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(54) CIRCUIT BREAKER

(57) A circuit breaker is provided, which includes a housing, and a circuit breaker phase pole and a leakage protection pole arranged on two sides of the housing side by side, wherein the leakage protection pole includes a zero-sequence current transformer, a leakage operating mechanism, and a leakage testing mechanism, and a major loop of the circuit breaker phase pole passes through the zero-sequence current transformer; the leakage testing mechanism includes an elastic member, a test button, and a first contact member and a second contact member respectively connected to two ends of a test loop, one end of the elastic member is provided with a first contact portion matched with the leakage operating mechanism or a phase pole operating mechanism, the other end of the elastic member is provided with a second contact portion matched with the test button, the leakage operating mechanism or a phase pole circuit breaker is capable of pushing the first contact portion to contact with the first contact member when the circuit breaker is switched on, the test button is capable of pushing the second contact portion to contact with the second contact member, the testing mechanism forms the test loop with double breakpoints through two contact points of the first contact portion and the second contact portion on the elastic member, and the first contact portion and the second contact portion are respectively driven by the electric leakage operating mechanism and the test button.

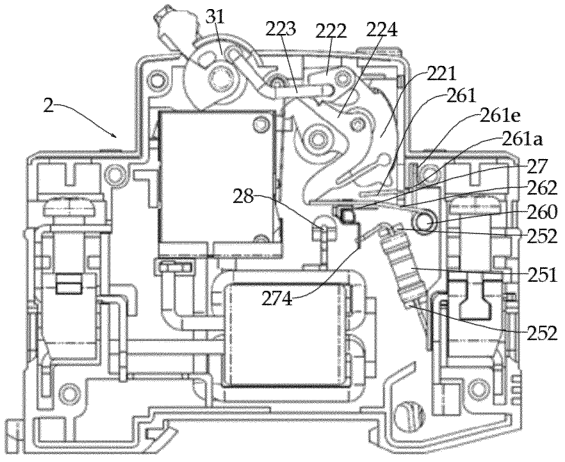

Fig.3

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Description

Technical Field

[0001] The present invention relates to the field of low-voltage appliances, and more particularly, to a circuit breaker.

Background Art

[0002] Since a test mechanism of a circuit breaker is limited by a space of a housing, a single breakpoint structure is usually used in a test loop of the test mechanism. However, when the circuit breaker is switched off, if a test button of the test mechanism is pressed, a voltage to ground may appear at an outlet end of the circuit breaker due to the conduction of the test loop, which leads to a risk of electric shock during use, and is also failed to meet safety regulations of specific areas, thus having certain limitations. Therefore, some circuit breakers change the test loop of the test mechanism into a double breakpoint structure, one of the double breakpoints is controlled by a handle, and the test loop can only be conducted by pressing the test button when the handle is switched on. However, speeds of conduction and disconnection of the breakpoint are affected by speeds of switching on and switching off of the handle. If the handle is reset slowly, then the breakpoint is disconnected slowly, and if the circuit breaker is connected reversely at the moment, the test loop may be disconnected slowly when the test button is pressed, leading to heating up and burning up of a coil of the circuit breaker, and failure of the circuit breaker, thus seriously affecting the reliability of the circuit breaker.

Summary of the Invention

[0003] The present invention aims to overcome the defects in the prior art, and provides a circuit breaker with a simple structure and a high reliability.

[0004] In order to achieve the above objective, the technical solutions used in the present invention are as follows.

[0005] A circuit breaker includes a housing, and a circuit breaker phase pole and a leakage protection pole arranged on two sides of the housing side by side, wherein the leakage protection pole includes a zero-sequence current transformer, a leakage operating mechanism, and a leakage testing mechanism, and a major loop of the circuit breaker phase pole passes through the zero-sequence current transformer; the leakage testing mechanism includes an elastic member, a test button, and a first contact member and a second contact member respectively connected to two ends of a test loop, one end of the elastic member is provided with a first contact portion matched with the leakage operating mechanism or a phase pole operating mechanism, the other end of the elastic member is provided with a second contact portion matched with the test button, the leakage operating mechanism or the phase pole operating mechanism is capable of pushing the first contact portion to contact with the first contact member when the circuit breaker is switched on, and the test button is capable of pushing the second contact portion to contact with the second contact member.

[0006] Preferably, according to the improvement of an embodiment of the present invention, the leakage operating mechanism pushes the first contact portion to contact with the first contact member when the circuit breaker is switched on. The leakage operating mechanism includes a protection lever pivotally installed in the housing, and a protection jump buckle and a protection lock catch pivotally installed on the protection lever respectively and clasped with each other, the protection jump buckle is hinged with one end of a protection connecting rod, the other end of the protection connecting rod is hinged with a circuit breaker handle, one end of the protection lock catch is arranged corresponding to a leakage release, the first contact member is arranged on one side of the protection lever, the first contact portion of the elastic member extends between the protection lever and the first contact member to match with the protection lever, and the elastic member drives the protection lever to rotate faster when releasing.

[0007] Preferably, the elastic member is a torsion spring, the elastic member includes a spiral portion connected between the first contact portion and the second contact portion, the spiral portion is installed on a spring shaft of the housing, the first contact portion and the second contact portion are both arranged vertical to an axis of the spiral portion, the first contact portion extends between the protection lever and the first contact member, and the second contact portion extends between the test button and the second contact member.

[0008] Preferably, the first contact member and the second contact member are arranged below the leakage operating mechanism, the first contact member is arranged between the second contact member and the elastic member, the test button is located on one side of the leakage operating mechanism and above the second contact portion, a length of the second contact portion is greater than that of the first contact portion, one end of the second contact portion close to the spiral portion is matched with the test button, the other end of the second contact portion passes through one side of the first contact member and extends above the second contact member, and a test resistor connected with the first contact member is arranged below a location between the first contact member and the elastic member.

[0009] Preferably, a back face of the protection lever is provided with a first pushing boss extending to one side of the first contact portion, a side edge of the protection lever is provided with a second pushing boss extending to a side face, and a pushing step face for limiting the first contact portion is formed between the second pushing boss and the first pushing boss.

[0010] According to the improvement of another embodiment of the present invention, the phase pole operating mechanism pushes the first contact portion to contact with the first contact member when the circuit breaker is switched on, the circuit breaker phase pole includes the phase pole operating mechanism, and a static contact and a moving contact which are oppositely arranged, and the moving contact is connected with the phase pole operating mechanism; the leakage protection pole includes a neutral pole static contact and a neutral pole moving contact oppositely arranged in the housing, and the phase pole operating mechanism pushes the first contact portion to contact with the first contact member through a neutral line driving member connected with the neutral pole moving contact when the circuit breaker is switched on.

[0011] Preferably, the neutral line driving member includes a protection driving rod and a shaft-machine coupling driving rod, one end of the protection driving rod is connected with the neutral pole moving contact, and the protection driving rod is hinged with the phase pole operating mechanism through the shaft-machine coupling driving rod; the first contact portion of the elastic member is matched with the protection driving rod, the protection driving rod pushes the first contact portion to contact with the first contact member, the neutral pole moving contact is connected with one end of a reset spring, and the other end of the reset spring is connected with the housing.

[0012] Preferably, the elastic member is a torsion spring, the elastic member includes a spiral portion connected between the first contact portion and the second contact portion, the spiral portion is sleeved on a spring shaft and connected with the housing, and the first contact portion and the second contact portion are both arranged vertical to an axis of the spiral portion; the second contact member is arranged on one side of the neutral pole moving contact close to the neutral pole static contact, the first contact member and the elastic member are arranged on one side of the neutral pole moving contact far away from the neutral pole static contact, the neutral pole moving contact is connected with the second contact member through the reset spring, the second contact portion passes through one side of the neutral pole moving contact and then is matched with the second contact member, and the first contact member is connected with a test resistor arranged below the first contact member.

[0013] Preferably, the first contact member and the shaft-machine coupling driving rod are oppositely arranged on two sides of the elastic member, a V-shaped fourth contact arm is arranged on the first contact portion, one end of the fourth contact arm inclines towards one side close to the shaft-machine coupling driving rod, and the other end of the fourth contact arm inclines towards one side close to the first contact member.

[0014] Preferably, one end of the shaft-machine coupling driving rod is connected with one end of the protection driving rod, and a shaft-machine coupling driving rod through hole matched with the other end of the shaft-machine coupling driving rod is arranged in the protection lever; the other end of the protection driving rod is provided with a contact driving rod rotationally connected with the neutral pole moving contact; and one end of that protection driving rod is laminated on the protection lever, and the neutral pole moving contact is laminated on the other end of the neutral pole moving contact.

[0015] Preferably, the test button includes a button connecting portion, and a button operating portion and a button pushing portion respectively arranged at two ends of the button connecting portion, the other end of the button operating portion extends out of the housing, the other end of the button pushing portion is matched with the second contact portion, the button connecting portion is connected with one end of the top side of the button pushing portion, the other end of the top side of the button pushing portion is in limit fit with the housing, the bottom side of the button pushing portion is provided with a first button pushing portion and a second button pushing portion respectively extending to two sides of the first contact portion, and a button pushing groove in limit fit with the second contact portion is formed between the first button pushing portion and the second button pushing portion.

[0016] The circuit breaker of the present invention is the leakage circuit breaker, which includes the circuit breaker phase pole and the leakage protection pole, the testing mechanism arranged in the leakage protection pole forms the test loop with double breakpoints through two contact points of the first contact portion and the second contact portion on the elastic member, and the first contact portion is driven by the leakage operating mechanism or the phase pole operating mechanism, and the second contact portion is driven by the test button, which can not only ensure that the test loop is not conducted by pressing the test button when the circuit breaker phase pole is switched off, but also improve a reliability of the circuit breaker.

[0017] In addition, according to an improved embodiment of the present invention, the elastic member is matched with the leakage operating mechanism, which can also increase an action speed of the leakage operating mechanism. Moreover, the elastic member adopts a torsion spring, which can not only be directly sleeved in the housing for installation, but also further reduce an assembly difficulty by limiting one end of the elastic member through a spring limiting groove of the housing, with characteristics of a simple structure and a low cost. A suspended end of a first conductive plate is matched with the protection lever and the first contact portion, and the first conductive plate may be buffered by an elasticity itself when contacting with the first contact portion, thus avoiding damage to the housing caused by hard contact.

[0018] In addition, according to the third improved embodiment of the present invention, the elastic member is matched with the phase pole operating mechanism, the phase pole operating mechanism drives the neutral pole moving contact at the same time through the neutral line driving member, and the elastic member is driven by the

neutral line driving member, which can ensure that the test loop is not conducted by pressing the test button when the circuit breaker phase pole is switched off, thus greatly improving a reliability of the circuit breaker. Moreover, an action speed of the operating mechanism can also be increased by matching between the elastic member and the operating mechanism, especially when overload or leakage current occurs in the circuit, the circuit breaker may be tripped faster to cut off the circuit.

Brief Description of the Drawings

[0019]

FIG. 1 is a schematic structural diagram of a top side of a circuit breaker;
FIG. 2 is a schematic structural diagram of a leakage protection pole in Embodiment 1;
FIG. 3 is a front view of the leakage protection pole in Embodiment 1;
FIG. 4 is another schematic structural diagram of the leakage protection pole in Embodiment 1;
FIG. 5 is a schematic structural diagram of an elastic member in Embodiment 1;
FIG. 6 is a schematic structural diagram of a first contact member in Embodiment 1;
FIG. 7 is a schematic structural diagram of a test button in Embodiment 1;
FIG. 8 is a schematic structural diagram of a front face of a protection lever in Embodiment 1;
FIG. 9 is a schematic structural diagram of a back face of the protection lever in Embodiment 1;
FIG. 10 is a front view of a circuit breaker phase pole in Embodiment 2;
FIG. 11 is a front view of a leakage protection pole in Embodiment 2;
FIG. 12 is a schematic diagram of matching between a leakage testing mechanism and a leakage operating mechanism in Embodiment 2;
FIG. 13 is a schematic diagram of matching among a neutral pole moving contact, a protection driving rod, and a protection lever in Embodiment 2;
FIG. 14 is a side view of FIG. 12;
FIG. 15 is a schematic structural diagram of an elastic member in Embodiment 2;
FIG. 16 is a schematic structural diagram of a protection driving rod in Embodiment 2;
FIG. 17 is a schematic structural diagram of a test button in Embodiment 2;
FIG. 18 is a schematic diagram of matching between a shaft-machine coupling driving rod and the protection lever in Embodiment 2;
FIG. 19 is a top view of an elastic member in Embodiment 3;
FIG. 20 is a side view of the elastic member in Embodiment 3;
FIG. 21 is a schematic diagram of a local structure of a circuit breaker in Embodiment 3;
FIG. 22 is a schematic diagram of matching between a leakage testing mechanism and a leakage operating mechanism in Embodiment 3;
FIG. 23 is another schematic diagram of the matching between the leakage testing mechanism and the leakage operating mechanism in Embodiment 3;
FIG. 24 is a schematic structural diagram of a leakage protection pole in Embodiment 3;
FIG. 25 is a schematic structural diagram of a phase pole operating mechanism in Embodiment 3;
FIG. 26 is a schematic diagram of a current flow direction in a leakage test loop when the circuit breaker is positively connected; and
FIG. 27 is a schematic diagram of a current flow direction in the leakage test loop when the circuit breaker is reversely connected.

Detailed Description of the Preferred Embodiments

[0020] The specific implementations of a circuit breaker of the present invention are further described hereinafter with reference to the embodiments shown in FIG. 1 to FIG. 27. The circuit breaker of the present invention is not limited to the descriptions in the following embodiments.

[0021] As shown in FIG. 1 to FIG. 4, and FIG. 9 to FIG. 10, a circuit breaker of the present invention includes a housing, and a circuit breaker phase pole 1 and a leakage protection pole 2 arranged on two sides of the housing side by side. A partition plate 32 is arranged between the circuit breaker phase pole 1 and the leakage protection pole 2. The circuit breaker phase pole 1 includes a static contact 111 and a moving contact 112 arranged oppositely and connected to a circuit respectively, and the moving contact 112 is installed on the phase pole operating mechanism 14 to swing and match with the static contact 111. The leakage protection pole 2 includes a zero-sequence current transformer 21, a leakage operating mechanism 22, and a leakage testing mechanism 25. A major loop of the circuit breaker phase pole 1 passes through the zero-sequence current transformer 21, and the zero-sequence current transformer 21 is capable of unlocking the phase pole operating mechanism 14 through the leakage operating mechanism 22 to drive the moving contact 112 to be separated from the static contact 111 when leakage current occurs in the major loop.

[0022] The leakage testing mechanism 25 includes an elastic member 26, a test button 29, and a first contact member 27 and a second contact member 28 respectively connected to the major loop of the circuit breaker phase pole 1. One end of the elastic member 26 is provided with a first contact portion 261 matched with the leakage operating mechanism 22 or the phase pole operating mechanism 14, and the other end of the elastic member 26 is provided with a second contact portion 262 matched with the test button 29. The leakage operating mechanism 22 or the phase pole operating mechanism

14 is capable of pushing the first contact portion 261 to contact with the first contact member 27 when the circuit breaker phase pole 1 is switched on, and the test button 29 is capable of pushing the second contact portion 262 to contact with the second contact member 28. When the first contact portion 261 and the second contact portion 262 contact with the first contact member 27 and the second contact member 28 respectively, the test loop is capable of being conducted to generate a leakage test signal in the major loop.

[0023] According to the circuit breaker of the present invention, the testing mechanism 25 forms the test loop with double breakpoints through two contact points of the first contact portion 261 and the second contact portion 262 on the elastic member 26, which can not only ensure that the test loop is conducted by pressing the test button 29 when the circuit breaker phase pole 1 is switched off, and improve a reliability of the circuit breaker, but also increase an action speed of the leakage operating mechanism 22 or the phase pole operating mechanism 14 by matching between the first contact portion 261 and the leakage operating mechanism 22 or the phase pole operating mechanism 14, especially when overload or leakage current occurs in the circuit, the leakage operating mechanism 22 may be helped to trip the circuit beaker faster to cut off the circuit.

[0024] FIG. 10 shows an implementation of the phase pole operating mechanism 14. The phase pole operating mechanism 14 includes a circuit breaker energy storage member, a rocker arm 141 pivotally installed in the housing and connected with the moving contact 112, a jump buckle 142 and a lock catch 143 pivotally installed on the rocker arm 141 respectively and clasped with each other, and a connecting rod 144 hinged with the jump buckle 142. The other end of the connecting rod 144 is hinged with a circuit breaker handle 31 extending out of the housing. When the jump buckle 142 and the lock catch 143 are clasped with each other, the phase pole operating mechanism 14 keeps balance, the circuit breaker handle 31 is capable of driving the phase pole operating mechanism 14, and then the moving contact 112 is driven to contact with the static contact 111 to conduct the major loop and separate from the static contact to disconnect the major loop, so as to switch on and off the circuit breaker. Moreover, energy is stored for the circuit breaker energy storage member during switching on.

[0025] Further, the circuit breaker phase pole 1 includes an electromagnetic releasing mechanism 12, a bimetallic releasing mechanism 13, and an arc extinguishing mechanism. The static contact 111 is fixed in the housing, and connected with the electromagnetic releasing mechanism 12 and a wiring terminal 15 at a left end through a major loop conductor. The moving contact 112 is installed on the phase pole operating mechanism 14 to swing and match with the static contact 111, and connected with the bimetallic releasing mechanism 15 and a circuit breaker wiring terminal 14 at a right end through a major loop conductor. In the case of short circuit, overload, and leakage of the circuit, the jump buckle 142 and the lock catch 143 are driven to be separated and unlocked from each other through the electromagnetic releasing mechanism 12, the bimetallic releasing mechanism 13, and the leakage operating mechanism 22 respectively, so that the phase pole operating mechanism 14 is out of balance, and the moving contact 112 is driven to be separated from the static contact 111 through energy release of the energy storage member to disconnect the major loop, thus cutting off a fault circuit to implement protection.

[0026] FIG. 2 to FIG. 9 show Embodiment 1 of the circuit breaker of the present invention. The leakage operating mechanism 22 and the leakage testing mechanism 25 are correspondingly arranged on one side above the zero-sequence current transformer 21, a leakage release 23 is arranged on the other side above the zero-sequence current transformer 21, and the circuit breaker handle 31 is correspondingly arranged above the leakage release 23. The leakage operating mechanism 22 includes a protection lever 221 pivotally installed in the housing, and a protection jump buckle 222 and a protection lock catch 224 pivotally installed on the protection lever 221 respectively and clasped with each other. The protection jump buckle 222 is hinged with one end of a protection connecting rod 223, and the other end of the protection connecting rod 223 is hinged with the circuit breaker handle 31. One end of the protection lock catch 224 is arranged corresponding to the leakage release 23, the first contact member 27 is arranged on one side of the protection lever 221, and the first contact portion 261 of the elastic member 26 extends between the protection lever 221 and the first contact member 27 to match with the protection lever 221. When the circuit breaker handle 31 rotates towards a location of switching on, the protection lever 221 is driven by the protection connecting rod 223, the protection jump buckle 222, and the protection lock catch 224 to rotate and push the first contact portion 261 to contact with the first contact member 27. When the circuit breaker handle 31 rotates towards a location of switching off, the protection lever 221 is driven to be far away from the first contact portion 261, and the first contact portion 261 resets under an elasticity itself and pushes the circuit breaker handle 31 to rotate towards the location of switching off at an accelerated speed.

[0027] FIG. 5 shows the first implementation of the elastic member 26. The elastic member 26 is a torsion spring, and the elastic member 26 includes a spiral portion 263 connected between the first contact portion 261 and the second contact portion 262. The spiral portion 263 is installed on a spring shaft 260 of the housing, and the first contact portion 261 and the second contact portion 262 are both arranged vertical to an axis of the spiral portion 263. The first contact portion 261 extends between the protection lever 221 and the first contact member 27, and the second contact portion 262 extends between the test button and the second contact member 28. The first contact portion 261 includes a first contact

arm 261a, a second contact arm 261b, and a third contact arm 261c connected in a U shape. The first contact arm 261a and the third contact arm 261c are oppositely arranged, and the second contact arm 261b is vertically connected between one ends of the first contact arm 261a and the third contact arm 261c. The other end of the first contact arm 261a is connected with the spiral portion 263, and the other end of the third contact arm 261c is connected with a fourth contact arm 261d. The fourth contact arm 261d extends between the test button 29 and the second contact member 28, and a spring limiting groove 261e for limiting the first contact arm 261a, the second contact arm 261b, and the third contact arm 261c is arranged in the housing. The elastic member 26 adopts the torsion spring, which can not only be directly sleeved in the housing for installation, but also further reduce an assembly difficulty by limiting one end of the elastic member 26 through the spring limiting groove 261e of the housing, with characteristics of a simple structure and a low cost.

[0028] Further, the fourth contact arm 261d is arranged substantially parallel to the second contact portion 262, and the first contact arm 261a, the second contact arm 261b, and the third contact arm 261c are arranged vertical to the second contact portion 262, which can improve a balance of the elastic member 26, and the elastic member 26 is capable of being more reliably fixed in the housing when being subjected to a torque.

[0029] Further, the first contact member 27 and the second contact member 28 are arranged below the leakage operating mechanism 22, and the first contact member 27 is arranged between the second contact member 28 and the elastic member 26. The test button 29 is located on one side of the leakage operating mechanism 22 and above the second contact portion 262. A length of the second contact portion 262 is greater than that of the fourth contact arm 261d of the first contact portion 261, one end of the second contact portion 262 close to the spiral portion 263 is matched with the test button 29, and the other end of the second contact portion 262 passes through one side of the first contact member 27 and extends above the second contact member 28. A test resistor 251 connected with the first contact member 27 is arranged below a location between the first contact member 27 and the elastic member 26, which not only has characteristics of a compact structure and a small volume, but also makes a length of the second contact portion 262 longer than that of the first contact portion 261, so that when the second contact portion 262 contacts with the second contact member 28, a second installing boss 280 may be prevented from being damaged by an elasticity of the second contact portion 262, thus being more reliable in contact.

[0030] FIG. 6 shows a preferred implementation of the first contact member 27. The first contact member 27 includes a first conductive plate 271 arranged along an axial direction of the spiral portion 263, and the elastic member 26 is arranged at an interval with the partition plate 32 along the axial direction. One end of the first conductive plate 271 is connected with the partition plate 32, and the other end of the first conductive plate 271 extends to one side of the protection lever 221 along the axis of the spiral portion 263 and is suspended. A suspended end of the first conductive plate 271 is matched with the protection lever 221 and the first contact portion 261, so that the first conductive plate may be buffered by an elasticity itself when contacting with the first contact portion 261, thus avoiding damage to the housing caused by hard contact.

[0031] Further, the first contact member 27 further includes a second conductive plate 272. A length direction of the second conductive plate 272 is arranged vertical to the first conductive plate 271, one end of the second conductive plate 272 is arranged opposite to one end of the first conductive plate 271, and one end of the second conductive plate 272 is connected with a side edge on one side of the first conductive plate 271 through a third conductive plate 273 to form a first installing portion with a U-shaped structure. A first installing groove 270 connected with the first installing portion is arranged on the partition plate 32, and the other end of the second conductive plate 272 extends out of the first installing groove 270. The second conductive plate 272 can not only facilitate reliable connection between the first contact member 27 and the housing by forming the U-shaped structure, but also facilitate grasping of the first contact member 27 and exertion of a fool-proof function during assembly, thus effectively reducing an assembly difficulty.

[0032] Further, a side edge at one side of the first conductive plate 271 close to the elastic member 26 is connected with a fourth conductive plate 274, the third conductive plate 273 is connected with a side edge at one side of the first conductive plate 271 far away from the elastic member 26, so that an opening of the U-shaped first installing portion faces towards the elastic member 26, and the test resistor 251 is arranged at one side far away from the second conductive plate 272 between the elastic member 26 and the first conductive plate 271. One end of the fourth conductive plate 274 is vertically connected with one side of the opening of the first installing portion, the other end of the fourth conductive plate 274 extends to the test resistor 251, and a connecting hole 275 is arranged in the fourth conductive plate 274 for connecting the test resistor 251. The first contact member 27 is arranged with the opening of the first installing portion facing towards the test resistor 251 on one side of the elastic member 26, and meanwhile, the fourth conductive plate 274 extending to the test resistor 251 is arranged on one side of the opening of the first installing portion, which can not only compact a structure of the first conductive plate 271 and reduce an occupied space, but also facilitate connection with the test resistor 251 by welding and other ways. In addition, a leading wire at one end of the test resistor 251 may pass through the connecting hole 275 to interlock with the fourth conductive plate 274 first, and then is connected with the

fourth conductive plate 274, which can not only improve a connection strength, but also reduce a connection difficulty. Preferably, two ends of the test resistor 251 are respectively provided with a resistor fixing plate 252, and the two resistor fixing plates 252 are respectively provided with an avoiding hole for avoiding the leading wires at the two ends of the test resistor 251. Certainly, the test resistor 251 may not be provided, and the opening of the U-shaped first installing portion may face towards one side far away from the elastic member 26. The two ways both belong to the scope of protection of the present invention.

[0033] FIG. 3 shows a preferred implementation of the second contact member 28. A second installing boss 280 arranged along an axial direction of the spiral portion 263 is arranged on the partition plate 32, and the second contact member 28 includes a U-shaped first conductive wire 281 inversely buckled on the second installing boss 280. One end of the first conductive wire 281 is located on a top side of the second installing boss 280 and matched with the second contact portion 262, and the other end of the first conductive wire 281 is located on a bottom side of the second installing boss 280 and connected with the major loop conductor the through the second conductive wire 282.

[0034] FIG. 7 shows the first implementation of the test button 29. The test button 29 includes a button connecting portion 291, and a button operating portion 292 and a button pushing portion 293 respectively arranged at two ends of the button connecting portion 291. The other end of the button operating portion 292 extends out of the housing, and the other end of the button pushing portion 293 is matched with the second contact portion 262. The button pushing portion 293 is arranged at an interval with the partition plate 32, a button guiding plate 294 (FIG. 3) extending to the button pushing portion 293 is arranged on the partition plate 32, and a button guiding groove 295 slidably matched with the button guiding plate 294 is arranged on a side face of the button pushing portion 293. The test button 29 is guided through the button guiding plate 294, so that the test button 29 may act more smoothly and reliably.

[0035] Further, a U-shaped button protruding portion 291a is arranged on the button connecting portion 291, and a button avoiding space 291b (FIG. 2) is formed between the button protruding portion 291a and a side wall of the housing. The button protruding portion 291a is connected with one end of the top side of the button pushing portion 293, and the other end of the top side of the button pushing portion 293 is in limit fit with the housing. The bottom side of the button pushing portion 293 is provided with a first button pushing portion 297 and a second button pushing portion 298 respectively extending to two sides of the first contact portion 261, and a button pushing groove 299 in limit fit with the second contact portion 262 is formed between the first button pushing portion 297 and the second button pushing portion 298.

[0036] Further, a side face of the button guiding plate 294 is provided with a contact guiding groove 296 matched with the first contact portion 261. When the first contact portion 261 is pushed by the test button 29 to reset by an elasticity itself, the first contact portion is capable of sliding along the contact guiding groove 296, and a location of the first contact portion 261 after reset is limited by the contact guiding groove 296, so that the button guiding plate 294 may also guide the first contact portion 261 when guiding the test button 29. In addition, the button guiding plate 294 may also form a side wall of the spring limiting groove 261e.

[0037] FIG. 8 and FIG. 9 show the first implementation of the protection lever 221. The protection lever 221 is fan-shaped, a middle portion of one side of the protection lever 221 is provided with a protection lever shaft hole 2210 rotatably connected with the housing, and a middle portion of a front face of the protection lever 221 is provided with a catch shaft hole 2218 connected with the protection lock catch 224. A jump buckle shaft 2217 and a protection lever shaft 2216 are correspondingly arranged on two sides of the catch shaft hole 2218 respectively, the jump buckle shaft 2217 is connected with the protection jump buckle 222, and the protection lever shaft 2216 is connected with the housing. A first lever boss 2214 is arranged on the back face of the protection lever 221 corresponding to the other side of the protection lever shaft hole 2210, a first pushing boss 2211 extending to one side of the first contact portion 261 is arranged on the back face of the protection lever 221 corresponding to a top corner on one side of the protection lever shaft hole 2210, a second lever boss 2215 is arranged on the other side of the protection lever shaft hole 2210 relative to the first pushing boss 2211, and a first lever groove 2215 is arranged on one side of the first lever boss 2214 far away from the protection lever shaft hole 2210. The first contact portion 261 is pushed by arranging the first pushing boss 2211 on the protection lever 221, which may ensure reliable contact between the first contact portion 261 and the first contact member 27.

[0038] A second pushing boss 2212 extending to a side face is arranged on the top corner provided with the first pushing boss 2211 on the protection lever 221, a pushing step face 2213 for limiting the first contact portion 261 is formed between the second pushing boss 2212 and the first pushing boss 2211, and the pushing step face 2213 may make the protection lever 221 more closely match with the first contact portion 261, thus preventing the first contact portion 261 from being misaligned with the first pushing boss 2211.

[0039] FIG. 10 to FIG. 18 show Embodiment 2 of the circuit breaker of the present invention. The leakage protection pole 2 includes the zero-sequence current transformer 21, the leakage operating mechanism 22, the leakage testing mechanism 25, and a neutral pole static contact 211 and a neutral pole moving contact 212 oppositely arranged in the housing. The neutral pole moving contact 212 is connected with the leakage operating mechanism 22 through the protection driving rod 225,

the other end of the protection driving rod 225 is hinged with one side of the leakage operating mechanism 22 through a shaft-machine coupling driving rod 220, and the other side of the leakage operating mechanism 22 is connected with the circuit breaker handle 31. The shaft-machine coupling driving rod 220 is arranged vertical to a swing plane of the protection driving rod 225, and two ends of the shaft-machine coupling driving rod 220 are respectively connected with the protection driving rod 225 and the leakage operating mechanism 22. The first contact member 27 is arranged on one side of the shaft-machine coupling driving rod 220, and the first contact portion 261 of the elastic member 26 extends between the shaft-machine coupling driving rod 220 and the first contact member 27 to match with a middle portion of the shaft-machine coupling driving rod 220. The test button 29 is capable of pushing the second contact portion 262 to contact with the second contact member 28, and the shaft-machine coupling driving rod 220 pushes the first contact portion 261 to contact with the first contact member 27 when the circuit breaker is switched on.

[0040] When the circuit breaker handle 31 rotates towards a location of switching on, the leakage operating mechanism 22 drives the protection driving rod 225 through the shaft-machine coupling driving rod 220, then the neutral pole static contact 211 is driven to contact with the neutral pole moving contact 212, and the first contact portion 261 is pushed to contact with the first contact member 27 through the shaft-machine coupling driving rod 220. When the circuit breaker handle 31 rotates towards a location of switching off, the shaft-machine coupling driving rod 220 is driven to be far away from the first contact portion 261, and the first contact portion 261 resets by an elasticity itself and pushes the circuit breaker handle 31 to rotate towards the location of switching off at an accelerated speed. In the implementation, on the basis of the test loop with double breakpoints, the first contact portion 261 is driven to contact with the first contact member 27 by the moving shaft-machine coupling driving rod 220 of the leakage operating mechanism 22, which can not only ensure that the test loop is not conducted by pressing the test button 29 when the circuit breaker phase pole 1 is switched off, and further improve a reliability of the circuit breaker, but also further increase an action speed of the leakage operating mechanism 22 by matching between the elastic member 26 and the moving shaft-machine coupling driving rod 220.

[0041] As a preferred implementation of the leakage operating mechanism 22, the leakage operating mechanism 22 includes the protection lever 221 pivotally installed in the housing, and the protection jump buckle 222 and the protection lock catch 224 pivotally installed on the protection lever 221 respectively and clasped with each other. The protection jump buckle 222 is hinged with one end of the protection connecting rod 223, and the other end of the protection connecting rod 223 is hinged with the circuit breaker handle 31. The protection driving rod 225 is hinged with the protection lever 221 through the shaft-machine coupling driving rod 220, the neutral pole moving contact 212 is hinged with the protection driving rod 225, and the neutral pole moving contact 212 is connected with one end of the reset spring 227. The other end of the reset spring 227 is connected with the housing, and when the protection jump buckle 222 and the protection lock catch 224 are clasped with each other, the circuit breaker handle 31 is capable of driving the neutral pole moving contact 212 to swing through the protection driving rod 225. One end of the protection shaft-machine coupling driving rod 220 is connected with one end of the protection driving rod 225, a shaft-machine coupling driving rod through hole matched with the other end of the shaft-machine coupling driving rod 220 is arranged in the protection lever 221, and the other end of the shaft-machine coupling driving rod 220 passes through the shaft-machine coupling driving rod through hole and extends to the other side of the protection lever 221 to be connected with a limiting member 226. Certainly, other solutions may also be used in the leakage operating mechanism 22.

[0042] With reference to FIG. 3, a switch-on process of the circuit breaker is as follows: the circuit breaker handle 31 rotates clockwise, the handle 31 pushes the link 223, the link 223 pushes the protection jump buckle 222 and the protection lock catch 224 to drive the protection lever 221 to rotate clockwise, and the elastic member 261 is compressed through the protection lever 221 to store energy until the mechanism is connected.

[0043] A releasing process is as follows: when overload or leakage current occurs in the circuit, the leakage release 23 pushes the protection lock catch 224 and the protection jump buckle 222 to unlock and release the protection lever 221, and the protection lever 221 is capable of rotating faster counterclockwise under actions of the reset spring and the elastic member 261.

[0044] Further, one end of the reset spring 227 is connected with the neutral pole moving contact 212, and the other end of the reset spring is connected with the second contact member 28. The second contact member 28 not only plays a role of the breakpoint of the test loop, but also plays a role of fixing the reset spring 227. Meanwhile, the reset spring 227 not only plays a role of matching with the neutral pole moving contact 212, but also plays a role of electrically connecting the neutral pole moving contact 212 with the second contact member 28.

[0045] Further, the second contact member 28 is arranged on one side of the neutral pole moving contact 212 close to the neutral pole static contact 211, and the first contact member 27 and the elastic member 26 are arranged on one side of the neutral pole moving contact 212 far away from the neutral pole static contact 211. The neutral pole moving contact 212 is connected with the second contact member 28 through the reset spring 227, the second contact portion 262 passes through one side of the neutral pole moving contact 212 and then is matched with the second contact member 28, and the

first contact member 27 is connected with the test resistor 251 arranged below the first contact member 27. The first contact member 27 and the second contact member 28 are respectively arranged on the two sides of the neutral pole static contact 211, which not only has characteristics of a compact structure, a short moving stroke, and a fast action speed, but also exerts a function of resetting the neutral pole moving contact 212 by connecting the second contact member 28 with the reset spring 227 on the basis of conducting the test loop, thus killing two birds with one stone, and being smart in design.

[0046] FIG. 12 to FIG. 16 show a preferred implementation of the protection driving rod 225. One end of the protection driving rod 225 is provided with a shaft-machine coupling driving boss 2251 arranged along an axial direction of the shaft-machine coupling driving rod 220, a shaft-machine coupling driving hole 2252 sleeved on the shaft-machine coupling driving rod 220 is arranged in the shaft-machine coupling driving boss 2251, and the other end of the protection driving rod 225 is provided with a contact driving boss 2253. A contact driving rod 2254 rotatably connected with the neutral pole moving contact 212 is arranged on the contact driving boss 2253, the contact driving rod 2254 is arranged vertical to the swing plane of the neutral pole moving contact 212, one end of the protection driving rod 225 is laminated on the protection lever 221, and the neutral pole moving contact 212 is laminated on the other end of the protection driving rod 225. In the implementation, the shaft-machine coupling driving hole 2252 is arranged at one end of the protection driving rod 225, and the contact driving rod 2254 is arranged at the other end of the protection driving rod 225, with characteristics of a simple structure, convenient processing, and convenient assembly, and the shaft-machine coupling driving boss 2251 is capable of improving a connection strength between the shaft-machine coupling driving hole 2252 and the shaft-machine coupling driving rod 220.

[0047] FIG. 15 shows the second implementation of the elastic member 26. The elastic member 26 is the torsion spring, and the elastic member 26 includes the spiral portion 263 connected between the first contact portion 261 and the second contact portion 262. The spiral portion 263 is sleeved on the spring shaft 260 and connected with the housing. The first contact portion 261 and the second contact portion 262 are both arranged vertical to an axis of the spiral portion 263, the first contact portion 261 extends between the protection lever 225 and the first contact member 27, and the second contact portion 262 extends between the test button 29 and the second contact member 28.

[0048] The first contact portion 261 includes the first contact arm 261a, the second contact arm 261b, and the third contact arm 261c connected in a U shape. The first contact arm 261a and the third contact arm 261c are oppositely arranged, and the second contact arm 261b is vertically connected between one ends of the first contact arm 261a and the third contact arm 261c. The other end of first contact arm 261a is connected with the spiral portion 263, and the other end of the third contact arm 261c is connected with the fourth contact arm 261d. The fourth contact arm 261d extends between the test button 220 and the second contact member 28, and the first contact portion 261 is inserted into the spring limiting groove 261e along a direction of the second contact arm 261b for limit fit.

[0049] Further, the first contact member 27 and the shaft-machine coupling driving rod 220 are oppositely arranged on two sides of the elastic member 26, and the fourth contact arm 261d of the first contact portion 261 is V-shaped. One end of the fourth contact arm 261d inclines towards one side close to the shaft-machine coupling driving rod 220, and the other end of the fourth contact arm 261d inclines towards one side close to the first contact member 27. The V-shaped fourth contact arm 261d of the first contact portion 261 can not only reduce a distance between the first contact portion 261 and the first contact member 27 effectively, and accelerate a conduction speed of the test loop, but also have a higher elasticity, and a characteristic of a fast reset speed without damaging the first contact member 27 due to hard contact.

[0050] Further, an end portion of the fourth contact arm 261d is provided with a bent contact arm 261f bent towards the first contact member 27, and an outer side of the bent contact arm 261f is in contact fit with the first contact member 27, which can increase a contact area and ensure reliable contact.

[0051] With reference to FIG. 12 to FIG. 16, a triangular moving contact guiding groove 213 is arranged in the middle portion of the neutral pole moving contact 212, and a moving contact guiding column 214 inserted into the moving contact guiding groove 213 and matched with the moving contact guiding groove 213 is arranged in the housing. One end of the reset spring 227 is sleeved in the guiding groove 213, the neutral pole moving contact 212 is respectively provided with a protection driving rod shaft hole and a neutral pole moving contact point 215 corresponding to two sides of the moving contact guiding groove 213, and the neutral pole moving contact point 215 is in contact fit with a neutral pole static contact point 216 on the neutral pole static contact 211. The neutral pole moving contact 212 in the implementation has characteristics of a small volume, a simple structure, and convenient processing and manufacturing, and is capable of reducing a production cost and an assembly difficulty.

[0052] Further, the neutral pole moving contact 212 is V-shaped, the middle portion of the neutral pole moving contact 212 protrudes towards one side close to the second contact member 28, and an opening 217 avoiding the first contact member 27 is formed on the other side of the neutral pole moving contact 212. The neutral pole moving contact point 215 and the protection driving rod shaft hole are respectively arranged at two ends of the V-shaped neutral pole moving contact 212, and one side of the neutral pole moving contact 212 is provided with

the test resistor 251 connected with the first contact member 27, which can prevent mutual interference between parts, further compact a structure of the testing mechanism, and reduce an occupied space.

[0053] FIG. 11 and FIG. 17 show the second implementation of the test button. The test button 29 includes the button connecting portion 291, and the button operating portion 292 and the button pushing portion 293 respectively arranged at two ends of the button connecting portion 291. The other end of the button operating portion 292 extends out of the housing, and the other end of the button pushing portion 293 is matched with the first contact portion 261. The button connecting portion 291 is connected with one end of the top side of the button pushing portion 293, and the other end of the top side of the button pushing portion 293 is in limit fit with the housing. The bottom side of the button pushing portion 293 is provided with the first button pushing portion 297 and the second button pushing portion 298 respectively extending to two sides of the first contact portion 261, and the button pushing groove 299 in limit fit with the first contact portion 261 is formed between the first button pushing portion 297 and the second button pushing portion 298.

[0054] FIG. 19 to FIG. 27 show Embodiment 3 of the circuit breaker of the present invention. The embodiment is different from the above Embodiment 2 in that a neutral line driving member is not connected between the leakage operating mechanism 22 and the neutral pole moving contact 212. The neutral line driving member in the embodiment is connected between the phase pole operating mechanism 14 of the circuit breaker phase pole 1 and the neutral pole moving contact 212, and an action of the neutral line driving member is driven by the phase pole operating mechanism 14 of the circuit breaker phase pole 1. The neutral line driving member includes the protection driving rod 225 connected with the neutral pole moving contact 212 of the neutral line moving contact and the shaft-machine coupling driving rod 220 connected between the protection driving rod 225 and the leakage protection mechanism 22. The first contact portion 261 of the elastic member 26 is matched with the protection driving rod 225 of the neutral line driving member.

[0055] Specifically, the leakage protection phase pole 2 is arranged on one side of the circuit breaker phase pole 1, and the leakage protection phase pole 2 includes the zero-sequence current transformer 21, the leakage operating mechanism 22, the leakage release 23, the leakage testing mechanism 25, a protection circuit board 211, and a neutral line contact mechanism.

[0056] The circuit breaker phase pole 1 includes the phase pole release, the phase pole operating mechanism 14, and a phase pole contact mechanism. The phase pole release includes the electromagnetic release mechanism 12 and/or the bimetallic release mechanism 13.

[0057] The phase pole contact mechanism includes the static contact 111 and the moving contact 112 respectively connected to a phase line. The neutral line contact mechanism includes the neutral pole moving contact 212 and the neutral pole static contact 211 respectively connected to a neutral line. The neutral pole moving contact 212 is connected with the phase pole operating mechanism 14 of the circuit breaker phase pole 1 through the protection driving rod 225.

[0058] The leakage testing mechanism 25 includes the test button 29 and the leakage test loop. The leakage test loop includes the elastic member 26, the first contact member 27, and the second contact member 28. The elastic member 26 includes the first contact portion 261 and the second contact portion 262 connected with each other. The first contact portion 261 is arranged between the first contact member 27 and the protection driving rod 225, and the second contact portion 262 is arranged between the second contact member 28 and the test button 29.

[0059] When the circuit breaker phase pole 1 is switched on, the phase pole operating mechanism 14 pushes the first contact portion 261 of the elastic member 26 to contact with the first contact member 27 through the protection driving rod 225, and when the test button 29 is pressed, the test button 29 pushes the second contact portion 262 of the elastic member 26 to contact with the second contact member 28. A loop is formed between the first contact member 27 and the second contact member 28 through the elastic member 26, thus conducting the leakage test loop.

[0060] The zero-sequence current transformer 21 of the leakage protection phase pole 2 is sleeved on the neutral line and the leakage test loop. When the leakage test loop is conducted, occurrence of leakage current of the neutral line is simulated, so that the zero-sequence current transformer 21 induces the leakage current. The zero-sequence current transformer 21 drives the leakage release 23 to unlock the leakage operating mechanism 22, and meanwhile, the leakage operating mechanism 22 drives the phase pole operating mechanism 14 of the circuit breaker phase pole 1 to be unlocked. When the phase pole operating mechanism 14 is unlocked, the moving contact 111 is driven to be separated from the moving contact 112 to disconnect the connected phase line. Meanwhile, the neutral pole moving contact 212 is driven to be separated from the neutral pole static contact 211 through the protection driving rod 225 to disconnect the connected neutral line.

[0061] The first contact portion 261 of the elastic member 26 and the first contact member 27 form a first test contact point of the leakage test loop, and the second contact portion 262 of the elastic member 26 is matched with the second contact member 28 to form a second test contact point of the leakage test loop. Connection and disconnection of the second test contact point are controlled by the test button 29.

[0062] After the circuit breaker is connected to a power supply, when the circuit breaker phase pole 1 is in a switch-off state, the second test contact point is in a disconnected state, and the test button 29 is pressed at the moment. After the second test contact point is connected,

since the first test contact point is in a disconnected state, the leakage test loop cannot be conducted, and a load side of the circuit breaker cannot form a voltage to ground or a voltage to the protection circuit board 211.

[0063] When the circuit breaker phase pole 1 is in a switch-on state, the first test contact point is in a connected state. The test button 29 is pressed at the moment, the first test contact point is connected and the leakage test loop is conducted to simulate a leakage signal. If the circuit breaker phase pole 1 trips, then a leakage protection function of the leakage protection phase pole 2 is not failed.

[0064] According to the circuit breaker of the embodiment, the first contact portion 261 of the elastic member 26 and the first contact member 27 form the first test contact point of the leakage test loop, and the second contact portion 262 of the elastic member 26 is matched with the second contact member 28 to form the second test contact point of the leakage test loop. Connection and disconnection of the second test contact point are controlled by the test button 29, and the first test contact point is controlled by the phase pole operating mechanism 14 of the circuit breaker phase pole 1, so that connection and disconnection of the first test contact point are synchronized with switching on and switching off of the circuit breaker phase pole 1, which can not only effectively prevent a single-contact-point leakage test loop from being conducted by pressing the test button 29 when the circuit breaker phase pole 1 is switched off, resulting in a voltage to ground or a voltage to the protection circuit board 211 generated by the leakage test loop, but also have characteristics of a compact structure, a small volume, and a high reliability.

[0065] When the circuit breaker handle 31 rotates towards the location of switching on, the phase pole operating mechanism 14 of the circuit breaker phase pole 1 drives the protection driving rod 225 to push the first contact portion 261 to contact with the first contact member 27 through the shaft-machine coupling driving rod 220. When the circuit breaker handle 31 rotates towards the location of switching off, the phase pole operating mechanism 14 of the circuit breaker phase pole 1 drives the protection driving rod 225 to be far away from the first contact portion 261 through the shaft-machine coupling driving rod 220.

[0066] In the implementation, on the basis of the test loop with double breakpoints, the first contact portion 261 is driven by the protection driving rod 225 of the leakage operating mechanism 22 instead of the shaft-machine coupling driving rod 220 of the leakage operating mechanism 22, and a contact area between the protection driving rod 225 and the first contact portion 261 is larger, which not only makes the matching more reliable, but also makes the assembly less difficult.

[0067] With reference to Embodiment 1 and Embodiment 2, the circuit breaker of the present invention includes the circuit breaker phase pole 1 (FIG. 1), the leakage protection pole 2 (FIG. 2), the leakage testing mechanism 25 (FIG. 3), and the operating mechanism respectively matched with the circuit breaker phase pole 1 and the leakage protection pole 2. The circuit breaker phase pole 1 and the leakage protection pole 2 respectively include the phase pole contact mechanism and the neutral line contact mechanism connected to the circuit.

[0068] When the circuit breaker is switched on, the operating mechanism respectively drives the phase pole contact mechanism and the neutral line contact mechanism to conduct the circuit. When the circuit fails, the operating mechanism unlocks and respectively drives the phase pole contact mechanism and the neutral line contact mechanism to disconnect the circuit.

[0069] The leakage testing mechanism 25 includes the test button 29 and the leakage test loop. The leakage test loop includes the second test contact point matched with the test button 29 and the first test contact point matched with the operating mechanism. The test button 29 is capable of driving the second test contact point to connect and disconnect, the operating mechanism is capable of driving the first test contact point to connect and disconnect while driving the phase pole contact mechanism and the neutral line contact mechanism to conduct and disconnect the circuit. When the first test contact point and the second test contact point are both connected, the leakage test loop is conducted and generates a leakage fault test signal to unlock the operating mechanism. When any one of the first test contact point and the second test contact point is disconnected, the leakage test loop is disconnected.

[0070] According to the circuit breaker of the present invention, the first test contact point and the second test contact point of the leakage test loop are respectively controlled by the operating mechanism and the test button 29. Only when the first test contact point and the second test contact point are both connected, the leakage test loop can be conducted, and when either of the first test contact point and the second test contact point is disconnected, the leakage test loop cannot be conducted, so that the load side of the circuit breaker cannot form a voltage to ground or a voltage to the circuit board, and the load and the circuit board are capable of being reliably protected.

[0071] The circuit includes the phase line and the neutral line. The phase pole contact mechanism is connected to the phase line, and the neutral line contact mechanism is connected to the neutral line. The operating mechanism includes the phase pole operating mechanism 14 matched with the phase pole contact mechanism and the leakage operating mechanism 22 arranged on one side of the phase pole operating mechanism 14 and matched with the neutral line contact mechanism, and the phase pole operating mechanism 14 and the leakage operating mechanism 22 are matched with each other.

[0072] When the circuit breaker is switched on, the phase pole operating mechanism 14 and the leakage operating mechanism 22 are locked in an energy storage state, and the phase pole contact mechanism is driven

to conduct the phase line by the phase pole operating mechanism 14. Meanwhile, the neutral line contact mechanism is driven to conduct the neutral line by the leakage operating mechanism 22, and the phase pole operating mechanism 14 or the leakage operating mechanism 22 corresponding to this circuit is unlocked and drives the other one to be unlocked, so that the phase pole contact mechanism and the neutral line contact mechanism respectively disconnect the phase line and the neutral line.

[0073] The first test contact point of the leakage test loop matched with the operating mechanism may be controlled by the leakage operating mechanism 22 of the operating mechanism, and may also be controlled by the phase pole operating mechanism 14 of the operating mechanism.

[0074] The phase pole contact mechanism is connected with the phase pole operating mechanism 14, the neutral line contact mechanism is connected with the phase pole operating mechanism 14 or the leakage operating mechanism 22 through the neutral line driving member, and the neutral line driving member drives the first test contact point to connect and disconnect.

[0075] A first test of the first test contact point controlled by the leakage operating mechanism 22 is Embodiment 1 of the circuit breaker of the present invention. The neutral line contact mechanism is connected with the leakage operating mechanism 22 through the neutral line driving member, and the first test contact point is matched with the neutral line driving member. The neutral line driving member includes the protection driving rod 225 and the shaft-machine coupling driving rod 220. One end of the protection driving rod 225 is connected with the neutral pole moving contact 212, and the other end of the protection driving rod 225 is hinged with the phase pole operating mechanism 22 through the shaft-machine coupling driving rod 220. The first contact portion 261 of the elastic member 26 is matched with the shaft-machine coupling driving rod 220, the shaft-machine coupling driving rod 220 pushes the first contact portion 261 to contact with the first contact member 27, the neutral pole moving contact 212 is connected with one end of the reset spring 227, and the other end of the reset spring 227 is connected with the housing.

[0076] A first test of the first test contact point controlled by the phase pole operating mechanism 14 is Embodiment 2 of the circuit breaker of the present invention. The neutral line contact mechanism is connected with the phase pole operating mechanism 14 through the neutral line driving member, and the first test contact point is matched with the neutral line driving member. The neutral line driving member includes the protection driving rod 225 and the shaft-machine coupling driving rod 220. One end of the protection driving rod 225 is connected with the neutral pole moving contact 212, and the protection driving rod 225 is hinged with the phase pole operating mechanism 14 through the shaft-machine coupling driving rod 220. The first contact portion 261 of the elastic member 26 is matched with the protection driving rod 225, the protection driving rod 225 pushes the first contact portion 261 to contact with the first contact member 27, the neutral pole moving contact 212 is connected with one end of the reset spring 227, and the other end of the reset spring 227 is connected with the housing.

[0077] The two embodiments of the circuit breaker of the present invention both have the following characteristics.

[0078] As shown in FIG. 12, the leakage testing mechanism 25 includes the first contact member 27 and the second contact member 28. The elastic member 26 is the torsion spring, and the elastic member 26 includes the spiral portion 263 connected between the first contact portion 261 and the second contact portion 262. The spiral portion 263 is sleeved on the spring shaft 260 and connected with the housing. The first contact portion 261 is arranged between the neutral line driving member and the first contact member 27, and forms the first test contact point with the first contact member 27. The second contact portion 262 is arranged between the second contact member 28 and the test button 29, and forms the second test contact point with the second contact member 28.

[0079] According to the circuit breaker of the present invention, the first contact portion 261 and the second contact portion 262 on the elastic member 26 respectively form the first test contact point and the second test contact point of the leakage test loop, which can not only ensure a reliability of the leakage test loop, but also improve an action speed of the operating mechanism by matching between the first contact portion 261 and the operating mechanism.

[0080] FIG. 26 shows the leakage test loop when the circuit breaker is positively connected, and FIG. 27 shows the leakage test loop when the circuit breaker is reversely connected. One end of the leakage test loop is connected with the phase line that the circuit breaker phase pole 1 is connected, and the other end of the leakage test loop is connected with the neutral line that the leakage protection pole 2 is connected. Specifically, the leakage test loop also includes the test resistor 251 and the reset spring 227. The first contact member 27 is connected to the phase line with the circuit breaker phase pole 1 through the test resistor 251. One end of the reset spring 227 is connected to the neutral line with the neutral line contact mechanism, and the other end of the reset spring 227 is rotatably installed on the second contact member 28. When the first test contact point and the second test contact point are both connected, the leakage test loop is conducted between the phase line and the neutral line to generate the leakage fault test signal, which can not only form the leakage test loop between the neutral line contact mechanism and the first contact member 27, but also increase a contact pressure of the neutral line contact mechanism by the reset spring 227. Certainly, other solutions may also be used in the leakage test loop to simulate the occurrence of leakage current, which all be-

long to the scope of protection of the present invention.

[0081] As shown in FIG. 10 and FIG. 21, the operating mechanism is connected with the circuit breaker handle 31. The circuit breaker handle 31 includes the phase pole handle 31a and a leakage protection handle 31b. The phase pole handle 31a is connected with the phase pole operating mechanism 14 of the circuit breaker phase pole 1, and the leakage protection handle 31b is connected with the leakage operating mechanism 22 of the leakage protection pole 2. A pushing block 31c is arranged on the leakage protection handle 31b, and the pushing block 31c extends to one side of the phase pole handle 31a rotating in a direction of switching on. When rotating in a direction of switching off in the case that a leakage current occurs, the leakage protection handle 31b pushes the phase pole handle 31a to rotate in the direction of switching off through the pushing block 31c, which can accelerate an action speed of the circuit breaker. When overload or short-circuit current occurs, the phase pole handle 31a rotates in the direction of switching off, but the leakage protection handle 31b does not act. A fault cause is capable of being indicated by locations of the phase pole handle 31a and the leakage protection handle 31b, if the phase pole handle 31a and the leakage protection handle 31b both act, then the fault cause is the overload or the short-circuit current, and if the phase pole handle 31a acts but the leakage protection handle 31b does not act, then the fault cause is the leakage current.

[0082] In the above Embodiment 1, the neutral line contact mechanism is connected with the leakage protection mechanism 22 of the operating mechanism through the neutral line driving member. The neutral line driving member includes the protection driving rod 225 connected with the neutral line moving contact and the shaft-machine coupling driving rod 220 connected between the protection driving rod 225 and the leakage protection mechanism 22. The first contact portion 261 of the elastic member 26 is matched with the protection driving rod 225 of the neutral line driving member or the shaft-machine coupling driving rod 220.

[0083] With reference to FIG. 26, according to the leakage test loop when the circuit breaker is positively connected, the current flows in from a wiring terminal 15 at a right end of the circuit breaker phase pole 1, passes through the moving contact 112 of the circuit breaker phase pole 1, the static contact 111 of the circuit breaker phase pole 1, the zero-sequence current transformer 21 of the leakage protection pole 2, a wiring terminal 15 at a left end of the circuit breaker phase pole 1, the test resistor 251, the first contact member 27, the second test contact point, the first test contact point, the elastic member 26, the reset spring 227, and the neutral pole moving contact 212, and flows to the wiring terminal 15 at the right end of the leakage protection pole 2.

[0084] With reference to FIG. 27, according to the test loop when the circuit breaker is reversely connected, the current flows in from the wiring terminal 15 at the left end of the circuit breaker phase pole 1, passes through the test resistor 251, the first contact member 27, the elastic member 26, the first test contact point, the second test contact point, the reset spring 227, the neutral pole moving contact 212, the neutral pole static contact 211, and the zero-sequence current transformer 21, and flows to the wiring terminal 15 at the left end of the leakage protection pole 2.

[0085] FIG. 19 to FIG. 20 show a structure of the elastic member in the embodiment. The structure of the elastic member 26 in the embodiment is the same as that of the elastic member 26 in Embodiment 1, but a difference lies in the protection driving rod 225. The first contact portion 261 of the elastic member 26 in the implementation is matched with the protection driving rod 225. That is, the first contact member 27 and the protection driving rod 225 are oppositely arranged on two sides of the elastic member 26. The fourth contact arm 261d of the first contact portion 261 is V-shaped, and one end of the fourth contact arm 261d inclines towards one side close to the protection driving rod 225.

[0086] Specifically, the elastic member 26 is the torsion spring, and the elastic member 26 includes the spiral portion 263 connected between the first contact portion 261 and the second contact portion 262. The spiral portion 263 is sleeved on the spring shaft 260 and connected with the housing. The first contact portion 261 and the second contact portion 262 are both arranged vertical to an axis of the spiral portion 263, the first contact portion 261 extends between the protection lever 225 and the first contact member 27, and the second contact portion 262 extends between the test button 29 and the second contact member 28.

[0087] Further, the spiral portion 263 is arranged on one side close to the test button 29, and the first contact portion 261 has a U-shaped structure. The first contact portion 261 includes the first contact arm 261a and the third contact arm 261c which are oppositely arranged, and the second contact arm 261b vertically connected between one ends of the first contact arm 261a and the second contact arm 261b. The second contact arm 261b is arranged in parallel with an axis of the spiral portion 263, one end of the second contact arm 261b far away from the first contact portion 261a extends to a swing plane of the protection driving rod 225, and the other end of the first contact arm 261a is connected with the spiral portion 263. The third contact arm 261c extends between the protection driving rod 225 and the second contact member 28, and the third contact arm 261c and the protection driving rod 225 are arranged in a same plane.

[0088] Further, the other end of the third contact arm 261c far away from the second contact arm 261b is connected with the fourth contact arm 261d with a V-shaped structure, and the fourth contact arm 261d extends between the protection driving rod 225 and the second contact member 28. A side edge on one side of the fourth contact arm 261d connected with the second contact arm 261b inclines towards a direction close to the protection driving rod 225, and a side edge at the other side of the

fourth contact arm 261d inclines towards a direction close to the first contact member 27 to match with the first contact member 27. A bending portion matched with the protection driving rod 225 is formed at a joint of the side edges at the two sides of the fourth contact arm 261d, and the protection driving rod 225 pushes the bending portion of the fourth contact arm 261d to make the fourth contact arm 261d far away from one end of the second contact arm 261b and the first contact member 27, thus connecting the second test contact point. The fourth contact arm 261d with the V-shaped structure can not only optimize layout of parts to ensure a reliable and safe electrical distance between the first contact member 27 and other parts, but also reduce a distance between the first contact portion 261 and the protection driving rod 225, which is convenient for the protection driving rod 225 to drive the first contact portion 261 to act, and ensures a sensitivity of the elastic member 26.

[0089] Further, one end of the fourth contact arm 261d matched with the first contact member 27 is provided with the bent contact arm 261f, the bent contact arm 261f bends towards one side far away from the first contact member 27, and an arc surface matched with the first contact member 27 is formed outside the bent contact arm 261f. The fourth contact arm 261d contacts with the first contact member 27 through the arc surface formed on the bent contact arm 261f, so that a contact area is larger, and the contact is more reliable.

[0090] As shown in FIG. 24, the partition plate 32 is arranged between the circuit breaker phase pole 1 and the leakage protection pole 2, and the spring shaft 260 for installing the spiral portion 263 of the elastic member 26 is arranged on the partition plate 32. The partition plate 32 is provided with the button guiding plate 294 matched with one side of the test button 29 on one side of the spring shaft 260, and the other side of the button guiding plate 294 is provided with the spring limiting groove 261e matched with the first contact portion 261 of the elastic member 26. The spiral portion 263 is rotatably sleeved on the spring shaft 260, and the first contact arm 261a, the second contact arm 261b, and the third contact arm 261c of the first contact portion 261 are inserted into the spring limiting groove 261e for limit fit. Preferably, the third contact arm 261c extends outside of the spring limiting groove 261e and then is connected with the fourth contact portion 261d, which has a characteristic of simple assembly.

[0091] With reference to FIG. 24, the triangular moving contact guiding groove 213 is arranged in the middle portion of the neutral pole moving contact 212, and the moving contact guiding column 214 inserted into the moving contact guiding groove 213 and matched with the moving contact guiding groove 213 is arranged in the housing. A rotatable moving contact limiting member 219 is arranged on the contact guiding column 214, and the neutral pole moving contact 212 is respectively provided with the protection driving rod shaft hole and the neutral pole moving contact point 215 corresponding to two sides of the moving contact guiding groove 213. The protection driving rod shaft hole and one end of the moving contact limiting member 219 are rotatably sleeved on one end of the contact driving rod 2254 respectively, the other end of the contact driving rod 2254 is rotatably connected with the protection driving rod 225, and the other end of the moving contact limiting member 219 is in limit fit with one side of the neutral pole moving contact 212 far away from the neutral pole static contact 211. One end of the reset spring 227 is sleeved on a side wall of one side of the guiding groove 213 and rotatably connected with the neutral pole moving contact 212, and the neutral pole moving contact point 215 is in contact fit with a neutral pole static contact point 216 on the neutral pole static contact 211.

[0092] When the phase pole operating mechanism 14 of the circuit breaker phase pole 1 acts, the protection driving rod 225 drives the neutral pole moving contact 212 and the moving contact limiting member 219 sleeved on the other end of the contact driving rod 2254 to act through the contact driving rod 2254, so that the triangular moving contact guiding groove 213 of the neutral pole moving contact 212 is sleeved on the contact guiding column 214 to swing. Meanwhile, the moving contact limiting member 219 rotates around the contact guiding column 214 and limits the swing of the neutral pole moving contact 212. The neutral pole moving contact 212 in the implementation has characteristics of a small volume, a simple structure, and convenient processing and manufacturing, and is capable of reducing a production cost and an assembly difficulty.

[0093] With reference to FIG. 21 to FIG. 23, the structure of the protection driving rod 225 in the embodiment is the same as that of the protection driving rod 225 in Embodiment 1. One end of the protection driving rod 225 is hinged with the phase pole operating mechanism 14 of the circuit breaker phase pole 1 through the shaft-machine coupling driving rod 220, and the other end of the protection driving rod 225 is hinged with the neutral pole moving contact 212 through the contact driving rod 2254. When the phase pole operating mechanism 14 of the circuit breaker phase pole 1 acts, the neutral pole moving contact 212 is driven to act by the protection driving rod 225.

[0094] As shown in FIG. 23, the partition plate 32 is provided with a stopper 2250 for limiting the protection driving rod 225. The stopper 2250 is matched with one end of the protection driving rod 225 close to the neutral pole moving contact 212, and the protection driving rod 225 is prevented from having a dead point through the stopper 2250.

[0095] FIG. 13 shows a structure of the leakage operating mechanism in the embodiment. The leakage operating mechanism 22 includes the protection lever 221 pivotally installed in the housing, and the protection jump buckle 222 and the protection lock catch 224 pivotally installed on the protection lever 221 respectively and clasped with each other. The protection jump buckle 222

is connected with the leakage protection handle 31b through the protection connecting rod 223, the protection lock catch 224 is connected with the protection lever 221 through the protection spring 228, and the protection spring 228 is capable of driving the protection lock catch 224 and the protection jump buckle 222 to clasp to keep energy storage. The leakage release 23 of the leakage protection pole 2 is capable of unlocking the protection lock catch 224 and the protection jump buckle 222 when a leakage fault occurs, an unlocking lever 229 extending to one side of the protection lever 221 is arranged on the phase pole operating mechanism 14 of the circuit breaker phase pole 1, and the phase pole operating mechanism 14 is unlocked through the unlocking lever 229 when the protection lock catch 224 and the protection jump buckle 222 are unlocked.

[0096] FIG. 25 shows a structure of the phase pole operating mechanism 14 of the circuit breaker phase pole 1 in the embodiment. The phase pole operating mechanism 14 includes the circuit breaker energy storage member, the rocker arm 141 pivotally installed in the housing and connected with the moving contact 112, the phase pole support 140 pivotally installed on the rocker arm 141, and the jump buckle 142 and the lock catch 143 pivotally installed on the phase pole support 140 respectively and clasped with each other. The jump buckle 142 is connected with the phase pole handle 31a through the connecting rod 144, and the phase pole support 140 is connected with the housing through the circuit breaker energy storage member. When the jump buckle 142 and the lock catch 143 of the phase pole operating mechanism 14 are clasped with each other, the phase pole operating mechanism 14 keeps balance, and the phase pole handle 31a rotates in a direction of switching on, which is capable of driving the moving contact 112 to contact with the static contact 111 through the phase pole operating mechanism 14, and storing energy for the circuit breaker energy storage member. When the jump buckle 142 and the lock catch 143 are released, the energy storage member releases the energy and drives the moving contact 112 to separate from the static contact 111. The unlocking lever 229 matched with the leakage operating mechanism of the leakage protection pole 2 is arranged on the lock catch 143. In the embodiment, the phase pole support 140 is connected with the protection driving rod 225 of the leakage protection pole 2 through the shaft-machine coupling driving rod 220, and the lock catch 143 is pivotally installed on the phase pole support 140 through the shaft-machine coupling driving rod 220.

[0097] The above is the further detailed descriptions of the present invention with reference to the specific preferred implementations, and the specific implementations of the present invention cannot be considered as being limited to these descriptions. Those of ordinary skills in the art may further make several modifications and improvements without departing from the inventive concept of the present invention, and these modifications and improvements all fall within the scope of protection of the present invention.

Claims

1. A circuit breaker, comprising a housing, and a circuit breaker phase pole (1) and a leakage protection pole (2) arranged on two sides of the housing side by side, wherein the leakage protection pole (2) comprises a zero-sequence current transformer (21), a leakage operating mechanism (22), and a leakage testing mechanism (25), and a major loop of the circuit breaker phase pole (1) passes through the zero-sequence current transformer (21); the leakage testing mechanism (25) comprises an elastic member (26), a test button (29), and a first contact member (27) and a second contact member (28) respectively connected to two ends of a test loop, one end of the elastic member (26) is provided with a first contact portion (261) matched with the leakage operating mechanism (22) or a phase pole operating mechanism (14), the other end of the elastic member (26) is provided with a second contact portion (262) matched with the test button (29), the leakage operating mechanism (22) or the phase pole operating mechanism (14) is capable of pushing the first contact portion (261) to contact with the first contact member (27) when the circuit breaker is switched on, and the test button (29) is capable of pushing the second contact portion (262) to contact with the second contact member (28).

2. The circuit breaker according to claim 1, wherein the leakage operating mechanism (22) pushes the first contact portion (261) to contact with the first contact member (27) when the circuit breaker is switched on, the leakage operating mechanism (22) comprises a protection lever (221) pivotally installed in the housing, and a protection jump buckle (222) and a protection lock catch (224) pivotally installed on the protection lever (221) respectively and clasped with each other, the protection jump buckle (222) is hinged with one end of a protection connecting rod (223), the other end of the protection connecting rod (223) is hinged with a circuit breaker handle (31), one end of the protection lock catch (224) is arranged corresponding to a leakage release (23), the first contact member (27) is arranged on one side of the protection lever (221), the first contact portion (261) of the elastic member (26) extends between the protection lever (221) and the first contact member (27) to match with the protection lever (221), and the elastic member (26) drives the protection lever (221) to rotate faster when releasing.

3. The circuit breaker according to claim 2, wherein the elastic member (26) is a torsion spring, the elastic member (26) comprises a spiral portion (263) con-

nected between the first contact portion (261) and the second contact portion (262), the spiral portion (263) is installed on a spring shaft (260) of the housing, the first contact portion (261) and the second contact portion (262) are both arranged vertical to an axis of the spiral portion (263), the first contact portion (261) extends between the protection lever (221) and the first contact member (27), and the second contact portion (262) extends between the test button (29) and the second contact member (28).

4. The circuit breaker according to claim 3, wherein the first contact member (27) and the second contact member (28) are arranged below the leakage operating mechanism (22), the first contact member (27) is arranged between the second contact member (28) and the elastic member (26), the test button (29) is located on one side of the leakage operating mechanism (22) and above the second contact portion (262), a length of the second contact portion (262) is greater than that of the first contact portion (261), one end of the second contact portion (262) close to the spiral portion (263) is matched with the test button (29), the other end of the second contact portion (262) passes through one side of the first contact member (27) and extends above the second contact member (28), and a test resistor (251) connected with the first contact member (27) is arranged below a location between the first contact member (27) and the elastic member (26).

5. The circuit breaker according to claim 2, wherein a back face of the protection lever (221) is provided with a first pushing boss (2211) extending to one side of the first contact portion (261), a side edge of the protection lever (221) is provided with a second pushing boss (2212) extending to a side face, and a pushing step face (2213) for limiting the first contact portion (261) is formed between the second pushing boss (2212) and the first pushing boss (2211).

6. The circuit breaker according to claim 3, wherein the first contact member (27) comprises a first conductive plate (271) arranged along an axial direction of the spiral portion (263), the elastic member (26) is arranged at an interval with a partition plate (32) between the circuit breaker phase pole (1) and the leakage protection pole (2) along the axial direction, one end of the first conductive plate (271) is connected with the partition plate (32), and the other end of the first conductive plate (271) extends to one side of the protection lever (221) along the axis of the spiral portion (263) and is suspended;

the first contact member (27) further comprises a second conductive plate (272), one end of the second conductive plate (272) is arranged opposite to one end of the first conductive plate (271), one end of the second conductive plate (272) is connected with a side edge on one side of the first conductive plate (271) through a third conductive plate (273) to form a first installing portion with a U-shaped structure, a first installing groove (270) connected with the first installing portion is arranged on the partition plate (32), and the other end of the second conductive plate (272) extends out of the first installing groove (270); and

a side edge on one side of the first conductive plate (271) close to the elastic member (26) is connected with a fourth conductive plate (274), the third conductive plate (273) is connected with a side edge on one side of the first conductive plate (271) far away from the elastic member (26), so that an opening of the U-shaped first installing portion faces towards the elastic member (26), a test resistor (251) is arranged on one side far away from the second conductive plate (272) between the elastic member (26) and the first conductive plate (271), one end of the fourth conductive plate (274) is vertically connected with one side of the opening of the first installing portion, the other end of the fourth conductive plate (274) extends to the test resistor (251), and a connecting hole (275) is arranged in the fourth conductive plate (274) for connecting the test resistor (251).

7. The circuit breaker according to claim 3, wherein the first contact portion (261) comprises a first contact arm (261a), a second contact arm (261b), and a third contact arm (261c) connected in a U shape, the first contact arm (261a) and the third contact arm (261c) are oppositely arranged, the second contact arm (261b) is vertically connected between one ends of the first contact arm (261a) and the third contact arm (261c), the other end of first contact arm (261a) is connected with the spiral portion (263), the other end of the third contact arm (261c) is connected with the fourth contact arm (261d), the fourth contact arm (261d) extends between the test button (29) and the second contact member (28), a spring limiting groove (261e) for limiting the first contact arm (261a), the second contact arm (261b), and the third contact arm (261c) is arranged in the housing, and the first contact portion (261) is inserted into the spring limiting groove (261e) along a direction of the second contact arm (261b) for limit fit.

8. The circuit breaker according to claim 3, wherein a partition plate (32) is arranged between the circuit breaker phase pole (1) and the leakage protection pole (2), a second installing boss (280) arranged along an axial direction of the spiral portion (263) is arranged on the partition plate (32), the second contact member (28) comprises a U-shaped first con-

ductive wire (281) inversely buckled on the second installing boss (280), one end of the first conductive wire (281) is located on a top side of the second installing boss (280) and matched with the second contact portion (262), and the other end of the first conductive wire (281) is located on a bottom side of the second installing boss (280) and connected with the major loop of the circuit breaker phase pole (1) through the second conductive wire (282).

9. The circuit breaker according to claim 4, wherein the test button (29) comprises a button connecting portion (291), and a button operating portion (292) and a button pushing portion (293) respectively arranged at two ends of the button connecting portion (291), the other end of the button operating portion (292) extends out of the housing, the other end of the button pushing portion (293) is matched with the second contact portion (262), the button pushing portion (293) is arranged at an interval with the partition plate (32), a button guiding plate (294) extending to the button pushing portion (293) is arranged on the partition plate (32), and a button guiding groove (295) slidably matched with the button guiding plate (294) is arranged on a side face of the button pushing portion (293); the button connecting portion (291) is connected with one end of the top side of the button pushing portion (293), the other end of the top side of the button pushing portion (293) is in limit fit with the housing, the bottom side of the button pushing portion (293) is provided with a first button pushing portion (297) and a second button pushing portion (298) respectively extending to two sides of the second contact portion (262), and a button pushing groove (299) in limit fit with the second contact portion (262) is formed between the first button pushing portion (297) and the second button pushing portion (298); and a side face of the button guiding plate (294) is provided with a contact guiding groove (296) matched with the first contact portion (261).

10. The circuit breaker according to claim 5, wherein a middle portion of one side of the protection lever (221) is provided with a protection lever shaft hole (2210) rotatably connected with the housing, a middle portion of a front face of the protection lever (221) is provided with a catch shaft hole (2218) connected with the protection lock catch (224), a jump buckle shaft (2217) and a protection lever shaft (2216) are correspondingly arranged on two sides of the catch shaft hole (2218) respectively, the jump buckle shaft (2217) is connected with the protection jump buckle (222), and the protection lever shaft (2216) is connected with the housing; a first lever boss (2214) is arranged on the back face of the protection lever (221) corresponding to the other side of the protection lever shaft hole (2210), a first pushing boss (2211) extending to one side of the first contact portion (261) is arranged on the back face of the protection lever (221) corresponding to a top corner on one side of the protection lever shaft hole (2210), a second lever boss (2215) is arranged on the other side of the protection lever shaft hole (2210) relative to the first pushing boss (2211), and a first lever groove (2215) is arranged on one side of the first lever boss (2214) far away from the protection lever shaft hole (2210).

11. The circuit breaker according to claim 1, wherein the phase pole operating mechanism (14) pushes the first contact portion (261) to contact with the first contact member (27) when the circuit breaker is switched on, the circuit breaker phase pole (1) comprises the phase pole operating mechanism (14), and a static contact (111) and a moving contact (112) which are oppositely arranged, and the moving contact (112) is connected with the phase pole operating mechanism (14); the leakage protection pole (2) comprises a neutral pole static contact (211) and a neutral pole moving contact (212) oppositely arranged in the housing, and the phase pole operating mechanism (14) pushes the first contact portion (261) to contact with the first contact member (27) through a neutral line driving member connected with the neutral pole moving contact (212) when the circuit breaker is switched on.

12. The circuit breaker according to claim 11, wherein the neutral line driving member comprises a protection driving rod (225) and a shaft-machine coupling driving rod (220), one end of the protection driving rod (225) is connected with the neutral pole moving contact (212), and the protection driving rod (225) is hinged with the phase pole operating mechanism (14) through the shaft-machine coupling driving rod (220); the first contact portion (261) of the elastic member (26) is matched with the protection driving rod (225), the protection driving rod (225) pushes the first contact portion (261) to contact with the first contact member (27), the neutral pole moving contact (212) is connected with one end of a reset spring (227), and the other end of the reset spring (227) is connected with the housing.

13. The circuit breaker according to claim 12, wherein the elastic member (26) is a torsion spring, the elastic member (26) comprises a spiral portion (263) connected between the first contact portion (261) and the second contact portion(262), the spiral portion (263) is sleeved on a spring shaft (260) and connected with the housing, and the first contact portion (261) and the second contact portion (262) are both arranged vertical to an axis of the spiral portion (263); the second contact member (28) is arranged on one side of the neutral pole moving contact (212) close to the neutral pole static contact (211), the first con-

tact member (27) and the elastic member (26) are arranged on one side of the neutral pole moving contact (212) far away from the neutral pole static contact (211), the neutral pole moving contact (212) is connected with the second contact member (28) through the reset spring (227), the second contact portion (262) passes through one side of the neutral pole moving contact (212) and then is matched with the second contact member (28), and the first contact member (27) is connected with a test resistor (251) arranged below the first contact member (27).

14. The circuit breaker according to claim 13, wherein the first contact member (27) and the shaft-machine coupling driving rod (220) are oppositely arranged on two sides of the elastic member (26), a V-shaped fourth contact arm (261d) is arranged on the first contact portion (261), one end of the fourth contact arm (261d) inclines towards one side close to the shaft-machine coupling driving rod (220), and the other end of the fourth contact arm (261d) inclines towards one side close to the first contact member (27).

15. The circuit breaker according to claim 11, wherein the test button (29) comprises a button connecting portion (291), and a button operating portion (292) and a button pushing portion (293) respectively arranged at two ends of the button connecting portion (291), the other end of the button operating portion (292) extends out of the housing, the other end of the button pushing portion (293) is matched with the second contact portion (262), the button connecting portion (291) is connected with one end of the top side of the button pushing portion (293), the other end of the top side of the button pushing portion (293) is in limit fit with the housing, the bottom side of the button pushing portion (293) is provided with a first button pushing portion (297) and a second button pushing portion (298) respectively extending to two sides of the first contact portion (261), and a button pushing groove (299) in limit fit with the second contact portion (262) is formed between the first button pushing portion (297) and the second button pushing portion (298).

16. The circuit breaker according to claim 11, wherein the leakage operating mechanism (22) comprises a protection lever (221) pivotally installed in the housing, and a protection jump buckle (222) and a protection lock catch (224) pivotally installed on the protection lever (221) respectively and clasped with each other, the protection jump buckle (222) is connected with a leakage protection handle (31b) through the protection connecting rod (223), the protection lock catch (224) is connected with the protection lever (221) through a protection spring (228), the protection spring (228) is capable of driving the protection lock catch (224) and the protection jump buckle (222) to clasp to keep energy storage, a leakage release (23) of the leakage protection pole (2) is capable of unlocking the protection lock catch (224) and the protection jump buckle (222) when a leakage fault occurs, an unlocking lever (229) extending to one side of the protection lever (221) is arranged on the phase pole operating mechanism (14) of the circuit breaker phase pole (1), and the phase pole operating mechanism (14) is unlocked through the unlocking lever (229) when the protection lock catch (224) and the protection jump buckle (222) are unlocked.

17. The circuit breaker according to claim 11, wherein the phase pole operating mechanism (14) comprises a circuit breaker energy storage member, a rocker arm (141) pivotally installed in the housing and connected with the moving contact (112), a phase pole support (140) pivotally installed on the rocker arm (141), and a jump buckle (142) and a lock catch (143) pivotally installed on the phase pole support (140) respectively and clasped with each other, the jump buckle (142) is connected with a phase pole handle (31a) through the connecting rod (144), the phase pole support (140) is connected with the housing through the circuit breaker energy storage member, when the jump buckle (142) and the lock catch (143) of the phase pole operating mechanism (14) are clasped with each other, the phase pole operating mechanism (14) keeps balance, and the phase pole handle (31a) rotates in a direction of switching on, which is capable of driving the moving contact (112) to contact with the static contact (111) through the phase pole operating mechanism (14), and storing energy for the circuit breaker energy storage member; when the jump buckle (142) and the lock catch (143) are released, the energy storage member releases the energy and drives the moving contact (112) to separate from the static contact (111); and an unlocking lever (229) matched with the leakage operating mechanism of the leakage protection pole (2) is arranged on the lock catch (143).

18. The circuit breaker according to claim 17, wherein the phase pole support (140) is connected with a protection driving rod (225) of the leakage protection pole (2) through a shaft-machine coupling driving rod (220).

19. The circuit breaker according to claim 13, wherein the spiral portion (263) is arranged on one side close to the test button (29), the first contact portion (261) has a U-shaped structure, the first contact portion (261) comprises a first contact arm (261a), a third contact arm (261c) which are oppositely arranged, and a second contact arm (261b) vertically connected between one ends of the first contact arm (261a)

and the second contact arm (261b), the second contact arm (261b) is arranged in parallel with an axis of the spiral portion (263), one end of the second contact arm (261b) far away from the first contact portion (261a) extends to a swing plane of the protection driving rod (225), the other end of the first contact arm (261a) is connected with the spiral portion (263), the third contact arm (261c) extends between the protection driving rod (225) and the second contact member (28), and the third contact arm (261c) and the protection driving rod (225) are arranged in a same plane.

20. The circuit breaker according to claim 19, wherein the other end of the third contact arm (261c) far away from the second contact arm (261b) is connected with a fourth contact arm (261d) with a V-shaped structure, the fourth contact arm (261d) extends between the protection driving rod (225) and the second contact member (28), a side edge on one side of the fourth contact arm (261d) connected with the second contact arm (261b) inclines towards a direction close to the protection driving rod (225), a side edge at the other side of the fourth contact arm (261d) inclines towards a direction close to the first contact member (27) to match with the first contact member (27), a bending portion matched with the protection driving rod (225) is formed at a joint of the side edges at the two sides of the fourth contact arm (261d), and the protection driving rod (225) pushes the bending portion of the fourth contact arm (261d) to make the fourth contact arm (261d) far away from one end of the second contact arm (261b) and the first contact member (27), thus connecting a second test contact point; one end of the fourth contact arm (261d) matched with the first contact member (27) is provided with a bent contact arm (261f), the bent contact arm (261f) bends towards one side far away from the first contact member (27), and an arc surface matched with the first contact member (27) is formed outside the bent contact arm (261f).

21. The circuit breaker according to claim 17, wherein the circuit breaker handle (31) comprises the phase pole handle (31a) and a leakage protection handle (31b), the phase pole handle (31a) is connected with the phase pole operating mechanism (14) of the circuit breaker phase pole (1), the leakage protection handle (31b) is connected with the leakage operating mechanism (22) of the leakage protection pole (2), a pushing block (31c) is arranged on the leakage protection handle (31b), the pushing block (31c) extends to one side of the phase pole handle (31a) rotating in a direction of switching on, when rotating in a direction of switching off in the case that a leakage current occurs, the leakage protection handle (31b) pushes the phase pole handle (31a) to rotate in the direction of switching off through the pushing block (31c); and when overload or short-circuit current occurs, the phase pole handle (31a) rotates in the direction of switching off, but the leakage protection handle (31b) does not act.

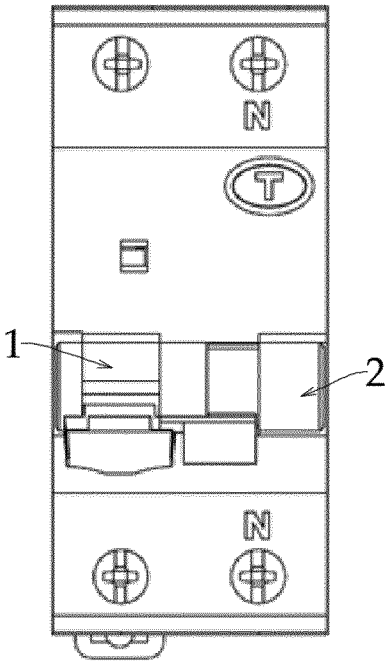


Fig.1

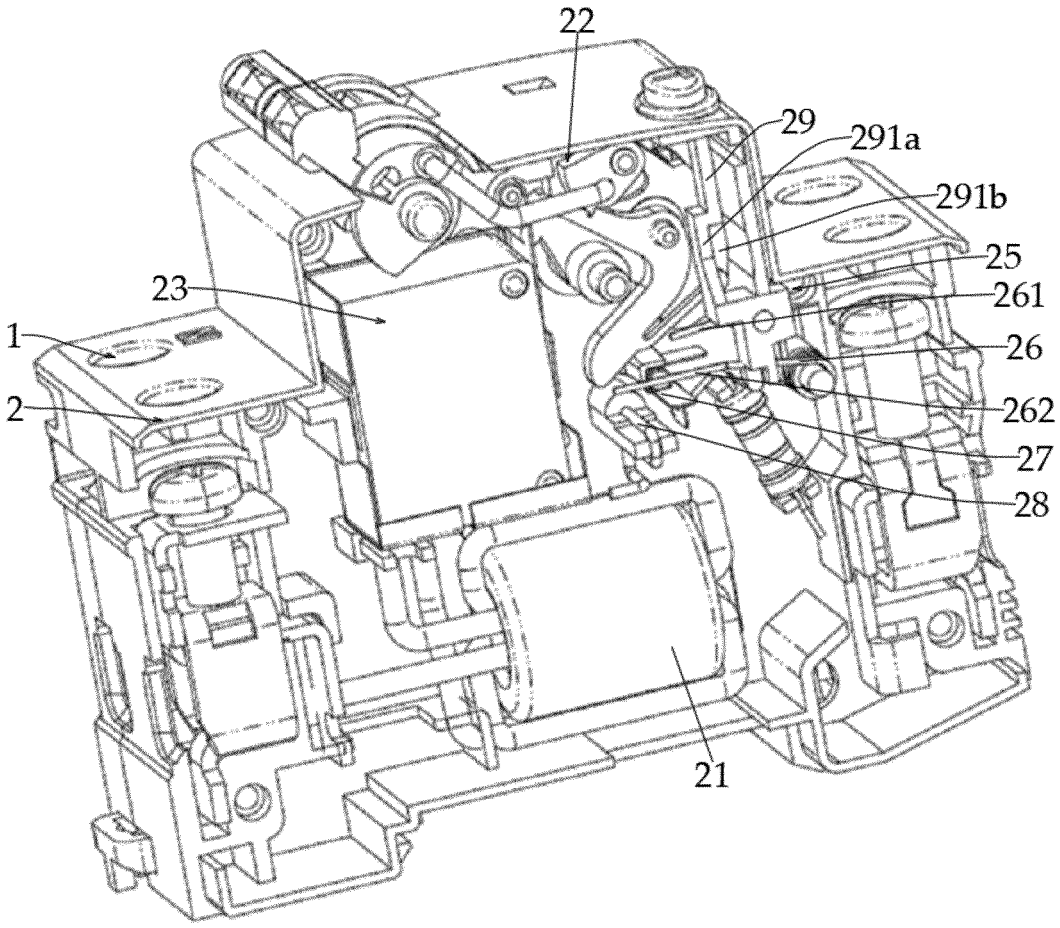


Fig.2

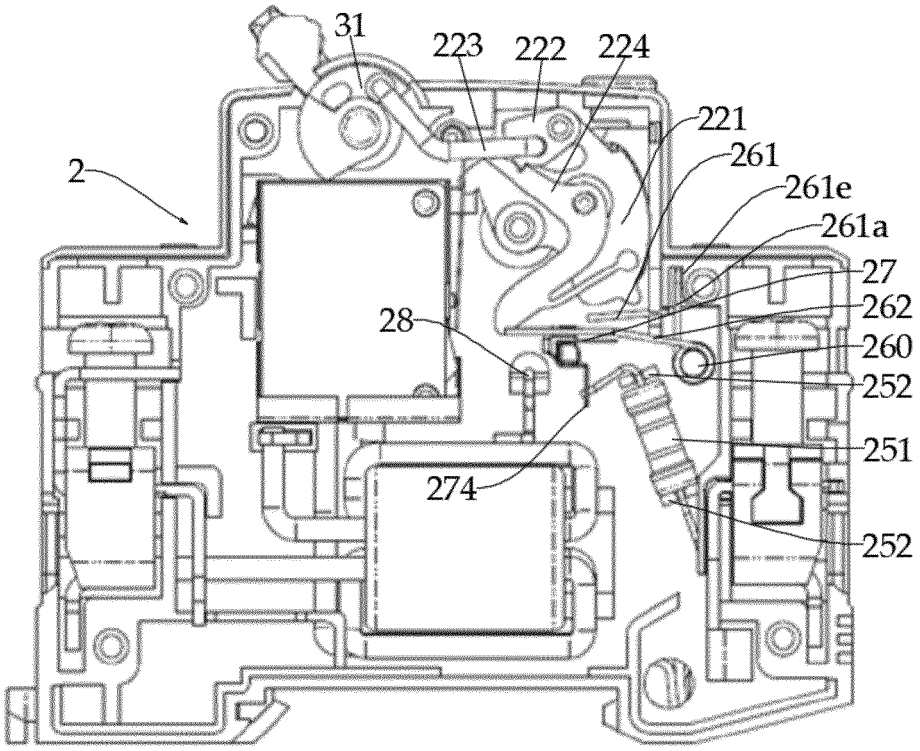
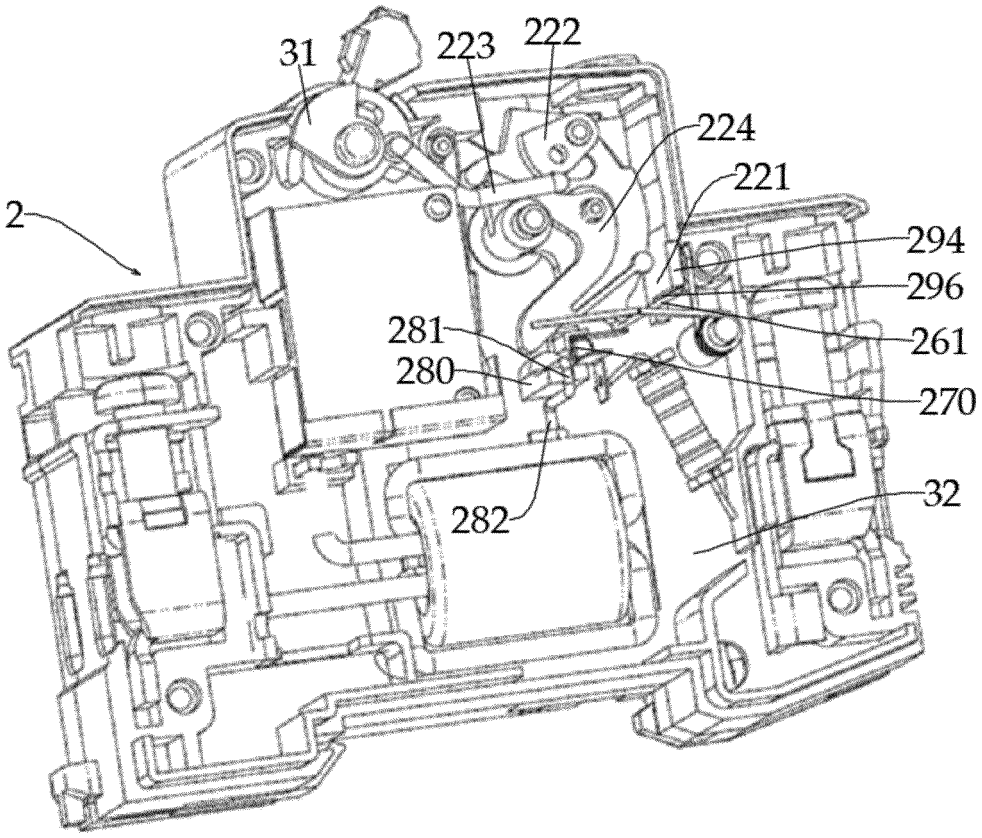

31
223
222
224
221
261
261e
261a
27
262
260
252
251
252
28
274
2

Fig.3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223
222
224
221
294
296
261
270
32
281
280
282
2

Fig.4

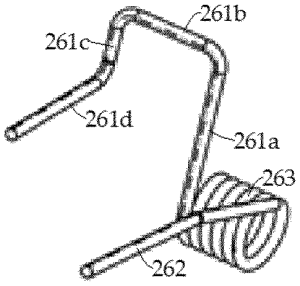

Fig.5

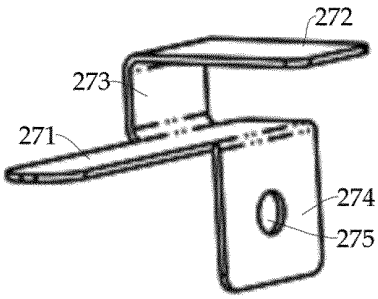

Fig.6

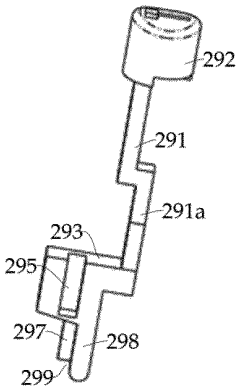

Fig.7

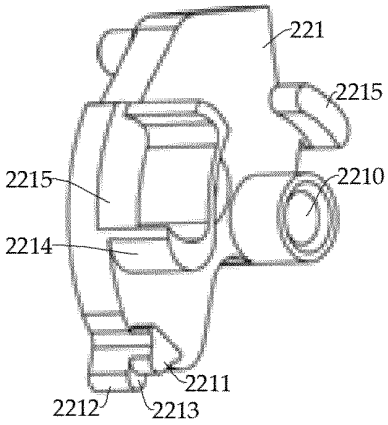

Fig.8

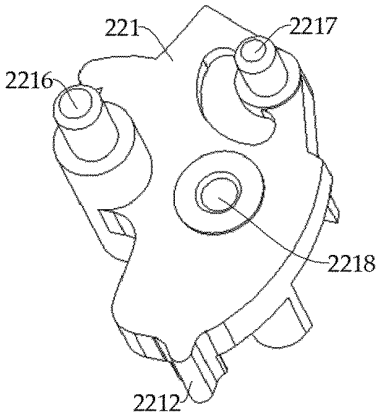

Fig.9

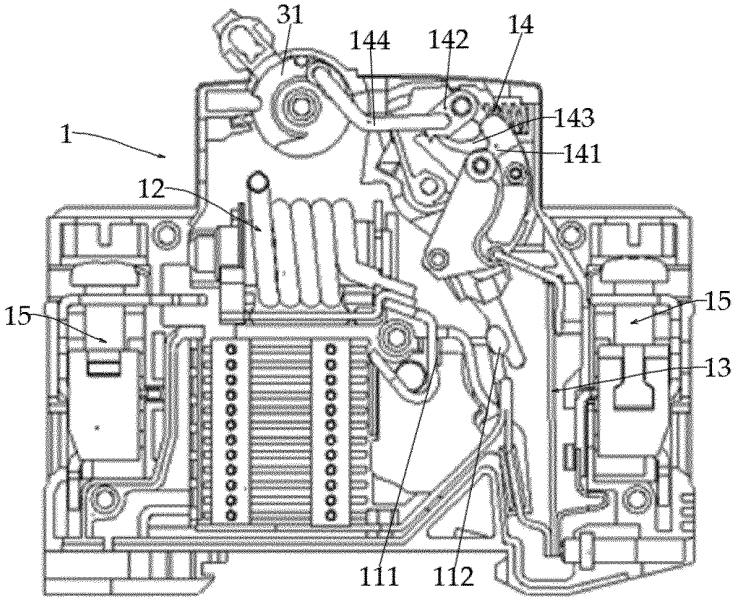

Fig.10

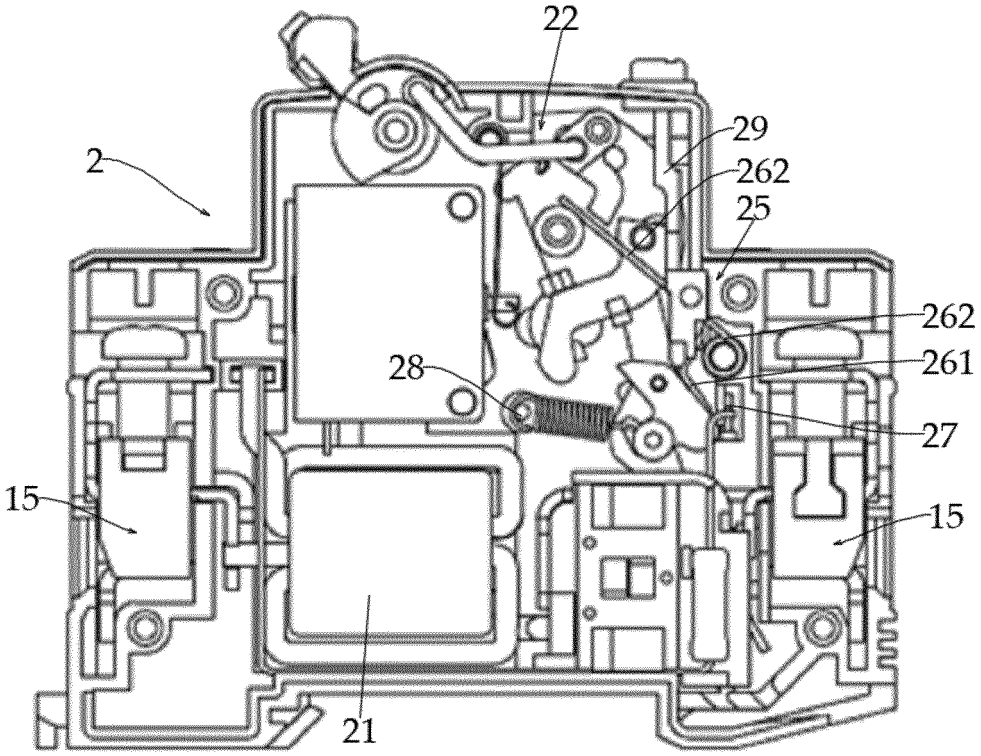

Fig.11

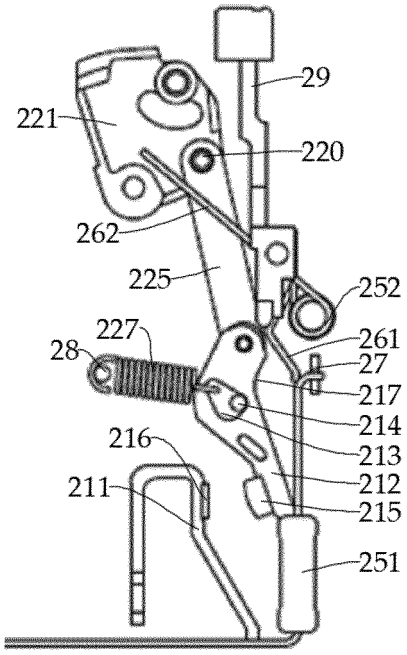

Fig.12

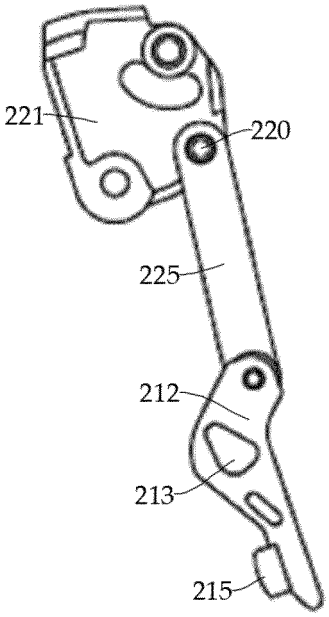

Fig.13

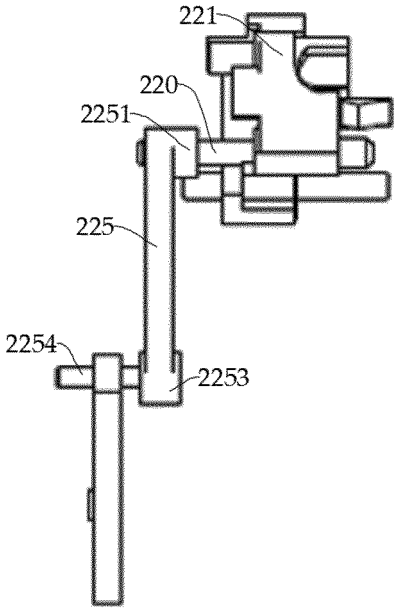

Fig.14

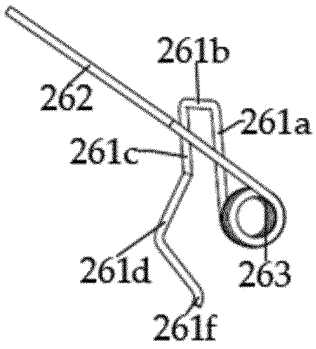

Fig.15

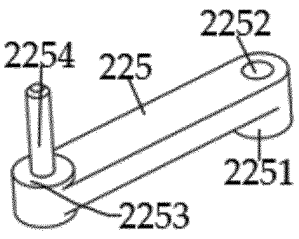

Fig.16

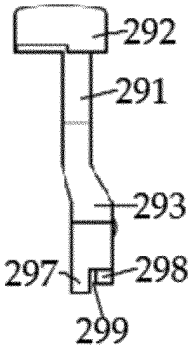

Fig.17

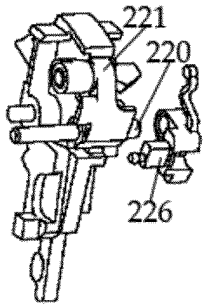

Fig.18

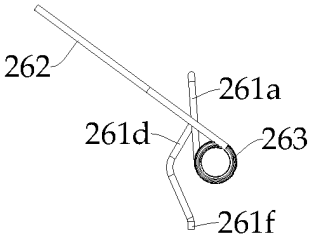

Fig.19

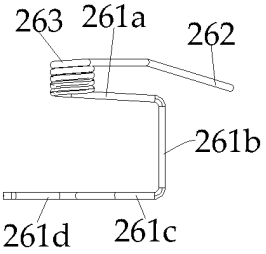

Fig.20

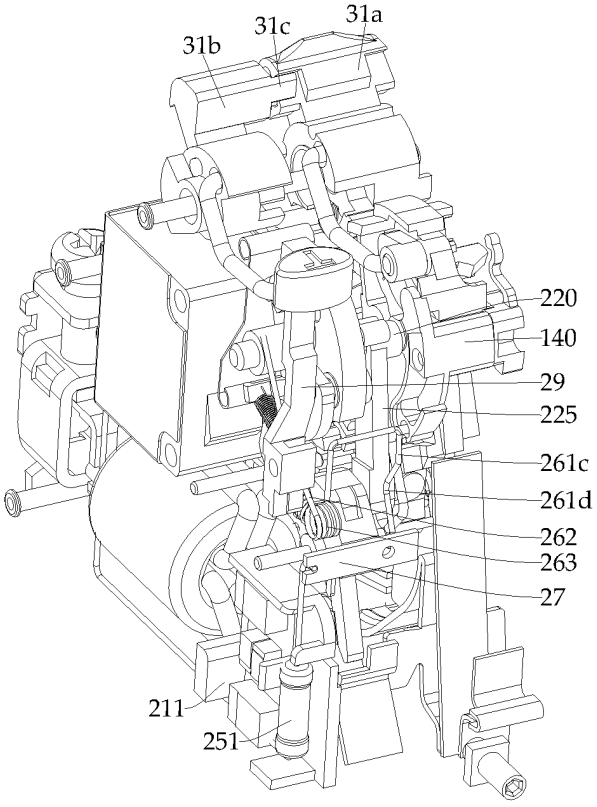

Fig.21

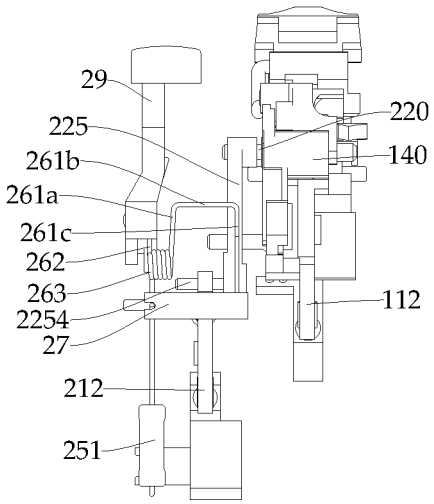

Fig.22

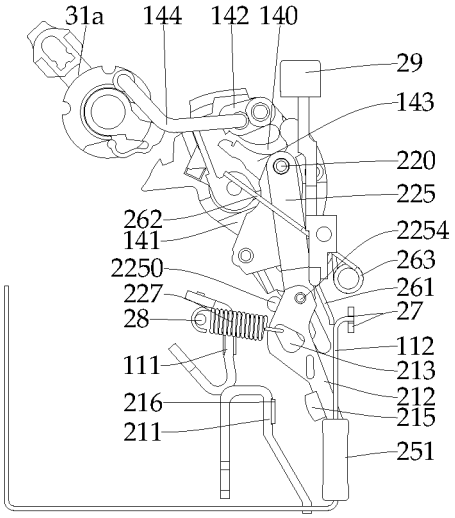

Fig.23

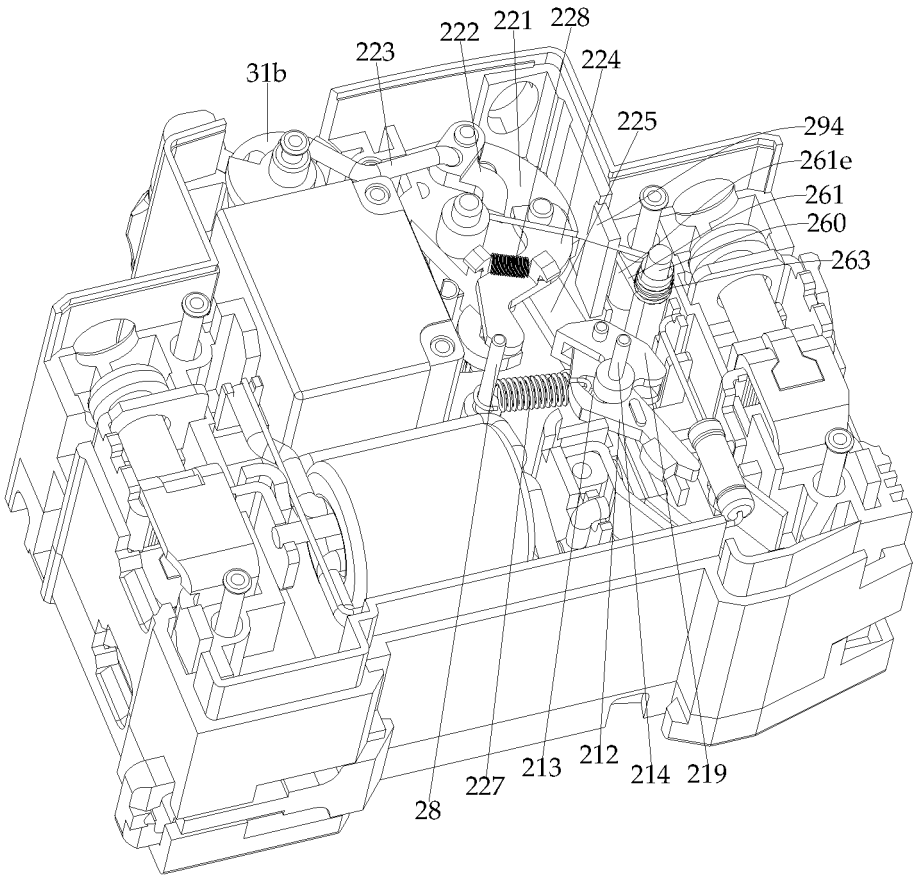

Fig.24

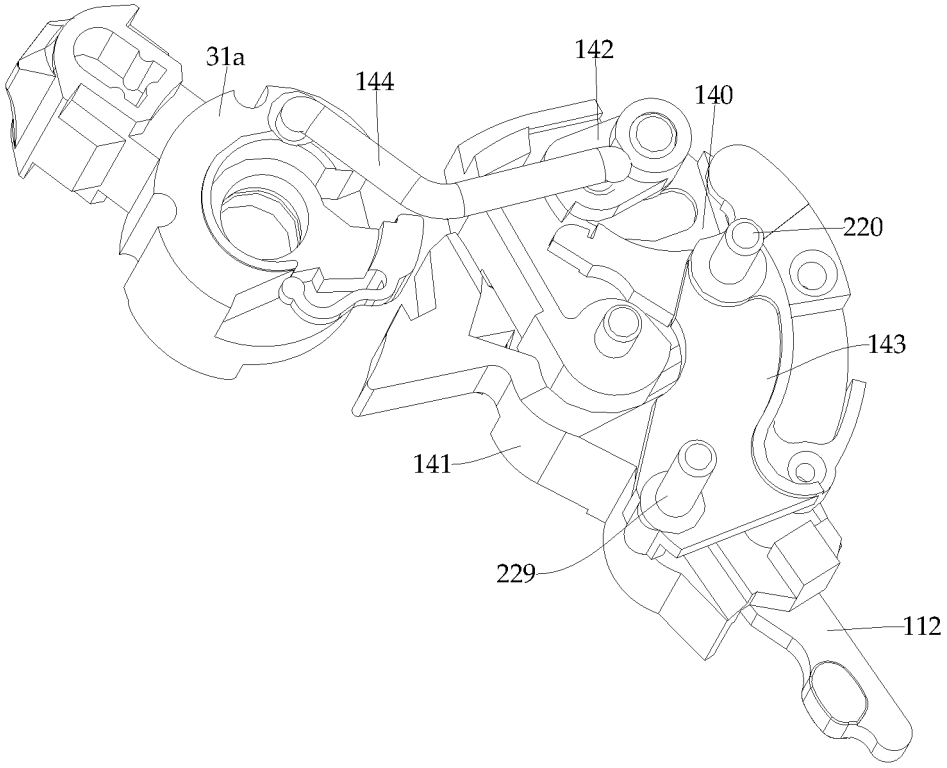

Fig.25

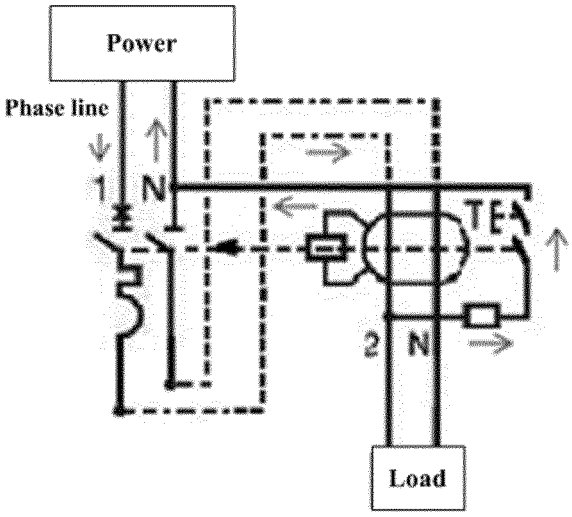

Fig.26

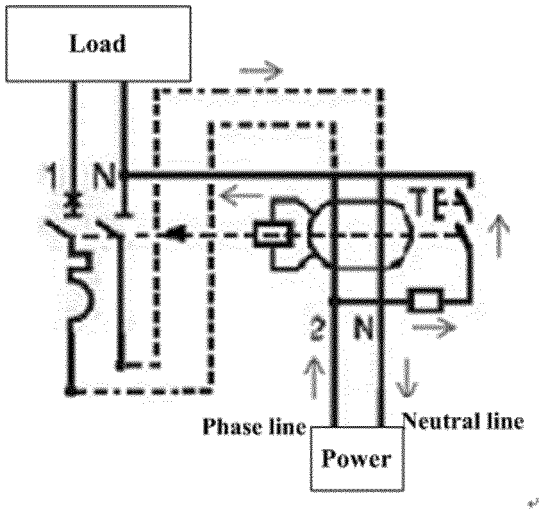

Fig.27

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/122030

A. CLASSIFICATION OF SUBJECT MATTER

H01H 83/14(2006.01)i; H01H 73/40(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01H

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

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

WPI, EPODOC, CNPAT, CNKI: 断路器, 漏电, 剩余电流, 测试, 双断点, 扭簧, breaker, leakage, test+, doubule, two, dual, point, spring, torsion

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 109659210 A (ZHEJIANG CHINT ELECTRIC APPLIANCE CO., LTD.) 19 April 2019 (2019-04-19) description, paragraphs [0038]-[0070], and figures 1-18	1-10
PX	CN 209544274 U (ZHEJIANG CHINT ELECTRIC APPLIANCE CO., LTD.) 25 October 2019 (2019-10-25) description, paragraphs [0038]-[0070], and figures 1-18	1-10
X	CN 206148380 U (YUEQING YEWEI ELECTRIC CO., LTD.) 03 May 2017 (2017-05-03) description, paragraphs [0023]-[0025], and figures 1-10	1
A	CN 207165502 U (YUEQING YEWEI ELECTRIC CO., LTD.) 30 March 2018 (2018-03-30) entire document	1-21
A	CN 102610457 A (ZHEJIANG DINGWEI TECHNOLOGY CO., LTD.) 25 July 2012 (2012-07-25) entire document	1-21
A	JP 0737482 A (FUJI ELECTRIC CO., LTD.) 07 February 1995 (1995-02-07) entire document	1-21

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

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"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
27 February 2020	**05 March 2020**
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.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2019/122030

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 109659210 A	19 April 2019	None	
CN 209544274 U	25 October 2019	None	
CN 206148380 U	03 May 2017	None	
CN 207165502 U	30 March 2018	None	
CN 102610457 A	25 July 2012	AU 2012373817 B2	23 November 2017
		AU 2012373817 A1	02 October 2014
		WO 2013139118 A1	26 September 2013
		CN 102610457 B	30 April 2014
JP 0737482 A	07 February 1995	None	

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