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(54) **MOLDED CASE CIRCUIT BREAKER**

(57) A circuit breaker includes a plurality of fixable bars configured to form fixable contacts, a plurality of movable bars configured to be rotated through a switch to be connected to or disconnected with the plurality of the fixable bars and configured to form movable contacts opposing the fixable contacts, a plurality of arc chambers configured to cover contact parts of the plurality of the fixable bars and the plurality of the movable bars to remove an arc being generated on the contact parts, a bottom base configured to separately accommodate the plurality of the movable bars, the plurality of the fixable bars and the plurality of the arc chambers, each being in a rotation direction and configured to be integrally molded and a top base configured to form a pair with the bottom base to separately seal the plurality of the movable bars,

the plurality of the fixable bars and the plurality of the arc chambers and to be integrally molded. The circuit breaker may prevent molten material inflow in a circuit breaker through a separate seal and insulation of components, each associated with a phase when a short circuit failure occurs, may prevent insulating performance decrease through the molten material inflow, may shorten an arc extinguishing time by an internal pressure increase through separately sealing components, each associated with a phase when a short circuit failure occurs thereby the circuit breaker may easily ensure short circuit performance, may implement a separate sealing structure of the components through a vertical integration of a bottom base and a top base, may have a simple structure and may increase assembly productivity.

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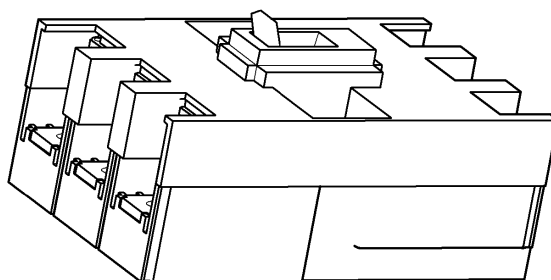


FIG. 1

Description

[Technical Field]

[0001] This application relates to a circuit breaker and more particularly to a circuit breaker that adopts a vertical coupling structure to seal each of components therein, each associated with a phase and prevents a molten material inflow therinto to prevent an insulation performance decrease, the circuit breaker being adopted in an apparatus which may connect or disconnect a current path by a manual operation and may automatically disconnect a current in an abnormal status such as overload and short current fault.

[0002] This application relates to a circuit breaker which particularly in an internal vertical coupling structure, may fix a plurality of fixable bars to a bottom base to form fixable contacts, arrange a plurality of movable bars thereon to form movable contacts and arrange arc chambers enclosing the fixable contacts and the movable contacts between the fixable contacts and movable contacts thereby the circuit breaker individually seals a plurality of fixable bars, a plurality of movable bars and a plurality of arc chambers

[Background Art]

[0003] Korean Patent Publication No. 10-2004-0079825 relates to a safety device of a circuit breaker. More particularly, the safety device is used to protect a user from a safety accident that may occur in a live wire state when external base installation and un-installation of a plug-in type circuit breaker are in progress and used to interlock a switch of the circuit breaker in a trip state.

[0004] Such disclosed technology includes a switch opening or closing a circuit and a crossbar actuating the switch at a trip position. In a circuit breaker being installed at an external base, the circuit breaker includes a pressure trip unit configured to move toward for pressing the crossbar to rotate a crossbar or for releasing to press the crossbar in order to actuate the switch to the trip position, a supporting member configured to be fixed at a bottom of the circuit breaker, a first lever configured to be rotatably supported by the supporting member and to provide an actuating force through one direction rotation when the circuit breaker is installed on an external base and another direction rotation when the circuit breaker is un-installed on the external base, a spring configured to provide elastic force to rotate the first lever toward the another direction, a safety tool assembly wherein one terminal thereof is connected to the first lever and another terminal thereof being installed to press the pressure trip unit and wherein the safety tool assembly includes a second lever releasing the crossbar to release to press the pressure trip unit when the first lever rotates toward one direction and pressing the pressure trip unit to rotatably press the crossbar to the trip position when the first lever

rotates toward another direction and a projection unit being projected toward a horizontal direction from the pressure trip unit to receive a pressure from the second lever. The circuit breaker always maintains a trip state when the circuit breaker is uninstalled on an external base to protect a user from a risk of an electric shock in a live wire state.

[0005] And Korean Utility Model Patent Application No. 20-2004-0035030 discloses a circuit breaker not requiring a separate component that minimizes an emission of the arc gas being generated in a single-pole breaking unit through an unintended route and prevents a gas pressure leakage.

[0006] The circuit breaker includes a fixable contact, a movable contact, a shaft rotatably supporting the movable contact, an insulation case rotatably supporting the shaft and a plurality of single-pole breaking units. In the circuit breaker, the shaft corresponds to a cylindrical member and the shaft includes an edge unit projecting from circumstances to an axis and a rotation axis unit projecting from a center to the axis. The insulation case includes a circular raised unit and a bearing groove unit in order to prevent a gas leakage and rotatably support the shaft. The circular raised unit has a diameter being larger than that of the shaft and is raised toward the axis direction. The bearing groove unit has a predetermined height from the center of the circular raised unit to the axis direction to rotatably seal a rotation axis of the shaft.

[0007] And Korean Patent Publication No. 10-2004-0079825 discloses a circuit breaker using a pressurized gas being generated by an arc generation thereby the circuit breaker is compact and has high blocking performance.

[0008] Such circuit breaker includes a fixable unit, a movable unit, a case and an exhaust pipe. The fixable unit has a fixed contact. The movable unit has a movable contact being connected with or disconnected from the fixed contact in one terminal thereof and a rotatable movable unit having a rotation center in another terminal thereof. The case forms a pressure accumulation space at one side of the arc generating position, the pressure accumulation space temporarily accumulating a pressurized gas pressurized by an arc and the arc being generated between the fixed contact and the movable contact when a current cuts off. The exhaust pipe is installed at another side of the arc generation position in the case so that the pressurized gas retained in the pressure accumulation space upon current cut-off is passed through between the fixed contact and the movable contact.

[0009] As described above, the circuit breaker may connect or disconnect an electrical path by manual operation or electric operation and may automatically block a current when an abnormal state such as overload current and short current occurs. A molten material may flow in the circuit breaker in the abnormal state thereby an insulation performance may be decreased.

[0010] And the conventional circuit breaker assembles the movable contacts at a side to be sealed and insulated

thereby the conventional circuit breaker requires separate modules for sealing each of components and assembly productivity thereof may be decreased.

[Technical Problem]

[0011] This application proposes to provide a circuit breaker preventing a molten material inflow therein through a seal and insulation of components, each associated with a phase when a short circuit failure occurs and preventing an insulating performance decrease through the molten material inflow.

[0012] This application proposes to provide a circuit breaker shortening an arc extinguishing time through sealing components, each associated with a phase to increase internal pressure when a short circuit failure occurs thereby the circuit breaker increases short circuit performance.

[0013] This application proposes to provide a circuit breaker implementing a sealing structure of components, each associated with a phase through a vertical integration of a bottom base and a top base thereby the circuit breaker has a simple structure and increases assembly productivity.

[Technical Solution]

[0014] In some embodiments, a circuit breaker includes a plurality of fixable bars configured to form fixable contacts, a plurality of movable bars configured to be rotated through a switch to be connected to or disconnected with the plurality of the fixable bars and configured to form movable contacts opposing the fixable contacts, a plurality of arc chambers configured to cover contact parts of the plurality of the fixable bars and the plurality of the movable bars to remove an arc being generated on the contact parts, a bottom base configured to separately accommodate the plurality of the movable bars, the plurality of the fixable bars and the plurality of the arc chambers, each being in a rotation direction and configured to be integrally molded and a top base configured to form a pair with the bottom base to separately seal the plurality of the movable bars, the plurality of the fixable bars and the plurality of the arc chambers and to be integrally molded.

[0015] In one embodiment, the plurality of the fixable bars may be separately fixed to the bottom base.

[0016] In one embodiment, the plurality of the fixable bars may further include members bending the fixable contacts into U-shape.

[0017] In one embodiment, the plurality of the movable bars may be connected with a rotation axis providing a rotation center and a movable axis being connected with the switch thereby the plurality of the movable bars may move the movable axis through the switch to rotate the plurality of the movable bars through the rotation axis.

[0018] In one embodiment, the plurality of the arc chambers may have a structure layered with a lattice

shaped plate to cover upper sides of the fixable contacts in the plurality of the fixable bars.

[0019] In one embodiment, the bottom base may include a fixing unit of the plurality of the fixable bars and a holding unit of the plurality of the movable bars and the bottom base may be molded by a curable resin.

[0020] In one embodiment, the top base may be divided into a section for separately sealing the plurality of the fixable bars, the plurality of the movable bars and the plurality of the arc chambers and the top base may be molded by the curable resin.

[0021] In one embodiment, the bottom base and the top base may be vertically linked.

[0022] In one embodiment, the switch may be installed on an upper side of the top base and rotate the plurality of the movable bars through the movable axis.

[Technical Effects]

[0023] The circuit breaker and related technologies may prevent molten material inflow in a circuit breaker through a separate seal and insulation of components, each associated with a phase when a short circuit failure occurs and prevent insulating performance decrease through the molten material inflow.

[0024] The circuit breaker and related technologies may shorten an arc extinguishing time by an internal pressure increase through separately sealing components, each associated with a phase when a short circuit failure occurs thereby the circuit breaker may easily ensure short circuit performance.

[0025] The circuit breaker and related technologies may implement a separate sealing structure of components, each associated with a phase through a vertical integration of a bottom base and a top base thereby the circuit breaker may have a simple structure and may increase assembly productivity.

[Description of Drawings]

[0026]

FIG. 1 is a perspective diagram illustrating a circuit breaker according to an example embodiment of the described technology.

FIG. 2 is an exploded diagram illustrating an internal structure of a circuit breaker in FIG. 1.

FIG. 3 is a perspective diagram illustrating an assembled form of an internal structure of a circuit breaker in FIG. 2.

FIG. 4 is an exploded diagram illustrating an actuation method of an internal structure in a circuit breaker in FIG. 3.

FIG. 5 is an expanded diagram illustrating a plurality of movable bars in FIG. 1.

FIG. 6 is an expanded diagram illustrating a bottom base in FIG. 1.

[Mode for Invention]

[0027] The embodiments and the configurations depicted in the drawings are illustrative purposes only and do not represent all technical scopes of the invention, so it should be understood that various equivalents and modifications may exist at the time of filing this application. Although a preferred embodiment of the disclosure has been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

[0028] Terms and words used in the specification and the claims shall be interpreted as to be relevant to the technical scope of the invention based on the fact that the inventor may properly define the concept of the terms to explain the invention in best ways.

[0029] The terms "first" and "second" can be used to refer to various components, but the components may not be limited to the above terms. The terms will be used to discriminate one component from the other component. For instance, the first component may be referred to the second component and vice versa without departing from the right of the disclosure.

[0030] When a component is referred to as being "connected to" or "linked to" another component, the component may be directly connected to or linked to another component or an intervening component may be present therebetween. In contrast, if a component is referred to as being "directly connected to" or "directly linked to" another component, an intervening component may not be present therebetween.

[0031] The terms used in the specification are for the purpose of explaining specific embodiments and have no intention to limit the disclosure. Unless the context indicates otherwise, the singular expression may include the plural expression. In the following description, the term "include" or "has" will be used to refer to the feature, the number, the step, the operation, the component, the part or the combination thereof without excluding the presence or addition of one or more features, the numbers, the steps, the operations, the components, the parts or the combinations thereof.

[0032] Unless defined otherwise, the terms including technical and scientific terms used in this specification may have the meaning that can be commonly apprehended by those skilled in the art. The terms, such as the terms defined in the commonly-used dictionary, must be interpreted based on the context of the related technology and must not be interpreted ideally or excessively.

[0033] FIG. 1 is a perspective diagram illustrating a circuit breaker according to an example embodiment of the described technology and FIG. 2 is an exploded diagram illustrating an internal structure of a circuit breaker in FIG. 1.

[0034] Referring to FIG. 1 and FIG. 2, a circuit breaker 100 includes a plurality of fixable bars 110, a plurality of

movable bars 120, a plurality of arc chambers 130, a bottom base 140, a top base 150 and a switch 160. In one embodiment, the circuit breaker 100 may actuate the plurality of the movable bars 120 by a movement of the switch 160 to connect or disconnect electrical path.

[0035] The plurality of the fixable bars 110 forms fixable contacts. In one embodiment, the plurality of the fixable bars 110 may be separately fixed into a fixing unit 141 of the bottom base 140. Also, the plurality of the fixable bars 110 may further include members bending the fixable contacts into U-shape.

[0036] The U-shape may wind current flow direction of the plurality of the fixable bars 110 and the plurality of the movable bars 120 to increase electric repulsion between the plurality of the fixable bars 110 and the plurality of the movable bars 120 in abnormal state.

[0037] FIG. 3 is a perspective diagram illustrating an assembled form of an internal structure of a circuit breaker in FIG. 2 and FIG. 4 is an exploded diagram illustrating an actuation method of an internal structure in a circuit breaker in FIG. 3.

[0038] In FIG. 3 and FIG. 4, an internal structure of the circuit breaker 100 includes the plurality of the fixable bars 110, the plurality of the movable bars 120, the plurality of the arc chambers 130, the bottom base 140, the top base 150 and the switch 160.

[0039] The plurality of the fixable bars 110 is projected between the bottom base 140 and the top base 150. In one embodiment, the plurality of the fixable bars 110 is projected through a groove formed by the bottom base 140. Projected parts of the plurality of the fixable bars 110 may be connected with external electrical path.

[0040] When the switch 160 is rotated to clockwise direction, the plurality of the movable bars 120 is rotated. Rotations of the plurality of the movable bars 120 are rotated at a rotation axis 121 to cause a movable axis 122 to lift the plurality of the movable bars 120.

[0041] As a result, when the switch 160 is rotated to clockwise direction, the plurality of the movable bars 120 is rotated to a clockwise direction to electrically disconnect the plurality of the fixable bars 110 and the plurality of the movable bars 120. In this case, an arc may be generated but the plurality of the arc chambers 130 may extinguish an arc.

[0042] On the other hand, when the switch 160 is rotated to counterclockwise direction, the plurality of the movable bars 120 is rotated. Rotations of the plurality of the movable bars 120 are rotated at the rotation axis 121 to cause a movable axis 122 to lower the plurality of the movable bars 120.

[0043] Therefore, when the switch 160 is rotated to counterclockwise direction, the plurality of the movable bars 120 is rotated to counterclockwise direction to electrically connect the plurality of the fixable bars 110 and the plurality of the movable bars 120. In this case, an arc may be generated but the plurality of the arc chambers 130 may extinguish an arc.

[0044] FIG. 5 is an expanded diagram illustrating a plu-

ality of movable bars in FIG. 1. In FIG. 1, FIG.2 and FIG. 5, the plurality of the movable bars 120 may be rotated through the switch 160 to be connected or disconnected with the plurality of the fixable bars 110 and may form movable contacts opposing the fixable contacts.

[0045] In one embodiment, the plurality of the movable bars 120 may be linked with the rotation axis 121 providing a rotation center and the movable axis 122 being connected with the switch 160 and may move the movable axis 122 through the switch 160 to rotate the plurality of the movable bars 120 at the rotation axis 121.

[0046] The plurality of the arc chambers 130 covers contact parts of the plurality of the fixable bars 110 and the plurality of the movable bars 120 to extinguish an arc being generated on the contact parts. In one embodiment, the plurality of the arc chambers 130 may have a structure layered with a lattice shaped plate to cover upper sides of the fixable contacts in the plurality of the fixable bars 110.

[0047] FIG. 6 is a an expanded diagram illustrating a bottom base in FIG 1. In FIG. 1, FIG.2 and FIG. 6, the bottom base 140 may separately accommodate the plurality of the fixable bars 110 and the plurality of the movable bars 120 to be integrally molded. In one embodiment, the bottom base 140 may include the fixing unit 141 of the fixable bar and a holding unit 142 of a movable bar and may be integrally molded by a curable resin to have a hard strength.

[0048] The top base 150 may form a pair with the bottom base 140 and may separately seal the plurality of the fixable bars 110, the plurality of the movable bars 120 and the plurality of the arc chambers 130 to be integrally molded. In one embodiment, the top base 150 may be divided into a section for separately sealing the plurality of the fixable bars 110, the plurality of the movable bars 120 and the plurality of the arc chambers 130 and may be integrally molded by the curable resin to have a hard strength.

[0049] In one embodiment, the bottom base 140 and the top base 150 may be divided into a section to separately accommodate the plurality of the fixable bars 110, the plurality of the movable bars 120 and the plurality of the arc chambers 130 and may be vertically linked to separately seal components, each associated with a phase.

[0050] A structure for separately sealing the components, each associated with a phase though the vertical link may shorten the arc extinguishing time according to an internal pressure increase thereby the structure may easily ensure short circuit performance when a short circuit fault occurs and may increase assembly productivity due to simplicity.

[0051] The switch 160 includes a movable axis connecting unit 161 linked with the movable axis 122. In one embodiment, the switch 160 may move the movable axis 122 through the movable axis connecting unit 161 to rotate the plurality of the movable bars 120 at the rotation axis 121.

[0052] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure.

Claims

1. A circuit breaker comprising:

a plurality of fixable bars configured to form fixable contacts;
a plurality of movable bars configured to be rotated through a switch to be connected to or disconnected with the plurality of the fixable bars and configured to form movable contacts opposing the fixable contacts;
a plurality of arc chambers configured to cover contact parts of the plurality of the fixable bars and the plurality of the movable bars to remove an arc being generated on the contact parts;
a bottom base configured to separately accommodate the plurality of the movable bars, the plurality of the fixable bars and the plurality of the arc chambers, each being in a rotation direction and configured to be integrally molded; and
a top base configured to form a pair with the bottom base to separately seal the plurality of the movable bars, the plurality of the fixable bars and the plurality of the arc chambers and to be integrally molded.

2. The circuit breaker of claim 1, wherein the plurality of the fixable bars is separately fixed to the bottom base.

3. The circuit breaker of claim 2, wherein the plurality of the fixable bars further includes members bending the fixable contacts into U-shape.

4. The circuit breaker of claim 1, wherein the plurality of the movable bars is connected with a rotation axis providing a rotation center and a movable axis being connected with the switch whereby the plurality of the movable bars moves the movable axis through the switch to rotate the plurality of the movable bars through the rotation axis.

5. The circuit breaker of claim 1, wherein the plurality of the arc chambers has a structure layered with a lattice shaped plate to cover upper sides of the fixable contacts in the plurality of the fixable bars.

6. The circuit breaker of claim 1, wherein the bottom base includes a fixing unit of the plurality of the fixable

bars and a holding unit of the plurality of the movable bars and wherein the bottom base is integrally molded by a curable resin.

7. The circuit breaker of claim 1, wherein the top base is divided into a section for separately sealing the plurality of the fixable bars, the plurality of the movable bars and the plurality of the arc chambers and wherein the top base is integrally molded by the curable resin. 5 10
8. The circuit breaker of claim 6 or 7, wherein the bottom base and the top base are vertically linked.
9. The circuit breaker of claim 1, wherein the switch is installed on an upper side of the top base and rotates the plurality of the movable bars through the movable axis. 15

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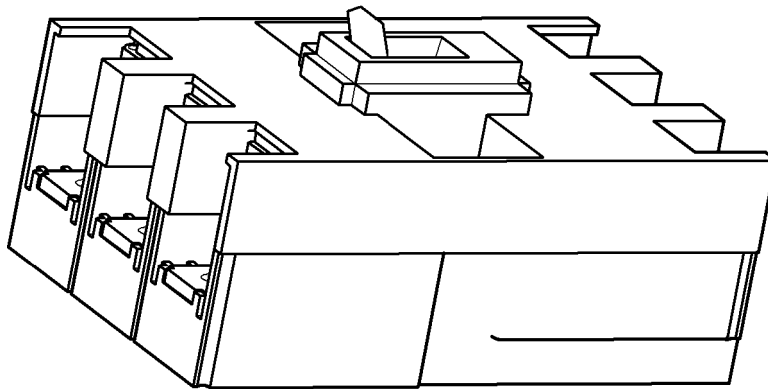
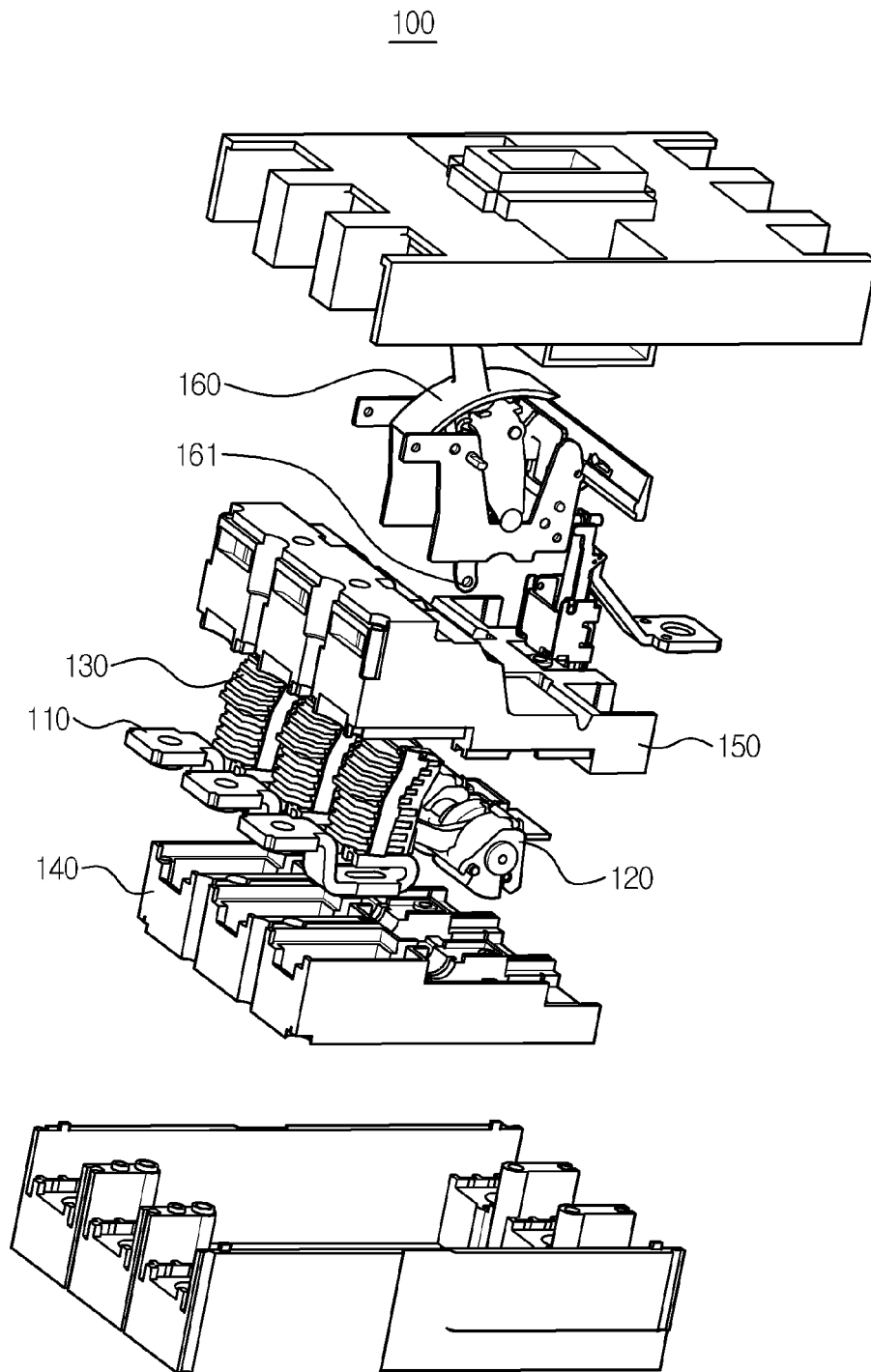


FIG. 1



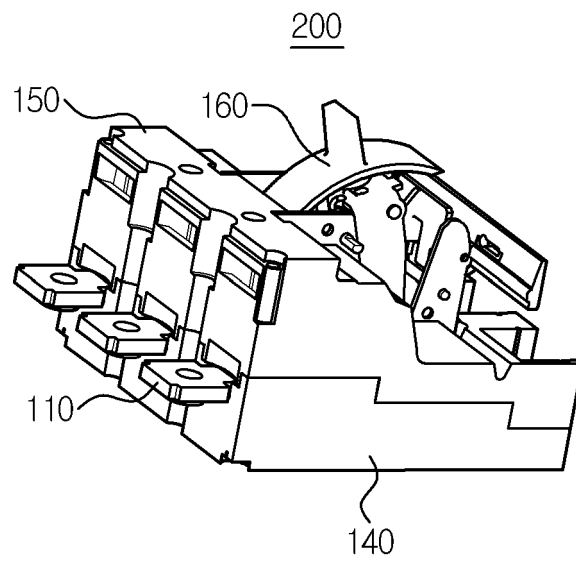


FIG. 3

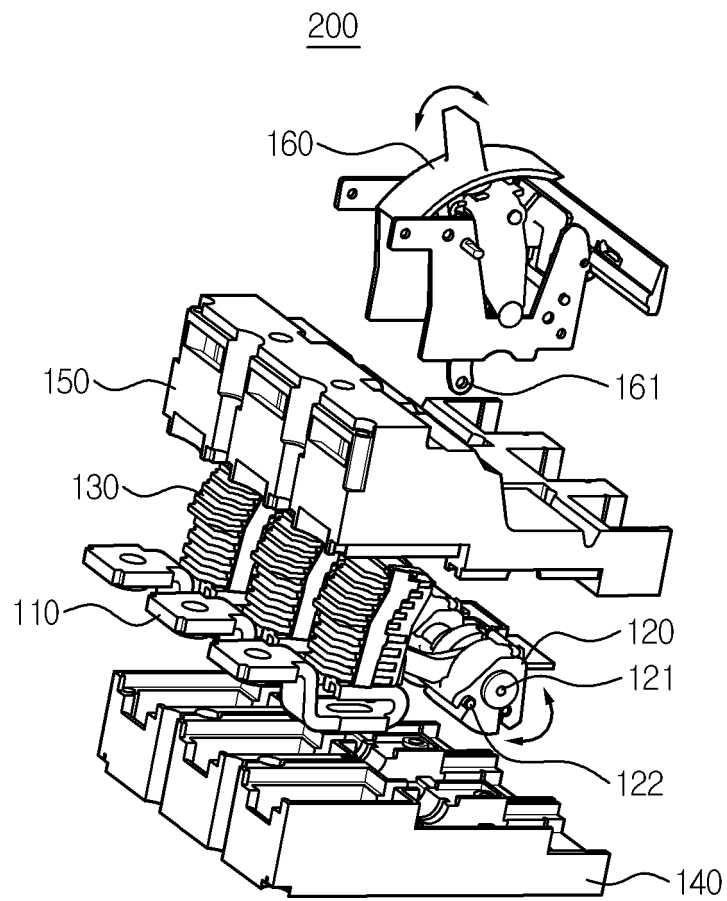


FIG. 4

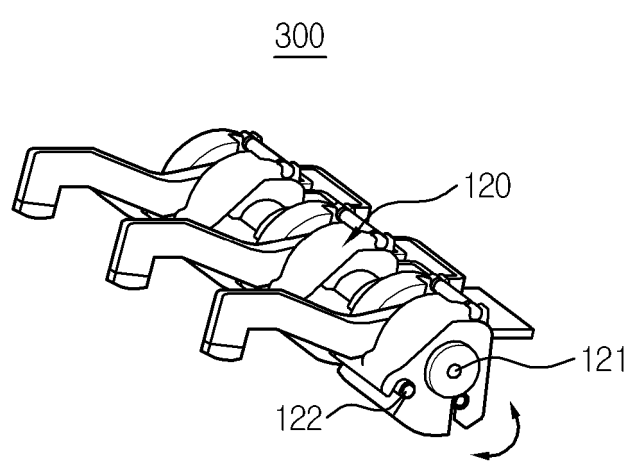


FIG. 5

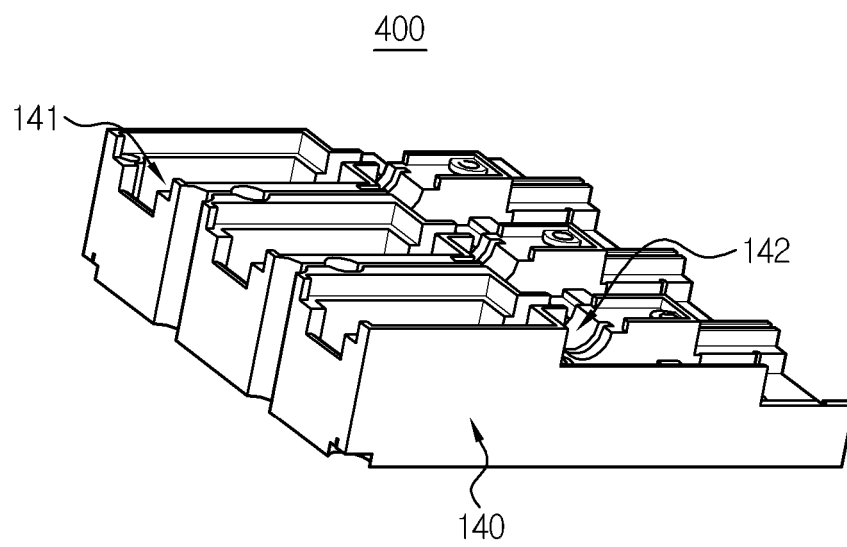


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2012/011260

A. CLASSIFICATION OF SUBJECT MATTER

H01H 71/02(2006.01)i, H01H 73/18(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 71/02; H01H 73/18

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

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

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

eKOMPASS (KIPO internal) & Keywords: circuit breaker, arc, chamber, fixture, moving, contact, base

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-2008-0034605 A (HYUNDAI HEAVY INDUSTRIES CO., LTD.) 22 April 2008 See abstract, claims 1-5, figures 5-6.	1-9
A	KR 10-2009-0028291 A (LSIS CO., LTD.) 18 March 2009 See abstract, claims 1-2, figures 7-8.	1-9
A	JP 2008-270136 A (MITSUBISHI ELECTRIC CORP) 06 November 2008 See abstract, claims 1-3, figure 1.	1-9

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

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"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

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"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

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Date of the actual completion of the international search

10 APRIL 2013 (10.04.2013)

Date of mailing of the international search report

12 APRIL 2013 (12.04.2013)

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2012/011260

Patent document cited in search report	Publication date	Patent family member	Publication date
KR 10-2008-0034605 A	22.04.2008	KR 10-1027780 B1	07.04.2011
KR 10-2009-0028291 A	18.03.2009	CN 101388308 A	18.03.2009
		KR 10-0919208 B1	28.09.2009
JP 2008-270136 A	06.11.2008	NONE	

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 1020040079825 [0003] [0007]
- KR 2020040035030 [0005]