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(54) **VACUUM CIRCUIT BREAKER**

(57) The present utility model relates to a vacuum circuit breaker. The vacuum circuit breaker includes an operating mechanism (2). The vacuum circuit breaker (1) further includes a plurality of vacuum arc extinguishing modules (3), the operating mechanism (2) is connected to and drives each of the vacuum arc extinguishing modules (3), and each of the vacuum arc extinguishing modules (3) includes: a housing (4); a vacuum arc extinguishing chamber (6), accommodated in the housing (4) and having a stationary contact and a movable contact disposed opposite to each other; and a contact support assembly (7), accommodated in the housing (4) and connected to the movable contact of the vacuum arc extinguishing chamber (6). The operating mechanism (2) is connected to and drives the contact support assembly (7). An inner wall of the housing (4) is provided with recesses and protrusions to match the vacuum arc extinguishing chamber (6) and the contact support assembly (7), and is provided with connection openings corresponding to the stationary contact, the movable contact and the contact support assembly (7).

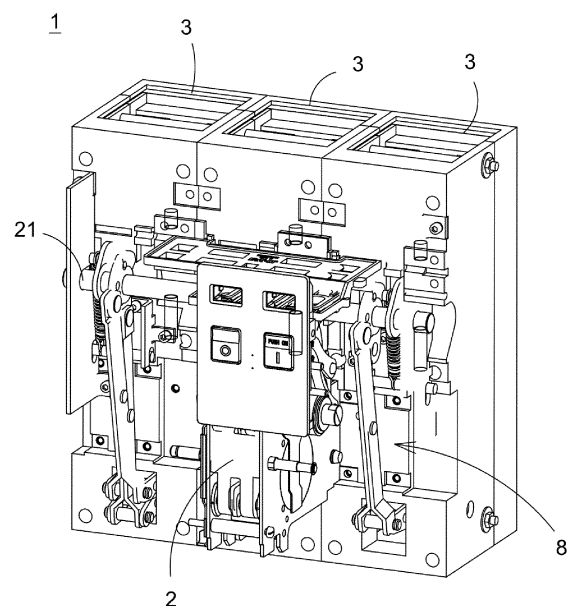


FIG. 1

Description

TECHNICAL FIELD

[0001] The present utility model relates to the technical field of control and protection of electrical equipment, and relates in particular to a vacuum circuit breaker.

BACKGROUND

[0002] In the new-energy wind power industry, the product demand on low-voltage circuit breakers has been upgraded to an operating voltage of AC 1150 V/1500 V. At the same time, the circuit breaker is required to have a long service life. In addition, in high-polluting industries such as coal mines and oil gas, it is also desirable that circuit breaker products can realize zero flashover to ensure the safety of operators, circuits and electrical equipment in flammable and explosive environments.

[0003] Therefore, there is a need in industry for a circuit breaker product having a long service life and zero flashover, and it is also desirable that such breaker product occupies an area as small as possible.

SUMMARY

[0004] The present utility model aims to provide a vacuum circuit breaker capable of solving at least part of the above problems.

[0005] In accordance with an aspect of the present utility model, provided is a vacuum circuit breaker, comprising an operating mechanism. The vacuum circuit breaker further comprises a plurality of vacuum arc extinguishing modules, the operating mechanism is connected to and drives each of the vacuum arc extinguishing modules, and each of the vacuum arc extinguishing modules comprises: a housing; a vacuum arc extinguishing chamber, accommodated in the housing and having a stationary contact and a movable contact disposed opposite to each other; and a contact support assembly, accommodated in the housing and connected to the movable contact of the vacuum arc extinguishing chamber. The operating mechanism is connected to and drives the contact support assembly. An inner wall of the housing is provided with recesses and protrusions to match the vacuum arc extinguishing chamber and the contact support assembly, and is provided with connection openings corresponding to the stationary contact, the movable contact and the contact support assembly.

[0006] In some embodiments, each of the vacuum arc extinguishing modules has a linkage mechanism connected to the contact support assembly, the operating mechanism is connected to and drives the linkage mechanism of each of the vacuum arc extinguishing modules, and the connection openings of the housing comprise a first connection opening through which the linkage mechanism passes.

[0007] In some embodiments, the stationary contact

of the vacuum arc extinguishing chamber is connected to a first connection terminal, and the connection openings of the housing comprise a second connection opening aligned with the first connection terminal.

[0008] In some embodiments, a coil is arranged at the first connection terminal, the inner wall of the housing has a recess for accommodating the coil, and the second connection opening is formed at the bottom of the recess.

[0009] In some embodiments, the movable contact of the vacuum arc extinguishing chamber is connected to a second connection terminal by a flexible connector, and the connection openings of the housing comprise a third connection opening aligned with the second connection terminal.

[0010] In some embodiments, the inner wall of the housing is provided with a ring extending along the perimeter of the housing, and the vacuum arc extinguishing chamber is surrounded by the ring.

[0011] In some embodiments, the housing comprises at least two housing portions that are detachably connected, and the recesses and protrusions are defined by combining the at least two housing portions.

[0012] In some embodiments, the vacuum arc extinguishing module is prefabricated.

[0013] In some embodiments, the contact support assembly comprises: a support; a contact spring, supported by the support; a movable member, connected to and moving along with the contact spring and having a wear indication portion; and a linkage, connected to the movable member, and provided with an end portion connected to the movable contact of the vacuum arc extinguishing chamber.

[0014] The position of the movable member relative to the linkage is arranged in such a way that during closing of the movable contact and the stationary contact, a change in the position of the wear indication portion is identifiable when the movable contact and/or the stationary contact reaches a predetermined wear thickness value.

[0015] In some embodiments, the movable member further has an installation indication portion, and the installation indication portion is located away from the support relative to the wear indication portion.

[0016] Part of the other features and advantages of the present utility model will be obvious to a person skilled in the art after reading the present application, and the rest will be described in the following detailed description with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Embodiments of the present utility model are described in detail below with reference to the accompanying drawings, wherein:

FIG. 1 is a schematic view of a vacuum circuit breaker according to the present utility model;

FIG. 2 is a side view of the vacuum circuit breaker

according to the present utility model;
 FIG. 3 is a schematic exploded view of the vacuum circuit breaker according to the present utility model;
 FIG. 4 is a schematic view of a vacuum arc extinguishing module according to the present utility model;
 FIG. 5 is a side view of the vacuum arc extinguishing module according to the present utility model;
 FIG. 6 is a schematic exploded view of the vacuum arc extinguishing module according to the present utility model; and
 FIG. 7 is a schematic exploded view of a contact support assembly according to the present utility model.

Description of the reference numerals

[0018] 1, vacuum circuit breaker; 2, operating mechanism; 21, main shaft; 22, connecting lever; 3, vacuum arc extinguishing module; 4, housing; 41, first housing portion; 411, first connection opening; 412, assembly hole; 42, second housing portion; 421, second connection opening; 422, third connection opening; 423, ring; 424, assembly hole; 425, recess; 426, protrusion portion; 5, coil; 6, vacuum arc extinguishing chamber; 61, first connection terminal; 62, flexible connector; 7, contact support assembly; 71, connecting shaft; 72, support; 73, linkage; 731, end portion; 732, flange; 74, first insulating pad; 75, movable member; 751, installation indication portion; 752, wear indication portion; 76, second insulating pad; 77, sleeve tube; 78, contact spring; 79, insulating sleeve; 8, linkage mechanism; 81, first rod; 82, second rod; and 83, third rod.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0019] A schematic scheme of a vacuum circuit breaker disclosed by the present utility model is described in detail with reference to the accompanying drawings. Although providing the accompanying drawings is to present some implementations of the present utility model, the accompanying drawings do not need to be drawn according to the size of the specific implementation schemes, and certain features can be enlarged, removed, or locally exploded to better illustrate and explain the disclosure of the present utility model. Part of the components in the accompanying drawings can be positionally adjusted according to actual requirements without affecting the technical effect. In the description, the term "in the accompanying drawings" or similar terms do not necessarily refer to all of the accompanying drawings or examples.

[0020] Some directional terms used in the following to describe the accompanying drawings, such as "in", "out", "upper", and "lower," and other directional terms are construed as having normal meanings thereof and refer to those directions involved when the accompanying drawings are viewed normally. Unless otherwise specified,

the directional terms in the description are substantially in accord with conventional directions understood by those skilled in the art.

[0021] The terms "first," "first one," "second," and "second one" and similar terms used in the present utility model do not indicate any sequence, number, or importance in the present utility model, and are used only to distinguish one component from other components.

[0022] FIGs. 1 to 3 show schematic views of a vacuum circuit breaker 1 according to the present utility model. As shown, the vacuum circuit breaker 1 includes an operating mechanism 2 and a plurality of vacuum arc extinguishing modules 3 driven by the operating mechanism 2 to achieve opening and closing. Three vacuum arc extinguishing modules 3 are shown in the figures, but those skilled in the art would appreciate that the vacuum arc extinguishing modules 3 are prefabricated and that during on-site installation in the working environment of the vacuum circuit breaker, a desired number of prefabricated vacuum arc extinguishing modules 3 can be connected in parallel to the operating mechanism 2 as required, and the number may be two or more, such as four, five, six or more.

[0023] Referring to FIGs. 1 and 3, a main shaft 21 of the operating mechanism 2 may be operated to rotate about its own central axis, so as to drive a linkage mechanism 8 of each of the vacuum arc extinguishing modules 3 connected to the main shaft 21, thereby driving stationary and movable contacts of each of the vacuum arc extinguishing chambers 3 to close or open. In the illustrated embodiment, a connecting lever 22 is sleeved on the main shaft 21 of the operating mechanism 2, and the rotation of the main shaft 21 can drive the connecting lever 22 to rotate synchronously. The connecting lever 22 is pivotally connected to a first rod 81 of the linkage mechanism 8, the first rod 81 is pivotally connected to a second rod 82, the second rod 82 is pivotally connected to a third rod 83, and the third rod 83 is pivotally connected to a contact support assembly 7 of a vacuum arc extinguishing chamber 6 from below (described in detail below), thereby controlling opening or closing of movable and stationary contacts within the vacuum arc extinguishing chamber 6. For the structure of the operating mechanism 2 and its control over the main shaft 21, reference may be made to the prior art, and the details are omitted here.

[0024] FIGs. 4 to 6 schematically show an example of one vacuum arc extinguishing module 3 according to the present utility model. As shown, in the vacuum arc extinguishing module 3, the vacuum arc extinguishing chamber 6 and the contact support assembly 7 are sealed in a housing 4. An inner wall of the housing 4 is provided with recesses and protrusions in order to match the accommodated components. To facilitate installation of the vacuum arc extinguishing chamber and the contact support assembly 7, the housing 4 is assembled from two or more housing portions. In the illustrated embodiment, the housing 4 consisting of two housing portions, i.e., a first

housing portion 41 and a second housing portion 42, is described as an example. Based on the normal placement direction of the vacuum circuit breaker 1 and the vacuum arc extinguishing module as shown in FIGs. 1 and 3, the first housing portion 41 and the second housing portion 42 may also be regarded as a front housing portion and a rear housing portion. As shown in FIG. 5, for ease of assembly, the first housing portion 41 and the second housing portion 42 are provided with corresponding assembly holes 412 and corresponding assembly holes 424, respectively. After fitting the first housing portion 41 with the second housing portion 42, the first housing portion 41 and the second housing portion 42 are joined together by inserting a connecting member, such as a bolt or pin, into an assembly hole 412 and an assembly hole 424 aligned with each other.

[0025] Each of the first housing portion 41 and the second housing portion 42 may be integrally made from a plastic material. To facilitate proper assembly of the first housing portion 41 and the second housing portion 42, the first housing portion and the second housing portion may be provided with recessed and protruding positioning structures matching each other. For example, a protruding portion is formed on the first housing portion, while a recessed portion that can accommodate the protruding portion is formed on the second housing portion. Conversely, the protruding portion may also be formed on the second housing portion and the recessed portion is formed on the first housing portion.

[0026] The vacuum arc extinguishing chamber 6 and the contact support assembly 7 are accommodated in the housing 4. The vacuum arc extinguishing chamber 6 includes a housing body, and a movable contact and a stationary contact (not shown) accommodated in the housing body. The contact support assembly 7 is connected to the movable contact, and the operating mechanism 2 can operate the contact support assembly 7 by means of the linkage mechanism 8, so as to further drive the movable contact to move toward or away from the stationary contact. The housing 4, such as the first housing portion 41, is provided with a first connection opening 411 at a position corresponding to the contact support assembly 7, so that the third rod 83 of the linkage mechanism 8 can pass through the first connection opening and connect to the contact support assembly 7.

[0027] FIG. 7 illustrates an example of the contact support assembly 7. As shown, in the contact support assembly 7, a connecting shaft 71 is installed at a support 72. The connecting shaft 71 is pivotally connected to the third rod 83 of the linkage mechanism 8. A sleeve tube 77 is supported on the support 72. A contact spring 78 is arranged within the sleeve tube 77. The contact spring 78 supports a movable member 75, and provides to the movable member 75 a pushing force in a direction that faces away from the support 72 (i.e. a direction pointing to the movable contact within the vacuum arc extinguishing chamber). A linkage 73 passes through the support 72, the contact spring 78, and the movable member 75,

and the linkage 73 is connected to the movable member 75. After assembly, the linkage 73 is not movable relative to the movable member 75, or at least the movable member 75 cannot move in the axial direction of the linkage 73, so that the movement of the movable member 75 (under the pushing force of the contact spring 78) drives the linkage 73 to move synchronously.

[0028] One end of the linkage 73 extends out of a side of the support 72 facing away from the sleeve tube 77 and is provided with a flange 732. The dimension of the flange 732 is larger than that of an aperture of the support 72 through which the linkage 73 passes, thereby preventing detachment of the linkage 73 from the support 72 during movement. The other end of the linkage 73 extends out of a side of the movable member 75 facing away from the support 72, and serves as an end portion 731 connecting to the movable contact within the vacuum arc extinguishing chamber 6.

[0029] In one embodiment, a screw is used as the linkage 73, and a nut in threaded connection to the linkage 73 is used as the flange 732. The movable member 75 is adaptively provided with an inner thread mating with an outer thread of the screw, so that during assembly, the position of the movable member can be adjusted in the axial direction of the linkage 73. This adjustment is continuous, and the movable member can be adjusted to a suitable position and then fixed relative to the linkage 73. In yet another embodiment, the movable member may be tightly sleeved on the linkage.

[0030] An installation indication portion 751 and a wear indication portion 752 are provided at the outer circumference of the movable member 75. In the illustrated embodiment, each of the installation indication portion 751 and the wear indication portion 752 is configured to be an indication line extending in a circumferential direction of the movable member 75. The installation indication portion 751 is closer to the end portion 731 of the linkage 73 connecting to the movable contact than the wear indication portion 752. In other embodiments, the installation indication portion 751 and the wear indication portion 752 may have other forms, such as an image marker, a text marker, a scale marker, a color marker, or a combination of at least two of the forms, etc.

[0031] An insulating sleeve 79 is further sleeved on the linkage 73. In the illustrated embodiment, the insulating sleeve 79 may be a heat shrink tube sleeved on the linkage 73 and passing through the support 72 and the contact spring 78. In other embodiments, the insulating sleeve may be sleeved on the linkage 73, and be provided with a radially extending flange at a position proximate to one end. The insulating sleeve passes through the support 72 and the contact spring 78 and is placed on the support by means of the radially extending flange, such that the support supports the insulating sleeve. A first insulating pad 74 may further be provided between a side of the support 72 facing away from the sleeve tube 77 and the flange 732 on the linkage 73. The first insulating pad 74 is sleeved on the linkage 73. Additionally,

a second insulating pad 76 may be arranged on a side surface of the movable member 75 that faces a contact connection end 421 of the linkage 73. The second insulating pad 76 is sleeved on the linkage 73.

[0032] Under initial normal assembly (the movable and stationary contacts within the vacuum arc extinguishing chamber are not worn), when the movable contact and the stationary contact within the vacuum arc extinguishing chamber are closed, the installation indication portion 751 of the movable member 75 is exposed outside of the sleeve tube 77. An operator determines that the contact support assembly 7 is properly installed based on the visible or detectable installation indication portion 751, thereby determining the movement stroke of the contact spring. At the time, the wear indication portion 752 is not visible or detectable by the operator since the wear indication portion is located within the sleeve tube 77.

[0033] However, once the movable and stationary contacts are worn, when the movable contact and the stationary contact within the vacuum arc extinguishing chamber 6 are closed, the installation indication portion 751 of the movable member 75 moves away from the upper edge of the sleeve tube 77 due to a larger stroke of the connecting rod 73, while the wear indication portion 752 is exposed outside of the sleeve tube 77. The operator identifies a change in position of the wear indication portion (relative to the sleeve tube) based on the fact that the wear indication portion 752 is visible or detectable, thereby determining that the wear thickness of the movable and stationary contacts has reached a predetermined value.

[0034] As described above, the movable contact of the vacuum arc extinguishing chamber 6 is connected to and driven by the contact support assembly 7, and the stationary contact is connected to a first connection terminal 61, and a coil 5 is arranged at the first connection terminal 61. As shown in FIG. 6, the coil 5 surrounds a portion of the first connection terminal 61, and said portion of the first connection terminal 61 is proximate to an inner wall of the second housing portion 42 of the housing 4. The housing 4, such as the second housing portion 42, is provided with a second connection opening 421 at a position corresponding to the first connection terminal 61, so that a wire can pass through the second connection opening and connect to the first connection terminal 61.

[0035] As shown in FIG. 6, to match the coil 5 surrounding the first connection terminal 61, a recess 425 is provided on the inner wall of the second housing portion 42 of the housing 4 and is used to accommodate the coil. The shape of the recess may match the shape of the coil 5 so that the coil 5 is stably installed within the housing 4. The second connection opening 421 is correspondingly formed at the bottom of the recess 425.

[0036] The vacuum arc extinguishing chamber 6, besides using the stationary contact to connect to the first connection terminal, also uses the movable contact to connect to a second connection terminal (not shown in the figure) by means of a flexible connector 62. The flex-

ible connector 62 may be sleeved on the linkage 73 of the contact support assembly 7. The housing 4, such as the second housing portion 42, is provided with a third connection opening 422 at a position corresponding to the flexible connector, so that the second connection terminal or a wire can pass through the third connection opening and connect to the flexible connector 62. In the illustrated embodiment, the second housing portion 42 may be provided with a protrusion portion 426 protruding toward the flexible connector 63 at a position corresponding to the third connection opening 422, the third connection opening 422 passes through the protrusion portion 426, and the second connection terminal can be accommodated in the third connection opening 422 and connected to the flexible connector 62.

[0037] To stably hold the vacuum arc extinguishing chamber 6 within the housing 4, the inner wall of the housing 4 is further integrally provided with a raised ring 423 that extends along the perimeter of the housing 4. The side surface of the ring 423 toward the vacuum arc extinguishing chamber 6 is a concave arc surface matching the outer periphery of the vacuum arc extinguishing chamber. The vacuum arc extinguishing chamber is surrounded and held by the ring such that horizontal movement of the vacuum arc extinguishing chamber is limited. According to the illustrated embodiment, the ring may be defined by combining a plurality of housing portions of the housing 4 together. For example, as shown in FIG. 6, each of the first housing portion 41 and the second housing portion 42 is integrally provided with a half-ring, and after the two portions are combined together, a complete ring is formed.

[0038] According to the present utility model, the vacuum arc extinguishing chamber and a series of components such as the support assembly are pre-sealed in a frame-type housing, so as to prefabricate a single small-sized vacuum arc extinguishing modular unit while retaining the zero flashover feature of the vacuum arc extinguishing chamber. Each modular unit has a reduced size and a neat appearance. After a required number of vacuum arc extinguishing modular units are connected in parallel to an operating mechanism, the overall structure of the vacuum circuit breaker is compact and the occupied space is small. In addition, because the vacuum arc extinguishing modular unit is a prefabricated unit, the on-site combination between the modular unit and the operating mechanism requires less time and effort, and the safety performance is good.

[0039] It should be appreciated that although the description is presented according to each embodiment, each embodiment does not necessarily include only one independent technical solution. The presentation manner of the description is merely for clearness, and those skilled in the art should regard the description as a whole, and the technical solutions in the embodiments can also be appropriately combined to form other implementations comprehensible by those skilled in the art.

[0040] What is described above is merely exemplary

specific implementations of the present utility model, but is not intended to limit the scope of the present utility model. Any equivalent change, modification, or combination made by a person skilled in the art without departing from the conception and principle of the present utility model shall fall within the protection scope of the present utility model.

Claims

1. A vacuum circuit breaker, comprising an operating mechanism (2), and **characterized in that:** the vacuum circuit breaker (1) further comprises a plurality of vacuum arc extinguishing modules (3), the operating mechanism (2) is connected to and drives each of the vacuum arc extinguishing modules (3), and each of the vacuum arc extinguishing modules (3) comprises:
 - a housing (4);
 - a vacuum arc extinguishing chamber (6), accommodated in the housing (4) and having a stationary contact and a movable contact disposed opposite to each other; and
 - a contact support assembly (7), accommodated in the housing (4) and connected to the movable contact of the vacuum extinguishing chamber (6), wherein the operating mechanism (2) is connected to and drives the contact support assembly (7);
 - an inner wall of the housing (4) is provided with recesses and protrusions to match the vacuum arc extinguishing chamber (6) and the contact support assembly (7), and is provided with connection openings corresponding to the stationary contact, the movable contact and the contact support assembly (7).
2. The vacuum circuit breaker according to claim 1, wherein each of the vacuum arc extinguishing modules (3) has a linkage mechanism (8) connected to the contact support assembly (7), the operating mechanism (2) is connected to and drives the linkage mechanism (8) of each of the vacuum arc extinguishing modules (3), and the connection openings of the housing (4) comprise a first connection opening (411) through which the linkage mechanism (8) passes.
3. The vacuum circuit breaker according to claim 1, wherein the stationary contact of the vacuum arc extinguishing chamber (6) is connected to a first connection terminal (61), and the connection openings of the housing (4) comprise a second connection opening (421) aligned with the first connection terminal (61).
4. The vacuum circuit breaker according to claim 3, wherein a coil (5) is arranged at the first connection terminal (61), the inner wall of the housing (4) has a recess (425) for accommodating the coil (5), and the second connection opening (421) is formed at the bottom of the recess (425).
5. The vacuum circuit breaker according to claim 1, wherein the movable contact of the vacuum arc extinguishing chamber (6) is connected to a second connection terminal by a flexible connector (62), and the connection openings of the housing (4) comprise a third connection opening (422) aligned with the second connection terminal.
6. The vacuum circuit breaker according to claim 1, wherein the inner wall of the housing (4) is provided with a ring (423) extending along the perimeter of the housing (4), and the vacuum arc extinguishing chamber (6) is surrounded by the ring (423).
7. The vacuum circuit breaker according to claim 1, wherein the housing (4) comprises at least two housing portions that are detachably connected, and the recesses and protrusions are defined by combining the at least two housing portions.
8. The vacuum circuit breaker according to claim 1, wherein the vacuum arc extinguishing module (3) is prefabricated.
9. The vacuum circuit breaker according to claim 1, wherein the contact support assembly (7) comprises:
 - a support (72);
 - a contact spring (78), supported by the support (72);
 - a movable member (75), connected to and moving along with the contact spring (78) and having a wear indication portion (752); and
 - a linkage (73), connected to the movable member (75), and provided with an end portion (731) connected to the movable contact of the vacuum arc extinguishing chamber (6);
 - the position of the movable member (75) relative to the linkage (73) is arranged in such a way that during closing of the movable contact and the stationary contact, a change in the position of the wear indication portion (752) is identifiable when the movable contact and/or the stationary contact reaches a predetermined wear thickness value.
10. The vacuum circuit breaker according to claim 9, wherein the movable member (75) further has an installation indication portion (751), and the installation indication portion (751) is located away from the

support (72) relative to the wear indication portion (752).

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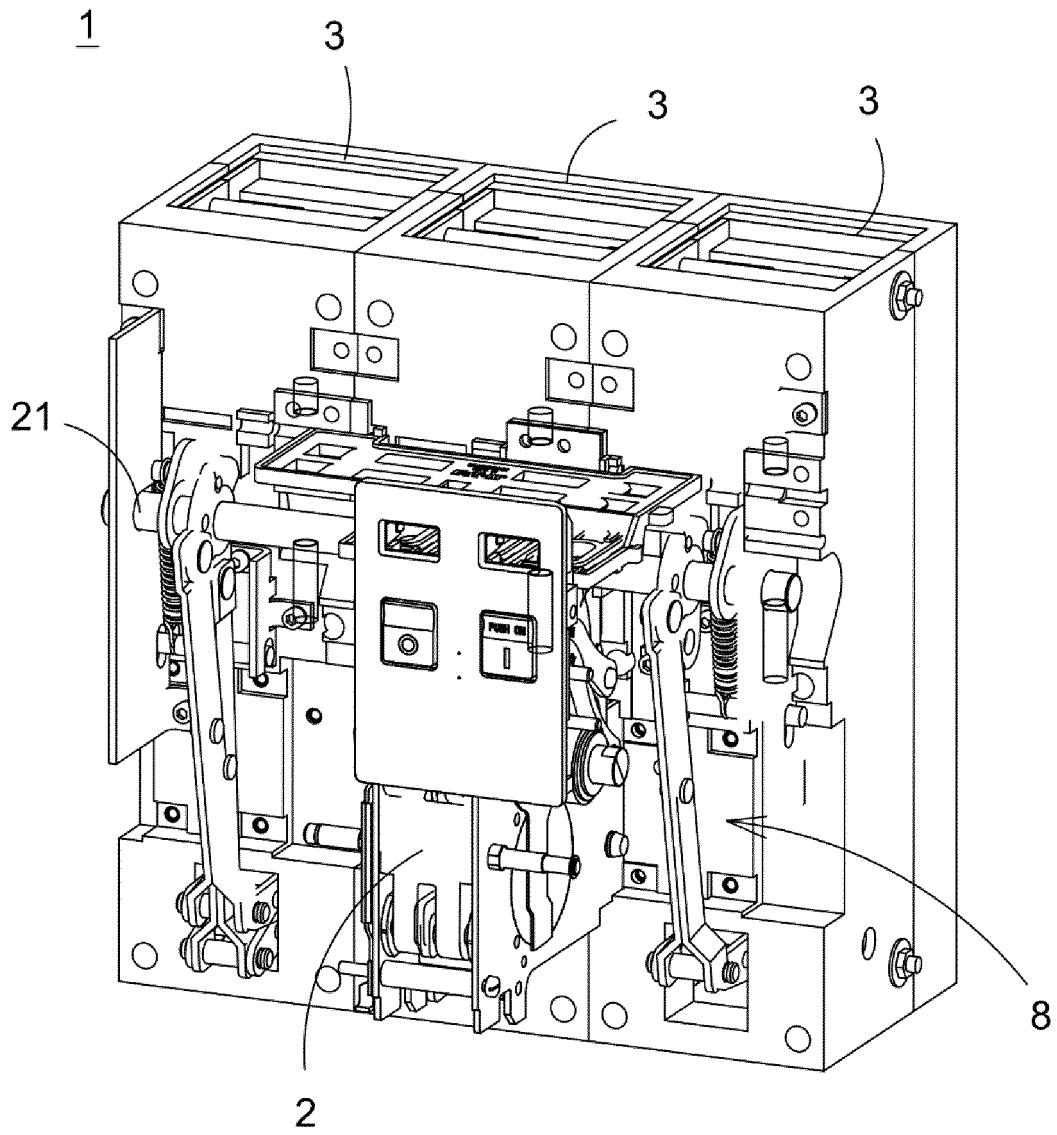


FIG. 1

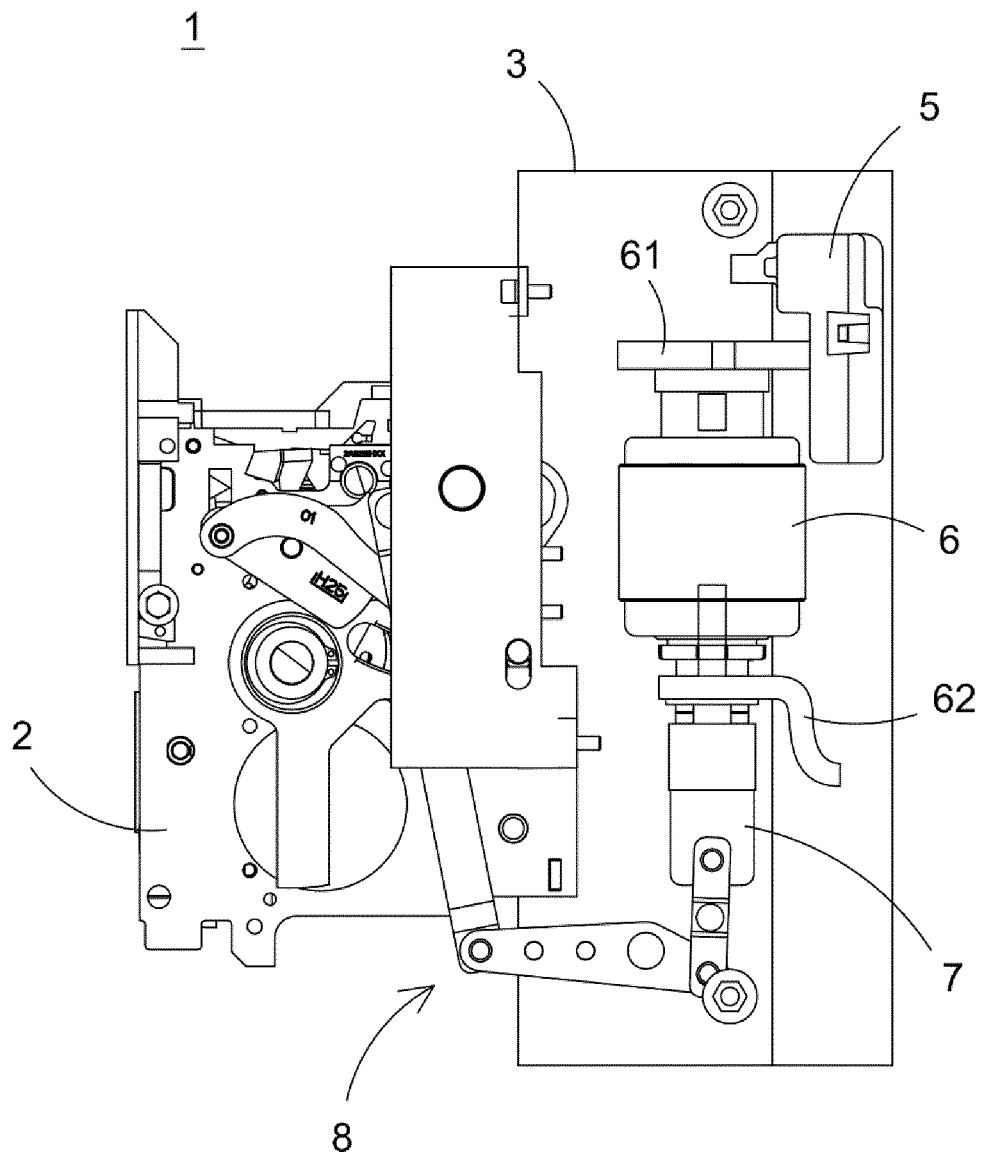


FIG. 2

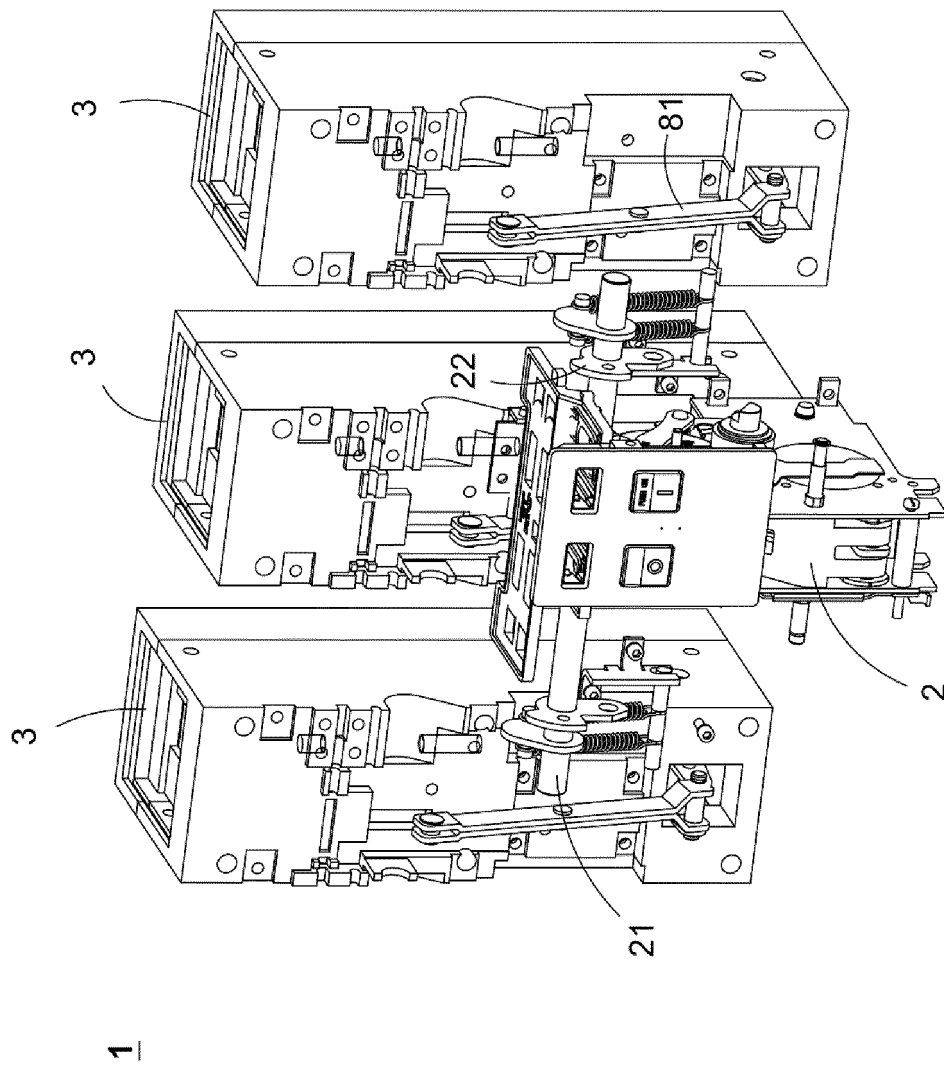


FIG. 3

3

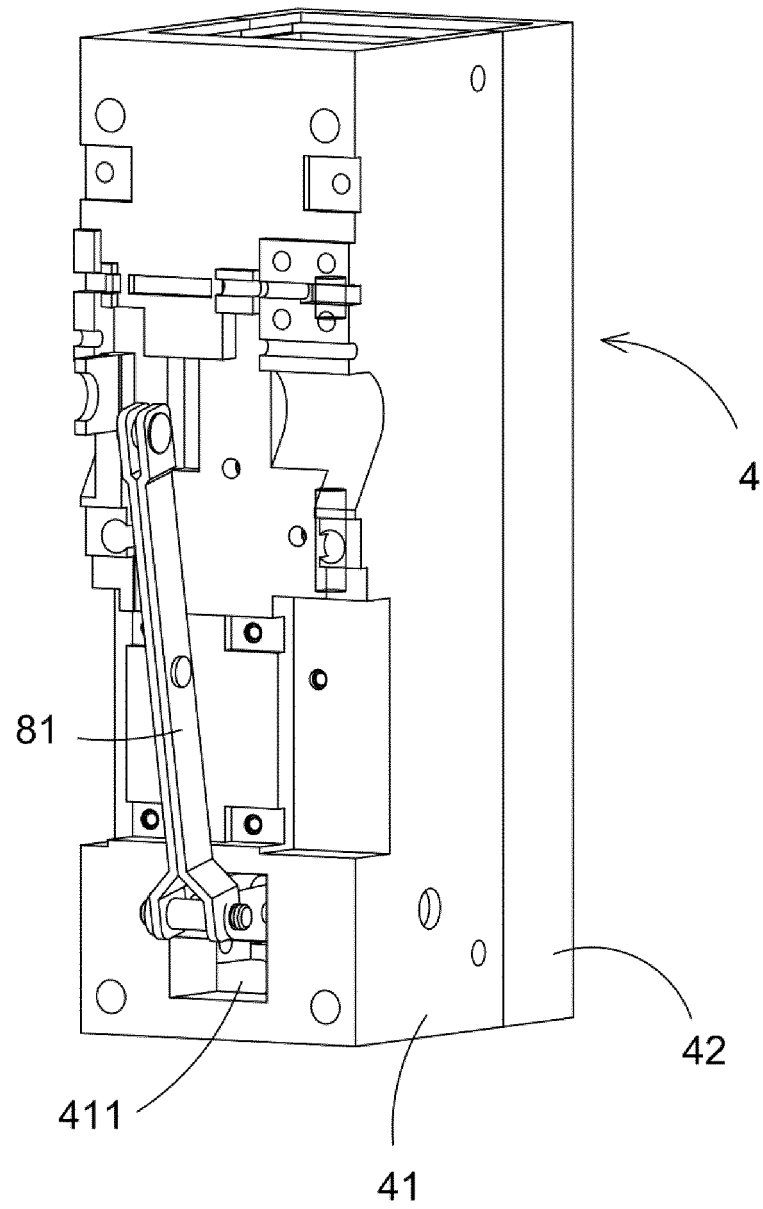


FIG. 4

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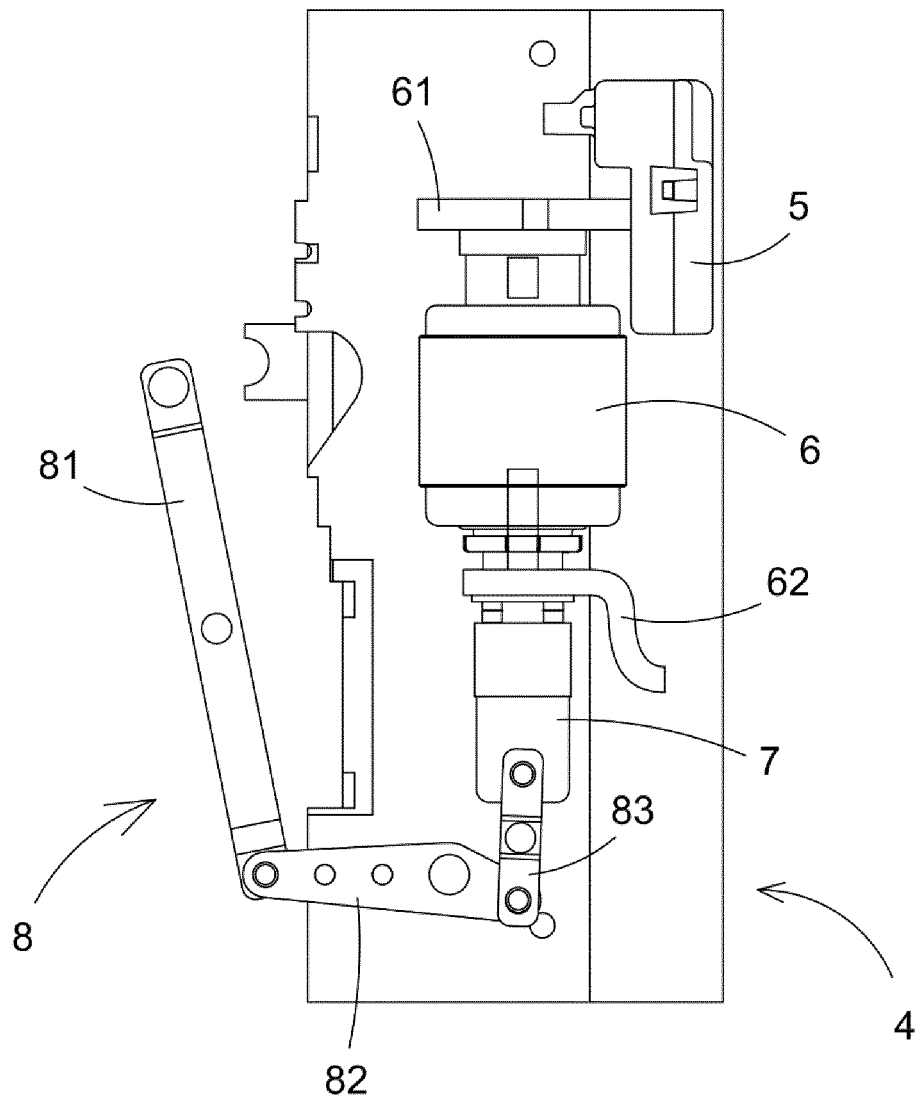


FIG. 5

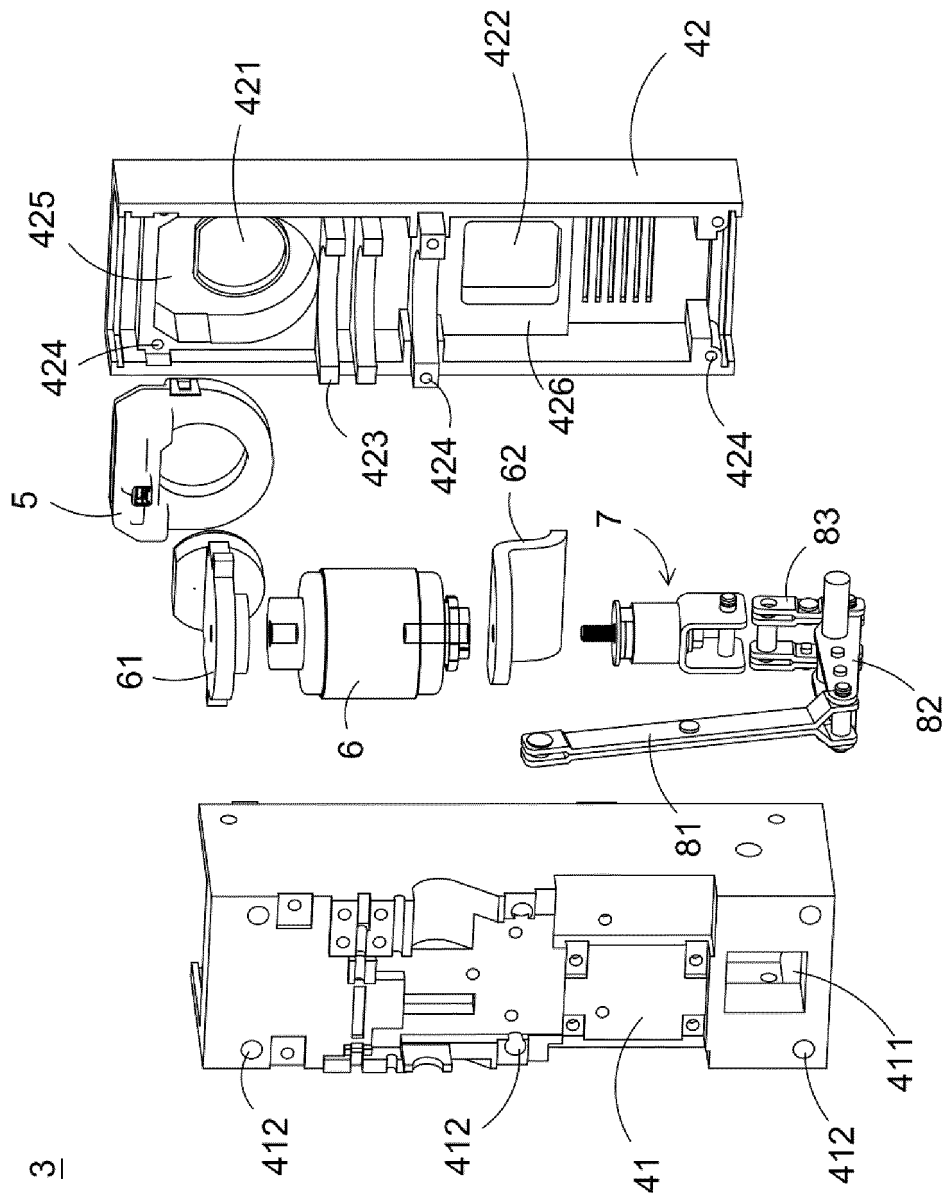


FIG. 6

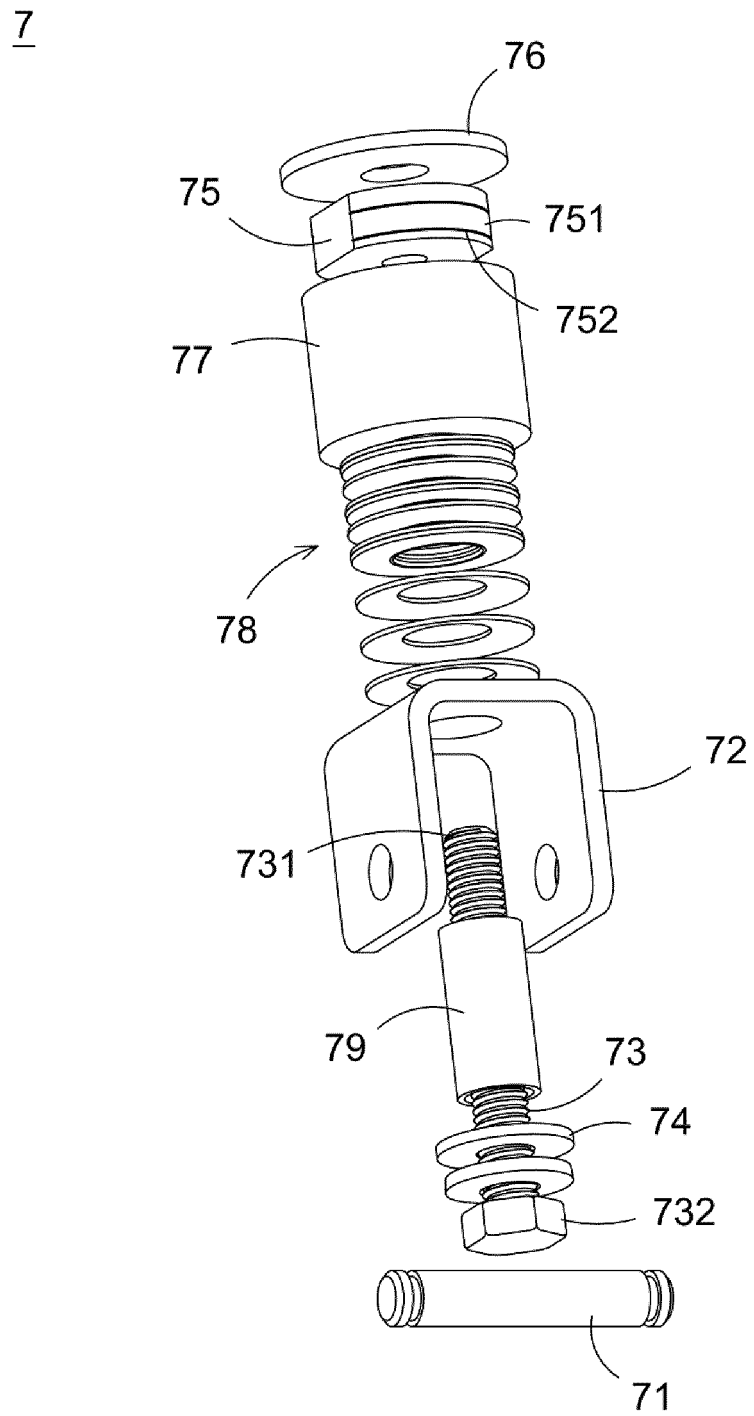


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2022/057417

A. CLASSIFICATION OF SUBJECT MATTER

H01H 33/66(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)

CNPAT, CNKI, WPI, EPODOC: 真空, 断路器, 灭弧, 灭弧室, 外壳, 开口, 支撑, 触头, 动触头, 移动, 活动, 静触头, 固定触头, 驱动, 操作, 操纵, 操纵, switch, breaker, operation, driving, support, contact, movable, moving, connecting, shell

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 215988571 U (EATON ELECTRICAL LTD.) 08 March 2022 (2022-03-08) claims 1-10	1-10
X	CN 213277930 U (ZICYELE CO., LTD.) 25 May 2021 (2021-05-25) description, paragraphs [0037]-[0052], and figures 1-5	1-10
X	CN 112259409 A (PINGGAO GROUP CO., LTD. et al.) 22 January 2021 (2021-01-22) description, paragraphs [0047]-[0087], and figure 1	1-10
A	CN 111276361 A (NANTONG TAIFU ELECTRIC APPLIANCE MANUFACTURING CO., LTD.) 12 June 2020 (2020-06-12) entire document	1-10
A	CN 201242971 Y (NANJING INTELLIGENT DISTRIBUTION AUTOMATION EQUIPMENT CO., LTD.) 20 May 2009 (2009-05-20) entire document	1-10
A	FR 2839193 A1 (ALSTOM SA) 31 October 2003 (2003-10-31) entire document	1-10

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

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“&” document member of the same patent family

Date of the actual completion of the international search

18 November 2022

Date of mailing of the international search report

28 November 2022

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
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