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

(11) **EP 4 300 536 A1**

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

(43) Date of publication:
03.01.2024 Bulletin 2024/01

(21) Application number: **22762376.6**

(22) Date of filing: **16.02.2022**

(51) International Patent Classification (IPC):
H01H 71/10 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H01H 71/10; H01H 73/18

(86) International application number:
PCT/CN2022/076511

(87) International publication number:
WO 2022/183910 (09.09.2022 Gazette 2022/36)

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

(30) Priority: **05.03.2021 CN 202110246059**

(71) Applicants:
- **Shanghai Electrical Apparatus Research Institute (Group) Co., Ltd.**
  Shanghai 200063 (CN)
- **Shanghai Electrical Apparatus Research Institute**
  Putuo District
  Shanghai 200063 (CN)

(72) Inventors:
- **ZHANG, Senlin**
  Shanghai 200063 (CN)
- **WANG, Bingqing**
  Shanghai 200063 (CN)
- **ZHOU, Rongwei**
  Shanghai 200063 (CN)
- **SUN, Jisheng**
  Shanghai 200063 (CN)

(74) Representative: **Boult Wade Tennant LLP**
Salisbury Square House
8 Salisbury Square
London EC4Y 8AP (GB)

(54) OPERATING MECHANISM FOR CIRCUIT BREAKER

(57) This application provides an operation mechanism for a circuit breaker, comprising an operation assembly, a transmission mechanism and a locking mechanism, the operation assembly comprising a support member and a rotating member rotatably mounted to the support member, and the rotating member comprising a first limit position and a second limit position in a rotation direction. In the operation mechanism for the circuit breaker of this application, the transmission chain and the locking chain are formed by providing the operation assembly, the transmission mechanism, and the locking mechanism. The arc extinguishing device is provided downwards, that is, also extends along the length direction of the circuit breaker extends. Compared with the arc extinguishing mechanism extinguishing device in the prior art that extends along the height direction of the circuit breaker, the arc extinguishing device of this application can occupy a larger space and thus break higher short-circuit currents.

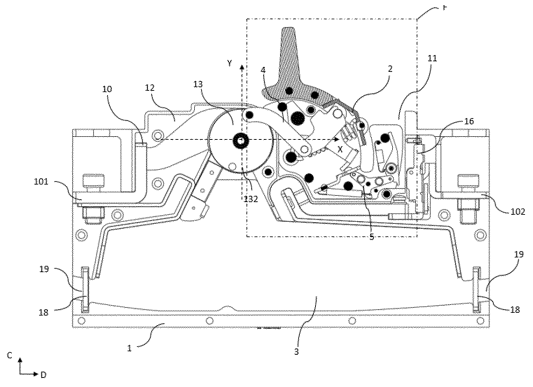

Fig. 1

EP 4 300 536 A1

Description

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Chinese Patent Application No. 202110246059.9, entitled "OPERATION MECHANISM FOR CIRCUIT BREAKER" filed on March 5, 2021, which is incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] This application relates to the technical field of circuit breakers, and in particular to an operation mechanism for a circuit breaker.

BACKGROUND

[0003] Circuit breakers can be used to distribute electrical energy and infrequently start asynchronous motors, thus protecting power circuits and motors. Circuit breakers can automatically cut off circuits when severe overload, short circuit, undervoltage or other fault occurs, and generally do not need to replace components after breaking the fault current. Therefore, they have been widely used. Circuit breakers generally include a contact mechanism, an arc extinguishing device, an operation mechanism, a releases, and an enclosure.

[0004] Existing operation mechanisms and arc extinguishing devices are arranged opposite to each other in a length direction of the circuit breakers, that is, the arc extinguishing devices extend along a height direction of the circuit breakers. The length is generally larger than the height, resulting in a smaller area occupied by the arc extinguishing devices in the circuit breaker, thus making it difficult for the arc extinguishing devices to break high short-circuit currents.

SUMMARY

[0005] Embodiments of this application provide an operation mechanism for a circuit breaker to at least solve the problem in existing circuit breakers that the operation mechanism occupies a large area, resulting in a small space occupied by the arc extinguishing device and thus making it different to break high short-circuit currents.

[0006] In an aspect, embodiments of this application provides an operation mechanism for a circuit breaker connected to the rotating wheel, comprising an operation assembly, a transmission mechanism and a locking mechanism, the operation assembly comprising a support member and a rotating member rotatably mounted to the support member, and the rotating member comprising a first limit position and a second limit position in a rotation direction; and

the locking mechanism comprising a trip member, a latch member, a traction member which is coupled with a release, and a transition member which is connected with the latch member and the traction member and comprising a released state and a buckled state, and when the locking mechanism is in the buckled state, the trip member and the latch member forming a first locking position, the transition member and the latch member forming a second locking position, and the transition member and the traction member forming a third locking position;

[0007] The transmission mechanism comprises a first connecting rod, a second connecting rod, a rotating shaft connected with the first connecting rod and the second connecting rod, and a main elastic member, one end of the first connecting rod comprises a first connection point pivotally connected with the trip member and the other end of the first connecting rod comprises a second connection point connected with the second connecting rod, one end of the second connecting rod comprises a third connection point connected with the first connecting rod and the other end of the second connecting rod comprises a fourth connection point connected with a rotating wheel, and the rotating shaft is provided between the second connection point and the third connection point; one end of the main elastic member comprises a first mounting position connected with the rotating member, and the other end of the main elastic member comprises a second mounting position connected with the rotating shaft;

a plane rectangular coordinate system is established with a center of the rotating wheel as an origin, a length direction of the circuit breaker is a direction of an X-axis, the first mounting position, the first connection point, the rotating shaft and the fourth connection point are sequentially arranged in a negative direction of the X-axis to form a transmission chain, and the first locking position, the second locking position and the third locking position are sequentially arranged in a positive direction of the X-axis to form a locking chain. The sequential arrangement in the negative direction of the X-axis mentioned in this embodiment refers to the arrangement sequence of the X-axis coordinates of the first mounting position, the first connection point, the rotating shaft, and the fourth connection point, rather than limiting the transmission chain to be in a straight line. That is, the first mounting position, the first connection point, the rotating shaft, and the fourth connection point may have the same or Y-axis coordinates, or they may have different Y-axis coordinates. Similarly, the sequential arrangement in the positive direction of the X-axis refers to the arrangement sequence of the X-axis coordinates of the first locking position, the second locking position, and the third locking position, rather than limiting the locking chain to be in a straight line.

[0008] According to an aspect of embodiments of this application, the locking chain is located below the transmission chain in the Y-axis direction.

[0009] According to an aspect of embodiments of this application, when the rotating member is located at the first limit position, the second locking position and the third locking position are located on two sides of the first

mounting position in the direction of the X-axis.

[0010] According to an aspect of embodiments of this application, wherein the operation assembly, the locking mechanism, and the main elastic member are located on a right side of the Y-axis, the first connection point, the second connection point and the third connection point are located on the right side of the Y-axis, the fourth connection point is capable of moving back and forth on two sides of the Y-axis, and the rotating shaft is capable of moving back and forth on two sides of the X-axis.

[0011] According to an aspect of embodiments of this application, the support member comprises two sub side plates opposite to each other in a first direction, and the two sub side plates each comprise a recessed portion recessed from one end of each sub side plate toward a central area of the sub side plate; the rotating member is rotatably connected with the sub side plates, is capable of being rotated partially into the recessed portion, and comprises two rotating plates opposite to each other in the first direction and a hanging portion between the two rotating plates which are connected with each other to form an accommodation space, the two sub side plates are clamped between the two rotating plates each of which comprises a rotating shaft connecting end for connecting one of the sub side plates and a rotating end opposite to the rotating shaft connecting end, and the hanging portion is provided at the rotating end for hanging the main elastic member; and a handle is mounted to the rotating end which is provided to be adjacent to the hanging portion.

[0012] According to an aspect of embodiments of this application, the latch member and the traction member are located on two sides of the recessed portion respectively and are rotatably mounted on the support member.

[0013] According to an aspect of embodiments of this application, the transition member is located below the recessed portion in the direction of the Y-axis.

[0014] According to an aspect of embodiments of this application, the support member comprises a fixed pin mounted on each sub side plate which is sheathed with a rolling wheel, the rotating shaft connecting end comprises an arc-shaped clamping surface clamped to an outer circumference of the rolling wheel, the hanging portion comprises a body which comprises a shaft pin placement groove extending in the first direction and comprising an opening facing away from the accommodation space, and a via hole through which the main elastic member passes is provided on a bottom surface of the shaft pin placement groove.

[0015] According to an aspect of embodiments of this application, the rotating member comprises a clamping portion, the clamping portion and the hanging portion are sequentially arranged at the rotating end in a direction where the rotation plates are rotated into the recessed portion, and the clamping portion comprises a first clamping surface and a second clamping surface which face the accommodation space and are connected at an angle and a limit surface which faces away from the first clamping surface and against which the handle abuts.

[0016] According to an aspect of embodiments of this application,the clamping portion comprises an avoidance surface facing away from the second clamping surface and connected with the limit surface, the hanging portion comprises an outer surface facing away from the accommodation space, the avoidance surface is located between the limit surface and the outer surface, an angle between the avoidance surface and the limit surface is 01, and an angle between the avoidance surface and the outer surface is $\Theta 2$, wherein $90° < \theta 1 < \theta 2$.

[0017] According to an aspect of embodiments of this application, the rotating plate is fan-shaped, and the rotating end comprises an arc-shaped edge.

[0018] According to an aspect of embodiments of this application, the hanging portion is provided at an end of the arc-shaped edge rotated into the recessed portion and comprises a first end and a second end opposite to each other in the rotation direction, the first end of the hanging portion is connected with the clamping portion, and the clamping portion is connected to the sub side plate through the hanging portion.

[0019] According to an aspect of embodiments of this application, the hanging portion comprises a third end and a fourth end opposite to each other in the first direction, a pin extending in the first direction is provided at each of the third end and the fourth end, an insertion column extending in the first direction is provided at the rotating end and provided with a insertion hole, and the pin is in interference fit with the insertion hole.

[0020] In the operation mechanism for the circuit breaker of the embodiments of this application, the transmission chain and the locking chain are formed by providing the operation assembly, the transmission mechanism, and the locking mechanism. The arc extinguishing device is provided downwards, that is, the arc extinguishing device also extends along the length direction of the circuit breaker extends. Compared with the arc extinguishing device in the prior art that extends along the height direction of the circuit breaker, the arc extinguishing device of this application can occupy a larger space and thus break higher short-circuit currents.

DESCRIPTION OF THE DRAWINGS

[0021] The features, advantages, and technical effects of the exemplary embodiments of this application will be described below with reference to the accompanying drawings.

Fig. 1 is a schematic structural diagram of a circuit breaker in a released state according to an embodiment of this application;

Fig. 2 is a schematic structural diagram of a circuit breaker in a buckled state as shown in Fig. 1;

Fig. 3 is a schematic structural diagram of a circuit breaker in a closed state as shown in Fig. 1;

Fig. 4 is a schematic structural diagram of a trans-

mission mechanism as shown in Fig. 1;
Fig. 5 is a schematic structural diagram of a transmission mechanism and an operation mechanism as shown in Fig. 1;
Fig. 6 is a partially enlarged view at a portion F as shown in Fig. 1;
Fig. 7 is a schematic structural diagram of a trip member in Fig. 6;
Fig. 8 is a schematic structural diagram of a latch member in Fig. 6;
Fig. 9 is a schematic structural diagram of a traction member in Fig. 6;
Fig. 10 is a schematic structural diagram of a transition member in Fig. 6;
Fig. 11 is a schematic structural diagram of an operation assembly as shown in Fig. 1;
Fig. 12 is a schematic structural diagram of a support member in Fig. 11;
Fig. 13 is a schematic structural diagram of a rotating member in Fig. 11;
Fig. 14 is a schematic diagram of connection of three circuit breakers according to an embodiment of this application.

[0022] Reference numerals:

1. housing; 11. accommodation portion; 12. accommodation cavity; 13. rotating wheel; 131. first rotating portion; 132. peripheral portion; 14. movable contact; 141. movable contact arc guide member; 15. fixed contact; 151. fixed contact arc guide member; 16. release; 161. overcurrent release; 162. release actuating rod; 17. limit shaft; 18. deionization device; 19. exhaust hole; 10. wiring board; 101. first wiring board; 102. second wiring board;
2. operation assembly; 21. support member; 211. sub side plate; 212. avoidance hole; 213. side wall; 214. fixed pin; 215. rolling wheel; 22. rotating member; 221. rotating plate; 2211. rotating shaft connecting end; 2212. arc-shaped clamping surface; 2213. rotating end; 222. hanging portion; 2221. body; 2222. shaft pin placement groove; 2223. via hole; 2224. first end; 2225. second end; 2226. outer surface; 223. clamping portion; 2231. avoidance surface; 2232. second clamping surface; 2233. limit surface; 23. handle;
3. arc extinguishing device; 31. arc extinguishing chamber;
4. transmission mechanism; 41. first connecting rod; 411. first connection point; 412. second connection point; 413. first specific point; 42. second connecting rod; 421. third connection point; 422. fourth connection point; 423. second specific point; 43. main elastic member; 431. third specific point; 44. rotating shaft;
5. locking mechanism; 51. trip member; 511. first side plate; 512. connecting plate; 513. second surface; 514. clamping surface; 515. mounting lug; 5151. first mounting hole; 516. transmission arm; 5161. first abutting surface; 5162. second abutting surface; 5163. second mounting hole; 517. guide plate; 518. arc-shaped guide surface;
52. latch member; 521. clamping fit portion; 522. transition connection portion; 523. first transmission portion; 524. first side surface; 525. clamping fit surface; 526. first avoidance hole; 527. second avoidance hole; 528. first through hole; 529. clamping groove; 520. protrusion;
53. traction member; 531. base body; 532. second transmission portion; 533. step structure; 534. rotating shaft accommodation portion; 535. first step surface; 536. second step surface; 537. arc-shaped transition surface;
54. linkage assembly; 541. first retractable member; 542. second retractable member; 543. transition member; 544. Y-shaped clamping plate; 5441. first free end; 5442. second free end; 5443. third free end; 545. first shaft rod; 546. second shaft rod; 547. roller; 548. mounting groove; 549. third shaft rod;
A. first direction; B. second direction; C. third direction; D. fourth direction; E. fifth direction.

DETAILED DESCRIPTION

[0023] Below, embodiments of this application will be further described in detail with reference to the drawings and embodiments. The following detailed description of the embodiments and the accompanying drawings are intended to exemplary illustrate the principles of this application and are not intended to limit the scope of this application, i.e., this application is not limited to the described embodiments.

[0024] In the description of this application, it should be noted that, unless otherwise stated, the meaning of "a plurality" is two or more; the orientation or positional relationship indicated by terms "upper", "lower", "left", "right", "inner", "outer" and the like is merely for the purpose of easily describing this application and simplifying the description and is not intended to indicate or imply that the device or element referred to has a particular orientation, is constructed and operated in a particular orientation, and therefore cannot be construed as limiting this application. Moreover, terms "first", "second", "third", and the like are configured for descriptive purposes only and are not to be construed as indicating or implying relative importance.

[0025] The orientations in the following description are all directions shown in the drawings and are not intended to limit specific structures of this application. In the description of this application, it should be noted that, unless otherwise stated, terms "mounting", "connected to", and "connected with" are to be understood broadly and may be, for example, a fixed connection, a disassemble connection, or an integral connection; they can be connected directly or indirectly through an intermediate medium. The specific meaning of the above terms in this application can be understood by the person skilled in the art

according to specific circumstance.

[0026] In order to better understand this application, embodiments of this application will be described below with reference to Figs. 1 to 14.

[0027] Please with reference to Figs. 1 to 3 together, Fig. 1 is a schematic structural diagram of a circuit breaker in a released state provided by an embodiment of this application, Fig. 2 is a schematic structural diagram of a circuit breaker in a buckled state as shown in Fig. 1, and Fig. 3 is a schematic structural diagram of a circuit breaker in a closed state as shown in Fig. 1. The circuit breaker provided in an embodiment of this application includes a housing 1, an operation assembly 2, an arc extinguishing device 3, and a transmission mechanism 4, where the housing 1 has, in a fifth direction E, a bottom and a top opposite to each other, an accommodation portion 11 recessed from the top to the bottom, and an accommodation cavity 12 semi-surrounding the accommodation portion 11; a rotating wheel 13 and a movable contact 14 connected to the rotating wheel 13 are provided in the accommodation cavity 12 close to the top and adjacent to the accommodation portion 11 in a second direction B; the operation assembly 2 is rotatably and detachably connected to the top of the housing 1 and can be rotated to be accommodated in or to exit from the accommodation portion 11; the arc extinguishing device 3 includes an arc extinguishing chamber 31 located in the accommodation cavity 12 and close to the bottom; and the transmission mechanism 4 is configured for transmitting, to the rotating wheel 13, a first signal sent by the operation assembly 2 in the second direction B, so as to drive the movable contact 14 to move.

[0028] In the embodiments of this application, the transmission mechanism 4 is close to the top of the housing 1, the arc extinguishing device 3 is close to the bottom of the housing 1 and arranged laterally, and the two are parallel to each other and do not interfere with each other, so compared with traditional circuit breakers, the arc extinguishing chamber 31 of this application has a larger volume and can accommodate more grids to improve the reliability of breaking a movable contact and a fixed contact; and the transmission of the transmission mechanism 4 in the second direction B avoids interference with other components.

[0029] The housing 1 has a recessed accommodation portion 11 and an accommodation cavity 12 surrounding the accommodation portion 11, where the accommodation cavity 12 may surround only two planes of the accommodation portion 11, or simultaneously surround three or more planes of the accommodation portion 11. In the embodiments of this application, the description is made by taking the case, in which the accommodation cavity 12 surrounds three planes of the accommodation portion 11, as an example. The accommodation cavity 12 presents a concave structure, the accommodation portion 11 is located in a recessed area of the concave structure and surrounded by the accommodation cavity 12, and the accommodation portion 11 is separated from the accommodation cavity 12 by the housing 1, that is, the housing 1 is in contact with the three planes of the accommodation portion 11 to form a semi-surrounding structure.

[0030] The rotating wheel 13, the movable contact 14, and the arc extinguishing device 3 are all located in the accommodation cavity 12. The rotating wheel 13 is located close to the top of the housing 1, and the movable contact 14 is located on the rotating wheel 13 away from the top of the housing 1. The rotating wheel 13 is rotatably connected to the housing 1 and moves synchronously with the movable contact 14. The movable contact 14 is used with a fixed contact 15. When the movable contact 14 engages with the fixed contact 15, the circuit breaker is in a connected state, that is, the circuit breaker is in a closed state. When the movable contact 14 disengages from the fixed contact 15, the circuit breaker is in a disconnected state, that is, the circuit breaker is in an open state.

[0031] The arc extinguishing chamber 31 in the arc extinguishing device 3 is located near the bottom of the housing 1, and the movable contact 14 is located between the rotating wheel 13 and the arc extinguishing chamber 31. At the moment when the movable contact 14 and the fixed contact 15 are disconnected, due to the capacitance between the movable contact 14 and the fixed contact 15, the insulation between the contacts is broken and a vacuum arc is generated. The existence of the arc not only expands the overall fault degree of the circuit system, but also causes damage to the contacts themselves, Therefore, the circuit breaker needs to be equipped with an arc extinguishing device 3 to reduce the burning loss of the contact caused by the arc and limit the space for arc expansion. In this solution, a length direction of the arc extinguishing chamber 31 is approximately parallel to the second direction B, that is, the arc extinguishing chamber 31 extends in a long edge direction of the circuit breaker. In an ordinary circuit breaker, the arc extinguishing chamber 31 usually extends in a height direction of the circuit breaker. Therefore, compared with existing circuit breakers, under the premise of the same overall volume of the circuit breakers, the arc extinguishing chamber 31 in this application has a larger capacity and can be mounted with more grids, thereby improving the reliability of high-voltage breaking of the movable and fixed contacts.

[0032] In this embodiment, the operation assembly 2 is arranged in the accommodation portion 12 and detachably connected to the housing 1. The operation assembly 2 is configured for driving the rotating wheel 13 to rotate on the housing 1, and a portion of the transmission mechanism 4 is located in the accommodation portion 11 for transmission connection with the operation assembly 2 and the rotating wheel 13. The operation assembly 2 sends a first signal to the transmission mechanism 4, and the transmission mechanism 4 transmits the first signal to the rotating wheel 13 in the second direction B, so that the movable contact 14 gets close to or away from the

fixed contact 15. The fifth direction E intersects the second direction B, and the angle between the two directions is not limited by this application, as long as the two directions do not overlap or parallel to each other. In some preferred solutions, the fifth direction E and the second direction B are perpendicular to each other. In this case, the fifth direction E is parallel to an overall length direction of the circuit breaker, and the second direction B is parallel to a height direction of the circuit breaker, that is, the transmission direction of the transmission mechanism 4 is parallel to the length direction of the arc extinguishing chamber 31, the transmission mechanism 4 is close to the top of housing 1, the arc extinguishing device 31 is close to the bottom of housing 1, and the two are parallel and do not interfere with each other.

[0033] Below, please with reference to Figs. 4 and 5, Fig, 4 is a schematic structural diagram of a transmission mechanism as shown in Fig. 1, and Fig. 5 is a schematic structural diagram of a transmission mechanism and an operation assembly as shown in Fig. 1. The transmission mechanism 4 includes a first connecting rod 41, a second connecting rod 42, and a main elastic member 43, where the first connecting rod 41 and the second connecting rod 42 are rotatably connected through a rotating shaft 44, the first signal is transmitted to the rotating wheel 13 via the first connecting rod 41 and the second connecting rod 42, one end of the main elastic member 43 is connected to the rotating shaft 44 and the other end is connected to the operation assembly 2, and force applied to the rotating shaft 44 by the main elastic member 43 enables displacement of the rotating shaft 44 in the fifth direction E.

[0034] One end of the first connecting rod 41 is relatively close to the operation assembly 2 and the other end is rotatably connected to the second connecting rod 42 through the rotating shaft 44, and an end, away from the first connecting rod 41, of the second connecting rod 42 is connected to the rotating wheel 13. In other embodiments, the operation assembly 2 and the rotating wheel 13 may alternatively be connected to other positions of the first connecting rod 41 and the second connecting rod 42, which is not limited by this application, as long as the transmission direction of the transmission mechanism 4 follows the second direction B. When the circuit breaker is opened or closed, the staff sends the first signal to the main elastic member 43 of the transmission mechanism 4 through the operation assembly 2, the first connecting rod 41 drives the second connecting rod 42 to move together, the rotating wheel 13 rotates, the movable contact 14 gets close to or away from the fixed contact 15, and the connection and disconnection of the overall circuit are achieved.

[0035] One end of the main elastic member 43 is connected to the rotating shaft 44 and the other end is connected to the operation assembly 2. The end, connected to the operation assembly 2, of the main elastic member 43 is configured for receiving external force, and the other end is configured for applying tensile force to the rotating shaft 44 and driving the rotating shaft 44 to move. The rotating shaft 44 may be fixedly connected to the first connecting rod 41 or the second connecting rod 42, or may be rotatably connected to both the first connecting rod 41 and the second connecting rod 42, which is not limited by this application. In the opening or closing process of the circuit breaker, the overall transmission direction of the first connecting rod 41 and the second connecting rod 42 follows the second direction B, while the movement direction of the rotating shaft 44 is the fifth direction E, that is, under the tensile force of the main elastic member 43, the movement direction of the connection between the first connecting rod 41 and the second connecting rod 42 intersects the overall transmission direction of the transmission mechanism 4. In some preferred embodiments, the movement direction of the rotating shaft 44 is nearly perpendicular to the overall transmission direction of the transmission mechanism 4. Through such design, the overall length of the transmission mechanism 4 in the second direction B can be reduced, so that the circuit breaker has a more compact structure to save lateral space

[0036] It may be understood that the transmission mechanism 4 includes a first connecting rod 41, a second connecting rod 42, and a main elastic member 43, where the first connecting rod 41 has a first connection point 411 and a second connection point 412 in its length direction, and the first connection point 411 is configured for rotating around a first specific point 413; the second connecting rod 42 has a third connection point 421 and a fourth connection point 422 in its length direction, the second connection point 412 is rotatably connected to the third connection point 421 through the rotating shaft 44, and the fourth connection point 422 is configured for rotating around a second specific point 423; and one end of the main elastic member 43 is connected to the rotating shaft 44, and the other end is configured for receiving external force, where the main elastic member 43 applies force to the rotating shaft 44 under an external force, so that the rotating shaft 44 moves towards a direction intersecting a line connecting the first connection point 411 and the second connection point 412.

[0037] The first connection point 411, the second connection point 412, the third connection point 421, and the fourth connection point 422 may be located at different positions of the first connecting rod 41 and the second connecting rod 42 respectively, which is not limited by this application. In some optional solutions, as shown in Fig. 4 and Fig. 5, the first connection point 411 and the second connection point 412 are located at two ends of the first connecting rod 41 separately, the third connection point 421 and the fourth connection point 422 are located at two ends of the second connecting rod 42 separately, and the second connection point 412 and the third connection point 421 are connected through the rotating shaft 44.

[0038] The motion of the transmission mechanism 4 in this application includes two cases. In the first case, the

first connection point 411 on the first connecting rod 41 remains fixed, the end, away from the second connecting rod 42, of the main elastic member 43 moves under an external force, and the position of the rotating shaft 44 does not change; when a specific moment arrives, the main elastic member 43 releases energy to the rotating shaft 44 and drives the rotating shaft 44 to move relatively; and then both the first connecting rod 41 and the second connecting rod 42 begin to rotate, the second connection point 412 on the first connecting rod 41 rotates around the first connection point 411, the third connection point 421 on the second connecting rod 42 has a same motion track as the second connection point 412, and the fourth connection point 422 rotates around the second specific point 423. In this process, the rotating shaft 44 rotates around the first connection point 411, and the movement direction of the rotating shaft 44 always intersects the line connecting the first connection point 411 and the fourth connection point 422, where the main elastic member 43 plays a role in transmitting the external force to drive the first connecting rod 41 and the second connecting rod 42 to move relatively.

[0039] In the second case, the first connection point 411 on the first connecting rod 41 can rotate relatively around the first specific point 413; under the influence of other external force factors, the first connection point 411 rotates around the first specific point 413, and the second connection point 412 on the first connecting rod 41, namely, the position of the rotating shaft 44 deviates with the movement of the first connection point 411; and the force applied to the rotating shaft 44 by the main elastic member 43 enables the rotating shaft 44 to get relatively close to the first connection point 411 in the second direction B, the third connection point 421 on the second connecting rod 42 has the same motion track as the second connection point 412, and the fourth connection point 422 rotates around the second specific point 423. Like the first case, the movement direction of the rotating shaft 44 always intersects the line connecting the first connection point 411 and the fourth connection point 422.

[0040] In the foregoing two cases, the movement direction of the rotating shaft 44 always intersects the line connecting the first connection point 411 and the fourth connection point 422, that is, the movement direction of the rotating shaft 44 intersects the transmission direction of the entire transmission mechanism 4. In the circuit breaker of this application, the overall transmission direction of the transmission mechanism 4 is nearly parallel to the second direction B, and the movement direction of the rotating shaft 44 intersects or even may be perpendicular to the transmission direction, that is, the movement direction of the connection points of the two connecting rods is nearly parallel to the fifth direction E. Compared with traditional circuit breakers, this design can make reasonable use of the internal spatial structure of the circuit breaker, thereby reducing the lateral space occupied by the entire transmission mechanism 4 in the circuit breaker.

[0041] In the transmission mechanism provided in the embodiments of this application, the end, away from the rotating shaft 44, of the main elastic member 43 is configured for rotating around the third specific point 431, where the third specific point 431, the second connection point 412, and the first connection point 411 are coplanar and non-collinear. The end, away from the rotating shaft 44, of the main elastic member 43 slides relatively along a specific track. The deflection angle of the main elastic member 43 relative to the third specific point 431 is determined according to the actual size inside the circuit breaker, and is not limited by this application.

[0042] In the transmission mechanism provided in the embodiments of this application, the main elastic member 43 has a tensile state and a reset state, and the length of the main elastic member 43 in the reset state is larger than that of the first connecting rod. The main elastic member 43 in this application may be an elastic member, that is, a spring, an elastic rope, or the like. The reset state indicates that the main elastic member 43 is not subjected to any external force in its length direction, while the tensile state indicates that the main elastic member elongates under an external force in its length direction, and the elongation is less than its maximum elastic deformation variable. Therefore, the length of the main elastic member 43 in the tensile state is larger than that in the reset state, In this application, the main elastic member 43 is always in the tensile state, so during the movement of the transmission mechanism 4, the length of the main elastic member 43 is always larger than that of the first connecting rod 41. Because one end of the main elastic member 43 overlaps the second connection point 412 on the first connecting rod 41, the end, away from the second connecting rod 42, of the main elastic member 43 is always separated from the first connection point 411 on the first connecting rod 41, that is, the main elastic member 43 will not interfere with the first connecting rod 41, thereby improving the overall reliability of the transmission mechanism 4.

[0043] The end, away from the second connecting rod 42, of the main elastic member 43 is configured for receiving external force. Under an external force, the main elastic member 43 is gradually elongated, and its elastic force gradually increases. When the main elastic member 43 elongates to a specific length, the main elastic member 43 releases energy to the rotating shaft 44 and drives the rotating shaft 44 to move. The main elastic member 43, the rotating shaft 44, and the operation assembly 2 may be mounted in various ways. In some solutions, hooks are provided at two ends of the main elastic member 43, which is hooked to the rotating shaft 44 and the operation assembly 2 through the hooks. In other solutions, their connections may alternatively be implemented by bonding or welding.

[0044] In the transmission mechanism 4 provided in the embodiments of this application, the first specific point 413 and the second specific point 423 are separately located on two sides of a line connecting the fourth

connection point 422 and the rotating shaft 44. The first specific point 413 is a rotational center of the first connection point 411, and the second specific point 423 is a rotational center of the fourth connection point 422. A line connecting the first specific point 413 and the second specific point 423 intersects the second connecting rod 42. The specific positions of the first specific point 413 and the second specific point 423 are determined according to the volume of the circuit breaker and the lengths of the first connecting rod 41 and the second connecting rod 42, which is limited by this application.

[0045] In the transmission mechanism 4 provided in the embodiments of this application, the distance between the second specific point 423 and the rotating shaft 44 is always larger than that between the second specific point 431 and the fourth connection point 422. Because the rotating shaft 44 is mounted on the third connection point 421 of the second connecting rod 42, the distance between the second specific point 423 and the rotating shaft 44 is the same as that between the second specific point 423 and the third connection point 421, that is, the distance between the second specific point 423 and the third connection point 421 is larger than that between the second specific point 423 and the fourth connection point 422. In this solution, a circle is made with the second specific point 423 as a center and the distance between the second specific point 423 and the fourth connection point 422 as a radius. The rotating shaft 44 is always outside the circle, which is equivalent to that the second connection point 412 is always outside the circumference, that is, the first connecting rod 41 will never interfere with the above circumference.

[0046] In the circuit breaker provided in the embodiments of this application, the rotating wheel 13 and the movable contact 14 connected to the rotating wheel 13 are provided in the housing 1, where the rotating wheel 13 includes a first rotating portion 131 and a peripheral portion 132 surrounding the first rotating portion 131, the first rotating portion 131 is rotatably arranged on the housing 1, the second connecting rod 42 is connected to the peripheral portion 132 through the fourth connection point 422, and the first specific point 423 overlaps the first rotating portion 131. As shown in Fig. 2, the second connecting rod 42 is configured for directly driving the rotating wheel 13 to rotate around the first rotating portion 131, and the first rotating portion 131 may be located in the center of the rotating wheel 13 or may be arranged eccentrically. The distance between the second specific point 423 and the rotating shaft 44 is always larger than that between the second specific point 423 and the fourth connection point 422, and the fourth connection point 422 is located on the peripheral portion of the rotating wheel 13, so the first connecting rod 41 will not interfere with the rotating wheel 13.

[0047] In the circuit breaker provided in the embodiments of this application, the operation assembly 2 sends the first signal, and the transmission mechanism 4 transmits the first signal to the rotating wheel 13, so as to drive the movable contact 14 to move. The staff operates the operation assembly 2 to implement opening or closing operations, and instructions are transmitted between the operation assembly 2 and the rotating wheel 13 through the transmission mechanism 4. Generally, the operation assembly 2 is rotatably mounted on the support member 21 which is fixed on the housing 1 of the circuit breaker, an end, away from the rotating shaft 44, of the main elastic member 43 is connected to the operation assembly 2 and moves synchronously with the operation assembly 2. During the movement of the operation assembly 2, the main elastic member 43 gradually elongates under the drive of the operation assembly 2, its elastic force gradually increases, and the main elastic member 43 releases energy to the rotating shaft 44 and drives the rotating shaft 44 to move.

[0048] In the circuit breaker provided in the embodiments of this application, the first connecting rod 41 is connected to a locking mechanism 5 through the first connection point 411, the locking mechanism 5 sends a second signal to the transmission mechanism 4, and the transmission mechanism 4 drives the rotating wheel 13, so as to drive the movable contact 14 to move. The locking mechanism 5 includes a trip member 51 and a latch member 52 locking each other, the first connecting rod 41 is connected to the trip member 51 through the first connection point 411, the trip member 51 is rotatably connected to the support member 21 through a first mounting hole 5151, and the first specific point 413 overlaps the first mounting hole 5151. When the circuit breaker is in a closed state, the locking mechanism 5 is in a buckled state, and the first connection point 411 remains fixed. When the circuit malfunctions, the locking mechanism 5 is released from the buckled state under an external force, the trip member 51 rotates counterclockwise, a lower part of the first mounting hole 5151 pushes the rotating shaft 44 to produce a downward displacement, and the fourth connection point 422 on the second connecting rod 42 begins to rotate around the first rotating portion 131 of the rotating wheel 13.

[0049] In some other embodiments, the locking mechanism 5 and the operation assembly 2 are synchronously stored in the accommodation portion 11, the locking mechanism 5 sends a second signal, and the transmission mechanism 4 transmits the second signal to the rotating wheel 13 in the second direction B, so as to drive the movable contact 14 to move.

[0050] When the circuit breaker is closed, the locking mechanism 5 is in the buckled state, the movable contact 14 and the fixed contact 15 are in close contact with each other, and a relatively stable structure is presented inside the entire circuit breaker. When the overall circuit malfunctions, the internal stability of the circuit breaker is disrupted, the locking mechanism 5 changes from the buckled state to a released state, the locking mechanism 5 sends a second signal to the transmission mechanism 4, and the transmission mechanism 4 drives the rotating wheel 13, so as to drive the movable contact 14 to move,

the movable contact 15 gets away from and separated from the fixed contact 150, and the circuit breaker changes from the closed state to an open state.

[0051] Below, please with reference to Figs. 6-10, Fig. 6 is a partially enlarged view at a portion F as shown in Fig. 1, Fig. 7 is a schematic structural diagram of a trip member in Fig. 6, Fig. 8 is a schematic structural diagram of a latch member in Fig. 6, Fig. 9 is a schematic structural diagram of a traction member in Fig. 6, and Fig. 10 is a schematic structural diagram of a transition member in Fig. 6. The locking mechanism 5 provided by an embodiment of this application includes a trip member 51 and a latch member 52 capable of locking each other, and the second signal is transmitted to the transmission mechanism 4 via the trip member 51 and the latch member 52, where an abutting point between the trip member 51 and the latch member 52 is located between the arc extinguishing chamber 31 and the transmission mechanism 4.

[0052] The trip member 51 and the latch member 52 lock each other to form a stable structure and complete transmission of force and locking of relative positions through the abutting point. In the process of transitions from a buckled state to a released state or from a released state to a buckled state, the abutting point between the the trip member 51 and the latch member 52 constantly changes, but remains between the arc extinguishing chamber 31 and the transmission mechanism 4, that is, the transmission process of the locking mechanism 5 occurs between the transmission mechanism 4 and the arc extinguishing device 3. In the structure shown in Fig. 1, a locking chain formed by the locking mechanism 5 is located below a transmission chain formed by the transmission mechanism 4 and above the arc extinguishing mechanism 3. In the fifth direction E, the transmission mechanism 4, the locking mechanism 5, and the arc extinguishing device 3 jointly form a longitudinal arrangement structure from top to bottom, and the three are staggered without mutual interference. In the second direction B, the extension direction of the transmission mechanism 4 and the extension direction of the locking mechanism 5 are both lateral, and the transmission directions of the both are parallel to the second direction B.

[0053] The internal components of the traditional circuit breakers are usually arranged laterally, the arc extinguishing device is located on one side of the circuit breaker, the transmission mechanism is next to the arc extinguishing device, the locking mechanism is located on a side, away from the arc extinguishing device, of the transmission mechanism, and the transmission directions of the locking mechanism and the transmission mechanism are vertical. Such structural design results in low overall space utilization of the circuit breaker, and some parts of the transmission structure and the locking mechanism overlap to interfere with each other and affect normal use of the circuit breakers. Therefore, compared with the arrangement of the traditional circuit breakers, the layered arrangement of the transmission chain and the locking chain in this application can make full use of the spatial structure inside the circuit breaker and make the overall structure more compact, and the parts of the transmission mechanism and the locking mechanism do not interfere with each other, thereby improving overall reliability.

[0054] In some other embodiments, the locking mechanism 5 includes a transition member 543 and a traction member 53, the latch member 52 and the transition member 543 are capable of locking each other, the transition member 543 and the traction member 53 are capable of locking each other, a release 16 is provided in the accommodation cavity 12 on a side, away from the rotating wheel 13, of the accommodation portion 11, and the release 16 sends the second signal to the traction member 53.

[0055] When the circuit breaker is closed, the trip member 51 and the latch member 52 lock each other, the latch member 52 and the transition member 543 lock each other, and the transition member 543 and the traction member 53 lock each other, where one end of the traction member 543 is connected to the release 16. The release 16 includes an overcurrent release 161 and a release actuating rod 162, and the traction member 53 and the release actuating rod 162 abut against each other. When the circuit malfunctions, the overcurrent release 161 senses an abnormality in the circuit and controls the release actuating rod 162 to move, and the traction member 53 moves with the release actuating rod 162 and unlocks the transition member 543. Subsequently, the latch member 52 and the trip member 51 are also successively unlocked and send a second signal to the transmission mechanism 4, and the transmission mechanism 4 transmits the signal to the rotating wheel 13 to separate the movable contact 14 from the fixed contact 15.

[0056] In some optional embodiments, the locking mechanism 5 includes a trip member 51, a latch member 52, a traction member 53, and a linkage assembly 54. The trip member 51 includes two first side plates 511 opposite to each other in a third direction C, and a connecting plate 512 connecting the two first side plates 511 at the same end; the connecting plate 512 has a first surface and a second surface 513 facing away from each other in its thickness direction, and a clamping surface 514 connected to the first surface and the second surface 513; and the first side plate 511 includes a mounting lug 515 which is located at an end, away from the connecting plate 512, of the first side plate 511. The latch member 52 is located on a side, away from the mounting lug 515, of the connecting plate 512 and includes a clamping fit portion 521, and a first transmission portion 523 in misaligned connection with the clamping fit portion 521 in a fourth direction D via a transition connection portion 522; the clamping fit portion 521 includes a first side surface 524 and a second side surface facing away from each other in the fourth direction D, and a clamping fit surface 525 connected to the first side surface 524 and the second side surface; and the transition connection portion

522 is provided with a first avoidance hole 526 penetrating therethrough in the thickness direction, and the clamping fit surface 525 at least partially passes through the first avoidance hole 526. The traction member 53 includes a base body 531, and a second transmission portion 532 and a step structure 533 on two opposite sides of the base body 531, where the base body 531 is provided with a rotating shaft accommodation portion 534 which is rotatably connected to the support member 21 after the shaft is mounted. The step structure 533 includes a first step surface 535 and a second step surface 536 connected to each other, and the second step surface 536 is connected to a side, away from the base body 531, of the first step surface 535. The linkage assembly 54 is configured for connecting the latch member 52 and the traction member 53. The locking mechanism 5 has a buckled state and a released state. When the locking state 5 transitions from the released state to the buckled state, the trip member 51 rotates clockwise from an initial position, the latch member 52 rotates counterclockwise, then the clamping fit surface 525 abuts against the clamping surface 514, and the latch member 52 enables the second transmission portion 532 to rotate clockwise to a first position through the linkage assembly 54. When the locking mechanism 5 transitions from the buckled state to the released state, the second transmission portion 532 rotates counterclockwise from the first position and enables the trip member 51 to rotate clockwise through the linkage assembly 54, then the clamping fit surface 525 gets away from the clamping surface 514, and the trip member 51 rotates counterclockwise to the initial position.

[0057] The trip member 51 is connected to the transmission mechanism 4, the two opposite first side plates 511 and the connecting plate 512 form a roughly U-shaped structure, the locking mechanism 5 transmits a second signal to the transmission mechanism 4 through the trip member 51 to drive the separation of the movable contact and the fixed contact, the first mounting hole 5151 is arranged on the mounting lug 515 of the first locking member 5, and the trip member 51 is rotatably connected to the support member 21 through the first mounting hole 5151.

[0058] The latch member 52 is configured for forming a locking structure together with the trip member 51 and rotatably connected to the support member 21 through the first transmission portion 523. The first transmission portion 523 is provided with a transmission shaft at one end in the fourth direction D, and the first transmission portion 523 is rotatably mounted on the support member 21 through the transmission shaft. Only one or two transmission shafts may be provided, that is, the latch member 52 may be rotatably connected to one side of the support member 21, or may be rotatably connected to two sides of the support member 21, and this application does not limit this.

[0059] The traction member 53 is configured for transmitting the second signal sent by the release 16, rotatably connected to the support 21 through the rotating shaft accommodation portion 534; the second transmission portion 532 is adjacent to the release 16 to receive the signal sent by the release 16; and the step structure 533 is located on a side, away from the second transmission portion 532, of the traction member 53 to form a locking mechanism together with the linkage assembly 54.

[0060] Generally, the locking mechanism 5 is used with the operation assembly 2 and the release 16. The operation assembly 2 can send a third signal to the locking mechanism 5 and drive the trip member 51 to rotate, and the locking mechanism 5 changes from the released state to the buckled state. When the circuit malfunctions, the release 16 sends a second signal, the traction member 53 transmits power to the locking mechanism 5, and the locking mechanism 5 changes from the buckled state to the released state.

[0061] Under the action of the third signal, the locking mechanism 5 changes from the released state to the buckled state. A specific workflow is as follows: the operation assembly 2 drives the trip member 51 to rotate clockwise around the first mounting hole 5151 on the mounting lug 515, the trip member 51 rotates and presses down the latch member 52, the latch member 52 begins to rotate counterclockwise by the pressure of the trip member 51 and the pulling of a first retractable member 541 in the linkage assembly 54, so that the clamping fit surface 525 abuts against the clamping surface 514, and the trip member 51 and the latch member 52 achieve first locking. The transition member 543 in the linkage assembly 54 rotates clockwise and form second locking with the latch member 52. The second transmission portion 532 rotates clockwise to the first position under the action of the linkage assembly 54 and forms transition with the transition member 543. In this case, the trip member 51, the latch member 52, the traction member 53, and the linkage assembly 54 form a triple locking structure with each other, and the entire locking mechanism 5 is in a buckled state. In the complete buckled state inside the buckled state, even if the operation assembly 2 continues to send a third signal to the locking mechanism 5, the locking mechanism 5 cannot be driven to move, that is, the operation assembly 2 can control the locking mechanism 5 to change only from the released state to the buckled state, but cannot control the locking mechanism 5 to change from the buckled state to the released state.

[0062] In some optional embodiments, the linkage assembly 54 includes a first retractable member 541, a second retractable member 542, and a transition member 543. The transition member 543 is located on a side, away from the first side surface 524, of the second side surface, is Y-shaped and includes a first clamping end, a second clamping end, and a connecting end spaced apart; the first clamping end abuts against the second side surface, and the second clamping end abuts against the step structure 533. One end of the first retractable member 541 is connected to the first transmission portion 523 of the latch member 52, and the other end is con-

nected to the connecting end of the transition member 543; the transition member 543 rotates clockwise under the action of the first retractable member 541, and the first clamping end rotates from a second position to a third position. One end of the second retractable member 542 is connected to the base body 531 of the traction member 53; and when the first clamping end rotates from the second position to the third position, the traction member 53 rotates clockwise under the action of the second retractable member 542, so that the second clamping end moves from the first step surface 535 and clamps onto the second step surface 536. The transition member 543 is connected to the latch member 52 and the traction member 53, forms a locking structure together with the latch member 52 through the first clamping end, and forms another locking structure together with the traction member 53 through the second clamping end. The first retractable member 541 is configured for driving the rotation of the transition member 543, and the second retractable member 542 is configured for driving the rotation of the traction member 53.

[0063] In some optional embodiments, the transition member 543 has a Y-shaped structure; the first clamping end, the second clamping end, and the connecting end are located at three end positions of the transition member 543, respectively; the first clamping end abuts against the second side surface; when the locking mechanism 5 is in the buckled state, the first clamping end is in the third position and farthest from the clamping fit surface 525; and when the locking mechanism 5 is in the released state, the first clamping end is in the second position and closest to the clamping fit surface 525. The second clamping end abuts against the traction member 53; when the locking mechanism 5 is in the buckled state, the second clamping end abuts against the second step surface 536; and when the locking mechanism 5 is in the released state, the second clamping end abuts against the first step surface 535.

[0064] One end of the first retractable member 541 is connected to the first transmission portion 523 of the latch member 52, and the other end is connected to the connecting end of the transition member 543. The first retractable member 541 is configured for driving the latch member 52 and the transition member 543. When the release 16 drives the traction member 53 to rotate counterclockwise, the traction member 53 and the transition member 543 do not remain locked any more, the transition member 543 rotates counterclockwise, the second clamping end moves from the second step surface 536 to the first step surface 535, the abutting point between the first clamping end and the second side surface moves downward with the first clamping end, the elongation of the first retractable member 541 increases, and the latch member 52 rotates counterclockwise under the drive of the elastic force of the first retractable member 541, thereby releasing the buckled state of the trip member 51 and the latch member 52.

[0065] One end of the second retractable member 542 is connected to the base body 531 of the traction member 53, and the other end is connected to the support member 21, where the specific positions are determined by the internal structure of the circuit breaker. The second retractable member 542 is always in a tensile state to provide tensile force to the traction member 53, thereby ensuring that the traction member 53 will not shake or separate from the transition member 543 when the locking mechanism 5 is in the buckled state.

[0066] In some optional embodiments, the first side plate 511 includes a transmission arm 516; the transmission arm 516 is located between the mounting lug 515 and the end, connected to the first side plate 511, of the connecting plate 512; and the transmission arm 516 and the clamping surface 514 are jointly located on the same side of the mounting lug 515, the transmission arm 516 includes a first abutting surface 5161 and a second abutting surface 5162 connected at an angle, and the first abutting surface 5161 and the second abutting surface 5162 form a clamping position for clamping.

[0067] The first connection point 411 of the first connecting rod 41 is rotatably connected to the transmission arm 516, the trip member 51 drives the first connecting rod 41 to move through the transmission arm 516, and the clamping surface 514 is configured for abutting against the clamping fit surface 525 of the second locking mechanism 5 to form a locking structure. In the second direction B, both the transmission arm 516 and the clamping surface 514 are located on one side of the mounting lug 515. In the structure shown in Fig. 1 of this application, both the transmission arm 516 and the clamping surface 514 are located on the right side of the mounting lug 515, and a limit shaft 17 is provided on the right side of the mounting lug 515 and fixed on the support member 21 to limit the first connecting rod 41 when releasing occurs and to increase an opening rate.

[0068] In some optional embodiments, the trip member 51 includes a guide plate 517, the guide plate 517 is connected to a connecting surface opposite to the clamping surface 514 in the connecting plate 512 and extends from the connecting surface away from the clamping surface 514, and the guide plate 517 has an arc-shaped guide surface 518 on a side away from the mounting lug 515. When the trip member 51 rotates counterclockwise, the guide plate 517 abuts against the first side surface 524 through the arc-shaped guide surface 518. The first side surface 524 is provided with a protrusion 520. When the trip member 51 rotates counterclockwise, the arc-shaped guide surface 518 abuts against the protrusion 520.

[0069] During the clockwise or counterclockwise rotation of the trip member 51, the guide plate 517 is in contact with the latch member 52 to play a guiding role. The design of the arc-shaped guide surface 518 can enable more stable and smooth sliding between the trip member 51 and the latch member 52.

[0070] In some optional embodiments, the first side surface 524 is provided with a through hole 528, and the

first clamping end in the second position is clamped to the through hole 528. The size of the through hole 528 is determined by the size of the first clamping end. When the locking mechanism 5 is in the released state, the first clamping end is in the second position and clamped in the through hole 528. When the locking mechanism 5 transitions from the released state to the buckled state, the first clamping end first separates from the through hole 528, moves relatively away from the clamping fit surface 525, and finally abuts against and locks the latch member 52. The first retractable member 541 remains in an elongated state throughout this process.

[0071] In some optional embodiments, the first transmission portion 523 has a second avoidance hole 527 penetrating therethrough in the fourth direction D and in commutation with the first avoidance hole 526. When the locking mechanism 5 transitions from the released state to the buckled state, the clamping surface 514 gradually approaches and finally fits closely with the clamping fit surface 525. In the movement process, the clamping surface 514 of the trip member 51 enters the first avoidance hole 526 and the second avoidance hole 527 due to the effect of inertia, thereby avoiding direct rigid contact between the clamping surface 514 and the latch member 52 and prolonging the service life of the trip member 51.

[0072] In some optional embodiments, the transition member 543 includes two Y-shaped clamping plates 544 opposite to each other and each including a first free end 5441, a second free end 5442, and a third free end 5443; two first free ends 5441 are sheathed with a first shaft rod 545, two second free ends 5442 are sheathed with a second shaft rod 546, a portion of the first shaft rod 545 between the two Y-shaped clamping plates 544 is sleeved with a roller 547 which rolls between the second position and the third position, a portion of the second shaft rod 546 between the two Y-shaped clamping plates 544 moves between a first bent surface 535 and a second bent surface 536, and the first retractable member 541 is hung on the third free end 5443. In this solution, the transition member 543 abuts against the latch member 52 through the roller 547 which can rotate freely relative to the first shaft rod 545. Therefore, the point contact between the latch member 52 and the transition member 543 can be adjusted through the rotation of the roller 547 to avoid damage caused by rapid contact between the two.

[0073] In some optional embodiments, the third free end 5443 is provided with a mounting groove 548 for hanging the first retractable member 541. The first retractable member 541 may be connected to the latch member 52 and the transition member 543 in many ways. In this application, hooks are provided at two ends of the first retractable member 541, corresponding mounting grooves 548 are provided at the first transmission portion 523 of the latch member 52 and the connecting end of the transition member 543, and the two ends of the first retractable member 541 are hung on the latch member 52 and the transition member 543 separately.

[0074] In some optional embodiments, the step structure 533 includes an arc-shaped step surface 537 located on the first step surface 535 and the second step surface 536. In the buckled state, the transition member 543 abuts against the second step surface 536. In the released state, the transition member 543 abuts against the first step surface 535. During the transition of the locking mechanism 5 between the buckled state and the released state, the transition member 543 starts from the first step surface 535 and passes through the arc-shaped step surface 537 to the second step surface 536, or starts from the second step surface 536 and passes through the arc-shaped step surface 537 to the first step surface 535. The arc-shaped step surface 537 plays a smooth transition role in this process, thereby ensuring relatively stable movement between the transition member 543 and the traction member 53.

[0075] In some other embodiments, the locking mechanism 5 surrounds and forms a concave space, and the operation assembly 2 slides inside a recessed portion of the concave space and sends the first signal to the transmission mechanism 44. The transition member 543 is located inside the concave space and below the recessed portion, the trip member 51 and the latch member 52 are located on one side of the transition member 543, the traction member 53 is located on the other side of the transition member 543, and the operation assembly 2 can slide relatively within the recessed portion and send the first signal to the transmission mechanism 4 to move the movable contact 14, or send a third signal to the locking mechanism 5 to transition the locking structure from the released state to the buckled state. In this embodiment, each locking member in the locking mechanism 5 may alternatively be arranged in other ways than this application. As long as the locking mechanism 5 surrounds and forms the concave space for relative movement of the operation assembly 2, this application does not limit the arrangement ways.

[0076] Please with reference to Figs. 1 to 13, Fig. 11 is a schematic structural diagram of an operation assembly as shown in Fig. 1, Fig. 12 is a schematic structural diagram of a support member in Fig. 11, and Fig. 13 is a schematic structural diagram of a rotating member in Fig. 11. The operation mechanism of an embodiment of this application includes an operation assembly 2, a transmission mechanism 4 and a locking mechanism 5, the operation assembly 2 includes a support member 21 and a rotating member 22 rotatably mounted to the support member 21, and the rotating member 21 includes a first limit position and a second limit position in a rotation direction. The locking mechanism 5 includes a trip member 51, a latch member 52, a traction member 53 which is coupled with a release 16, and a transition member 543 which is connected with the latch member 52 and the traction member 53 and includes a released state and a buckled state, and when the locking mechanism 5 is in the buckled state, the trip member 51 and the latch member 52 form a first locking position, the transition

member 543 and the latch member 52 forms a second locking position, and the transition member 543 and the traction member 53 forms a third locking position. The transmission mechanism 4 includes a first connecting rod 41, a second connecting rod 42, a rotating shaft 44 connected with the first connecting rod 41 and the second connecting rod 42, and a main elastic member 43, one end of the first connecting rod 41 includes a first connection point 411 pivotally connected with the trip member 51 and the other end of the first connecting rod 41 includes a second connection point 412 connected with the second connecting rod 42, one end of the second connecting rod 42 includes a third connection point 421 connected with the first connecting rod 41 and the other end of the second connecting rod 42 includes a fourth connection point 422 connected with a rotating wheel 13, and the rotating shaft 44 is provided between the second connection point 412 and the third connection point 421. One end of the main elastic member 43 includes a first mounting position connected with the rotating member 22, and the other end of the main elastic member 43 includes a second mounting position connected with the rotating shaft 44. A plane rectangular coordinate system is established with a center of the rotating wheel 13 as an origin, a length direction of the circuit breaker is a direction of an X-axis, the first mounting position, the first connection point 411, the rotating shaft 44 and the fourth connection point 412 are sequentially arranged in a negative direction of the X-axis to form a transmission chain, and the first locking position, the second locking position and the third locking position are sequentially arranged in a positive direction of the X-axis to form a locking chain. The sequential arrangement in the negative direction of the X-axis mentioned in this embodiment refers to the arrangement sequence of the X-axis coordinates of the first mounting position, the first connection point 411, the rotating shaft 44, and the fourth connection point 422, rather than limiting the transmission chain to be in a straight line. That is, the first mounting position, the first connection point 411, the rotating shaft 44, and the fourth connection point 422 may have the same or Y-axis coordinates, or they may have different Y-axis coordinates. Similarly, the sequential arrangement in the positive direction of the X-axis refers to the arrangement sequence of the X-axis coordinates of the first locking position, the second locking position, and the third locking position, rather than limiting the locking chain to be in a straight line.

[0077] In the operation mechanism for the circuit breaker of the embodiments of this application, the transmission chain and the locking chain are formed by providing the operation assembly 2, the transmission mechanism 4, and the locking mechanism 5. The arc extinguishing device is provided below the Y-axis direction, that is, the arc extinguishing device 3 also extends along the length direction of the circuit breaker extends. Compared with the arc extinguishing device in the prior art that extends along the height direction of the circuit breaker, the arc extinguishing device 3 of this application can occupy a larger space and thus break higher short-circuit currents.

[0078] In some optional embodiments, the locking chain is located below the transmission chain in the direction of the Y-axis. This provision saves more space.

[0079] In some optional embodiments, when the rotating member 22 is located at the first limit position, the second locking position and the third locking position are located on two sides of the first mounting position in the direction of the X-axis. The first limit position is a limit position of the rotating member 22 for clockwise rotation, and the second limit position is a limit position of the rotating member 22 for counterclockwise rotation.

[0080] In some optional embodiments, the operation assembly 2, the locking mechanism 2, and the main elastic member 43 are located on a right side of the Y-axis, the first connection point, the second connection point and the third connection point are located on the right side of the Y-axis, the fourth connection point is capable of moving back and forth on two sides of the Y-axis, and the rotating shaft 44 is capable of moving back and forth on two sides of the X-axis.

[0081] In some optional embodiments, the operation assembly 2 includes a support member 21, a rotating member 22, and a handle 23. The support member 21 includes two sub side plates 211 opposite to each other in a first direction A and each having a recessed portion 212 penetrating therethrough in the first direction A and recessed from one end of the sub side plate 211 to a central area of the sub side plate 211. The rotating member 22 is rotatably connected to the sub side plates 211 and can partially rotatably extend into the recessed portions 212. The rotating member 22 includes two rotating plates 221 opposite to each other in the first direction A, and a hanging portion 222 and a clamping portion 223 between the two rotating plates 221. The two rotating plates 221 surround and form an accommodation space, and the two sub side plates 211 are clamped between the two rotating plates 221. Each rotating plate 221 has a rotating shaft connecting end 2211 for connecting the sub side plate 211 and a rotating end 2213 opposite to the rotating shaft connecting end 2211. The clamping portion 223 and the hanging portion 222 are sequentially arranged at the rotating end 2213 in a direction where the rotating plate 221 is rotated into the recessed portion 212. The clamping portion 223 has a first clamping surface and a second clamping surface 2232 that face the accommodation space, are connected at an angle, and are used for clamping the trip member 51. The hanging portion 222 is configured for hanging the main elastic member 43 of the circuit breaker. The handle 23 is mounted on the rotating end 2213 and located on a side, away from the hanging portion 222, of the clamping portion 223.

[0082] In some optional embodiments, the rotating end 2213 is provided with a through hole penetrating therethrough in the first direction A, and the handle 23 is fixedly connected to the rotating plate 221 via the through hole.

Optionally, the two are in threaded connection, or certainly, may be connected by riveting, bonding, or the like.

[0083] In some optional embodiments, the latch member 52 and the traction member 53 are respectively located on two sides of the recessed portion 212 and rotatably mounted on the support member 21.

[0084] In some optional embodiments, the transition member 53 is located below the recessed portion 212 in the Y-axis direction. The latch member 52 and the traction member 53 are provided on two sides of the recessed portion 212, and the transition member 53 is provided below the recessed part 212, thereby making full use of space and reducing the volume of the circuit breaker.

[0085] In some optional embodiments, the support member 21 includes a fixed pin 214 mounted on the sub side plate 211 and sheathed with a rolling wheel 215, and the rotating shaft connecting end 2211 has an arc-shaped clamping surface 2212 clamped to an outer circumference of the rolling wheel 215. The rolling wheel 215 is arranged on the fixed pin 214, so that the rotating plate 221 rotates more flexibly. Optionally, one fixed pin 214 is provided on each of the two sub side plates 211. Alternatively, one fixed pin 214 is provided on the two sub side plates 211 jointly.

[0086] In some optional embodiments, the hanging portion 222 includes a body 2221 which has a shaft pin placement groove 2222 extending in the first direction A and having an opening facing away from the accommodation space, and a via hole 2223 through which the main elastic member 43 passes is provided in a bottom surface of the shaft pin placement groove 2222. The provision of the shaft pin placement groove 2222 and the via hole 2223 facilitates hanging of the main elastic member 43.

[0087] In some optional embodiments, the clamping portion 223 has a limit surface 2233 away from the first clamping surface, and the handle 23 abuts against the limit surface 2233. Through the limit surface 2233 facing away from the first clamping surface, the handle 23 provides support and limit during mounting to save time and labor in the mounting process.

[0088] In some optional embodiments, the clamping portion 223 has an avoidance surface 2231 facing away from the second clamping surface 2232 and connected to the limit surface 2233, the hanging portion 222 has a outer surface 2226 facing away from the accommodation space, the avoidance surface 2231 is located between the limit surface 2233 and the outer surface 2226, an angle between the avoidance surface 2231 and the limit surface 2233 is 01, and an angle between the avoidance surface 2231 and the outer surface 2226 is $\Theta 2$, where $90° < \theta 1 < \Theta 2$. The avoidance surface 2231 is provided, and the angles between the avoidance surface 2231 and the limit surface 2233 and between the avoidance surface 2231 and the outer surface 2226 satisfy the foregoing relationship, so that the angle between the clamping portion 223 and the hanging portion 222 can satisfy the condition for rotation of the rotating member 22 into the recessed portion 212.

[0089] In some optional embodiments, the rotating plate 221 is fan-shaped, and the rotating end 2213 includes an arc-shaped edge. Correspondingly, the recessed portion 212 is in an adapted arc shape. The fan-shaped rotating plate 221 is easy to manufacture and attractive, and can be rotated into the recessed portion 212 more smoothly.

[0090] In some optional embodiments, the hanging portion 222 is arranged at an end of the arc-shaped edge rotated into the recessed portion 212, the hanging portion 222 has a first end 2224 and a second end 2225 opposite to each other in the rotating direction, and the sub side plate 211 has a side wall 213 surrounding and forming the recessed portion 212. When the rotating member 22 is rotated into the recessed portion 212, the second end 2225 of the hanging portion 222 can abut against the side wall 213. Only one end of the arc-shaped edge of the rotating end 2213 is rotated into the recessed portion 212, the hanging portion 222 is arranged at this end, and when the second end abuts against the side wall 213, the main elastic member 43 can obtain maximum tension, so as to provide enough elastic force for the subsequent process.

[0091] In some optional embodiments, the first end 2224 of the hanging portion 222 is connected to the clamping portion 223 which is fixedly connected to the sub side plate 211 through the hanging portion 222. The clamping portion 223 is connected to the sub side plate 211 through the hanging portion 222. Such connections facilitate manufacturing with low cost. Optionally, the clamping portion 223 and the hanging portion 222 are integrally formed, and the hanging portion 222 and the rotating plate 221 are integrally formed.

[0092] In other optional embodiments, the clamping portion 223 is fixedly connected to the rotating plate 221, and the hanging portion 222 is fixedly connected to the rotating plate 221.

[0093] In some optional embodiments, the hanging portion 222 has a third end and a fourth end opposite to each other in the first direction A, a pin extending in the first direction A is provided at each of the third end and the fourth end, an insertion column extending in the first direction A is provided at the rotating end 2213 and provided with an insertion hole, and the pin is in interference fit with the insertion hole. The hanging portion 222 and the rotating plate 221 are configured in a matching insertion manner of the pin and the insertion hole, which facilitates disassembly of the hanging portion 222 and the clamping portion 223, so as to adapt according to different models of circuit breakers.

[0094] In some optional embodiments, the insertion column includes a plurality of first sub insertion columns and a plurality of second sub insertion columns, the plurality of first sub insertion columns are spaced apart in the extension direction of the arc-shaped edge, and the plurality of second sub insertion columns are spaced apart along the arc-shaped edge towards the rotating shaft connecting end 2211. The first sub insertion col-

umns and the second sub insertion columns facilitate adjustment of specific positions of the hanging portion 222 and the clamping portion 223 relative to the rotating plate 221, so as to adjust according to different models of circuit breakers or different needs. For example, when the circuit breaker cannot be used normally due to yielding and difficult rebounding of the main elastic member 43 after long-time use, the position of the hanging portion 222 can be slightly adjusted outward from the rotating shaft connecting end 2211 to the arc-shaped edge, and then the main elastic member 43 can be stretched to meet elastic force requirements.

[0095] As shown in Fig. 14 which is a schematic connection diagram of three circuit breakers provided by an embodiment of this application. When the operation assembly 2 is mounted to the housing 1, a connecting shaft rod first passes through the fourth connection point 422 of the second connecting rod 42 and the peripheral portion 132 of the rotating wheel 13 to articulate the rotating wheel 13 and the second connecting rod 42. A plurality of circuit breakers of this application may be connected in series. When the plurality of circuit breakers are connected in series, the operation assembly 2 may be mounted in any one of them, and the connecting shaft rod can extend into any circuit breaker and drive the rotating wheels 13 of other circuit breakers to rotate. In this case, one connecting shaft rod can control a plurality of circuit breakers. Circuit breakers with other protective functions, such as overload protection or negative pressure protection, may be provided.

[0096] During the mounting of the circuit breaker, the operation assembly 2 is first connected to the transmission mechanism 4 through the main elastic member 43. In this case, the fourth connection point 422 on the second connecting rod 42 is not connected to the rotating wheel 13, thus the second connecting rod 42 can move freely. During the mounting, one end of the main elastic member 43 is connected to the operation assembly 2, and the other end is connected to the rotating shaft 43. Since the second connecting rod 42 is in a movable state, the main elastic member 43 can be connected to the operation assembly 2 without stretching. Then, the connection between the second connecting rod 42 and the rotating wheel 13 can realize the rotatable mounting of the operation assembly 2 on the accommodation portion 11. Finally, the operation assembly 2 can be fixed on the accommodation portion 11 via bolts or other means. Compared with the traditional mounting process, the main elastic member 43 in the embodiments of this application does not need to be stretched too long, and the entire mountingmounting process is simple and fast and can be operated by a single person.

[0097] In some other embodiments, a fixed contact 15 is provided in the accommodation cavity 12 and located on one side of the movable contact 14, and the rotating wheel 13 is configured for driving the movable contact 14 to move, so that the movable contact 14 gets close to or away from the fixed contact 15.

[0098] In some other embodiments, the arc extinguishing device 3 further includes a fixed contact arc guide member 151 and a movable contact arc guide member 141; the fixed contact arc guide member 151 is located on a side, away from the movable contact 14, of the fixed contact 15; the movable contact arc guide member 141 is arranged on a side, away from the fixed contact arc guide member 151, of the movable contact 14; and the movable contact arc guide member 141, the fixed contact arc guide member 151, and the base surround and form the arc extinguishing chamber 31.

[0099] The movable contact arc guide member 141 and the fixed contact arc guide member 151 are located on two sides of the movable contact 14, and the fixed contact 15 is mounted on the fixed contact arc guide member 151. When the circuit breaker is in the open state, the movable contact 14 abuts against the movable contact arc guide member 141; and in the closed state, the movable contact 14 is separated from the movable contact arc guide member 141 and connected to the fixed contact 15 located on the fixed contact arc guide member 151. Deionization devices 18 are mounted on the movable contact arc guide member 141 and the fixed contact arc guide member 151 near the bottom of the housing 1. The movable contact arc guide member 141, the fixed contact arc guide member 151, and the deionization devices 18 surround and form the arc extinguishing chamber 31. Arc extinguishing grids, which are not shown in the figures, may be mounted inside the arc extinguishing chamber 31. An exhaust hole 19 is provided on a side, away from the arc extinguishing chamber 31, of the deionization device 18. The specific arrangement of the arc extinguishing grids, the movable arc guide members 141, the fixed arc guide members 151, the deionization devices 18, and the like may alternatively be different from the structures in the figures, and this application does not limit this.

[0100] A wiring board 10 is further provided in the circuit breaker of an embodiment of this application at two ends of the housing 1 in the second direction B, the wiring board 10 is configured for connection with an external circuit, the wiring board 10 includes a first wiring board 101 and a second wiring board 102, the first wiring board 101 is electrically connected to the movable contact 14 in a form of soft connection or by means of other devices, the second wiring board 102 is electrically connected to both the fixed contact arc guide member 151 and the release 16, and the release 16 may sense, through the second wiring board 102, whether the external circuit operates normally. When the circuit malfunctions, the release 16 enables the locking mechanism 5 to move and separates the movable contact 14 and the fixed contact 15, thereby ensuring circuit safety.

[0101] The usage states of the circuit breaker in this application may be divided into three stages, namely, a released state, a buckled state, and a closed state, and in the released state and the buckled state, the movable contact 14 and the fixed contact 15 are not in contact

with each other. During normal use of the circuit breaker, the circuit breaker changes between the closed state and the buckled state. In the released state, the movable contact 14 and the fixed contact 15 are not in contact with each other and the locking mechanism 5 is also in a released state; the staff controls the operation assembly 2 to send a third signal to the locking mechanism 5, the locking mechanism 5 changes to a buckled state, and the entire circuit breaker transitions from the released state to the buckled state. In this process, the movable contact 14 always abuts against the movable contact arc guide member 141. Afterwards, the operation assembly 2 is controlled to send a first signal to the transmission mechanism 4, the movable contact 14 is enabled to move close to and contact the fixed contact 15, the locking mechanism 5 remains locked, the entire circuit breaker changes from the buckled state to the closed state, and the entire circuit is connected. When the release 16 detects a circuit malfunction, the release 16 operates and drives the locking mechanism 5 to move, and the locking mechanism 5 is released from the buckled state and sends a second signal to the transmission mechanism 4, so the rotating wheel 13 is enabled to drive the movable contact 14 away from the fixed contact 15, the circuit breaker changes from the closed state to the released state, and the entire circuit is disconnected.

[0102] The normal opening process of the circuit breaker in this application is the release state - the buckled state - the closed state. When the circuit breaker is required to be manually disconnected, the operation assembly 2 is manually controlled to send a first signal to the transmission mechanism 4, so as to separate the movable contact 14 and the fixed contact 15 and disconnect the entire circuit. However, in this process, the locking mechanism 5 is still in the buckled state and has not changed, that is, the circuit breaker transitions from the closed state to the buckled state.

[0103] Figs. 1, 2, and 3 represent a released state, a buckled state, and a closed state of the circuit breaker, respectively. In the figures, a rectangular coordinate system is established with the first rotating portion 131 of the rotating wheel 13 as a center, the lateral direction of the circuit breaker as an X axis, and the longitudinal direction of the circuit breaker as a Y axis, where a division into a total of four quadrant spaces is made by the X axis and the Y axis. In this application, the released, buckled, and closed states of the circuit breaker will be described in detail with the structures shown in Figs. 1-3, respectively.

[0104] Fig. 1 is a schematic structural diagram of the circuit breaker in the released state. The locking mechanism 5 is in a released state, the arc-shaped guide surface 518 of the trip member 51 abuts against the protrusion of the first side surface 524, and the trip member 51 is in the initial position. The first clamping end of the transition member is located in the through hole 528, and the second clamping end abuts against the first bent surface 535. The first retractable member 541 is in a tensile state and has elastic potential energy. The second retractable member 542 is in a tensile state and has elastic potential energy.

[0105] The transmission arm 516 and the first connection point 411 of the trip member 51 are located in the first quadrant, the rotating shaft 44 connecting the first connecting rod 41 and the second connecting rod 42 is located in the fourth quadrant, and the second connecting rod 42 and the fourth connection point 422 of the rotating wheel 13 are located in the first quadrant. In this case, the movable contact 14 abuts against the movable contact arc guide member 141 and the two are located in the third quadrant, while the fixed contact 15 is located in the fourth quadrant and separated from the movable contact 14.

[0106] Fig. 2 is a schematic structural diagram of the circuit breaker in the buckled state. The locking mechanism 5 is in a buckled state. When the circuit breaker changes from the released state to the buckled state, the operation assembly 2 rotates clockwise to drive the trip member 51 in the locking mechanism 5 to rotate clockwise. As the trip member 51 does not abut against the protrusion of the latch member 52, the first retractable member 541 releases energy, the latch member 52 rotates counterclockwise under the elastic force of the first retractable member 541, and then the clamping fit surface 525 abuts against the clamping surface 514. In this case, the main elastic member 43 is in a tensile state, and the main elastic member 43 applies tensile force to the trip member 51 through the first connecting rod 41, so that the trip member 51 has a tendency to rotate counterclockwise. Meanwhile, the transition member rotates clockwise under the elastic force of the first retractable member 541, and its first clamping end moves from the second position to the third position. At this time, the second retractable member 542 releases energy to drive a traction member to rotate clockwise, and the second transmission portion 532 rotates to the first position, so that the second clamping end moves from the first step surface 535 and is clamped to the second step surface 536.

[0107] During the movement of the locking mechanism 5, the first connecting rod 41 moves with the trip member 51, and the first connection point 411 rotates clockwise but is still within the first quadrant. Compared with the released state, the distance between the first connection point 411 and the X axis is shorter. In addition, the rotating shaft 44 moves downward under the drive of the first connecting rod 41, and the rotating shaft 44 is in a lowest position in the buckled state. Throughout the entire movement process, the fourth connection point 422 remains within the first quadrant and does not produce displacement, that is, the rotating wheel 13 does not rotate, the movable contact 14 still abuts against the movable contact arc guide member 141 and separates from the fixed contact 15, and the circuit breaker remains in an open-circuit state internally.

[0108] Fig. 3 is a schematic structural diagram of the

circuit breaker in the closed state. The locking mechanism 5 is in the buckled state. When the circuit breaker changes from the buckled state to the closed state, the operation assembly 2 rotates counterclockwise and the main elastic member 43 moves together. The elongation of the main elastic member 43 gradually increases. The main elastic member 43 pulls the rotating shaft 44 to move upwards. Afterwards, the elongation of the main elastic member 43 gradually decreases, the rotating shaft 44 moves from the fourth quadrant to the first quadrant, the second connecting rod 42 moves with the rotating shaft 44, and the fourth connection point 422 rotates counterclockwise from the first quadrant to the second quadrant, that is, the rotating wheel 13 begins to rotate counterclockwise and drives the movable contact 14 to move, and the movable contact 14 gradually approaches and finally contacts the fixed contact 15 located in the fourth quadrant. In this process, the locking mechanism 5 remains in the buckled state, so the first connection point 411 connected to the trip member 51 remains in the first quadrant and remains fixed, and the first connecting rod 41 rotates clockwise around the first connection point 411.

[0109] When the circuit breaker is required to be manually disconnected, the operation assembly 2 is manually driven to rotate clockwise, and the elongation of the main elastic member 43 gradually increases. When the clamping portion 222 crosses the first connection point 411 counterclockwise, the extension and contraction amount of the main elastic member 43 becomes maximum, the main elastic member 43 begins to release elastic force and pulls the rotating shaft 44 to move downwards. Afterwards, the elongation of the main elastic member 43 gradually decreases, the rotating shaft 44 moves from the first quadrant to the fourth quadrant, the second connecting rod 42 moves with the rotating shaft 44, the fourth connection point 422 rotates clockwise from the second quadrant to the first quadrant, that is, the rotating wheel 13 rotates clockwise and drives the movable contact 14 away from the fixed contact 15, and the movable contact 14 finally abuts against the movable contact arc guide member 141 located in the third quadrant. In this process, the locking mechanism 5 does not move, and the circuit breaker changes from the closed state to the buckled state.

[0110] When the release 16 detects a malfunction in the circuit, a contact of the release 16 produces displacement to drive the traction member 53 to rotate counterclockwise. The trip member 51 acts on the latch member 52 at a position of the blocking surface, causing the latch member 52 to rotate clockwise and to press down the roller 547, so the transition member 543 rotates counterclockwise until it enters the first through hole 528 and then the second locking end abuts against the first step surface 535.

[0111] The trip member 51 rotates counterclockwise to drive the first connecting rod 41 to move together, the first connection point 411 rotates counterclockwise away from the X axis, the rotating shaft 44 moves downward and moves from the first quadrant to the fourth quadrant, the second connecting rod 42 moves with the rotating shaft 44, the fourth connection point 422 rotates clockwise from the second quadrant to the first quadrant, that is, the rotating wheel 13 rotates clockwise and drives the movable contact 14 away from the fixed contact 15, and the movable contact 14 finally abuts against the movable contact arc guide member 141 located in the third quadrant. Driven by the locking mechanism 5, the movable contact 14 and the fixed contact 15 separate, and the circuit breaker changes from the closed state to the released state.

[0112] In summary, the transmission mechanism in this application is in lateral transmission and the transmission direction is parallel to the length direction of the arc extinguishing chamber. Therefore, under the premise of a definite volume of the entire circuit breaker, the size of the arc extinguishing chamber is larger, and interference between the transmission mechanism and other components can be avoided to improve overall reliability.

[0113] Although this application has been described with reference to preferred embodiments, various modifications can be made thereto and parts therein can be replaced with equivalents without departing from the scope of the present disclosure. Especially, as long as there is no structural conflict, technical features mentioned in various embodiments can be combined in any manner. This application is not limited to the specific embodiments disclosed herein, but includes all technical solutions falling within the scope of the claims.

Claims

1. An operation mechanism for a circuit breaker, comprising an operation assembly, a transmission mechanism and a locking mechanism,

   the operation assembly comprising a support member and a rotating member rotatably mounted to the support member, and the rotating member comprising a first limit position and a second limit position in a rotation direction; and

   the locking mechanism comprising a trip member, a latch member, a traction member which is coupled with a release, and a transition member which is connected with the latch member and the traction member and comprising a released state and a buckled state, and when the locking mechanism is in the buckled state, the trip member and the latch member forming a first locking position, the transition member and the latch member forming a second locking position, and the transition member and the traction member forming a third locking position;

2. The operation mechanism for a circuit breaker ac-

cording to claim 1, wherein the transmission mechanism comprises a first connecting rod, a second connecting rod, a rotating shaft connected with the first connecting rod and the second connecting rod, and a main elastic member, one end of the first connecting rod comprises a first connection point pivotally connected with the trip member and the other end of the first connecting rod comprises a second connection point connected with the second connecting rod, one end of the second connecting rod comprises a third connection point connected with the first connecting rod and the other end of the second connecting rod comprises a fourth connection point connected with a rotating wheel of the circuit breaker, and the rotating shaft is provided between the second connection point and the third connection point; one end of the main elastic member comprises a first mounting position connected with the rotating member, and the other end of the main elastic member comprises a second mounting position connected with the rotating shaft;
in a state of a connection with the rotating wheel, a plane rectangular coordinate system is established with a center of the rotating wheel as an origin, a length direction of the circuit breaker is a direction of an X-axis, the first mounting position, the first connection point, the rotating shaft and the fourth connection point are sequentially arranged in a negative direction of the X-axis to form a transmission chain, and the first locking position, the second locking position and the third locking position are sequentially arranged in a positive direction of the X-axis to form a locking chain.

3. The operation mechanism for a circuit breaker according to claim 2, wherein a height direction of the circuit breaker is a direction of a Y-axis in which the locking chain is located below the transmission chain.

4. The operation mechanism for a circuit breaker according to claim 2, wherein when the rotating member is located at the first limit position, the second locking position and the third locking position are located on two sides of the first mounting position in the direction of the X-axis.

5. The operation mechanism for a circuit breaker according to claim 3, wherein the operation assembly, the locking mechanism, and the main elastic member are located on a right side of the Y-axis,
the first connection point, the second connection point and the third connection point are located on the right side of the Y-axis, the fourth connection point is capable of moving back and forth on two sides of the Y-axis, and the rotating shaft is capable of moving back and forth on two sides of the X-axis.

6. The operation mechanism for a circuit breaker according to claim 3, wherein

the support member comprises two sub side plates opposite to each other in a first direction, and the two sub side plates each comprise a recessed portion recessed from one end of each sub side plate toward a central area of the sub side plate;
the rotating member is rotatably connected with the sub side plates, is capable of being rotated partially into the recessed portion, and comprises two rotating plates opposite to each other in the first direction and a hanging portion between the two rotating plates which are connected with each other to form an accommodation space, the two sub side plates are clamped between the two rotating plates each of which comprises a rotating shaft connecting end for connecting one of the sub side plates and a rotating end opposite to the rotating shaft connecting end, and the hanging portion is provided at the rotating end for hanging the main elastic member; and
a handle is mounted to the rotating end which is provided to be adjacent to the hanging portion.

7. The operation mechanism for a circuit breaker according to claim 6, wherein the latch member and the traction member are located on two sides of the recessed portion respectively and are rotatably mounted on the support member.

8. The operation mechanism for a circuit breaker according to claim 7, wherein the transition member is located below the recessed portion in the direction of the Y-axis.

9. The operation mechanism for a circuit breaker according to claim 6, wherein the support member comprises a fixed pin mounted on each sub side plate which is sheathed with a rolling wheel, the rotating shaft connecting end comprises an arc-shaped clamping surface clamped to an outer circumference of the rolling wheel, the hanging portion comprises a body which comprises a shaft pin placement groove extending in the first direction and comprising an opening facing away from the accommodation space, and a via hole through which the main elastic member passes is provided on a bottom surface of the shaft pin placement groove

10. The operation mechanism for a circuit breaker according to claim 9, wherein the rotating member comprises a clamping portion, the clamping portion and the hanging portion are sequentially arranged at the rotating end in a direction where the rotation plates are rotated into the recessed portion, and the clamp-

ing portion comprises a first clamping surface and a second clamping surface which face the accommodation space and are connected at an angle and a limit surface which faces away from the first clamping surface and against which the handle abuts.

11. The operation mechanism for a circuit breaker according to claim 10, wherein the clamping portion comprises an avoidance surface facing away from the second clamping surface and connected with the limit surface, the hanging portion comprises an outer surface facing away from the accommodation space, the avoidance surface is located between the limit surface and the outer surface, an angle between the avoidance surface and the limit surface is 01, and an angle between the avoidance surface and the outer surface is $\Theta 2$, wherein $90° < \theta 1 < \theta 2$.

12. The operation mechanism for a circuit breaker according to claim 6, wherein the rotating plate is fan-shaped, and the rotating end comprises an arc-shaped edge.

13. The operation mechanism for a circuit breaker according to claim 12, wherein the hanging portion is provided at an end of the arc-shaped edge rotated into the recessed portion and comprises a first end and a second end opposite to each other in the rotation direction, the first end of the hanging portion is connected with the clamping portion, and the clamping portion is connected to the sub side plate through the hanging portion.

14. The operation mechanism for a circuit breaker according to claim 13, wherein the hanging portion comprises a third end and a fourth end opposite to each other in the first direction, a pin extending in the first direction is provided at each of the third end and the fourth end, an insertion column extending in the first direction is provided at the rotating end and provided with a insertion hole, and the pin is in interference fit with the insertion hole.

15. The operation mechanism for a circuit breaker according to claim 2, wherein the first connection point rotates around a first specific point, and the fourth connection point rotates around a second specific point; and

wherein the main elastic member applies force to the rotating shaft under an external force, so that the rotating shaft moves towards a direction intersecting a line connecting the first connection point and the fourth connection point.

16. The operation mechanism for a circuit breaker according to claim 15, wherein the main elastic member comprises a tensile state and a reset state, and a length of the main elastic member in the reset state is always larger than a length of the first connecting rod.

17. The operation mechanism for a circuit breaker according to claim 15, wherein the first specific point and the second specific point are located on two sides of a line connecting the fourth connection point and the rotating shaft, respectively.

18. The operation mechanism for a circuit breaker according to claim 15, wherein a distance between the second specific point and the rotating shaft is always larger than a distance from the second specific point to the fourth connection point.

19. The operation mechanism for a circuit breaker according to claim 15, wherein the rotating wheel comprises a first rotating portion and a peripheral portion surrounding the first rotating portion, the first rotating portion is rotatably arranged on a housing, the second connecting rod is connected with the peripheral portion through the fourth connection point, and the first specific point overlaps the first rotating portion.

20. The operation mechanism for a circuit breaker according to claim 15, wherein the operation assembly sends a first signal and the transmission mechanism transmits the first signal to the rotating wheel to drive a movable contact to move.

21. The operation mechanism for a circuit breaker according to claim 15, wherein the locking mechanism sends a second signal and the transmission mechanism transmits the second signal to the rotating wheel to drive a movable contact to move.

22. The operation mechanism for a circuit breaker according to claim 21, further comprising the release which sends the second signal to the traction member.

23. The operation mechanism for a circuit breaker according to claim 1, wherein the trip member comprises two first side plates opposite to each other in a third direction and a connecting plate connected with the two first side plates at a same end, and the connecting plate comprises a first surface and a second surface facing away from each other in its own thickness direction and a clamping surface connected with the first surface and the second surface;

the latch member comprises a clamping fit portion and a first transmission portion in misaligned connection with the clamping fit portion in a fourth direction via a transition connection portion, and the clamping fit portion comprises a first side surface and a second side surface facing away from each other in the fourth direction

and a clamping fit surface connected with the first side surface; and

the traction member comprises a base body, and a second transmission portion and a step structure on two opposite sides of the base body, the base body is provided with a rotation shaft, and the step structure comprises a first step surface and a second step surface connected to each other which is connected to a side of the first step surface away from the base body.

24. The operation mechanism for a circuit breaker according to claim 23, further comprising a first retractable member and a second retractable member, the transition member is located on a side of the second side surface away from the first side surface and comprises a first clamping end, a second clamping end and a connecting end spaced apart from one another, the first clamping end abuts against the second side surface, and the second clamping end abuts against the step structure; and

one end of the first retractable member is connected with the first transmission portion and the other end of the first retractable member is connected with the connecting end, and one end of the second retractable member is connected with the base body and the other end of the second retractable member is connected with the support member.

25. The operation mechanism for a circuit breaker according to claim 23, wherein the first side plate comprises a mounting lug which is located at an end of the first side plate away from the connecting plate and a transmission arm which is located between the mounting lug and an end of the first side plate connected with the connecting plate, the transmission arm and the clamping surface are jointly located on a same side of the mounting lug, and the transmission arm comprises a first abutting surface and a second abutting surface at an angle therebetween to form a clamping position for clamping.

26. The operation mechanism for a circuit breaker according to claim 25, wherein the trip member comprises a guide plate which is connected with a connecting surface of the connecting plate opposite to the clamping surface, extends from the connecting surface away from the clamping surface, and comprises an arc-shaped guide surface on a side away from the mounting lug, the first side surface is provided with a protrusion, and the arc-shaped guide surface abuts against the protrusion when the trip member rotates counterclockwise.

27. The operation mechanism for a circuit breaker according to claim 23, wherein the transition connection portion is provided with a first avoidance hole which penetrates therethrough in a thickness direction and through which the clamping fit surface at least partially passes; and the first transmission portion comprises a second avoidance hole penetrating therethrough in the fourth direction and in communication with the first avoidance hole.

28. The operation mechanism for a circuit breaker according to claim 23, wherein the transition member comprises two Y-shaped clamping plates opposite to each other, and the Y-shaped clamping plates each comprise a first free end, a second free end, and a third free end, two first free ends are sheathed with a first shaft rod, two second free ends are sheathed with a second shaft rod, a portion of the first shaft rod between the two Y-shaped clamping plates is sleeved with a roller moving between the second locking position and the fourth locking position, and a portion of the second shaft rod between the two Y-shaped clamping plates moves between the first step surface and the second step surface.

29. The operation mechanism for a circuit breaker according to claim 1, wherein the locking mechanism surrounds and forms a concave space, and the operation assembly slides inside a recessed portion of the concave space and sends a first signal to the transmission mechanism to drive a movable contact to move.

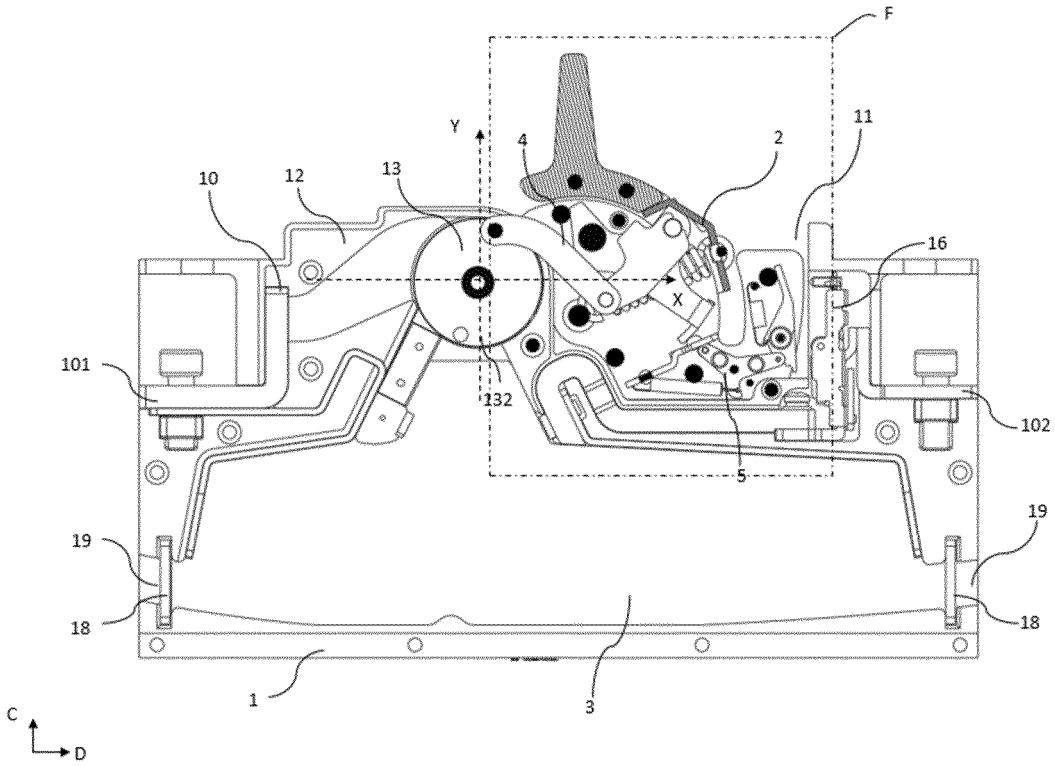
F
Y
X
4
2
11
10
12
13
16
101
132
102
5
19
19
18
18
1
3
C
D

Fig. 1

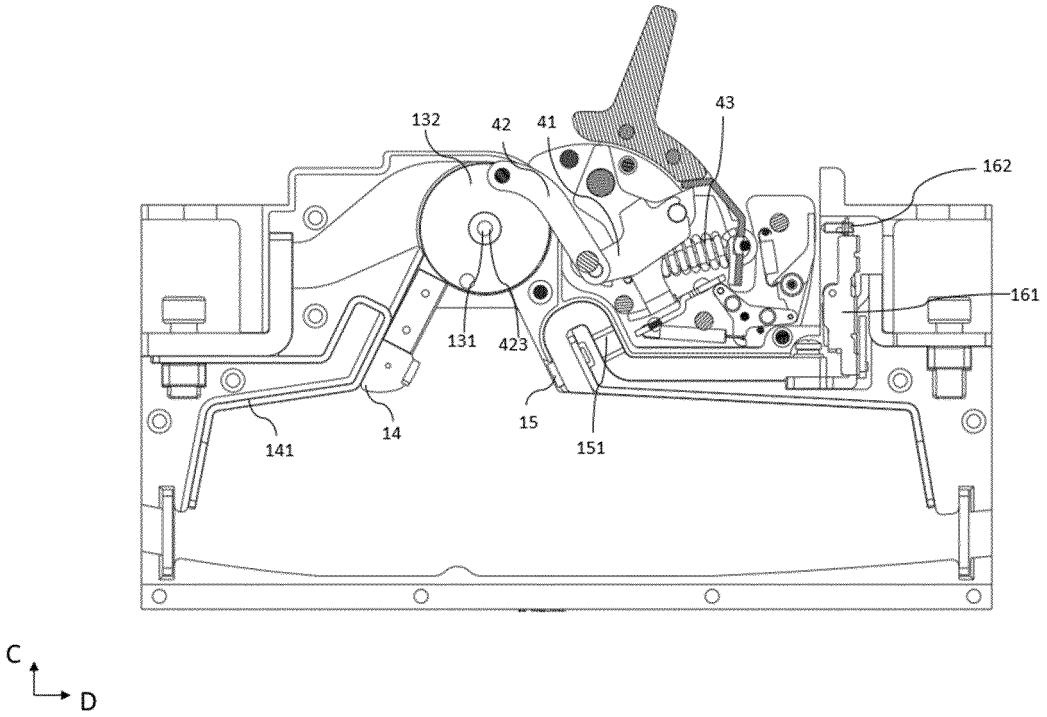
132
42
41
43
162
161
131
423
15
151
14
141
C
D

Fig. 2

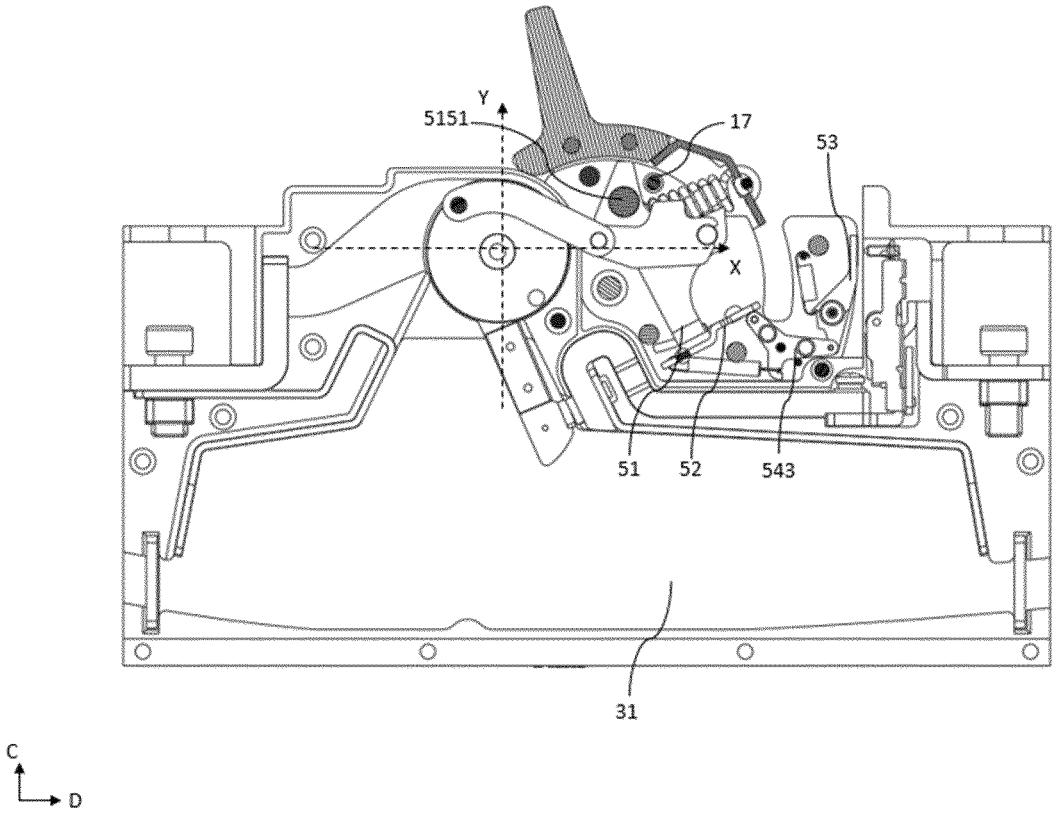

Fig. 3

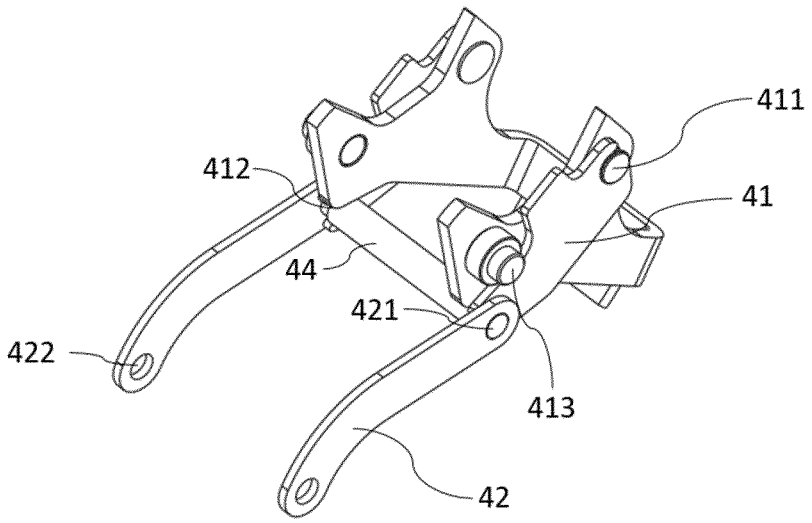

Fig. 4

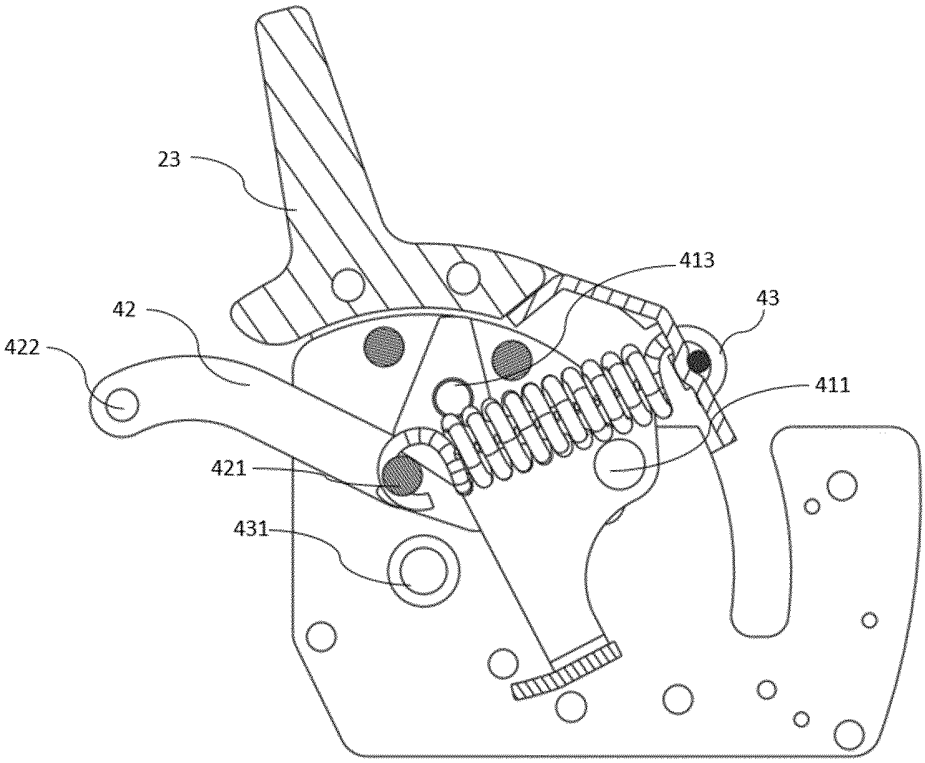

Fig. 5

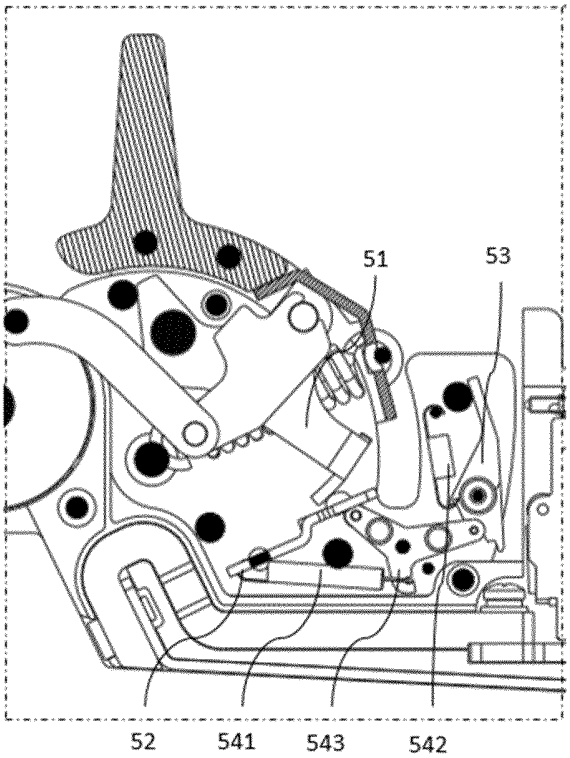

Fig. 6

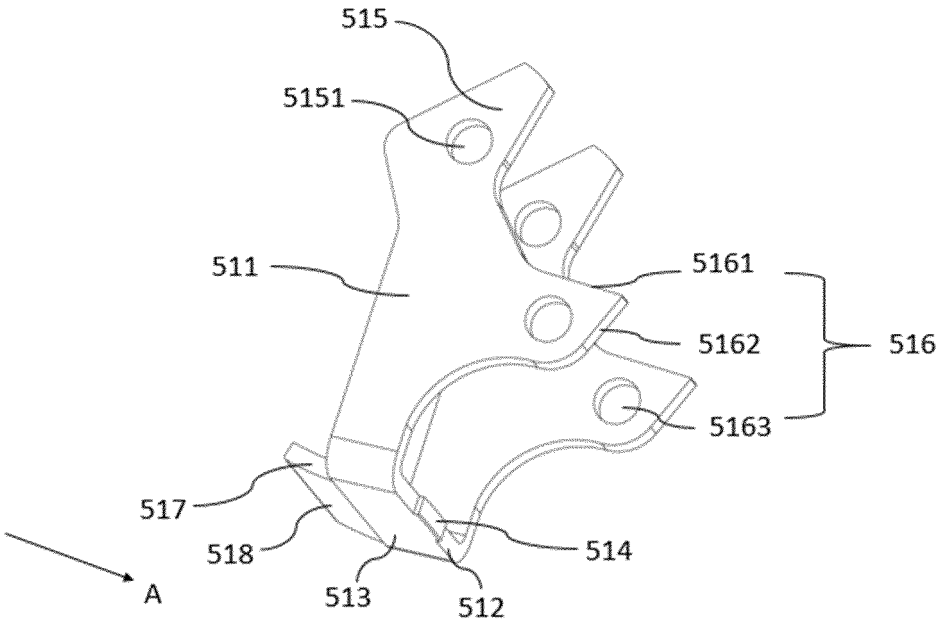
515
5151
511
5161
5162
516
5163
517
518
514
513
512
A

Fig. 7

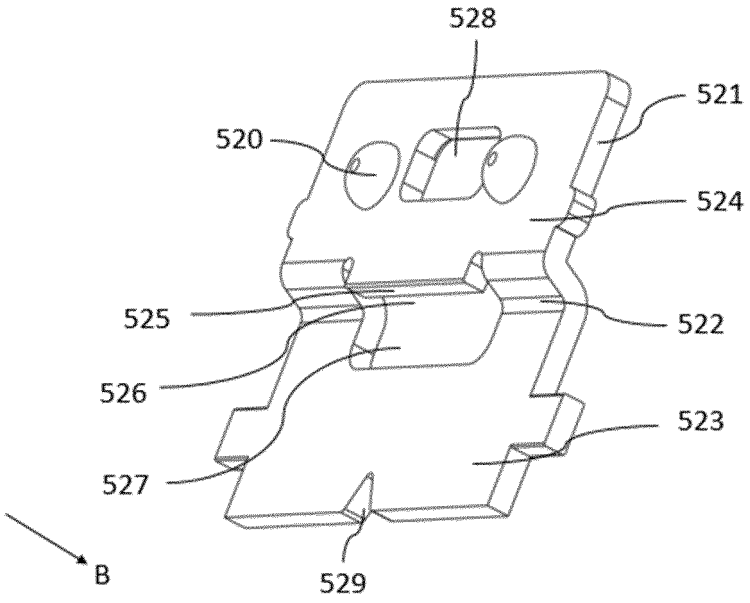
528
521
520
524
525
522
526
523
527
529
B

Fig. 8

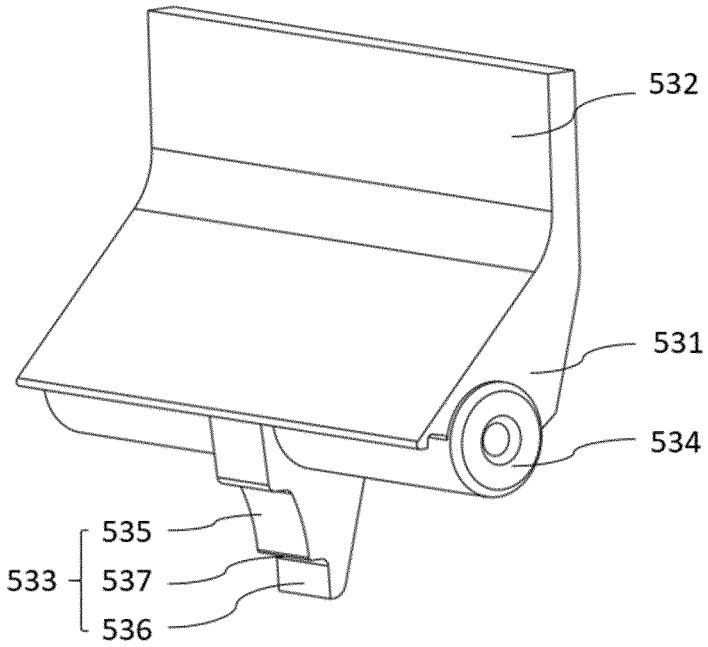
532
531
534
535
533
537
536

Fig. 9

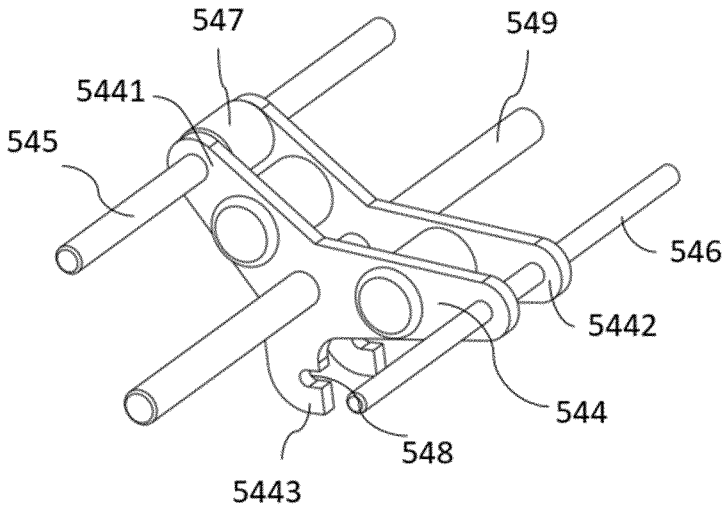
547
549
5441
545
546
5442
544
548
5443

Fig. 10

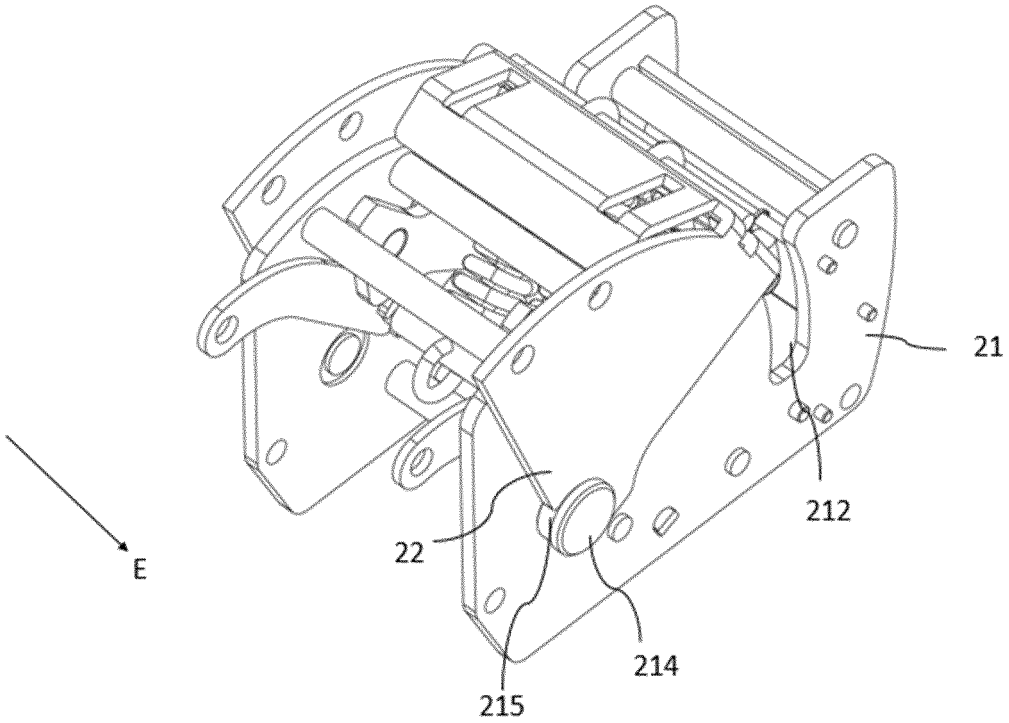

Fig. 11

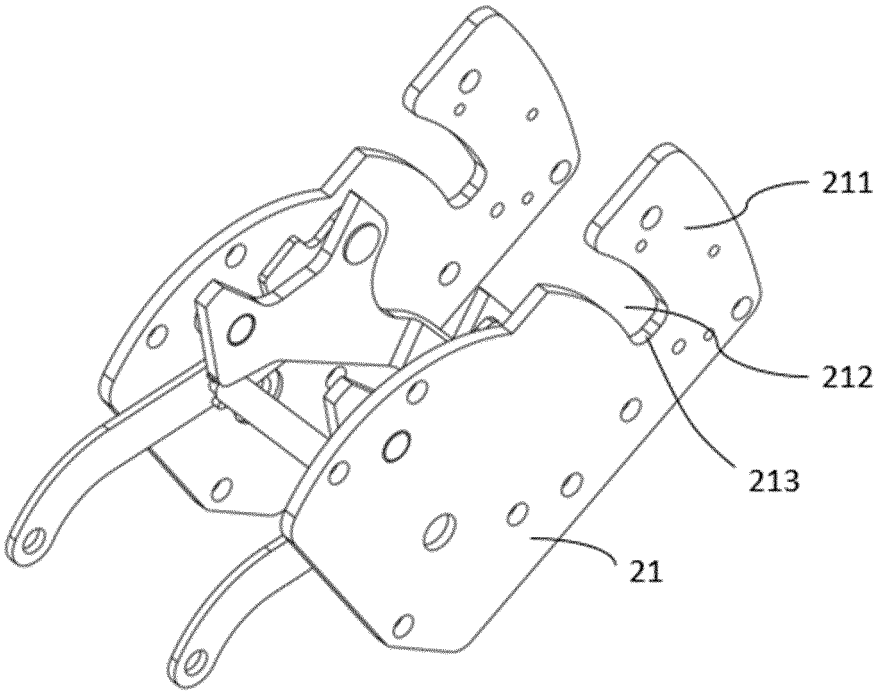

Fig. 12

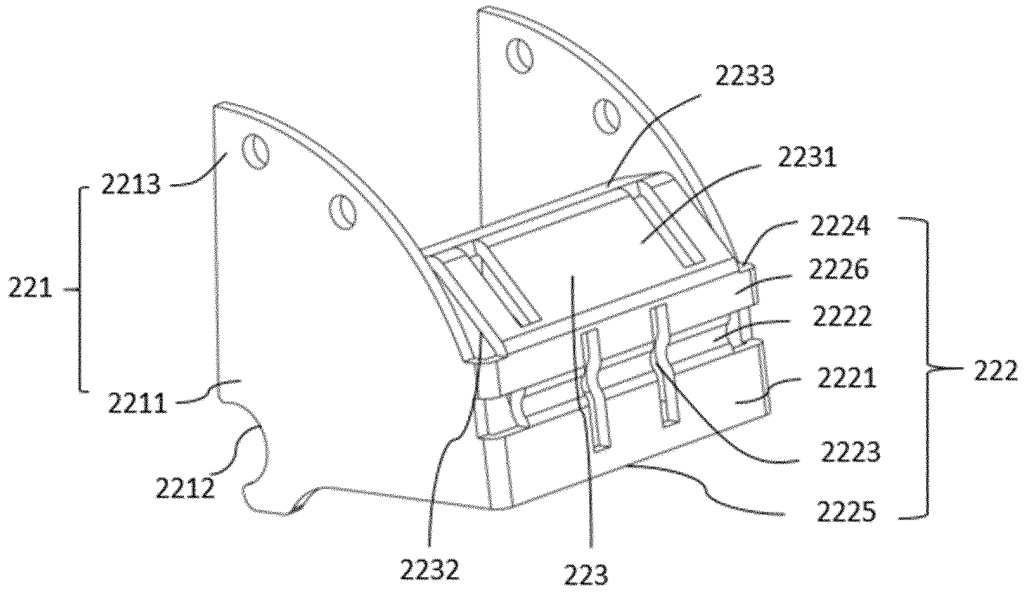
2233
2231
2213
2224
221
2226
2222
2221
222
2211
2223
2212
2225
2232
223

Fig. 13

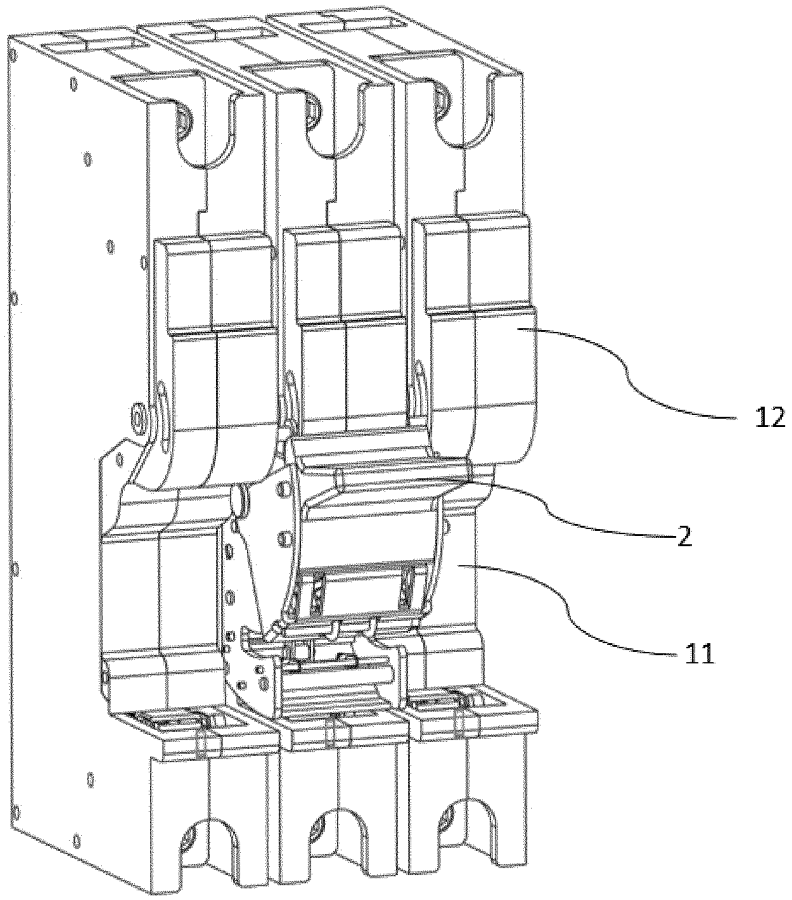
12
2
11

Fig. 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/076511

A. CLASSIFICATION OF SUBJECT MATTER

H01H 71/10(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)

CNTXT, ENTXT, ENTXTC, DWPI, CNABS, CNKI: 操作机构, 跳扣, 脱扣, 锁扣, 连杆, 弹簧, 凹陷, 卡, 槽, 手柄, 抵接, 形状, operating, tripping, lock, rod, elastic, spring, recess, snap, block, groove, handle, abut, shape

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 203038867 U (CHANGSHU SWITCHGEAR MANUFACTURING CO., LTD.) 03 July 2013 (2013-07-03) description, paragraphs 37-53, and figures 1-10	1-9, 12, 15-23, 25-27, 29
A	CN 101685729 A (ZHEJIANG CHINT ELECTRIC APPLIANCE CO., LTD.) 31 March 2010 (2010-03-31) entire document	1-29
A	CN 101488423 A (SHANGHAI ELECTRICAL APPARATUS RESEARCH INSTITUTE (GROUP) CO., LTD. et al.) 22 July 2009 (2009-07-22) entire document	1-29
A	EP 1353349 A2 (ABB PATENT GMBH) 15 October 2003 (2003-10-15) entire document	1-29
A	US 5258733 A (EATON CORP.) 02 November 1993 (1993-11-02) entire document	1-29

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 April 2022	**29 April 2022**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/076511

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 203038867 U	03 July 2013	None	
CN 101685729 A	31 March 2010	CN 101685729 B	08 February 2012
CN 101488423 A	22 July 2009	CN 101488423 B	01 June 2011
EP 1353349 A2	15 October 2003	DE 10216439 A1	27 November 2003
		EP 1353349 A3	20 April 2005
		DE 10216439 B4	24 February 2011
		EP 1353349 B1	14 August 2013
US 5258733 A	02 November 1993	None	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 202110246059 **[0001]**