



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

(43) Date of publication:  
**08.07.2015 Bulletin 2015/28**

(51) Int Cl.:  
**H01H 3/40 (2006.01) H01H 9/24 (2006.01)**

(21) Application number: **13832595.6**

(86) International application number:  
**PCT/CN2013/082434**

(22) Date of filing: **28.08.2013**

(87) International publication number:  
**WO 2014/032581 (06.03.2014 Gazette 2014/10)**

(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**

(72) Inventors:  
• **QU, Degang**  
**Shanghai 200063 (CN)**  
• **ZHOU, Mi**  
**Shanghai 200063 (CN)**  
• **BA, Li**  
**Shanghai 200063 (CN)**  
• **SHEN, Di**  
**Shanghai 200063 (CN)**  
• **YOU, Anshun**  
**Shanghai 200063 (CN)**

(30) Priority: **30.08.2012 CN 201210315582**

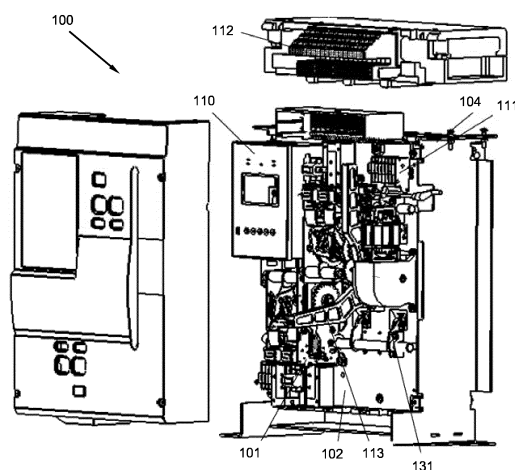
(71) Applicants:  
• **Seari Electric Technology Co., Ltd.**  
**Shanghai 200063 (CN)**  
• **Zhejiang Chint Electrics Co., Ltd.**  
**Yueqing, Zhejiang 325603 (CN)**

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

(54) **TRANSFER SWITCH APPLIANCE**

(57) The present invention discloses a transfer switch appliance, installed between a primary side power supply and a backup side power supply. The transfer switch appliance comprises a front base, a rear base, a contact system, and an operation system. The front base and the rear base combine to define a space. The contact system is installed within the space. The contact system closes or breaks a circuit. The contact system comprises a moving contact and a static contact. The moving contact comprises three work positions, namely a primary side position, an intermediate position, and a backup side position. The operation system is installed on the front base. The operation system is an energy storage mechanism implementing disconnecting/closing operations. The operation mechanism is connected to the moving contact via a connecting rod. The operation system comprises a primary side operation mechanism and a backup side operation mechanism connected by a gear group. The primary side operation mechanism and the backup side operation mechanism are installed respectively on the upper side and lower side of the front base. The primary side operation mechanism and the backup side operation mechanism are connected to a handle or an electric motor via a common shaft. The handle or the electric motor completes an energy storage operation with respect to both the primary side operation mechanism and

the backup side operation mechanism within one circle.



**FIG 1a**

## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

**[0001]** The present invention relates to low voltage electrical apparatus, more particularly, to a transfer switch appliance with automatic transfer ability.

#### 2. The Related Art

**[0002]** In most existing integrated automatic transfer switching appliances, electromagnets, linear electric motors or manual operations are commonly used to rotate a primary power supply side main shaft or a backup power supply side main shaft. The primary power supply side main shaft or the backup power supply side main shaft rotates to drive the contact system to transfer to a closed position. However, the operation force generated by the electromagnet is limited by the volume of the electromagnet, it is also very difficult to generate a large operation force through manual operation. Therefore, the capacity of the transfer switching appliance is limited. If large capacity integrated automatic transfer switching appliances still use electromagnets, linear electric motors or manual operations, the volume of the transfer switching appliance will be very large, and the reliability will be poor.

### SUMMARY

**[0003]** The present invention provides a large capacity transfer switch appliance having three work positions and automatic operation ability.

**[0004]** According to an embodiment of the present invention, a transfer switch appliance is provided. The transfer switch appliance is installed between a primary side power supply and a backup side power supply. The transfer switch appliance comprises a front base and a rear base, a contact system and an operation system. The front base and the rear base combines to define a space. The contact system is installed within the space, the contact system closes or disconnects a circuit. The contact system comprises a moving contact and a static contact, the moving contact has three work positions, namely a primary side position, an intermediate position and a backup side position. The operation system is installed on the front base, the operation system is an energy storage mechanism implementing disconnecting/closing operations. The operation system is connected to the moving contact via a connecting rod. The operation system comprises a primary side operation mechanism and a backup side operation mechanism connected by a gear group. The primary side operation mechanism and the backup side operation mechanism are installed respectively on an upper side and a lower side of the front base, the primary side operation mechanism and the backup side operation mechanism are connected

to a handle or an electric motor via a common shaft. The handle or the electric motor completes an energy storage operation with respect to both the primary side operation mechanism and the backup side operation mechanism within one circle.

**[0005]** According to one embodiment, an interlocking device is disposed between the primary side operation mechanism and the backup side operation mechanism. The interlocking device ensures that the backup side power supply is open while the primary side power supply is closed, and the primary side power supply is open while the backup side power supply is closed. The interlocking device comprises a first interlocking member and a second interlocking member which are disposed symmetrically. The first interlocking member comprises a first bracket, a first lever, a first shaft and a first connector. The first bracket is welded to a main shaft of the primary side operation mechanism. The first bracket is connected to one end of the first lever via the first shaft, and the other end of the first lever is connected to the first connector. The first connector is installed on a side plate of the backup side operation mechanism. The second interlocking member comprises a second bracket, a second lever, a second shaft and a second connector. The second bracket is welded to a main shaft of the backup side operation mechanism. The second bracket is connected to one end of the second lever via the second shaft, and the other end of the second lever is connected to the second connector. The second connector is installed on a side plate of the primary side operation mechanism. When the primary side operation mechanism is closed, the main shaft of the primary side operation mechanism rotates to a closed position, the first bracket also rotates and drives the first connector to rotate via the first lever, the first connector presses a disconnecting shaft of the backup side operation mechanism so that the backup side operation mechanism is open. When the backup side operation mechanism is closed, the main shaft of the backup side operation mechanism rotates to a closed position, the second bracket also rotates and drives the second connector to rotate via the second lever, the second connector presses a disconnecting shaft of the primary side operation mechanism so that the primary side operation mechanism is open.

**[0006]** According to one embodiment, the transfer switch appliance further comprises a controller to achieve automatic operation. The controller collects voltage signals of the primary side power supply and the backup side power supply and switches between the primary side power supply and the backup side power supply based on the collected voltage signals.

**[0007]** According to one embodiment, the contact system has an arc extinguishing chamber installed on the outside of a contact point of the moving contact and the static contact. The arc extinguishing chamber comprises an arc striking sheet, a plurality of arc chutes and a plurality of hole containing press plates. The plurality of arc chutes are disposed in vertical arrangement and cross

to each other. The arc striking sheet is installed on the bottom of the arc chutes. The plurality of hole containing press plates are disposed above the arc chutes, the plurality of hole containing press plates are disposed in stacked arrangement and the positions of the holes on the different hole containing press plates interleave.

**[0008]** According to one embodiment, the contact system has a busbar, the busbar is connected to a common end of the primary side power supply and the backup side power supply. The busbar is connected to a plurality of parallel connected contact plates via soft connections. The moving contact is installed on the contact plates, the moving contact has a prominent contact point, the static contact is convex.

**[0009]** According to one embodiment, the handle or the electric motor performs the energy storage operation with respect to the primary side operation mechanism via a primary side cam, and performs the energy storage operation with respect to the backup side operation mechanism via a backup side cam. The primary side operation mechanism and the backup side operation mechanism are crosswise assembled on the front base. The front base and the rear base are insulation bases.

**[0010]** According to one embodiment, the transfer switch appliance further comprises an auxiliary contact, terminal rows, a closing electromagnet, a shunt release and contactors. The auxiliary contact and the terminal rows are connected to corresponding functional components respectively, including the closing electromagnet, the shunt release, the contactors, the electric motors and the controller. The terminal rows are also connected to external components so that remote controls and communications may be achieved.

**[0011]** The transfer switch appliance of the present invention uses an energy storage type operation system, so that the transfer switch appliance may have the characteristics such as small volume, large capacity, full functions and high reliability.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0012]** 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,

FIG. 1a and FIG. 1b disclose the structure of a transfer switch appliance according to an embodiment of the present invention.

FIG. 2 discloses the internal structure of a transfer switch appliance according to an embodiment of the present invention.

FIG. 3 discloses the structure of an operation system according to an embodiment of the present invention.

FIG. 4 discloses the structure of a gear group within the operation system of the transfer switch appliance according to an embodiment of the present invention.

FIG. 5 discloses the structure of an interlocking device within the operation system of the transfer switch appliance according to an embodiment of the present invention.

FIG. 6 discloses the structure of a contact system of the transfer switch appliance according to an embodiment of the present invention.

FIG. 7 discloses the structure of an arc extinguishing chamber of the transfer switch appliance according to an embodiment of the present invention.

FIG. 8 discloses the structure of a controller of the transfer switch appliance according to an embodiment of the present invention.

FIG. 9a, FIG. 9b and FIG. 9c disclose the structure of an auxiliary contact, terminal rows and a closing electromagnet of the transfer switch appliance according to an embodiment of the present invention.

#### DETAILED DESCRIPTION OF EMBODIMENTS

**[0013]** Referring to Figs 1-9, Figs 1-9 disclose the structure of a transfer switch appliance according to an embodiment of the present invention, including diagrams of the overall structure and diagrams of different components.

**[0014]** As shown in the drawings, the transfer switch appliance 100 is installed between a primary side power supply and a backup side power supply. The transfer switch appliance 100 comprises a front base 102 and a rear base 103, a contact system and an operation system 101.

**[0015]** The front base 102 and the rear base 103 combines together to define a space. In one embodiment, the front base 102 and the rear base 103 are insulation bases. The combined front base 102 and the rear base 103 are divided into four phases. The contact system is installed within the space combined by the front base 102 and the rear base 103. The contact system closes or disconnects a circuit. The contact system comprises moving contacts 105 and static contacts 106. A pair of a moving contact 105 and a static contact 106 is included in each phase, and an arc extinguishing chamber 104 is also included in each phase. A primary side busbar 107, a common side busbar 108 and a backup side busbar 109 are disposed on the combined base. These busbars are respectively connected to corresponding power supply inlet and outlet terminals. The moving contact 105 has three work positions, namely a primary side position, an intermediate position and a backup side position. The

operation system 101 is installed on the front base. The operation system 101 is an energy storage mechanism implementing disconnecting/closing operations. Operation mechanisms are connected to the moving contact 105 via a connecting rod 131. The operation system 101 comprises a primary side operation mechanism and a backup side operation mechanism connected by a gear group 113. The primary side operation mechanism and the backup side operation mechanism are installed respectively on an upper side and a lower side of the front base. In one embodiment, the primary side operation mechanism and the backup side operation mechanism are crosswise assembled on the front base. The primary side operation mechanism and the backup side operation mechanism are connected to a handle or an electric motor 124 via a common shaft 114. The handle or the electric motor 124 completes an energy storage operation with respect to both the primary side operation mechanism and the backup side operation mechanism within one circle, which means a rotation of 360°. In one embodiment, the handle or the electric motor 124 performs the energy storage operation with respect to the primary side operation mechanism via a primary side cam 115, and performs the energy storage operation with respect to the backup side operation mechanism via a backup side cam 116.

**[0016]** The primary side operation mechanism and the backup side operation mechanism are disposed in an upper-lower crosswise arrangement, so that the longitudinal dimension of the product may be reduced. As the handle or the electric motor completes an energy storage operation with respect to both the primary side operation mechanism and the backup side operation mechanism within a 360° rotation, the lateral dimension of the product may be reduced.

**[0017]** To ensure the operation safety of the primary side operation mechanism and the backup side operation mechanism, and to prevent the primary side operation mechanism and the backup side operation mechanism from closing simultaneously, an interlocking device is disposed between the primary side operation mechanism and the backup side operation mechanism. The interlocking device ensures that the backup side power supply is open while the primary side power supply is closed, or the primary side power supply is open while the backup side power supply is closed. As shown in the drawings, the interlocking device comprises a first interlocking member and a second interlocking member which are disposed symmetrically. The first interlocking member comprises a first bracket 125, a first lever 130, a first shaft 128 and a first connector 129. The first bracket 125 is welded to a main shaft 126 of the primary side operation mechanism. The first bracket 125 is connected to one end of the first lever 130 via the first shaft 128, and the other end of the first lever 130 is connected to the first connector 129. The first connector 129 is installed on a side plate of the backup side operation mechanism. When the primary side operation mechanism is closed,

the main shaft 126 of the primary side operation mechanism rotates to a closed position, the first bracket 125 also rotates and drives the first connector 129 to rotate via the first lever 130, the first connector 129 presses a disconnecting shaft of the backup side operation mechanism so that the backup side operation mechanism is open. The second interlocking member comprises a second bracket 225, a second lever 230, a second shaft 228 and a second connector 229. The second bracket 225 is welded to a main shaft 226 of the backup side operation mechanism. The second bracket 225 is connected to one end of the second lever 230 via the second shaft 228, and the other end of the second lever 230 is connected to the second connector 229. The second connector 229 is installed on a side plate of the primary side operation mechanism. When the backup side operation mechanism is closed, the main shaft 226 of the backup side operation mechanism rotates to a closed position, the second bracket 225 also rotates and drives the second connector 229 to rotate via the second lever 230, the second connector 229 presses a disconnecting shaft of the primary side operation mechanism so that the primary side operation mechanism is open.

**[0018]** To achieve automatic transfer between the primary side power supply and the backup side power supply, in one embodiment, the transfer switch appliance 100 further comprises a controller 110. The controller 110 collects voltage signals of the primary side power supply and the backup side power supply, and further switches between the primary side power supply and the backup side power supply based on the collected voltage signals. In one embodiment, the controller 110 is composed of electronic circuits. The controller 110 makes a real time logical determination based on the signals collected from the primary power supply side and the backup power supply side respectively. If a fault is detected on the primary side power supply, a signal is automatically sent to disconnect the primary side power supply and close the backup side power supply. Similarly, if a fault is detected on the backup side power supply, a signal is automatically sent to disconnect the backup side power supply and close the primary side power supply. The controller 110 is able to achieve automatic transfer between the power supplies.

**[0019]** Without using the controller 110, the transfer switch appliance 100 may also accomplish the transfer of the power supply via manual operations. When a fault on the primary side power supply is detected, the primary side contact point of the contact system will disconnect the connection with the primary side power supply if a disconnecting button of the primary side operation mechanism is pressed. By closing the backup side operation mechanism, the contact point of the contact system will close the connection with the backup side power supply and achieve the transfer of the power supply. When a fault on the backup side power supply is detected, similar operations will be performed.

**[0020]** The initial position of the transfer switch appli-

ance of the present invention is an intermediate position (the Zero position). The transfer switch appliance 100 is installed into a circuit with two power supply systems, namely a primary side power supply and a backup side power supply. Under normal conditions, the primary side power supply supplies power. A handle is manually operated to rotate one circle, or an electric motor is remotely controlled to rotate one circle so as to perform an energy storage operation with respect to both the primary side cam 115 and the backup side cam 116. By manually pressing a closing button of the primary side operation mechanism, or pressing the primary side operation mechanism via remote control of a closing electromagnet, the primary side contact point of the operation system is closed and the connection with the primary side power supply is closed, then power is supplied.

**[0021]** Continue with the embodiments shown in the drawings, the contact system has an arc extinguishing chamber 104 installed on the outside of a contact point of the moving contact 105 and the static contact 106. The arc extinguishing chamber 104 comprises an arc striking sheet 118, a plurality of arc chutes 119 and a plurality of hole containing press plates 120. The plurality of arc chutes 119 are disposed in vertical arrangement and cross with each other. Such an arrangement of the arc chutes is good for striking the arc. The arc chutes 119 are disposed in the middle of the arc extinguishing chamber 104. The arc striking sheet 118 is installed on the bottom of the arc chutes 119. The plurality of hole containing press plates 120 are disposed above the arc chutes 119, that is, above the arc extinguishing chamber 104. The plurality of hole containing press plates 120 are disposed in stacked arrangement and the positions of the holes on the different hole containing press plates interleave with each other. Such an arrangement is good for elimination of free gas and may avoid arcing. Arc may be generated during closing/disconnecting procedures of the switch. The arc is introduced into the arc extinguishing chamber by the arc striking sheet and is extinguished by the crosswise arc chutes. Multiple layers of hole containing press plates are installed on the top of the arc extinguishing chamber. The hole containing press plates eliminate free gas generated by the arc so as to avoid arcing.

**[0022]** Continue with the drawings, the contact system has a busbar connected with a common end of the primary side power supply and the backup side power supply. The busbar may be a common side busbar 108. The busbar may further comprise a primary side busbar 107 and a backup side busbar 109. The busbar is connected to a plurality of parallel connected contact plates 117 via soft connections. The moving contact 105 is installed on the contact plates 117. The contact plates 117 and the moving contact 105 perform closing or disconnecting operations so as to close or disconnect the connection with the corresponding power supply sides. The moving contact 105 may have three prominent contact points, which are thicker than other contact points so that a larger con-

tact press force is obtained. The static contact matching the moving contact is convex so as to facilitate arc introduction. The contact system with a plurality of parallel connected contact plates may operate a large capacity switch with a relatively small operation force, so that a large capacity and small volume design may be realized.

**[0023]** The transfer switch appliance also has remote control and communication functions, which are implemented by the following components: an auxiliary contact 111 and terminal rows 112. The auxiliary contact 111 and the terminal rows 112 are respectively connected to corresponding functional components including a closing electromagnet 121, a shunt release 122, contactors 123, an electric motor 124 and the controller 110. The terminal rows 112 are also connected to external components so that the remote control and communication functions may be implemented.

**[0024]** The transfer switch appliance of the present invention uses an energy storage type operation system, so that the transfer switch appliance may have the characteristics such as small volume, large capacity, full functions and high reliability.

**[0025]** 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 transfer switch appliance installed between a primary side power supply and a backup side power supply, comprising:

a front base and a rear base, the front base and the rear base combining to define a space;  
a contact system installed within the space, the contact system closing or disconnecting a circuit, the contact system comprising a moving contact and a static contact, the moving contact having three work positions, namely a primary side position, an intermediate position and a backup side position;  
an operation system installed on the front base, the operation system being an energy storage mechanism implementing disconnecting/closing operations, wherein the operation system is connected to the moving contact via a connecting rod, wherein the operation system comprises a primary side operation mechanism and a backup side operation mechanism connected by a gear group, the primary side operation

- mechanism and the backup side operation mechanism are installed respectively on an upper side and a lower side of the front base, the primary side operation mechanism and the backup side operation mechanism are connected to a handle or an electric motor via a common shaft;
- wherein the handle or the electric motor completes an energy storage operation with respect to both the primary side operation mechanism and the backup side operation mechanism within one circle.
2. The transfer switch appliance according to claim 1, wherein an interlocking device is disposed between the primary side operation mechanism and the backup side operation mechanism, the interlocking device ensuring that the backup side power supply is open while the primary side power supply is closed, and the primary side power supply is open while the backup side power supply is closed.
  3. The transfer switch appliance according to claim 2, wherein the interlocking device comprises a first interlocking member and a second interlocking member which are disposed symmetrically, the first interlocking member comprises a first bracket, a first lever, a first shaft and a first connector, the first bracket being welded to a main shaft of the primary side operation mechanism, the first bracket being connected to one end of the first lever via the first shaft, the other end of the first lever being connected to the first connector, the first connector being installed on a side plate of the backup side operation mechanism;

the second interlocking member comprises a second bracket, a second lever, a second shaft and a second connector, the second bracket being welded to a main shaft of the backup side operation mechanism, the second bracket being connected with one end of the second lever via the second shaft, the other end of the second lever being connected to the second connector, the second connector being installed on a side plate of the primary side operation mechanism.

  4. The transfer switch appliance according to claim 3, wherein, when the primary side operation mechanism is closed, the main shaft of the primary side operation mechanism rotates to a closed position, the first bracket also rotates and drives the first connector to rotate via the first lever, the first connector presses a disconnecting shaft of the backup side operation mechanism so that the backup side operation mechanism is open;

when the backup side operation mechanism is closed, the main shaft of the backup side operation mechanism rotates to a closed position, the second bracket also rotates and drives the second connector to rotate via the second lever, the second connector presses a disconnecting shaft of the primary side operation mechanism so that the primary side operation mechanism is open.

  5. The transfer switch appliance according to claim 1, further comprising:
    - a controller for collecting voltage signals of the primary side power supply and the backup side power supply and switching between the primary side power supply and the backup side power supply based on the collected voltage signals.
  6. The transfer switch appliance according to claim 1, wherein the contact system has an arc extinguishing chamber installed on the outside of a contact point of the moving contact and the static contact, the arc extinguishing chamber comprising an arc striking sheet, a plurality of arc chutes and a plurality of hole containing press plates, the plurality of arc chutes being disposed in vertical arrangement and cross to each other, the arc striking sheet being installed on the bottom of the arc chutes, the plurality of hole containing press plates being disposed above the arc chutes, the plurality of hole containing press plates being disposed in stacked arrangement and the positions of the holes on the different hole containing press plates interleave.
  7. The transfer switch appliance according to claim 1, wherein the contact system has a busbar, the busbar being connected with a common end of the primary side power supply and the backup side power supply, the busbar being connected to a plurality of parallel connected contact plates via soft connections, the moving contact being installed on the contact plates, the moving contact having a prominent contact point, the static contact being convex.
  8. The transfer switch appliance according to claim 1, wherein the handle or the electric motor performs the energy storage operation with respect to the primary side operation mechanism via a primary side cam, and performs the energy storage operation with respect to the backup side operation mechanism via a backup side cam, the primary side operation mechanism and the backup side operation mechanism being crosswise assembled on the front base.
  9. The transfer switch appliance according to claim 1, wherein the front base and the rear base are insulation bases.

10. The transfer switch appliance according to claim 1, further comprising an auxiliary contact, terminal rows, a closing electromagnet, a shunt release and contactors.

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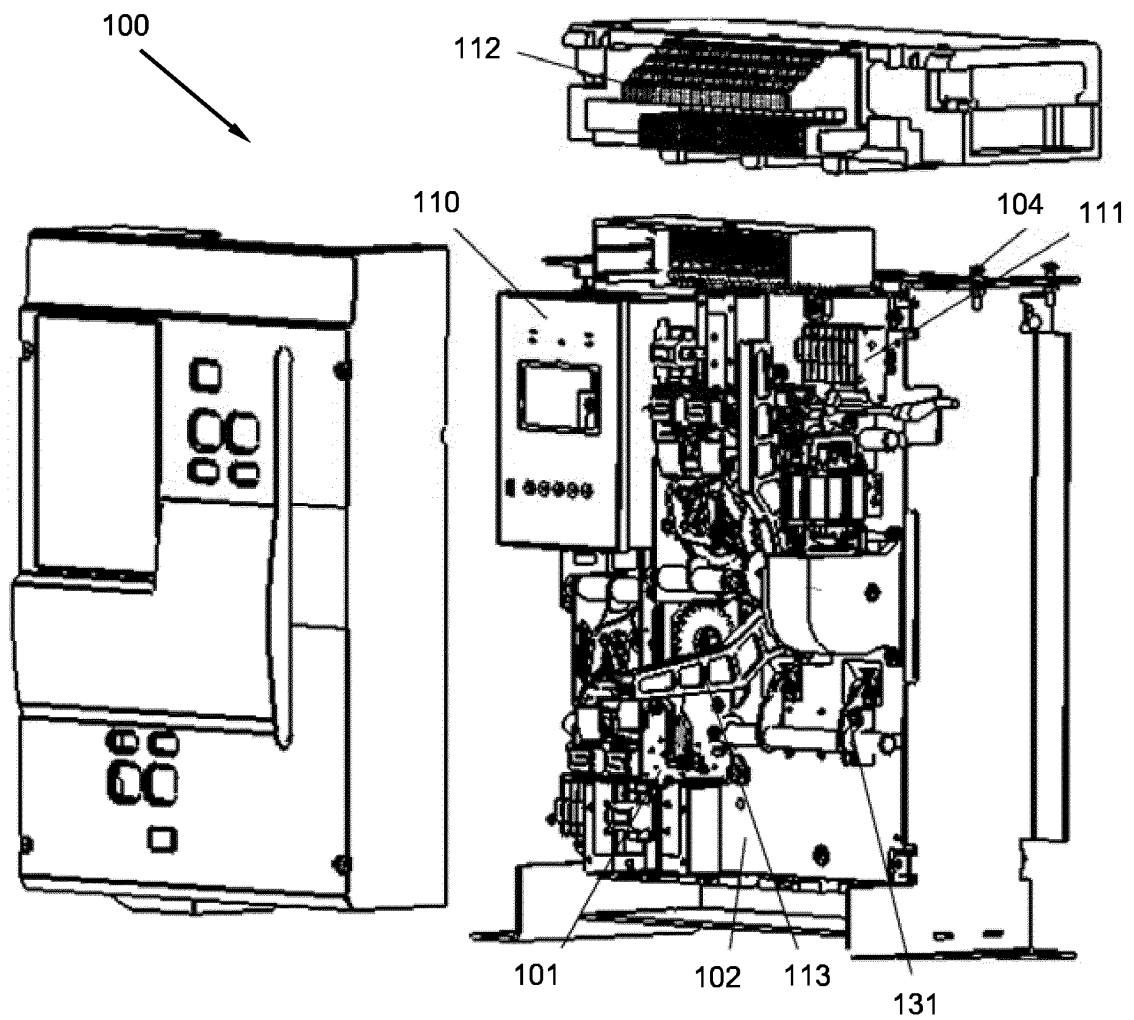
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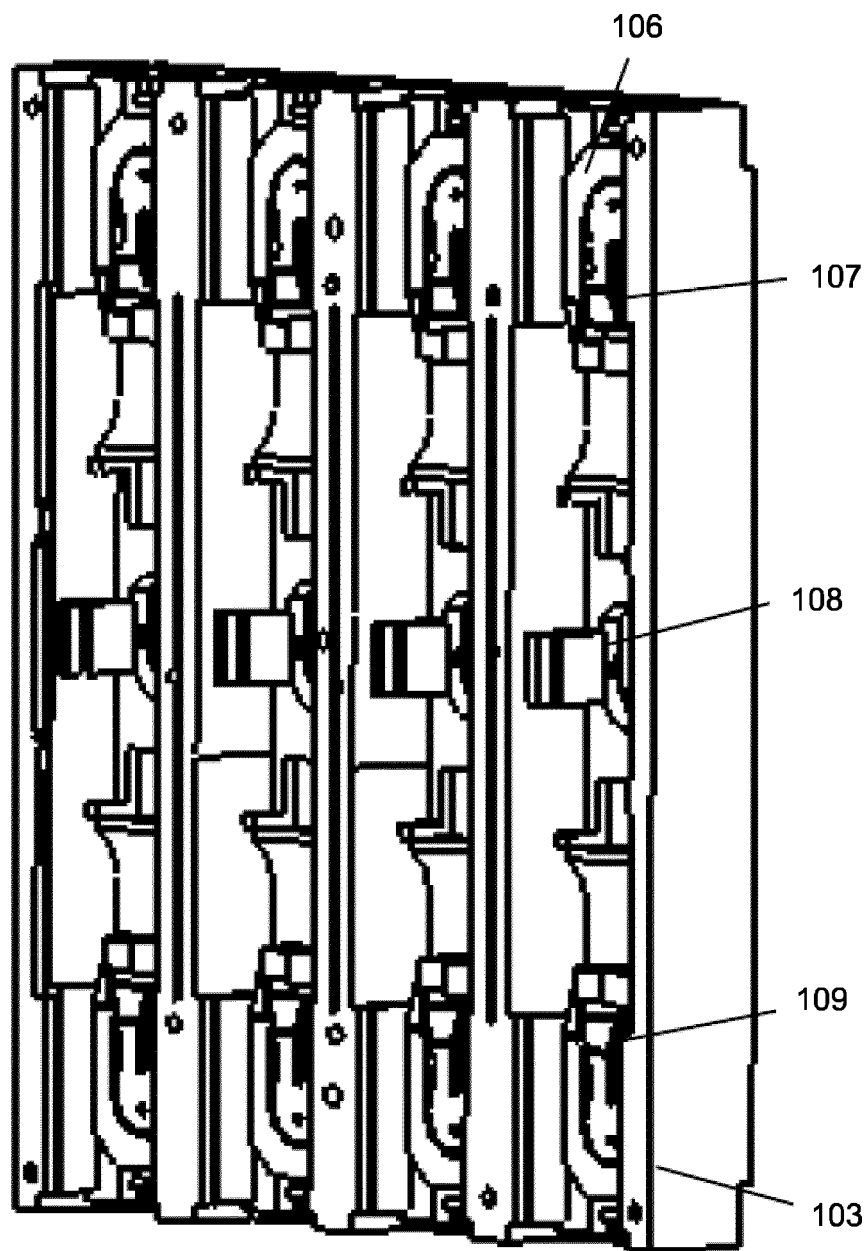
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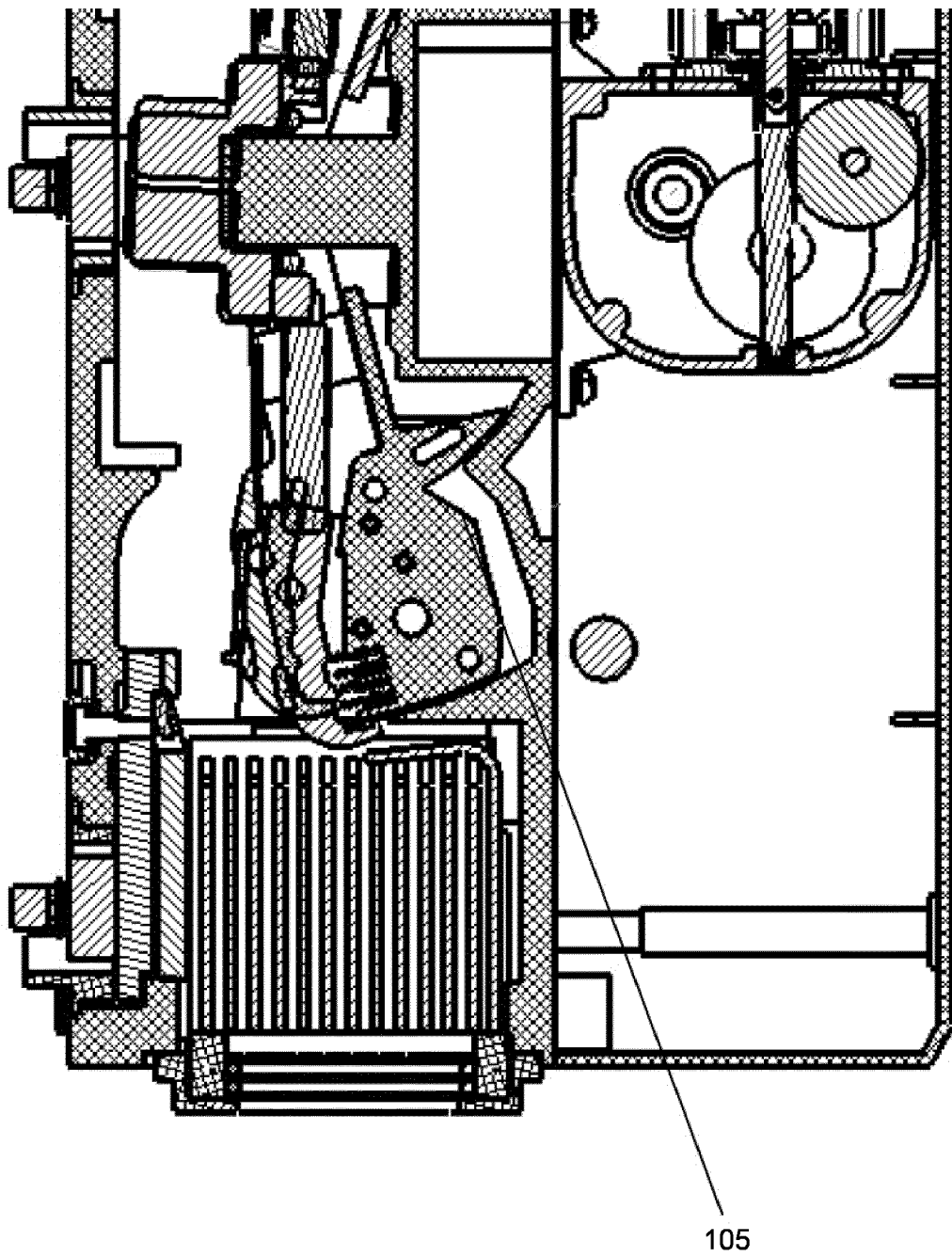
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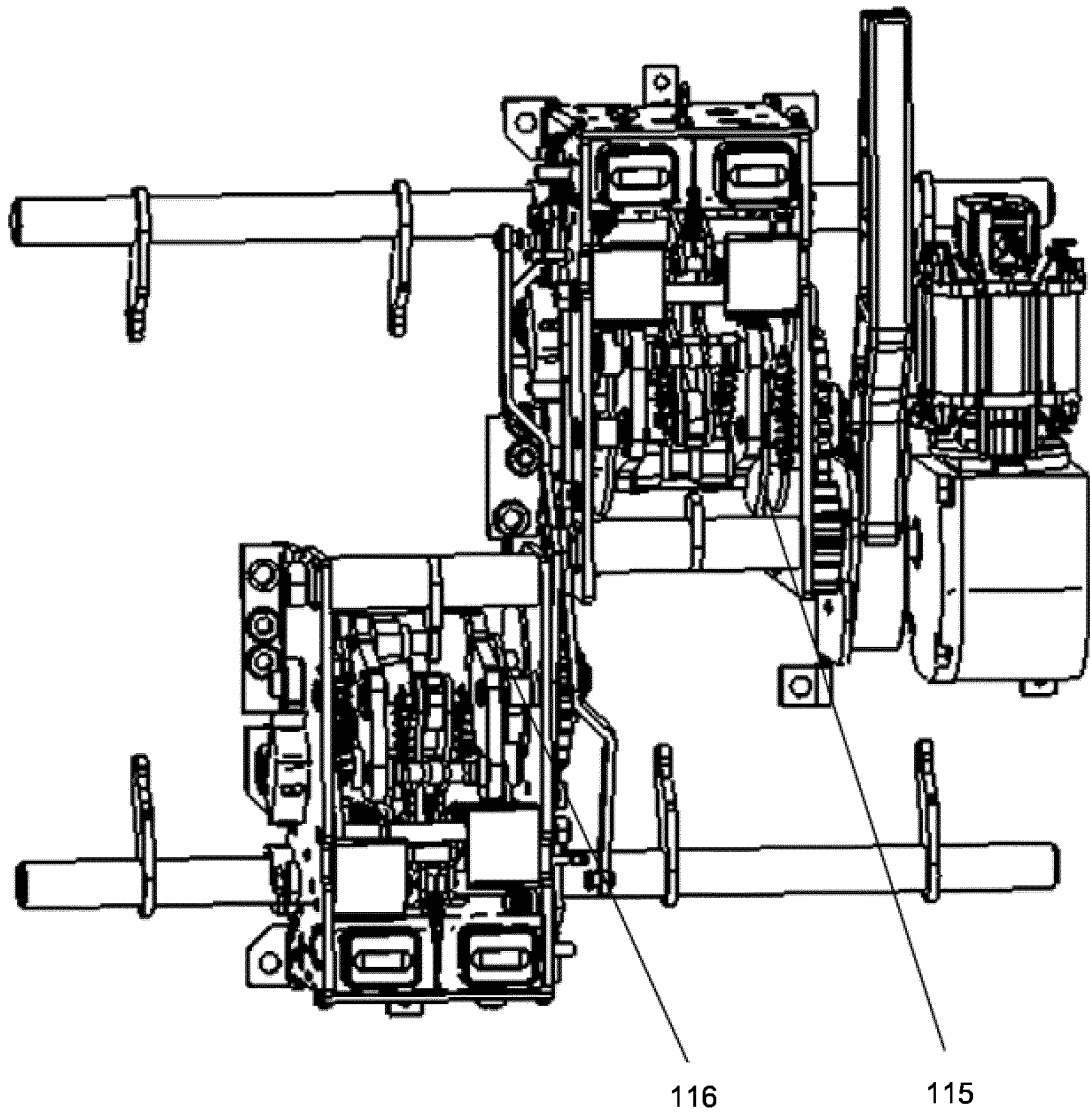
**FIG 1a**



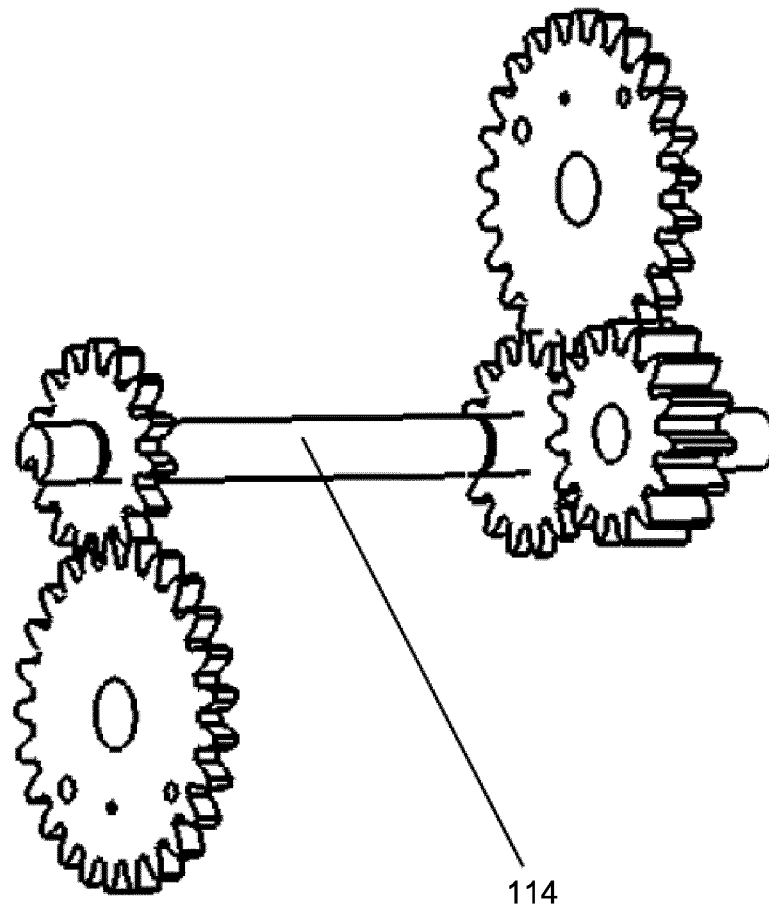
**FIG 1b**



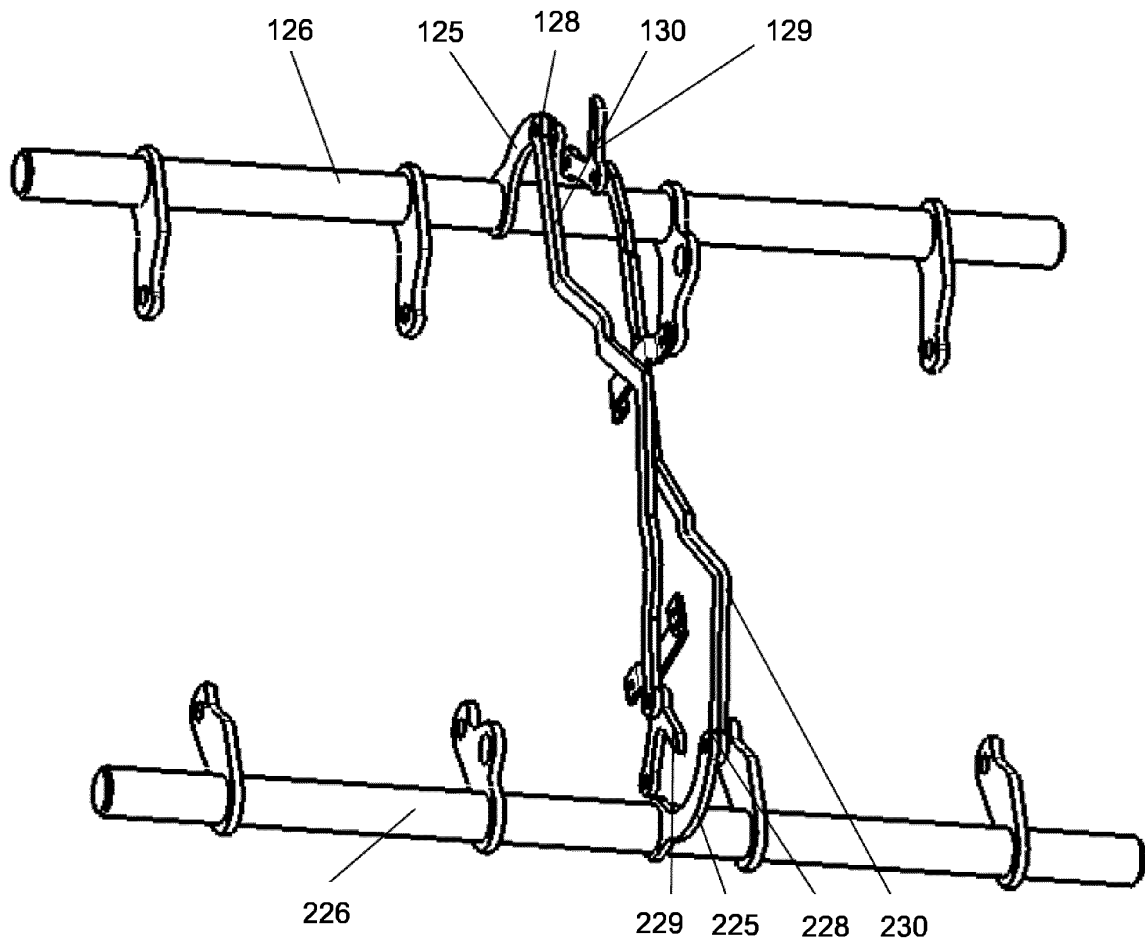
**FIG 2**



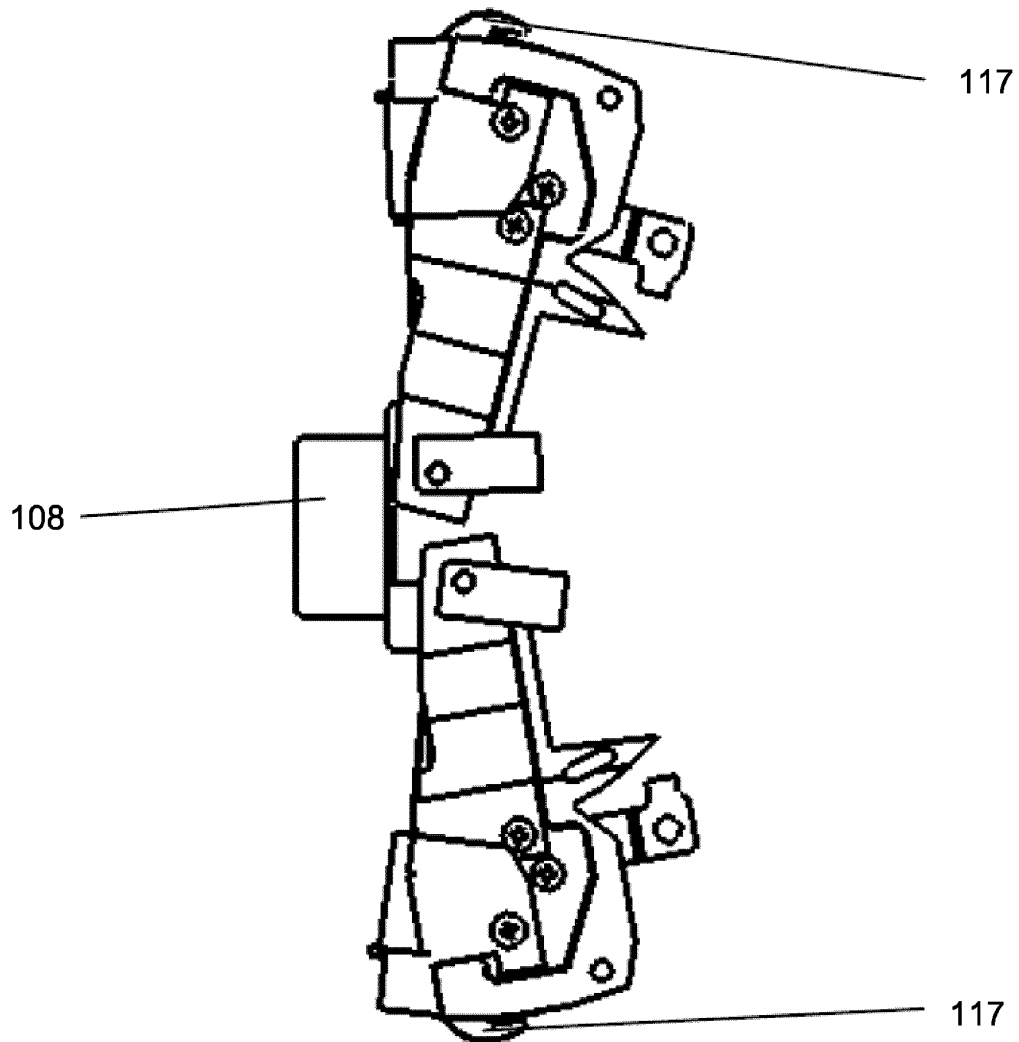
**FIG 3**



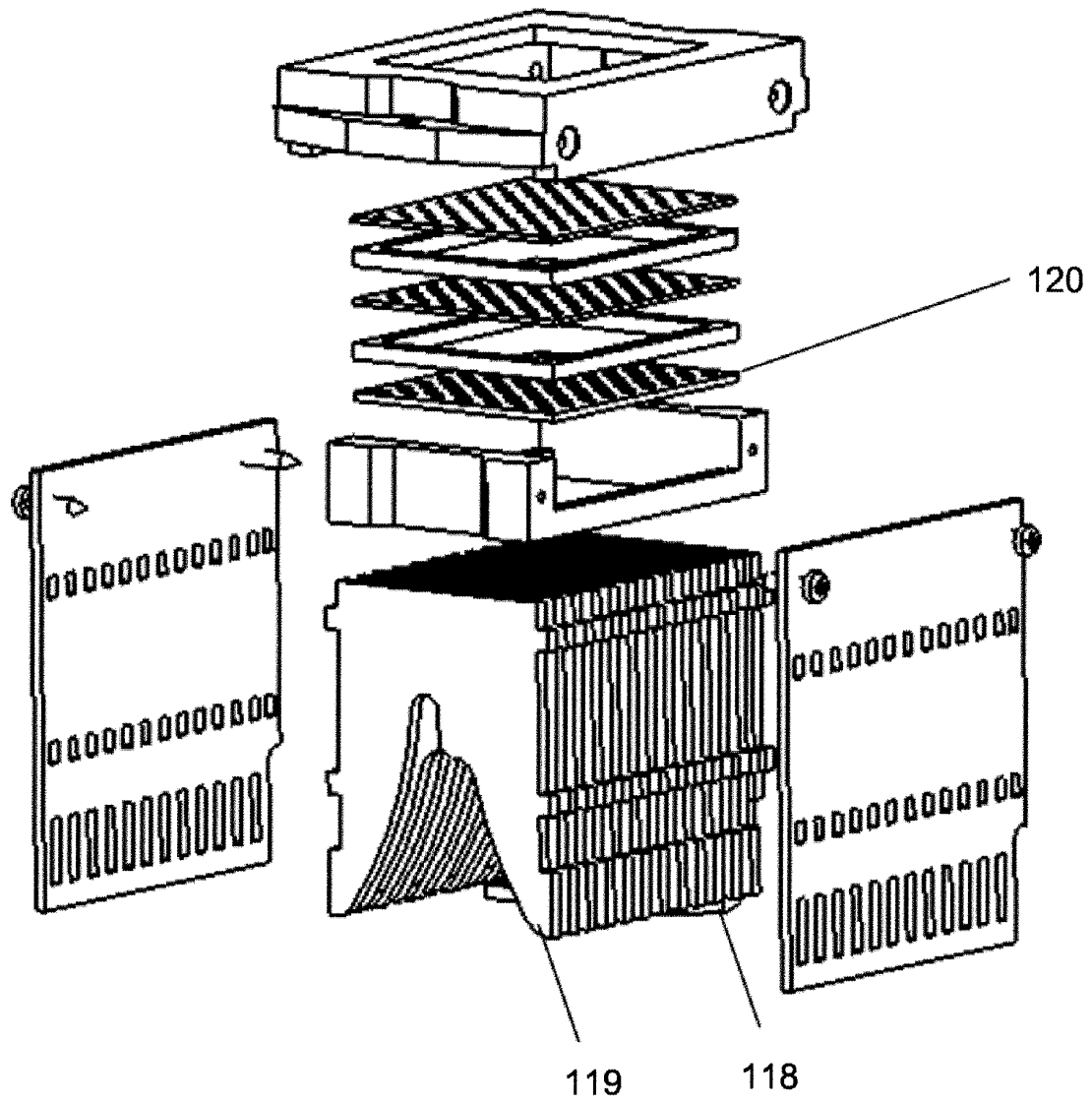
**FIG 4**



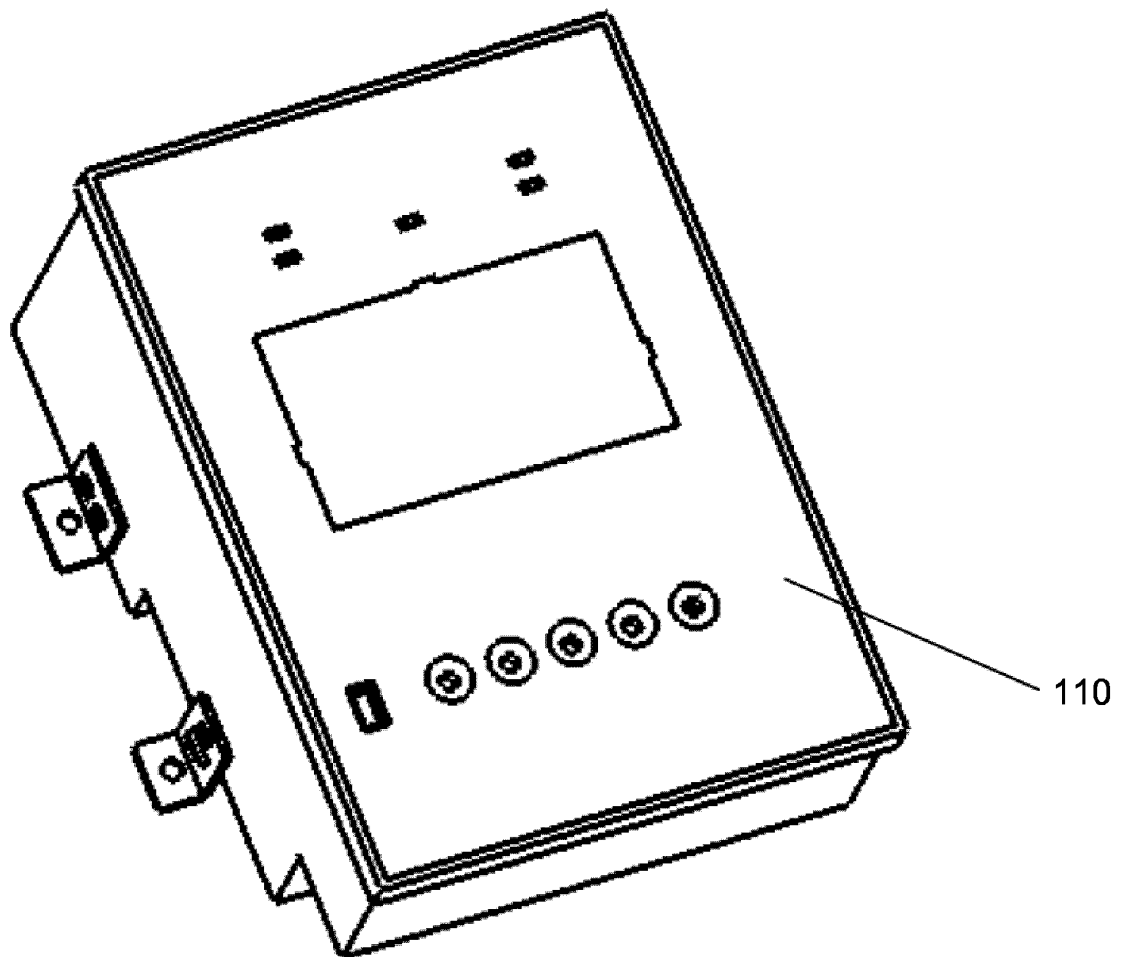
**FIG 5**



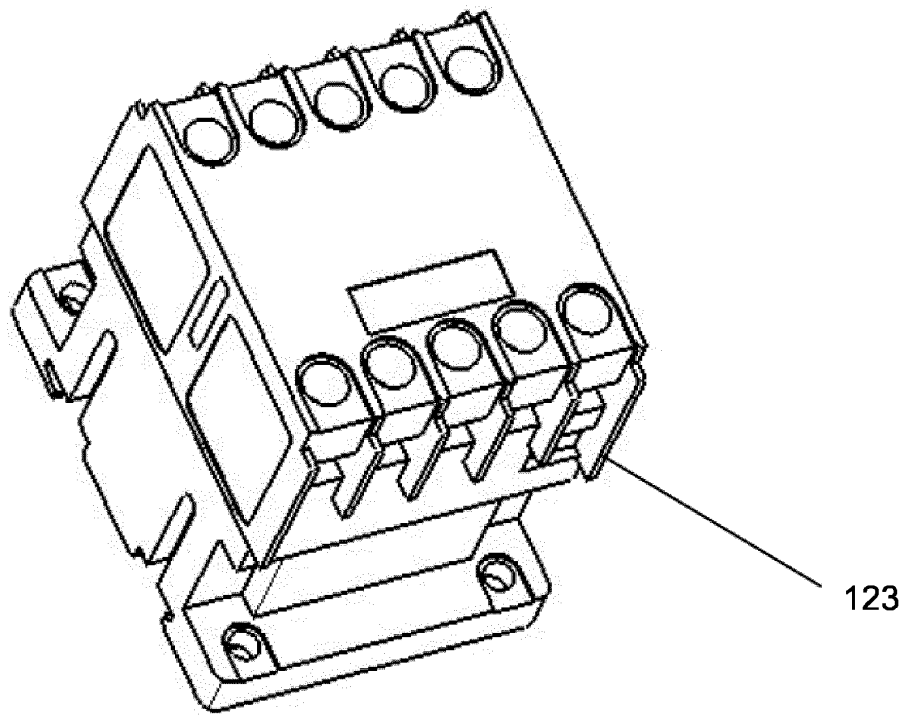
**FIG 6**



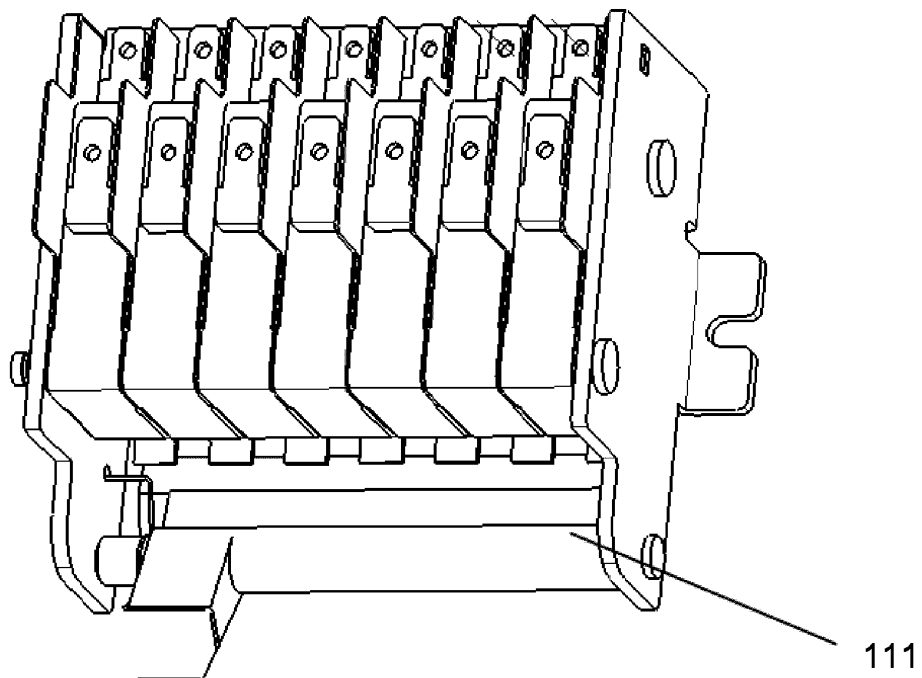
**FIG 7**



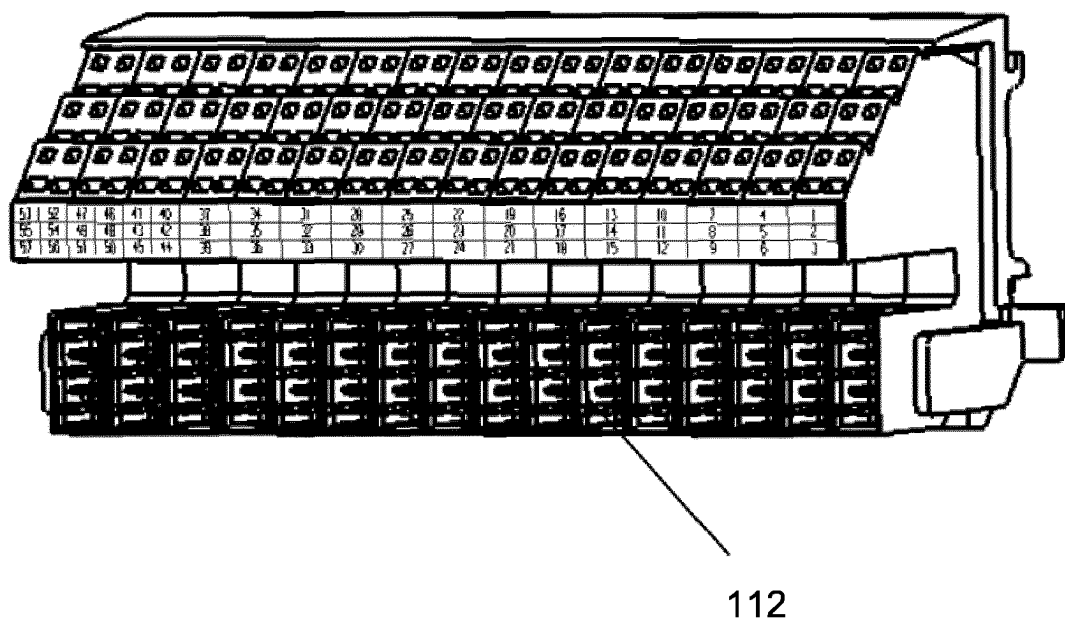
**FIG 8**



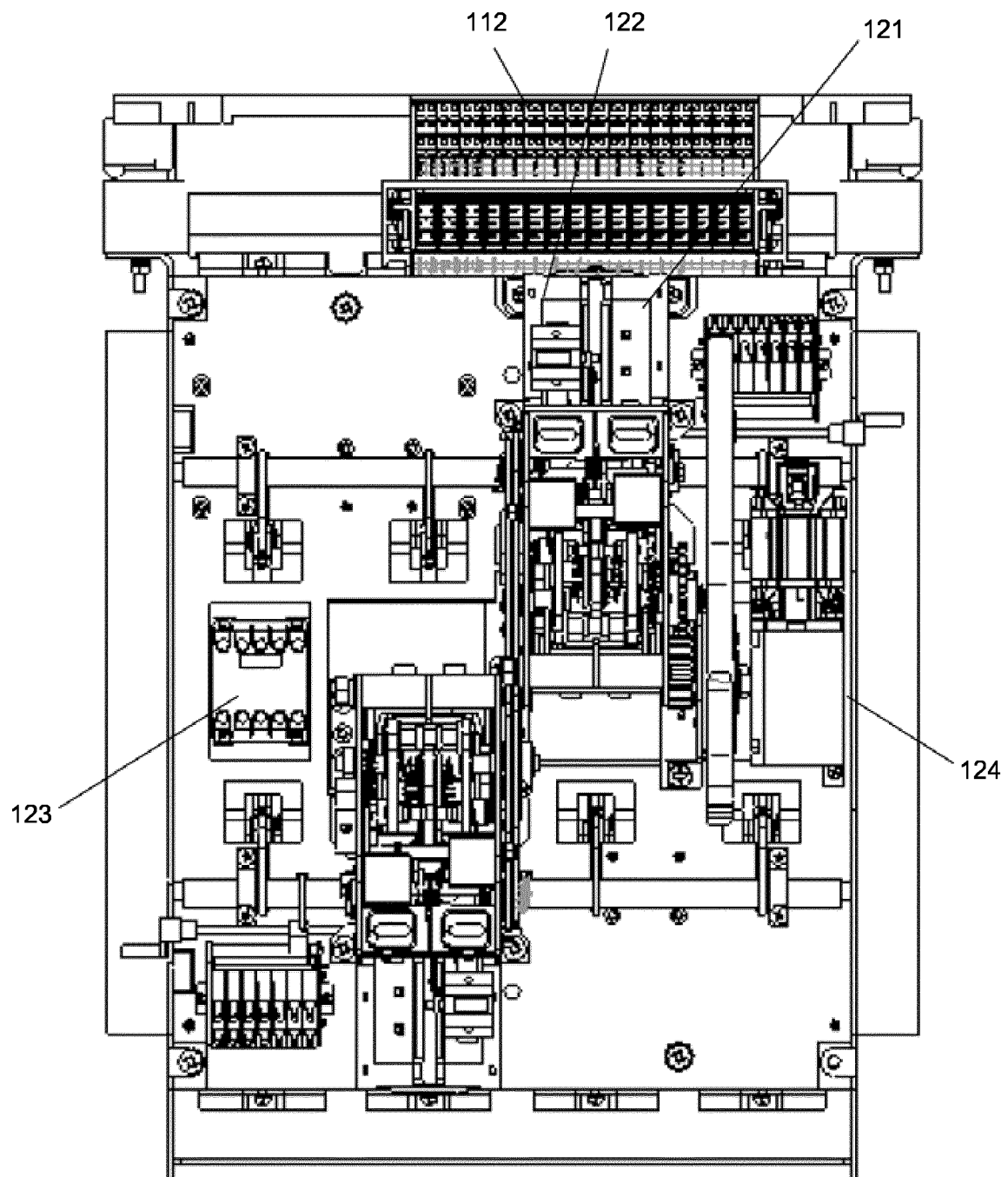
**FIG 9a**



**FIG 9b**



**FIG 9c**



**FIG 9d**

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2013/082434

## A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

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)

IPC: 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: transfer, switch+, change+, switch+, gear+, stor+, energy, rota+, axis+, axes+, lock+

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                       | Relevant to claim No. |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | CN 101826403 A (SEARI ELECTRICAL APPARATUS TECHNOLOGY CO LTD) 08 September 2010 (08.09.2010) description, paragraphs [0025] to [0036] and figures 1 to 3 | 1, 5-10               |
| Y         |                                                                                                                                                          | 2                     |
| A         |                                                                                                                                                          | 3, 4                  |
| Y         | CN 101093753 A (SHANGHAI JINGYI ELECTRONICS CO LTD) 26 December 2007 (26.12.2007) description, page 1, paragraph [0002]                                  | 2                     |
| A         | CN 101350260 A (SHENZHEN TAIYONG SCI&TECH CO LTD) 21 January 2009 (21.01.2009) the whole document                                                        | 1-10                  |
| A         | US 5638948 A (ONAN CORP.) 17 June 1997 (17.06.1997) the whole document                                                                                   | 1-10                  |

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Date of the actual completion of the international search<br>26 November 2013 (26.11.2013)                                                                                                                    | Date of mailing of the international search report<br>12 December 2013 (12.12.2013) |
| Name and mailing address of the ISA<br>State Intellectual Property Office of the P. R. China<br>No. 6, Xitucheng Road, Jimenqiao<br>Haidian District, Beijing 100088, China<br>Facsimile No. (86-10) 62019451 | Authorized officer<br><br>LI, Li<br>Telephone No. (86-10) 62411773                  |

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
PCT/CN2013/082434

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| CN 101093753 A                             | 26.12.2007       | None           |                  |
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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

H01H 3/40 (2006.01) i

H01H 9/24 (2006.01) i