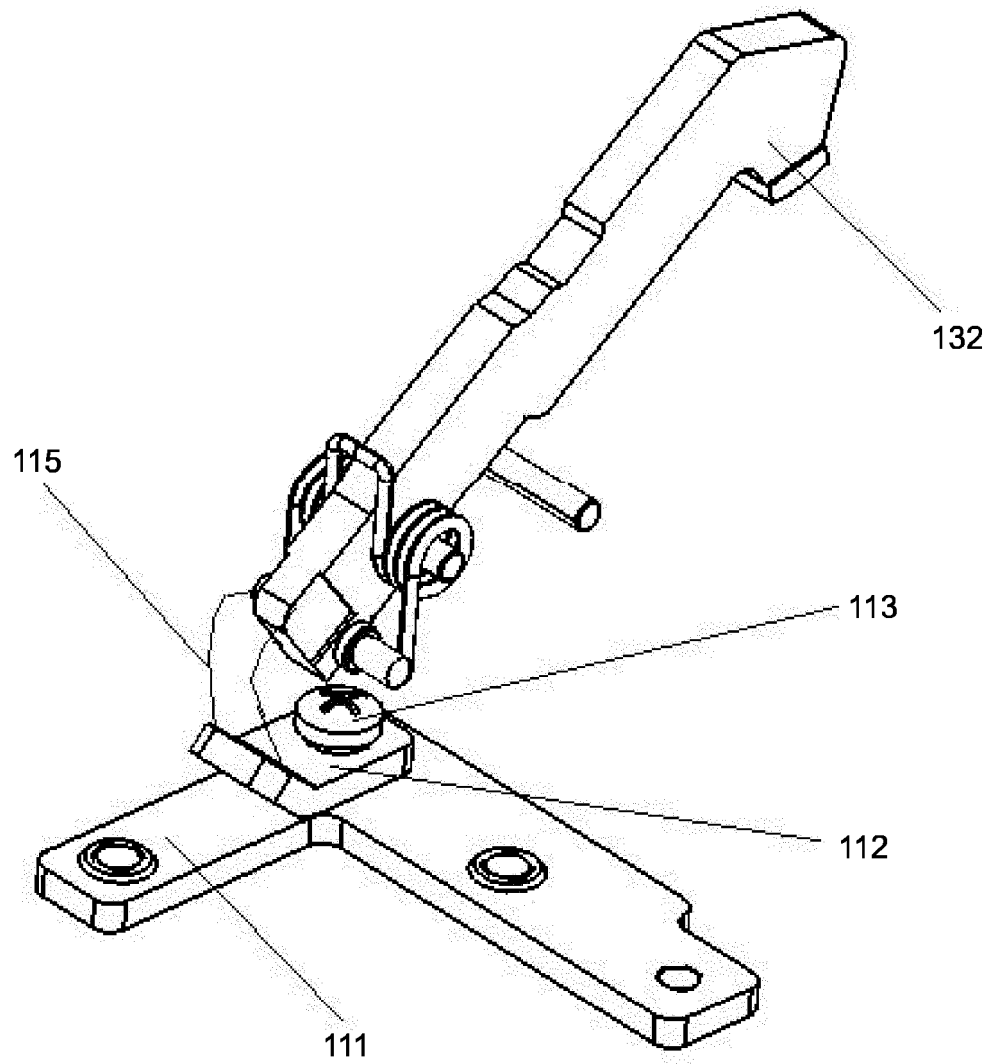


FIG 2

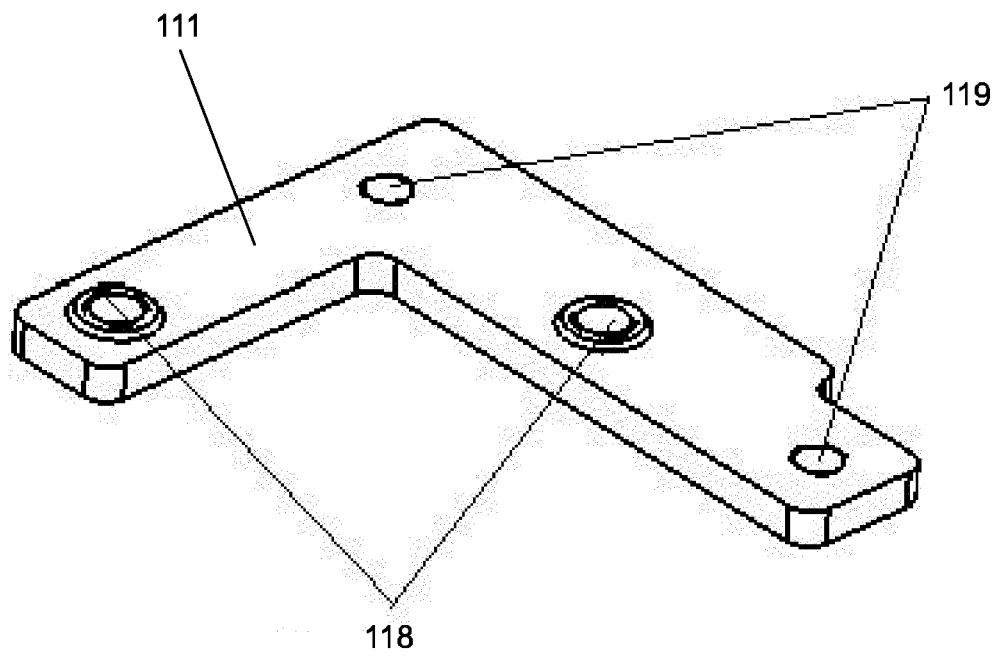


FIG 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/091415

A. CLASSIFICATION OF SUBJECT MATTER

H01H 71/08 (2006.01) i; H01H 73/04 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01H

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

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

WPI; EPODOC; CNPAT; CNKI: SHANGHAI NOARK ELECTRIC CO., LTD., zhejiang chint electric appliance co., ltd., seari electrical apparatus technology co., ltd., gu xiang, jiang guping, jiang zhili, hao wennan, outgoing line, breaker, contact, conductive loop, circuit, connect, soft, connector, moving contact, fixed contact, hard link, soft link

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 105931928 A (SEARI ELECTRICAL APPARATUS TECHNOLOGY CO., LTD. et al.) 07 September 2016 (07.09.2016) claims 1-8, description, paragraphs [0018]-[0024], and figures 1a-3	1-8
PX	CN 205863108 U (SEARI ELECTRICAL APPARATUS TECHNOLOGY CO., LTD. et al.) 04 January 2017 (04.01.2017) claims 1-8, description, paragraphs [0018]-[0024], and figures 1a-3	1-8
X	CN 102456515 A (BEIJING PEOPLE'S ELECTRIC PLANT CO., LTD.) 16 May 2012 (16.05.2012) description, paragraphs [0006] and [0021]-[0025], and figures 1 and 3-10	1
A	CN 105719918 A (CHANGSHU SWITCHGEAR MFG CO., LTD.) 29 June 2016 (29.06.2016) the whole document	1-8

☒ 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

07 September 2017

Date of mailing of the international search report

27 September 2017

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

KU, Deqiang

Telephone No. (86-10) 61648435

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

5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/091415

10

15

20

25

30

35

40

45

50

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 1416150 A (ZHEJIANG CHINT ELECTRIC APPLIANCE CO., LTD.) 07 May 2003 (07.05.2003) the whole document	1-8
A	CN 101819908 A (JIANGSU HUINENG ELECTRIC CO., LTD.) 01 September 2010 (01.09.2010) the whole document	1-8
A	EP 1126486 A1 (SERD SOC ETUD & REAL DISJONCTEURS SA) 22 August 2001 (22.08.2001) the whole document	1-8

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

55

5

10

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/091415

15

20

25

30

35

40

45

50

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 105931928 A	07 September 2016	None	
CN 205863108 U	04 January 2017	None	
CN 102456515 A	16 May 2012	CN 102456515 B	24 September 2014
CN 105719918 A	29 June 2016	None	
CN 1416150 A	07 May 2003	CN 1220234 C	21 September 2005
CN 101819908 A	01 September 2010	CN 101819908 B	29 August 2012
EP 1126486 A1	22 August 2001	PL 345841 A1	27 August 2001
		FR 2805078 A1	17 August 2001
		PL 198444 B1	30 June 2008
		FR 2805078 B1	17 September 2004

55