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(54) **THERMAL OVERLOAD RELAY**

(57) A thermal overload relay comprises a housing, and a main circuit, a heat protection system, an operating mechanism and a control circuit respectively arranged inside the housing, wherein a first direct connecting wire is arranged inside the housing, the wire-inlet end of the main circuit is provided with a wire-inlet end lead portion extending to the outside of the housing, the first direct connecting wire includes a first contact portion connected to the control circuit and a first lead portion extending out of the housing, one end of the first direct connecting wire is connected to the control circuit, the first lead portion is arranged on the same side of the housing with the wire-in-

let end lead portion of the main circuit to connect a coil of a contactor, on overload the heat protection system triggers the operating mechanism to act, so as to drive the control circuit to disconnect the power supply of the first direct connecting wire. The first direct connecting wire connected to the control circuit is arranged inside the housing, so that the control circuit is directly connected to the coil of the contactor through the first direct connecting wire, such structure can decrease wiring steps without necessity to additionally wire the control circuit, and has the characteristics of convenient wiring.

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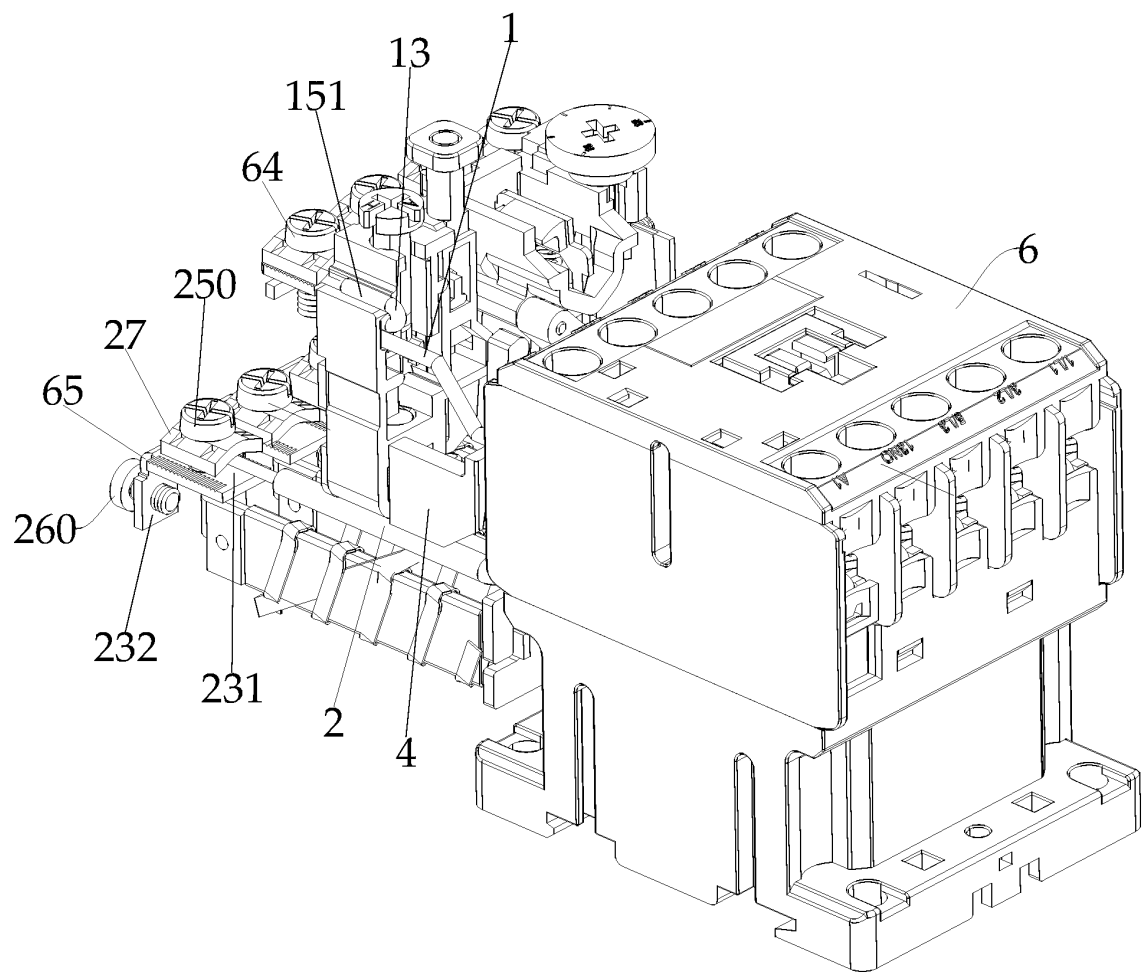


FIG.4

Description

TECHNICAL FIELD

[0001] The present invention relates to the field of low-voltage electrical appliances, in particular to a thermal overload relay.

BACKGROUND ART

[0002] Typically, a normally-closed contact of a thermal overload relay is respectively connected with a coil end A1 and coil end A2 of a contactor, and a 14NO/22NC normally-opened wiring port of the contactor is connected in series with the normally-closed contact of the thermal overload relay, so as to realize the self-holding function of the contactor. Of course, the 14NO/22NC wiring port of the contactor is not connected in series with the normally-closed contact of the thermal overload relay in some special cases, but it can also be used for other functions.

[0003] However, the existing small thermal overload relay is not only unable to directly connect with the contactor, but also the small thermal overload relay needs to be used with insertion into the small contactor, that will cause the small thermal overload relay to cover the coil end A2 and the 14NO/22NC wiring port of the contactor, causing difficulty in wiring and abating use experience. Moreover, there is a complex arrangement of wires inside the existing small thermal overload relay, and the electrical clearance and creepage distance between the wires cannot meet requirements.

SUMMARY OF THE INVENTION

[0004] The objective of the present invention is to overcome the deficiencies of the prior art, providing a thermal overload relay with convenient wiring and ability to directly connect with the contactor.

[0005] In order to achieve the above object, the technical scheme adopted in the present invention is as follows:

A thermal overload relay comprising a housing, and a main circuit, a heat protection system, an operating mechanism and a control circuit respectively arranged inside the housing, wherein a first direct connecting wire is arranged inside the housing, the wire-inlet end of the main circuit is provided with a wire-inlet end lead portion extending to the outside of the housing, the first direct connecting wire comprises a first contact portion connected to the control circuit and a first lead portion extending out of the housing, one end of the first direct connecting wire is connected to the control circuit, the first lead portion is arranged on the same side of the housing with the wire-inlet end lead portion of the main circuit and the first lead portion (12) is used to connect a coil of a contactor, on overload the heat protection system triggers the operating mechanism to act, so as to drive

the control circuit to disconnect the power supply of the first direct connecting wire.

[0006] Further, a second auxiliary terminal and a second direct connecting wire are arranged inside the housing, of the second direct connecting wire one end is connected to the second auxiliary terminal, and the other end extends out of the housing for connecting a third auxiliary terminal of the contactor.

[0007] Further, the second direct connecting wire comprises a second contact portion connected to the second auxiliary terminal of the thermal overload relay, and a second lead portion extending out of the housing, the first lead portion and the second lead portion are arranged on the same side of the housing with the wire-inlet end lead portion of the main circuit; the wire-outlet end of the main circuit is provided with a wire-outlet end connecting terminal, the wire-outlet end connecting terminal and the wire-inlet end lead portion are positioned on both sides of the housing, and the second auxiliary terminal and the wire-outlet end connecting terminal are all arranged on the other side of the housing.

[0008] Further, the outside of the first direct connecting wire and/or the second direct connecting wire is wrapped with an insulating layer, respectively.

[0009] Further, the thermal overload relay is provided with a first auxiliary terminal connected to the control circuit, the first direct connecting wire is connected with the first auxiliary terminal; a fixing seat used to install the operating mechanism is arranged inside the housing, the first auxiliary terminal and the operating mechanism are respectively arranged at both sides of the fixing seat, a first position-restricting hole is set on the fixing seat, the first direct connecting wire is provided with a position-restricting portion passing through the first position-restricting hole, and the position-restricting portion restrictively cooperates with the first position-restricting hole.

[0010] Further, the first direct connecting wire is provided with at least first bent segment and second bent segment respectively formed by means of bending, a straight segment is formed at intervals between the first bent segment and the second bent segment, and a first folded segment and a second folded segment are formed outside the first bent segment and the second bent segment, respectively, the second folded segment overlaps on the bottom side of the straight segment to form a position-restricting portion cooperating with the first position-restricting hole, the first folded segment crosses the fixing seat from the outside, and is connected with the first auxiliary terminal.

[0011] Further, a resetting button and a stopping button are arranged the fixing seat, respectively, a first groove and a second groove respectively used to accommodate the resetting button and the stopping button are arranged on the fixing seat, the first position-restricting hole is disposed on the side of the first groove away from the second groove.

[0012] Further, the resetting button comprises a pivot portion, and an operating portion and a swing portion

respectively arranged at both ends of the pivot portion, the swing portion includes a first swing arm and a second swing arm, which respectively protrude radially, forming a swing groove therebetween, a first swing groove and a second swing groove respectively cooperating with the first swing arm and the second swing arm are arranged on the side wall of the first groove away from the second groove, a swing protrusion cooperating with the swing groove is arranged between the first swing arm and the second swing arm, the first position-restricting hole is disposed on the side wall of the first groove away from the second groove, and positioned on one side of the first swing groove away from the second swing groove.

[0013] Further, the first contact portion of the first direct connecting wire is connected with the normally-closed contact of the control circuit, the heat protection system comprises multiple groups of bimetallic strip, and two groups of guiding plates respectively cooperating with the multiple groups of bimetallic strip, the two groups of guiding plates respectively cooperate with a differential lever, the bimetallic strip respectively bends to both sides to push different guiding plates during overload and phase failure, and then drive the operating mechanism through displacement of the differential lever, enabling the operating mechanism to break or hold the normally-closed contact.

[0014] Further, the second direct connecting wire comprises a first connection portion and a second connection portion, of which one ends are crookedly connected with each other, a second contact portion and a second lead portion are respectively disposed at one ends of the first connection portion and the second connection portion away from each other; a baffle plate is arranged inside the housing, an upper cavity and a lower cavity are formed on both sides of the baffle plate, the operating mechanism and the heat protection system are arranged inside the upper cavity and the lower cavity, respectively, a first connecting portion of the second direct connecting wire is disposed inside the lower cavity, of a second connecting portion of the second direct connecting wire one end is disposed inside the upper cavity, and the other end extends into the lower cavity and is connected with the first connecting portion; the heat protection system is disposed at one end of the lower cavity, and spaced from the other end of the lower cavity to form a side cavity, and a position-restricting structure for restricting the second direct connecting wire is arranged inside the side cavity.

[0015] Further, the position-restricting structure comprises a position-restricting transverse plate and a position-restricting upright plate, which are connected with each other, the position-restricting transverse plate and the position-restricting upright plate are respectively connected with the side wall of the housing and the baffle plate, the position-restricting transverse plate, the position-restricting upright plate, the side wall of the housing and the baffle plate surround a second position-restricting hole, the first connecting portion of the second direct

connecting wire passes through the second position-restricting hole and cooperates with the second position-restricting hole; at least a pair of spaced isolation ribs is arranged on the baffle plate, a position-restricting groove is set between the pair of isolation ribs, the position-restricting groove is used to restrict the second connecting portion of the second direct connecting wire.

[0016] Further, a fixing seat used to install the operating mechanism is arranged inside the housing, the housing comprises a base and a side cover mounted on one side of the base, a dodging holes is set on the side cover, the dodging holes is used to dodge the main circuit conducting wire of the thermal overload relay, a supporting part is arranged between the side cover and the operating mechanism, the supporting part is connected with the fixing seat, and the side of the supporting part close to the side cover is provided with a wire-arranging structure used to restrict the main circuit conducting wire; a wire-arranging structure used to restrict the second direct connecting wire is arranged on the supporting part.

[0017] Further, the wire-arranging structure comprises two position-restricting ribs disposed opposite each other.

[0018] Further, the supporting part comprises two connecting pieces disposed opposite each other, and a supporting plate connected between one ends of the two connecting pieces, one ends of the two connecting pieces away from the supporting plate are respectively connected with the fixing seat, a dodging groove for dodging the operating mechanism is formed between the two connecting pieces and the supporting plate, the wire-arranging structure is disposed on the side of the supporting plate close to the side cover.

[0019] A structure connecting a thermal overload relay with a contactor comprising a contactor and the thermal overload relay wherein the wire-inlet end lead portion and the first lead portion of the thermal overload relay are inserted into the connecting terminal of the contactor and connect, the first lead portion is connected to the coil of the contactor through the connecting terminal of the contactor.

[0020] In the thermal overload relay according to the present invention, the first direct connecting wire connected to the control circuit is arranged inside the housing, so that the control circuit is directly connected to the coil of the contactor through the first direct connecting wire, such structure can decrease wiring steps without necessity to additionally wire the control circuit, and has the characteristics of convenient wiring.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

FIGs.1-3 are a diagram showing the thermal overload relay and contactor of the present invention cooperating with each other;

FIG.4 is a structure diagram of the thermal overload

relay according to the present invention;
 FIG.5 is another structure diagram of the thermal overload relay according to the present invention;
 FIG.6 is a structure diagram of the fixing seat according to the present invention;
 FIG.7 is a structure diagram of the first direct connecting wire according to the present invention;
 FIG.8 is a structure diagram of the second direct connecting wire according to the present invention;
 FIG.9 is a structure diagram of the connecting piece according to the present invention;
 FIG. 10 is a structure diagram of the housing according to the present invention;
 FIG. 11 is a structure diagram of the first main circuit conducting wire according to the present invention;
 FIG. 12 is an exploded view of the housing according to the present invention;
 FIG. 13 is a structure diagram of the side cover according to the present invention;
 FIG. 14 is a structure diagram of the base according to the present invention;
 FIG 15 is a schematic diagram of the self-holding circuit according to the present invention;
 FIG. 16 is a structure diagram of the supporting part according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] We shall further describe the specific embodiments of the thermal overload relay of the present invention in combination with the examples given in FIGs.1-16 as follows. The thermal overload relay 5 according to the present invention is not limited to the description of the following examples.

[0023] As shown in FIGs.1-4, the thermal overload relay 5 according to the present invention comprises a housing, and a main circuit, the heat protection system 7, the operating mechanism 8 and a control circuit respectively arranged inside the housing, the main circuit of the thermal overload relay 5 is used to connect with the main circuit of the contactor 6, the first direct connecting wire 1 is arranged inside the housing, of the first direct connecting wire 1 one end is connected to the control circuit, and the other end extends out of the housing to connect with the coil of the contactor 6, on overload the heat protection system 7 triggers the operating mechanism 8 to act, so as to drive the control circuit to disconnect the power supply of the first direct connecting wire 1, so that the coil of the contactor 6 is released, and then the main circuit of the contactor 6 and the main circuit of the thermal overload relay 5 are disconnected with each other.

[0024] In the thermal overload relay according to the present invention, the first direct connecting wire 1 connected to the control circuit is arranged inside the housing, so that the control circuit is directly connected to the coil of the contactor 6 through the first direct connecting

wire 1, such structure can decrease wiring steps without necessity to additionally wire the control circuit, and has the characteristics of convenient wiring.

[0025] As shown in FIGs.4-5, the second auxiliary terminal 65 and the second direct connecting wire 2 are arranged inside the housing, of the second direct connecting wire 2 one end is connected to the second auxiliary terminal 65, and the other end extends out of the housing, so as to connect with the third auxiliary terminal 66 of the contactor 6, the second auxiliary terminal 65 is used to connect with a self-holding circuit (not shown in the figure), and the self-holding circuit can be locked by means of the second direct connecting wire 2.

[0026] Specifically, the first direct connecting wire 1 comprises the first contact portion 11 connected to the control circuit of the thermal overload relay 5, and the first lead portion 12 extending out of the housing, the second direct connecting wire 2 comprises the second contact portion 21 connected to the second auxiliary terminal 65 of the thermal overload relay 5, and the second lead portion 22 extending out of the housing, the wire-inlet end of the main circuit is provided with a wire-inlet end lead portion extending to the outside of the housing, the first lead portion 12 and the second lead portion 22 are arranged on the same side of the housing with the wire-inlet end lead portion of the main circuit, the wire-inlet end lead portion, the first lead portion 12 and the second lead portion 22 of the thermal overload relay are inserted into the connecting terminal of the contactor and connect and cooperate with each other. The second lead portion 22 is connected with the third auxiliary terminal 66 of the contactor, and the third auxiliary terminal 66 is connected with the normally-opened or normally-closed auxiliary contact of the contactor 6, so as to enable completing wiring the contactor 6 on one side of the thermal overload relay 5 with great convenience. The first lead portion 12 is connected to the A1 terminal or the A2 terminal of the contactor, and connected to the coil of the contactor 6 through connection to the A1 terminal or the A2 terminal.

[0027] The first contact portion 11 of the first direct connecting wire 1 in this example is connected to the first auxiliary terminal 64 of the thermal overload relay 5, and the first auxiliary terminal 64 is connected with the normally-closed contact of the control circuit of the thermal overload relay 5, the first lead portion 12 of the first direct connecting wire 1 is connected with the A1 terminal or A2 terminal of the contactor, and connected with the coil of the contactor 6 through connection to the A1 terminal or the A2 terminal, thereby realizing the direct connection between the coil of the contactor 6 and the normally-closed contact of the thermal overload relay 5; the normally-closed contact of the control circuit is used to control the coil of the contactor 6 to be electrified and de-electrified, when the normally-closed contact of the control circuit breaks contact, the coil of the contactor 6 is de-electrified and released, so that the main circuit of the contactor 6 is disconnected with the main circuit of the

thermal overload relay 5.

[0028] The second contact portion 21 of the second direct connecting wire 2 in this example is connected with the second auxiliary terminal 65 of the thermal overload relay 5, the second auxiliary terminal 65 is a 14NO/22NC terminal, the second auxiliary terminal 65 is connected to a self-holding circuit, the second lead portion 22 of the second direct connecting wire 2 is connected to the third auxiliary terminal 66 of the contactor 6, the third auxiliary terminal 66 is a 13NO terminal or a 14NO terminal, the third auxiliary terminal 66 is connected with the normally-opened or normally-closed auxiliary contact of the contactor 6, in this way such structure realizes the connection between the second auxiliary terminal 65 of the thermal overload relay 5 and the normally-closed or normally-opened auxiliary connecting terminal of the contactor 6, so as to enable this end of the thermal overload relay 5 to directly wire the contactor 6 after the thermal overload relay 5 and the contactor are electrically plugged with each other, without necessity to make wiring from that end of the contactor 6, moreover, enable the wiring to be more convenient, and the original conducting wire of the thermal overload relay 5 not to interfere, therefore such structure has a sufficiently safe creepage distance and electrical clearance.

[0029] Specifically, the contactor 6 comprises a main circuit connecting terminal respectively connected to the main circuit of contactor 6, an A1 terminal and an A2 terminal respectively connected to the coil of contactor 6, and a 13NO terminal or a 14NO terminal connected to the normally-closed or normally-opened auxiliary connecting terminal of the contactor, the wire-inlet end lead portion of the thermal overload relay 5 is connected to the main circuit connecting terminal of the contactor, this example provides a three-phase thermal overload relay 5, which comprises three groups of main circuits, which correspond to three groups of main circuit conducting wires, the three groups of main circuit conducting wires are the first main circuit conducting wire 31, the second main circuit conducting wire 32 and the third main circuit conducting wire 33, respectively, the wire-inlet end lead portions of the three groups of main circuits are the first wire-inlet end 91, the second wire-inlet end 92 and the third wire-inlet end 93, respectively, the first wire-inlet end 91, the second wire-inlet end 92 and the third wire-inlet end 93 are respectively used to connect the connecting terminals of three main circuits of the contactor 6, that is, the 6/T3 terminal 61, the 4/T2 terminal 62 and the 2/T1 terminal 63 in the figure, the first lead portion 12 is connected to the A2 connecting terminal of the contactor, the second lead portion 22 is connected to the 14NO/22NC connecting terminal of the contactor, the first lead portion 12, the second lead portion 22, the first wire-inlet end 91, the second wire-inlet end 92 and the third wire-inlet end 93 are arranged on the same side of the housing.

[0030] As shown in FIG. 15, on pressing the starting button SB2 (jogging), the circuit is connected, the coil

KM2 of the contactor 6 is electrified, and the normally-opened contact KM1 of the contactor 6 changes from a normally-opened state to a normally-closed state, thereby locking the contactor 6 in a make-contact state. The self-holding circuit is within the prior art, not defined in this example.

[0031] Further, the wire-outlet end of the main circuit of the thermal overload relay 5 is provided with a wire-outlet end connecting terminal, the wire-outlet end connecting terminal and the wire-inlet end lead portion are respectively positioned on both sides of the housing, and the second auxiliary terminal 65 and the wire-outlet end connecting terminal are both arranged on the other side of the housing. The wire-outlet end connecting terminal of the thermal overload relay 5 in the figure is a 2/T1 terminal, a 4/T2 terminal and a 6/T3 terminal, respectively, and the second auxiliary terminal 65 is arranged in a line with the wire-outlet end connecting terminal. As shown in FIGs. 6-7, a first position-restricting hole 35 is set on the fixing seat 80, the first contact portion 11 and the first lead portion 12 of the first direct connecting wire 1 are positioned on both sides of the fixing seat 80, the middle of the first direct connecting wire 1 is provided with the position-restricting portion 13 passing through the first position-restricting hole 35, and the position-restricting portion 13 restrictively cooperates with the first position-restricting hole 35. The position-restricting portion 13 fits with the first position-restricting hole 35, so as to achieve disconnection-free installation, not only providing ease to install, but also enabling achievement only depending on the structural features of the component itself.

[0032] Specifically, the first auxiliary terminal 64 and the operating mechanism 8 are respectively arranged on both sides of the fixing seat 80, and the middle of the first direct connecting wire 1 is provided with at least first bent segment 141 and second bent segment 142 respectively formed by means of bending, the straight segment 15 is formed at intervals between the first bent segment 141 and the second bent segment 142, and the first folded segment 151 and the second folded segment 152 are formed outside the first bent segment 141 and the second bent segment 142, respectively, the second folded segment 152 overlaps on the bottom side of the straight segment 15 to form the position-restricting portion 13, the first folded segment 151 crosses the fixing seat 80 from the outside, and is connected with the first auxiliary terminal 64 through the first contact portion 11. It is understandable that the shape of the position-restricting portion 13 also may be adjusted, and it can also be bent more times. In addition, the position-restricting portion 13 may also be a linear structure, directly passing through the first position-restricting hole 35, these structures all belong to the protection scope of the present invention.

[0033] As shown in FIG.6, the resetting button 81 and the stopping button 82 are arranged the fixing seat 80, respectively, the resetting button 81 is used to reset products after tripping and protecting due to thermal overload,

the stopping button 82 is used to urgently disconnect products, the first groove 810 and the second groove 820 respectively used to accommodate the resetting button 81 and the stopping button 82 are arranged on the fixing seat 80, the first position-restricting hole 35 is disposed on the side of the first groove 810 away from the second groove 820.

[0034] Specifically, the resetting button 81 comprises the pivot portion 811, and the operating portion 812 and the swing portion 813 respectively arranged at both ends of the pivot portion 811, the operating portion 812 extends out of the first groove 810 for operation, the swing portion 813 comprises a first swing arm and a second swing arm, which respectively protrude radially, forming a swing groove therebetween (not shown in the figure), the first swing groove 816 and the second swing groove 817 respectively cooperating with the first swing arm and the second swing arm are arranged on the side wall of the first groove 810 away from the second groove 820, the swing protrusion 818 cooperating with the swing groove is arranged between the first swing arm and the second swing arm, the first position-restricting hole 35 is disposed on the side wall of the first groove 810 away from the second groove 820, and positioned on one side of the first swing groove 816 away from the second swing groove 817. This embodiment makes full use of the structure of the fixing seat 80 to set the first position-restricting hole 35, not only avoiding necessity to change the structure of the existing fixing seat 80, but also meeting the safety requirements of the electrical clearance and creepage distance between the first direct connecting wire 1 and other components.

[0035] As shown in FIG.8, the second direct connecting wire 2 is Z-shaped, the second direct connecting wire 2 comprises the first connection portion 211 and the second connection portion 212, of which one ends are crookedly connected with each other, the second contact portion 21 and the second lead portion 22 are respectively disposed at one ends of the first connection portion 211 and the second connection portion 212 away from each other, the second contact portion 21 and the first connection portion 211 are arranged in the same straight line, and the second lead portion 22 is arranged perpendicular to the second connection portion 212.

[0036] As shown in FIGs.8-10, the second auxiliary terminal 65 comprises the connecting piece 23 and the wiring screw 250, the wiring screw 250 can fix the second direct connecting wire 2 with the connecting piece 23, facilitating the customer to connect the second direct connecting wire 2. Specifically, the connecting groove 24 used to accommodate the second auxiliary terminal 65 is set the housing, the connecting piece 23 is L-shaped, the connecting piece 23 comprises the first wiring portion 231 and the second wiring portion 232 connected with each other, the second wiring portion 232 is connected to the housing, the first threaded hole 25 and the second threaded hole 26 are set on the first wiring portion 231 and the second wiring portion 232, respectively, the sec-

ond threaded hole 26 cooperates with the fixing screw 260 (FIG.4) and is fixed on the housing, and the first threaded hole 25 cooperates with the wiring screw 250 (FIG.4) for fixing wires.

[0037] As another connection method of connecting the connecting piece 23 with the housing, the second wiring portion 232 also may be not connected to the housing by the fixing screw 260, instead the socket 24 is set inside the connecting groove 24 on the housing, and the second wiring portion 232 is inserted into the socket by ways of tight fit or interference fit, these structures all fall within the protection scope of the present invention.

[0038] Further, the relay further comprises the crimping tab 27 cooperating with the wiring screw 250, the second contact portion 21 of the second direct connecting wire 2 is inserted between the connecting piece and the crimping tab 27.

[0039] Preferably, a striped surface used to raise friction is set on the connecting piece 23, effectively improving mechanical properties and abating temperature rise.

[0040] Further, the connecting piece 23 is disposed at the same height as the second connecting portion 212, enabling the second contact portion and the second connecting portion 212 to lie in the same straight line, decreasing the volume of the second direct connecting wire 2 and abating the difficulty in wiring.

[0041] As shown in FIGs.5 and 14, the baffle plate 500 is arranged inside the housing, an upper cavity and a lower cavity are formed on both sides of the baffle plate 500, the operating mechanism 8 and the heat protection system 7 are arranged inside the upper cavity and the lower cavity, respectively, the first connecting portion 211 of the second direct connecting wire 2 is disposed inside the lower cavity, of the second connecting portion 212 of the second direct connecting wire 2 one end is disposed inside the upper cavity, and the other end extends into the lower cavity and is connected with the first connecting portion 211. This embodiment optimizes the shape of the second direct connecting 2, and makes use of the structure of the upper cavity and the lower cavity in the housing to execute respective arrangement of wires, enabling meeting the safety requirements of the electrical clearance and creepage distance between the second direct connecting wire 2 and other components.

[0042] Further, the heat protection system 7 is disposed at one end of the lower cavity, and spaced from the other end of the lower cavity to form the side cavity 70, and a position-restricting structure for restricting the second direct connecting wire is arranged inside the side cavity 70.

[0043] Arranging the position-restricting structure for restricting the second direct connecting wire inside the side cavity 70 enables ease to fix the second direct connecting wire 2 and further meets the safety requirements of the electrical clearance and creepage distance between the second direct connecting wire 2 and other components.

[0044] Specifically, the position-restricting structure

comprises the position-restricting transverse plate 73 and the position-restricting upright plate 74, which are connected with each other, the position-restricting transverse plate 73 and the position-restricting upright plate 74 are respectively connected with the side wall of the housing and the baffle plate 500, the position-restricting transverse plate 73, the position-restricting upright plate 74, the side wall of the housing and the baffle plate 500 surround the second position-restricting hole 75, and the first connecting portion 211 of the second direct connecting wire 2 passes through the second position-restricting hole 75 and cooperates with the second position-restricting hole 75. It is understandable that position-restricting structure also may not be related to the side wall of the housing and the baffle plate 500, moreover it may also be a structure independently made on the housing, these structures all fall within the protection scope of the present utility mode.

[0045] As shown in FIG.5, the heat protection system 7 is provided with three groups of bimetallic strip corresponding to three phases, and two groups of guiding plates 71 respectively cooperating with the three groups of bimetallic strip, the two groups of guiding plates 71 respectively cooperate with the differential lever 72, the bimetallic strip respectively bends to both sides to push different guiding plates 71 during overload and phase failure, and then drive the operating mechanism 8 through displacement of the differential lever 72, enabling the operating mechanism 8 to break or hold the normally-closed contact of the thermal overload relay 5, upon overload the heat protection system 7 triggers the operating mechanism 8, and the operating mechanism 8 acts to break the normally-closed contact of the control circuit of the thermal overload relay 5, so that the coil of the contactor 6 is de-electrified and released and the main circuit of the contactor 6 is disconnected with the main circuit of the thermal overload relay 5, so as to achieve the function of protecting motors.

[0046] Further, at least a pair of spaced isolation ribs is arranged on the baffle plate 500, a position-restricting groove is set between a pair of isolation ribs, the position-restricting groove is used to restrict the second connecting portion 212 of the second direct connecting wire 2. Arranging the isolation ribs not only can restrict the second direct connecting wire 2, but also enhances the tightness between the upper cavity and the lower cavity and prevents the heat of the heat protection system 7 from diffusing into the operating mechanism 8, ensuring that the bimetallic strip can react according to temperature and effectively improving the stability of products.

[0047] Specifically, the housing comprises the base 51 and the side cover 52 mounted on one side of the base 51 close to the contactor 6, the baffle plate 500 comprises the first partition plate 550 and the second partition plate 560 respectively disposed on the base 51 and the side

cover 52, the isolation ribs include the first isolation rib 55 and the second isolation rib 56 constitute the isolation rib after installing the base 51 and the side cover 52.

[0048] As shown in FIGs.12-14, there is the first insulation method of the invention, the housing is respectively provided with the partition plates 54 corresponding to the interspace between the direct connecting wires, between the main circuit conducting wires of the contact system, and between the direct connecting wires and the main circuit conducting wires. Specifically, the side cover 52 is provided with the dodging holes 53 respectively corresponding to the first direct connecting wire 1, the second direct connecting wire 2, the first main circuit conducting wire 31, the second main circuit connecting wire 32 and the third main circuit connecting wire 33, the partition plate 54 is arranged between the dodging holes 53, the partition plate 54 can effectively increase the electrical clearance and creepage distance between adjacent conducting wires. In addition, the partition plate and the isolation rib can also increase the electrical clearance and creepage distance between adjacent conducting wires.

[0049] As shown in FIGs.7,8 and 11, there is the second insulation method of the invention, the first direct connecting wire 1, the second direct connecting wire 2, the first main circuit conducting wire 31, the second main circuit connecting wire 32 and the third main circuit connecting wire 33 respectively include the insulation layer 50, which can insulate the interspace among the first direct connecting wire 1, the second direct connecting wire 2, the first main circuit conducting wire 31, the second main circuit connecting wire 32 and the third main circuit connecting wire 33, preventing the insulation from decreasing after adding the first direct connecting wire 1 and the second direct connecting wire 2. It is understandable that it is also possible not to wrap the insulation layer 50, instead adopt the first insulation method using the partition plate 54, the baffle plate 500 and the isolation ribs described above for insulation, such structure can also meet the safety requirements of the insulation.

[0050] The wiring process of this example is as follows, for external wiring, firstly directly connecting the first lead portion 12 of the first direct connecting wire 1 to the A1 terminal or A2 terminal of the contactor 6, connecting the first contact portion 11 of the other end of the direct connecting wire 1 to the normally-closed contact of the control circuit of the thermal overload relay 5, then connecting the second lead portion 22 of one end of the second direct connecting wire 2 to the 13NO terminal or 14NO terminal of the contactor 6, connecting the second contact portion 21 of the other end of the second direct connecting wire 2 to the connecting piece 23 of the second auxiliary terminal 65, enabling the connecting piece 23 to cooperate with the screw to form the second auxiliary terminal 65 in the figure, connecting three groups of main circuit conducting wires in series to the 2/T1 terminal, 4/T2 terminal

and 6/T3 terminal of the main circuit of contactor 6, respectively, and then just directly wiring the 96th terminal and the second auxiliary terminal 65 of the thermal overload relay 5 according to the needs of the control circuit, so as to enable this end of the thermal overload relay 5 to directly wire the contactor 6, without necessity to make wiring from that end of the contactor 6, thereby achieve the function of convenient wiring; for internal wiring, connecting the first direct connecting wire 1 and the second direct connecting wire 2 to three groups of main circuit conducting wires wrapped with the insulation layer 50, if not using the insulation layer 50, skipping it, then inserting the upper position-restricting portion 13 of the first direct connecting wire 1 into the first position-restricting hole 35 of the fixing seat 80, so as to achieve the role of installation without disengagement, and enable the guiding structure on the side cover 52 to achieve the function of quick installation.

[0051] As shown in FIGs.4 and 16, the supporting part 4 is arranged between the side cover 52 and the operating mechanism 8, the supporting part 4 is connected with the fixing seat 80, and the side of the supporting part 4 close to the side cover 52 is provided with a wire-arranging structure used to restrict the main circuit conducting wire. In the thermal overload relay of the present invention, arranging the independent supporting part 4 between the side cover 52 and the operating mechanism 8 and further wire-arranging structure on the supporting part 4 not only can achieve installing the main circuit conducting wire without disengagement, but also enable the main circuit conducting wire to align with the dodging hole 53 on the housing, in this way such structure not only can abate the difficulty of assembling the housing, but also decrease the electrical clearance and creepage distance between the main circuit conducting wires and improve the reliability of the thermal overload relay 5.

[0052] As shown in FIG. 16, the supporting part 4 is U-shaped, the supporting part 4 comprises two connecting pieces 43 disposed opposite each other, and the supporting plate 44 connected between one ends of the two connecting pieces 43, one ends of the two connecting pieces 43 away from the supporting plate 44 are respectively connected with the fixing seat 80, a dodging groove for dodging the operating mechanism 8 is formed between the two connecting pieces 43 and the supporting plate 44, the wire-arranging structure is disposed on the side of the supporting plate 44 close to the side cover 52.

[0053] Further, the positioning groove 45 restrictively cooperating with the fixing seat 80 is set inside one of the two connecting pieces 43, the positioning post 46 is arranged on the other connecting piece 43, and the positioning post 46 is inserted into the fixing seat for position-restricting. It is understandable that the two connecting pieces 43 may also restrictively cooperate with the fixing seat 80 by other means; such structure still falls within the protection scope of the present invention.

[0054] Four groups of the wire-arranging structures are arranged on the supporting part 4 in this example, the

four groups of wire-arranging structures are respectively used to restrict the first main circuit conducting wire 31, the second main circuit conducting wire 32, the third main circuit conducting wire 33 and the second direct connecting wire 2. It is understandable that the second direct connecting wire 2 and the corresponding wire-arranging structure may not be arranged in the above structure, or even if the second direct connecting wire 2 is provided, but the corresponding wire-arranging structure is not arranged on the supporting part 4, instead the supporting part 4 may be used to restrict the existing first main circuit conducting wire 31, the second main circuit conducting wire 32 and the third main circuit conducting wire 33. These structures all fall within the protection scope of the present invention.

[0055] As shown in FIG. 16, the wire-arranging structure comprises two position-restricting ribs 41 disposed opposite each other, and the corresponding main circuit conducting wire or second direct connecting wire 2 is restricted inside the corresponding two position-restricting ribs 41. Further, the insides of the two position-restricting ribs 41 of the wire-arranging structure are respectively provided with two groups of position-restricting protrusions 42, which more reliably restrict the main circuit conducting wire or the second direct connecting wire 2 on the supporting part 4.

[0056] We have made further detailed description of the present invention mentioned above in combination with specific preferred embodiments, but it is not deemed that the specific embodiments of the present invention is only limited to these descriptions. A person skilled in the art can also, without departing from the concept of the present invention, make several simple deductions or substitutions, which all be deemed to fall within the protection scope of the present invention.

Claims

1. A thermal overload relay comprising a housing, and a main circuit, a heat protection system (7), an operating mechanism (8) and a control circuit respectively arranged inside the housing, wherein a first direct connecting wire (1) is arranged inside the housing, the wire-inlet end of the main circuit is provided with a wire-inlet end lead portion extending to the outside of the housing, the first direct connecting wire (1) comprises a first contact portion (11) connected to the control circuit and a first lead portion (12) extending out of the housing, one end of the first direct connecting wire (1) is connected to the control circuit, the first lead portion (12) is arranged on the same side of the housing with the wire-inlet end lead portion of the main circuit and the first lead portion (12) is used to connect a coil of a contactor (6), on overload the heat protection system (7) triggers the operating mechanism (8) to act, so as to drive the control circuit to disconnect the power supply of the

first direct connecting wire (1).

2. The thermal overload relay according to claim 1, wherein a second auxiliary terminal (65) and a second direct connecting wire (2) are arranged inside the housing, of the second direct connecting wire (2) one end is connected to the second auxiliary terminal (65), and the other end extends out of the housing for connecting a third auxiliary terminal (66) of the contactor (6).
3. The thermal overload relay according to claim 2, wherein the second direct connecting wire (2) comprises a second contact portion (21) connected to the second auxiliary terminal (65) of the thermal overload relay (5), and a second lead portion (22) extending out of the housing, the first lead portion (12) and the second lead portion (22) are arranged on the same side of the housing with the wire-inlet end lead portion of the main circuit; the wire-outlet end of the main circuit is provided with a wire-outlet end connecting terminal, the wire-outlet end connecting terminal and the wire-inlet end lead portion are positioned on both sides of the housing, and the second auxiliary terminal (65) and the wire-outlet end connecting terminal are all arranged on the other side of the housing.
4. The thermal overload relay according to claim 2, wherein the outside of the first direct connecting wire (1) and/or the second direct connecting wire (2) is wrapped with an insulating layer (50), respectively.
5. The thermal overload relay according to claim 3, wherein the thermal overload relay (5) is provided with a first auxiliary terminal (64) connected to the control circuit, the first direct connecting wire (1) is connected with the first auxiliary terminal (64); a fixing seat (80) used to install the operating mechanism (8) is arranged inside the housing, the first auxiliary terminal (64) and the operating mechanism (8) are respectively arranged at both sides of the fixing seat (80), a first position-restricting hole (35) is set on the fixing seat (80), the first direct connecting wire (1) is provided with a position-restricting portion (13) passing through the first position-restricting hole (35), and the position-restricting portion (13) restrictively cooperates with the first position-restricting hole (35).
6. The thermal overload relay according to claim 5, wherein the first direct connecting wire (1) is provided with at least first bent segment (141) and second bent segment (142) respectively formed by means of bending, a straight segment (15) is formed at intervals between the first bent segment (141) and the second bent segment (142), and a first folded segment (151) and a second folded segment (152) are formed outside the first bent segment (141) and the second bent segment (142), respectively, the second folded segment (152) overlaps on the bottom side of the straight segment (15) to form a position-restricting portion (13) cooperating with the first position-restricting hole (35), the first folded segment (151) crosses the fixing seat (80) from the outside, and is connected with the first auxiliary terminal (64).
7. The thermal overload relay according to claim 5, wherein a resetting button (81) and a stopping button (82) are arranged the fixing seat (80), respectively, a first groove (810) and a second groove (820) respectively used to accommodate the resetting button (81) and the stopping button (82) are arranged on the fixing seat (80), the first position-restricting hole (35) is disposed on the side of the first groove (810) away from the second groove (820).
8. The thermal overload relay according to claim 7, where the resetting button (81) comprises a pivot portion (811), and an operating portion (812) and a swing portion (813) respectively arranged at both ends of the pivot portion (811), the swing portion (813) includes a first swing arm and a second swing arm, which respectively protrude radially, forming a swing groove therebetween, a first swing groove (816) and a second swing groove (817) respectively cooperating with the first swing arm and the second swing arm are arranged on the side wall of the first groove (810) away from the second groove (820), a swing protrusion (818) cooperating with the swing groove is arranged between the first swing arm and the second swing arm, the first position-restricting hole (35) is disposed on the side wall of the first groove (810) away from the second groove (820), and positioned on one side of the first swing groove (816) away from the second swing groove (817).
9. The thermal overload relay according to claim 1, wherein the first contact portion (11) of the first direct connecting wire (1) is connected with the normally-closed contact of the control circuit, the heat protection system (7) comprises multiple groups of bimetallic strip, and two groups of guiding plates (71) respectively cooperating with the multiple groups of bimetallic strip, the two groups of guiding plates (71) respectively cooperate with a differential lever (72), the bimetallic strip respectively bends to both sides to push different guiding plates (71) during overload and phase failure, and then drive the operating mechanism (8) through displacement of the differential lever (72), enabling the operating mechanism (8) to break or hold the normally-closed contact.
10. The thermal overload relay according to claim 3, wherein the second direct connecting wire (2) comprises a first connection portion (211) and a second connection portion (212), of which one ends are

crookedly connected with each other, a second contact portion (21) and a second lead portion (22) are respectively disposed at one ends of the first connection portion (211) and the second connection portion (212) away from each other; a baffle plate (500) is arranged inside the housing, an upper cavity and a lower cavity are formed on both sides of the baffle plate (500), the operating mechanism (8) and the heat protection system (7) are arranged inside the upper cavity and the lower cavity, respectively, a first connecting portion (211) of the second direct connecting wire (2) is disposed inside the lower cavity, of a second connecting portion (212) of the second direct connecting wire (2) one end is disposed inside the upper cavity, and the other end extends into the lower cavity and is connected with the first connecting portion (211); the heat protection system (7) is disposed at one end of the lower cavity, and spaced from the other end of the lower cavity to form a side cavity (70), and a position-restricting structure for restricting the second direct connecting wire (2) is arranged inside the side cavity (70).

11. The thermal overload relay according to claim 10, wherein the position-restricting structure comprises a position-restricting transverse plate (73) and a position-restricting upright plate (74), which are connected with each other, the position-restricting transverse plate (73) and the position-restricting upright plate (74) are respectively connected with the side wall of the housing and the baffle plate (500), the position-restricting transverse plate (73), the position-restricting upright plate (74), the side wall of the housing and the baffle plate (500) surround a second position-restricting hole (75), the first connecting portion (211) of the second direct connecting wire (2) passes through the second position-restricting hole (75) and cooperates with the second position-restricting hole (75); at least a pair of spaced isolation ribs is arranged on the baffle plate (500), a position-restricting groove is set between the pair of isolation ribs, the position-restricting groove is used to restrict the second connecting portion (212) of the second direct connecting wire (2).

12. The thermal overload relay according to claim 2, wherein a fixing seat (80) used to install the operating mechanism (8) is arranged inside the housing, the housing comprises a base (51) and a side cover (52) mounted on one side of the base (51), a dodging holes (53) is set on the side cover (52), the dodging holes (53) is used to dodge the main circuit conducting wire of the thermal overload relay (5), a supporting part (4) is arranged between the side cover (52) and the operating mechanism (8), the supporting part (4) is connected with the fixing seat (80), and the side of the supporting part (4) close to the side cover (52) is provided with a wire-arranging structure

used to restrict the main circuit conducting wire; a wire-arranging structure used to restrict the second direct connecting wire (2) is arranged on the supporting part (4).

13. The thermal overload relay according to claim 12, wherein the wire-arranging structure comprises two position-restricting ribs (41) disposed opposite each other.
14. The thermal overload relay according to claim 12, wherein the supporting part (4) comprises two connecting pieces (43) disposed opposite each other, and a supporting plate (44) connected between one ends of the two connecting pieces (43), one ends of the two connecting pieces (43) away from the supporting plate (44) are respectively connected with the fixing seat (80), a dodging groove for dodging the operating mechanism (8) is formed between the two connecting pieces (43) and the supporting plate (44), the wire-arranging structure is disposed on the side of the supporting plate (44) close to the side cover (52).
15. A structure connecting a thermal overload relay with a contactor comprising a contactor and the thermal overload relay according to any one of claims 1-14, wherein the wire-inlet end lead portion and the first lead portion (12) of the thermal overload relay are inserted into the connecting terminal of the contactor and connect, the first lead portion (12) is connected to the coil of the contactor (6) through the connecting terminal of the contactor.

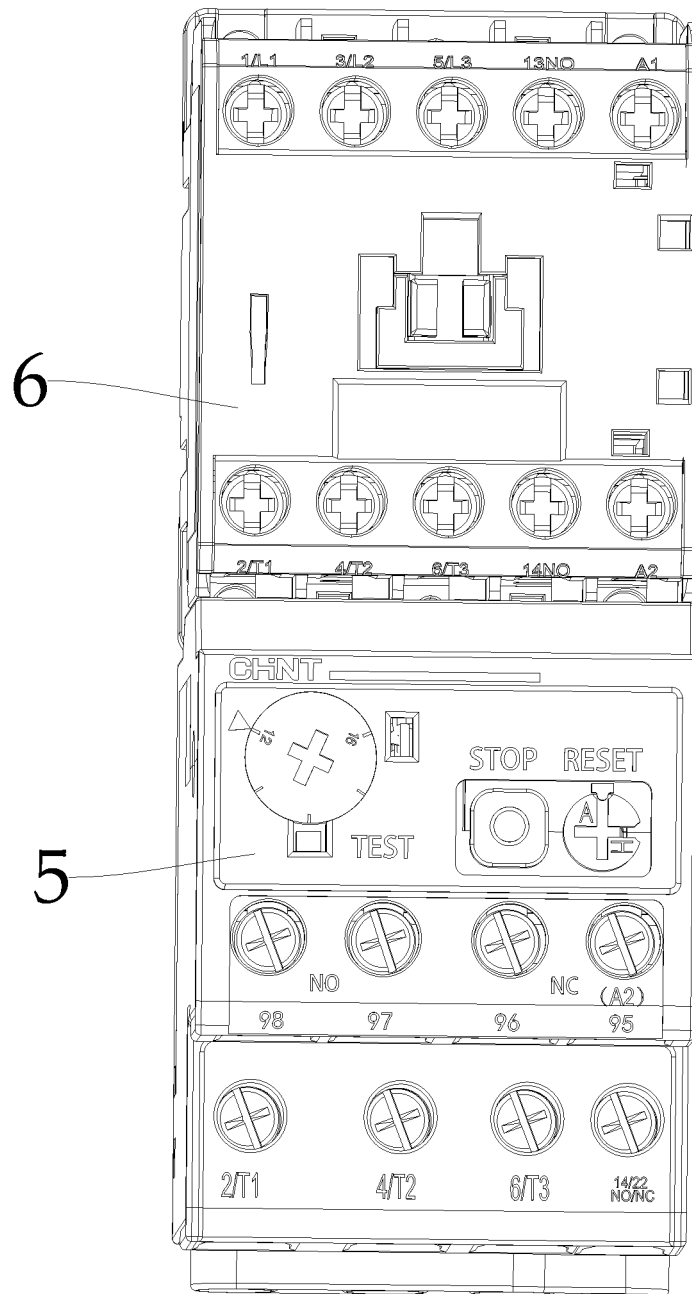


FIG.1

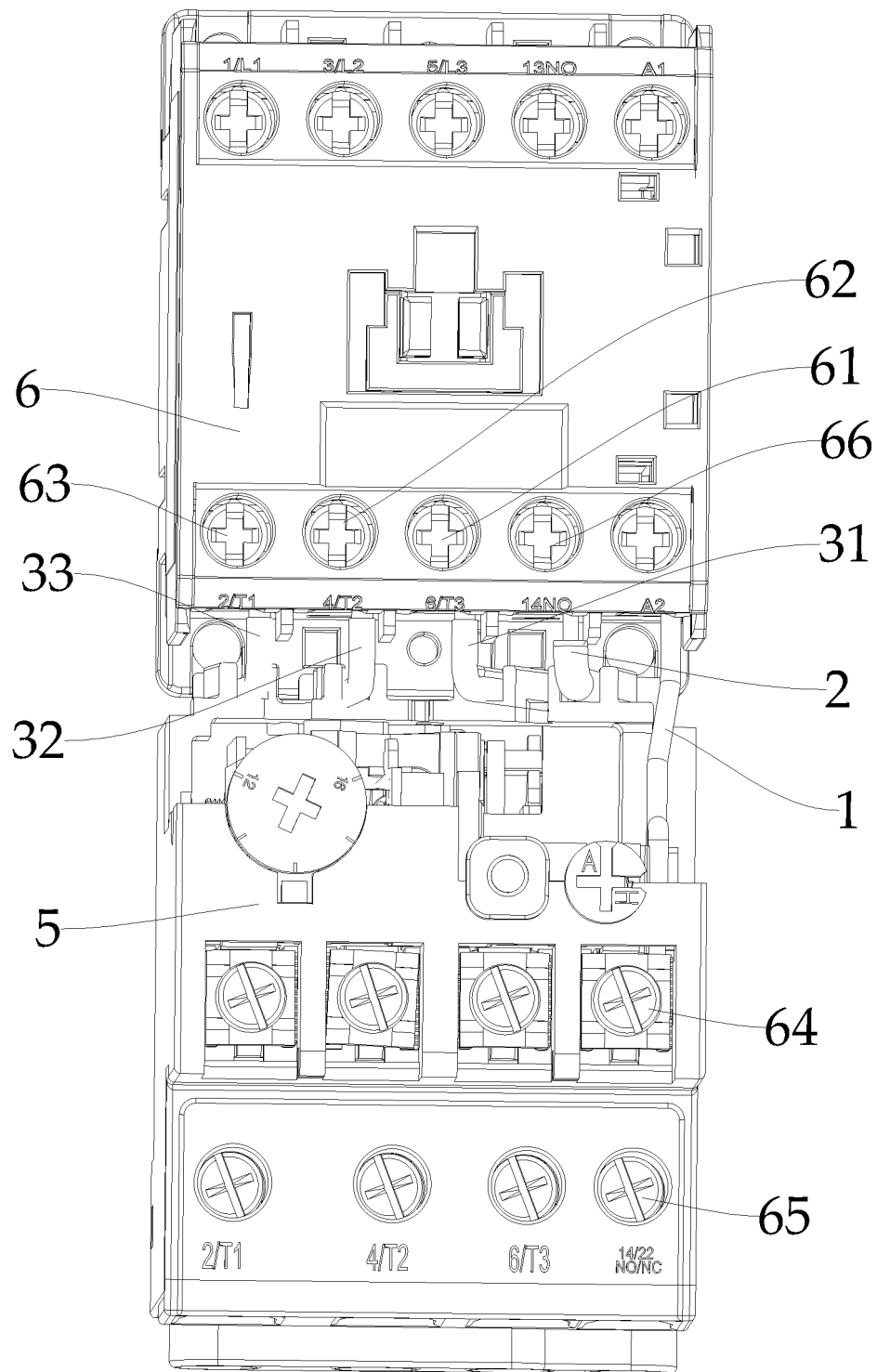


FIG. 2

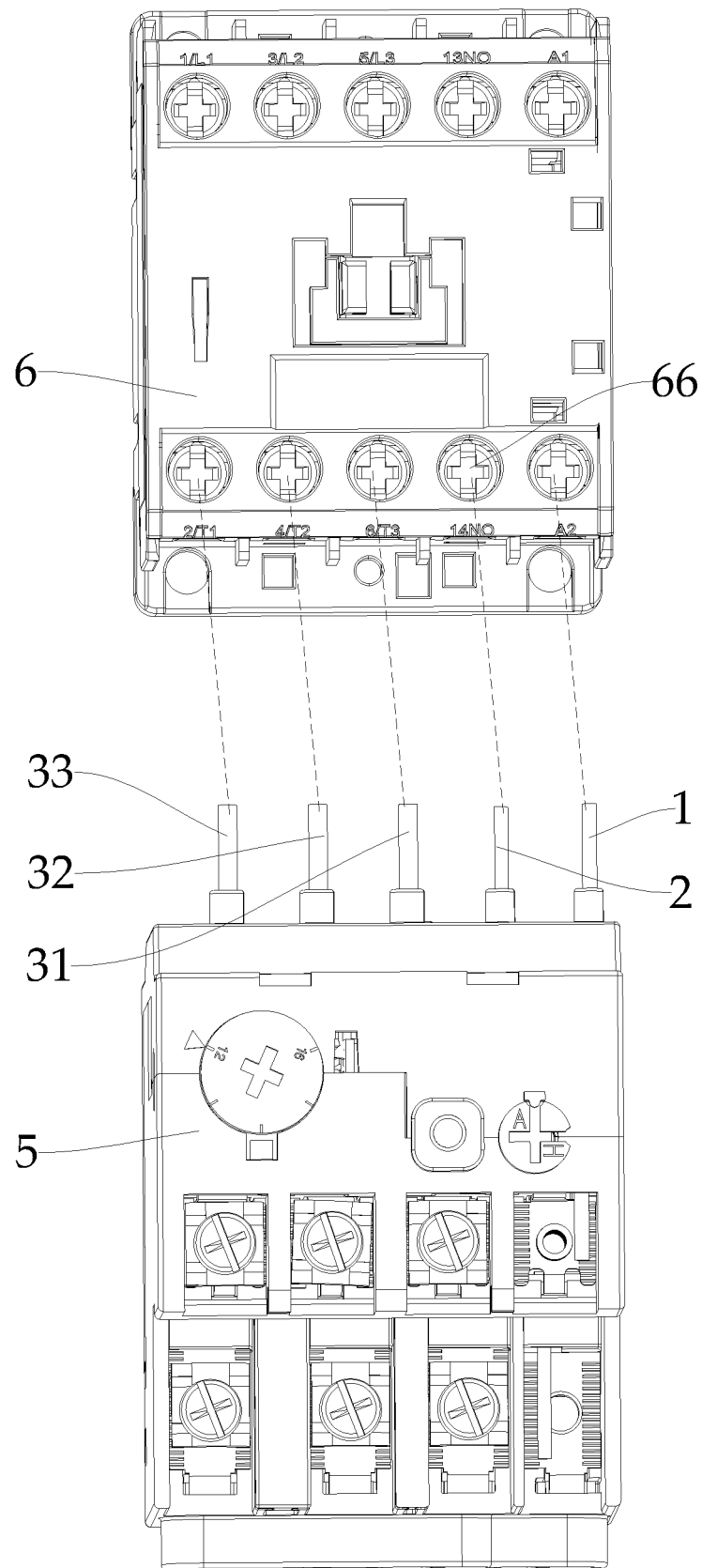


FIG.3

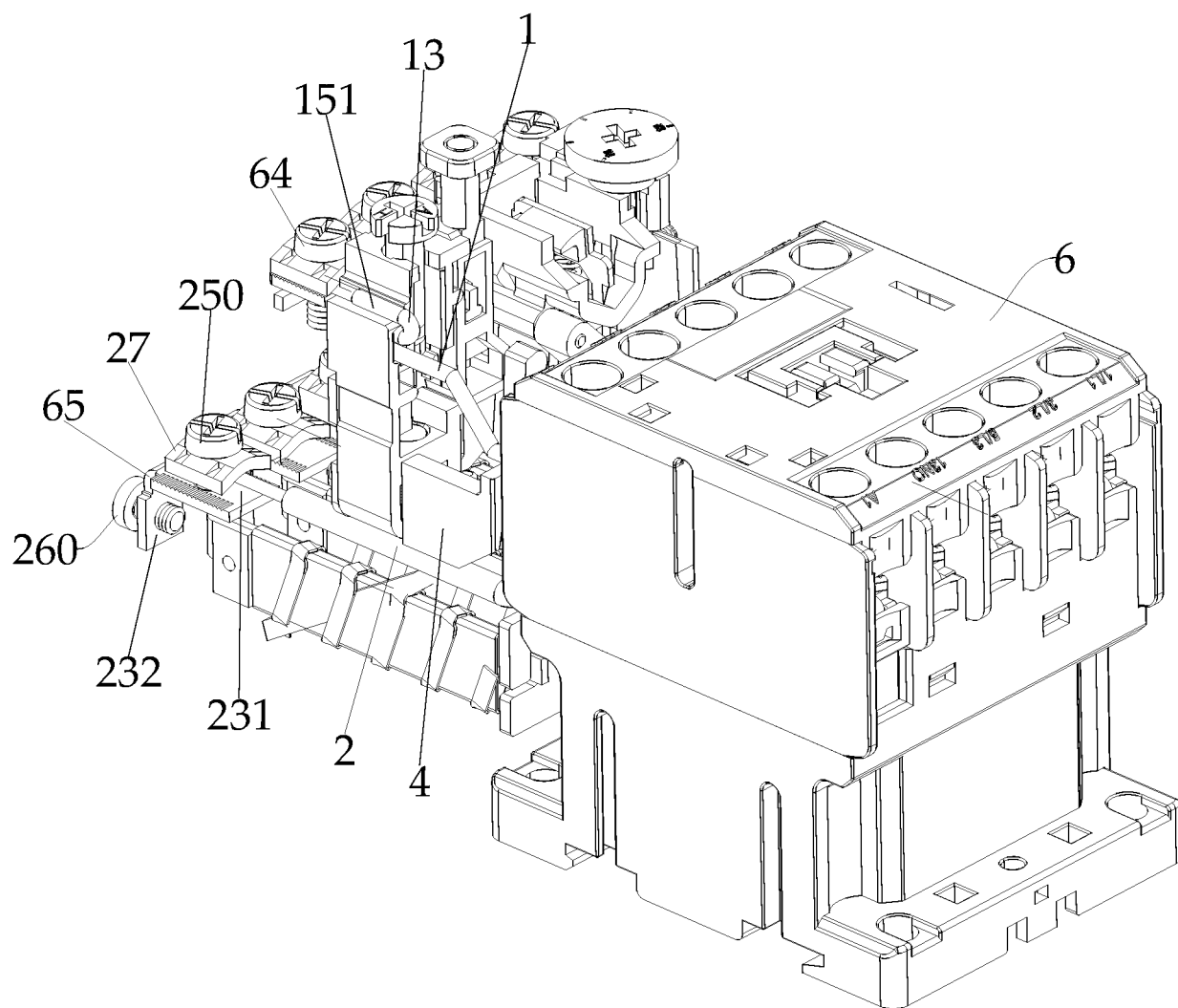


FIG.4

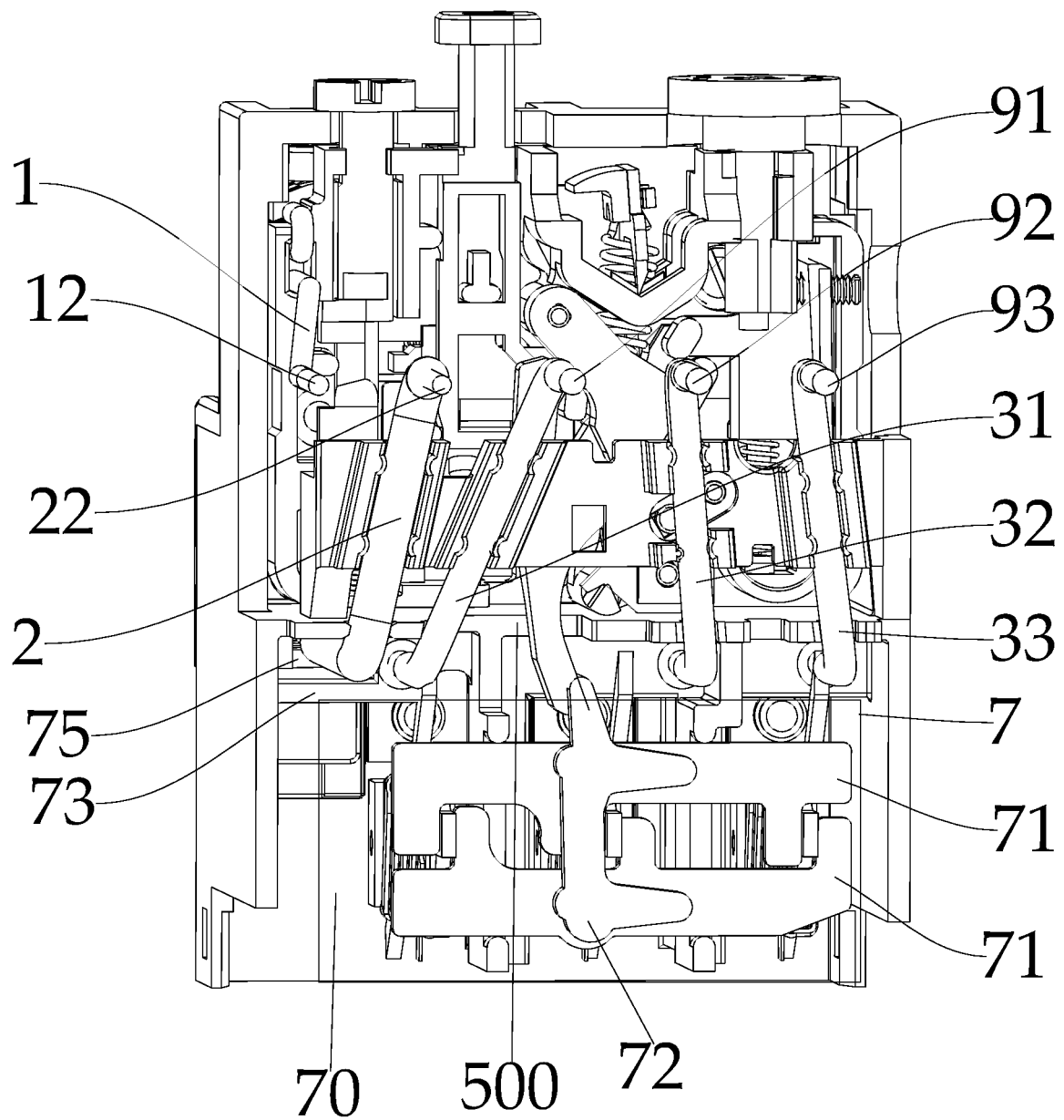


FIG. 5

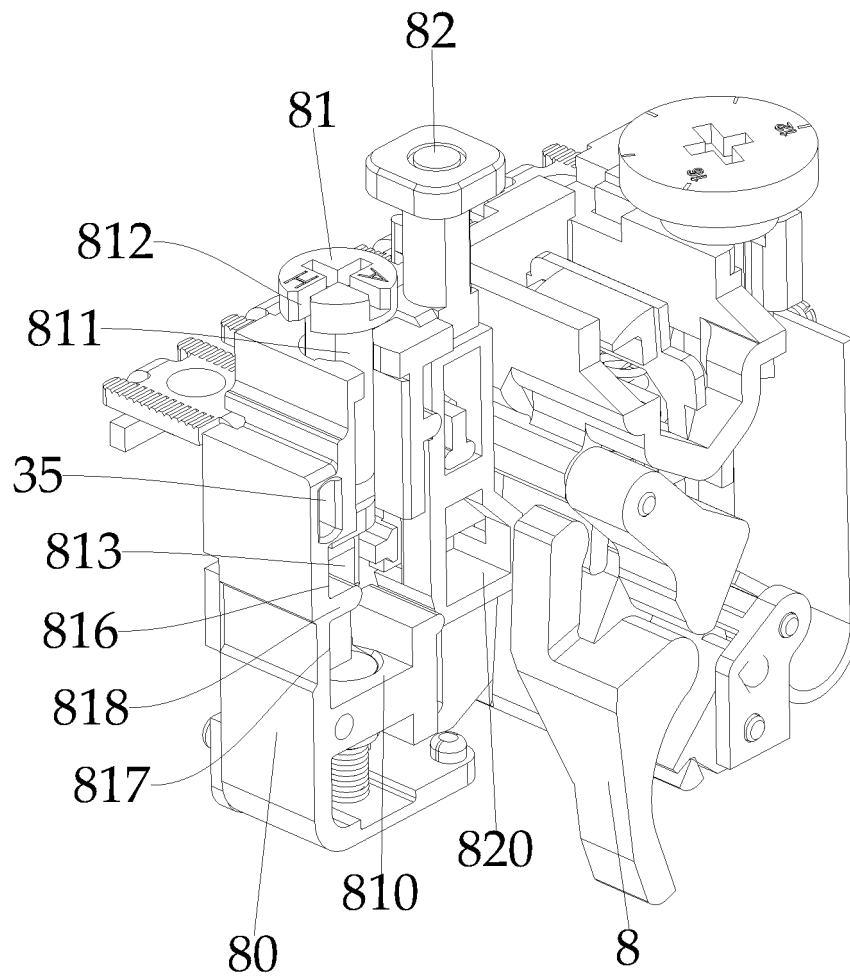


FIG. 6

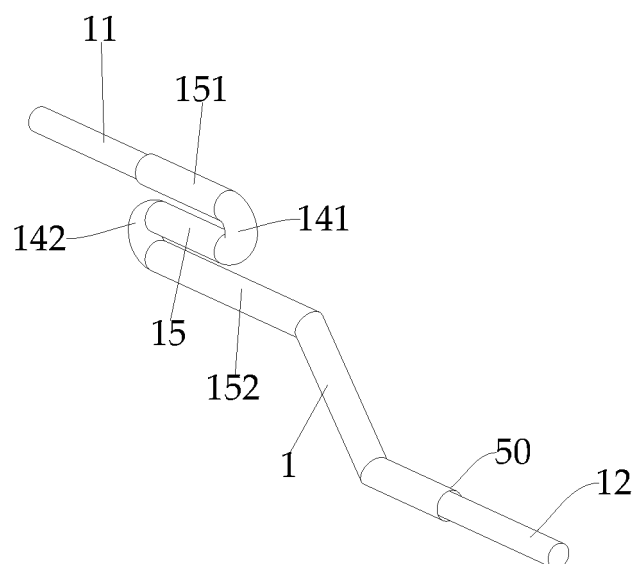


FIG. 7

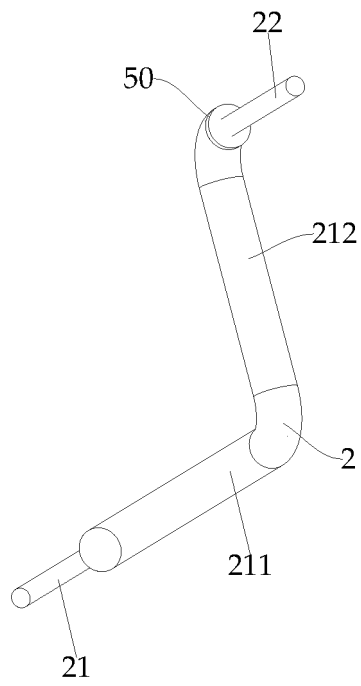


FIG. 8

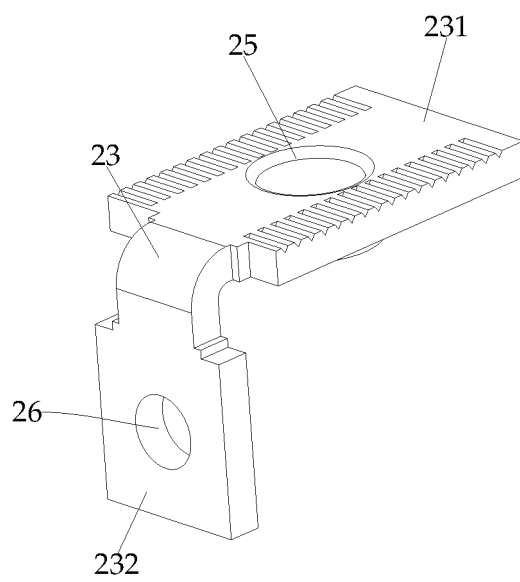


FIG. 9

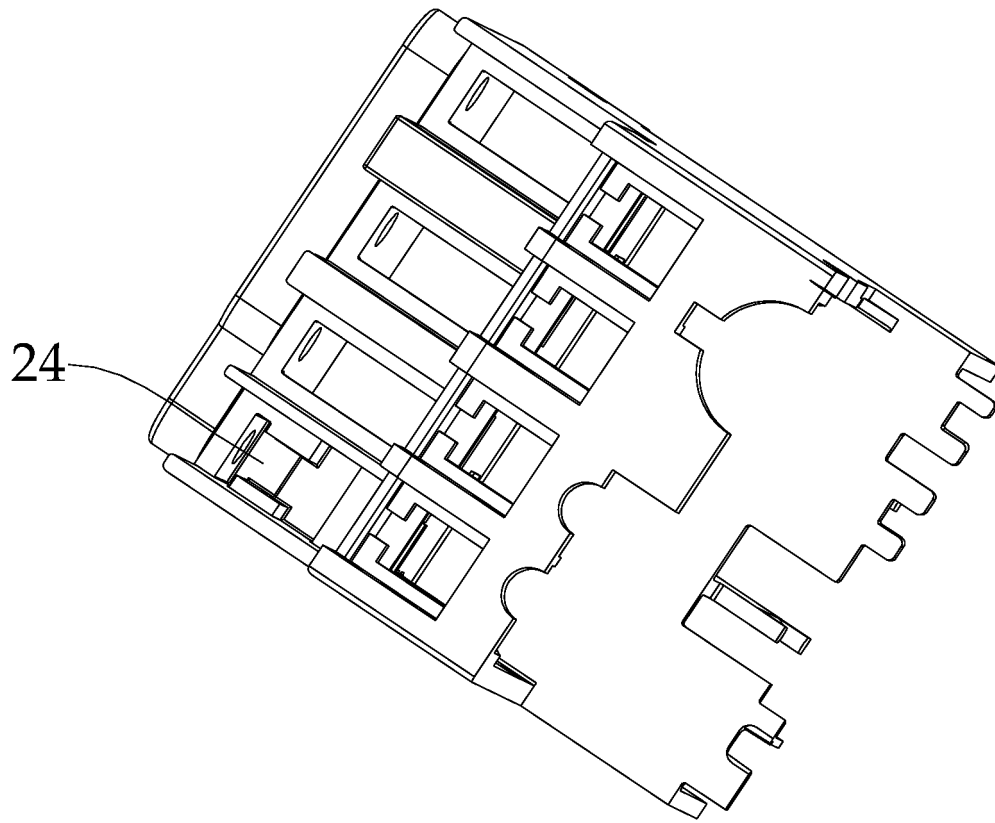


FIG. 10

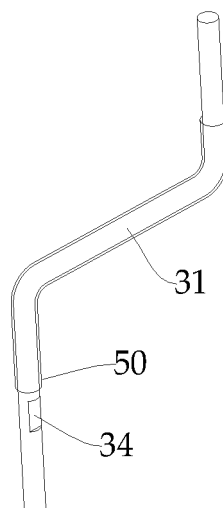


FIG. 11

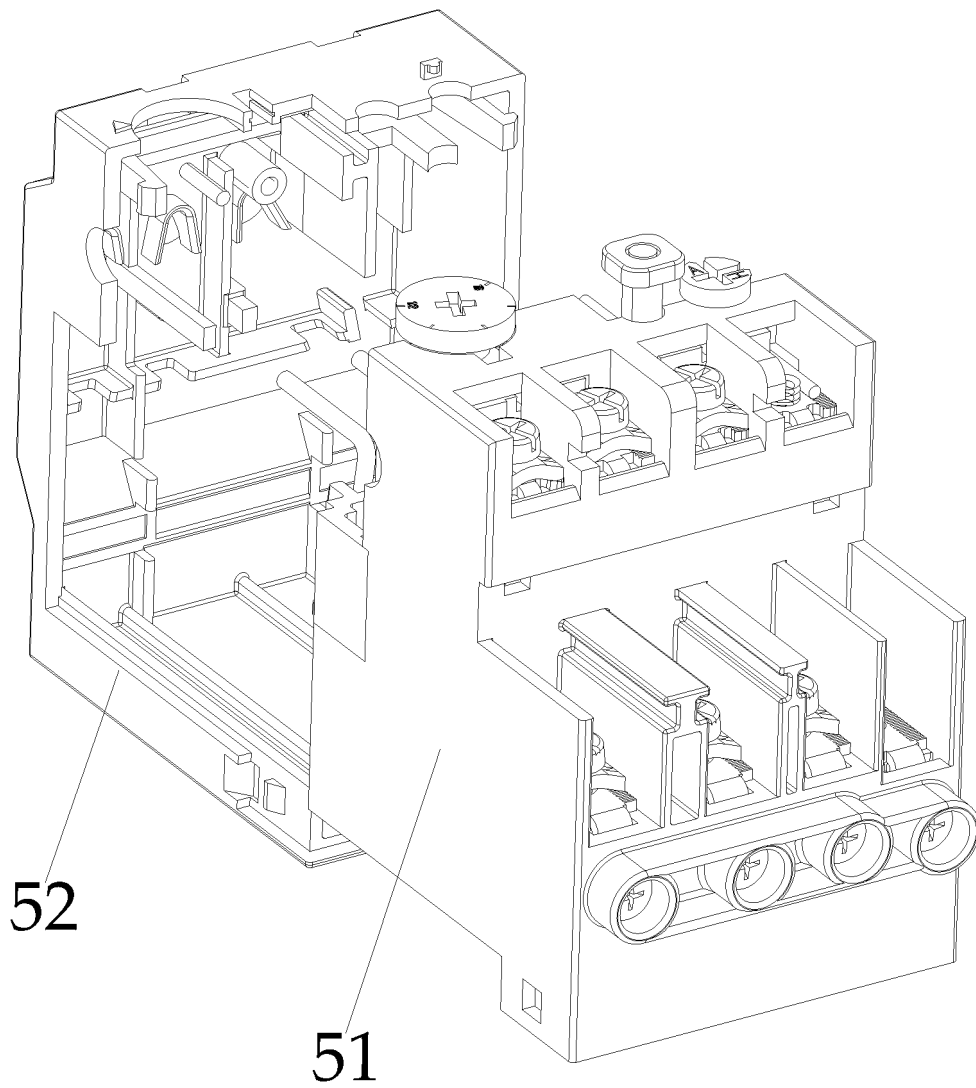


FIG.12

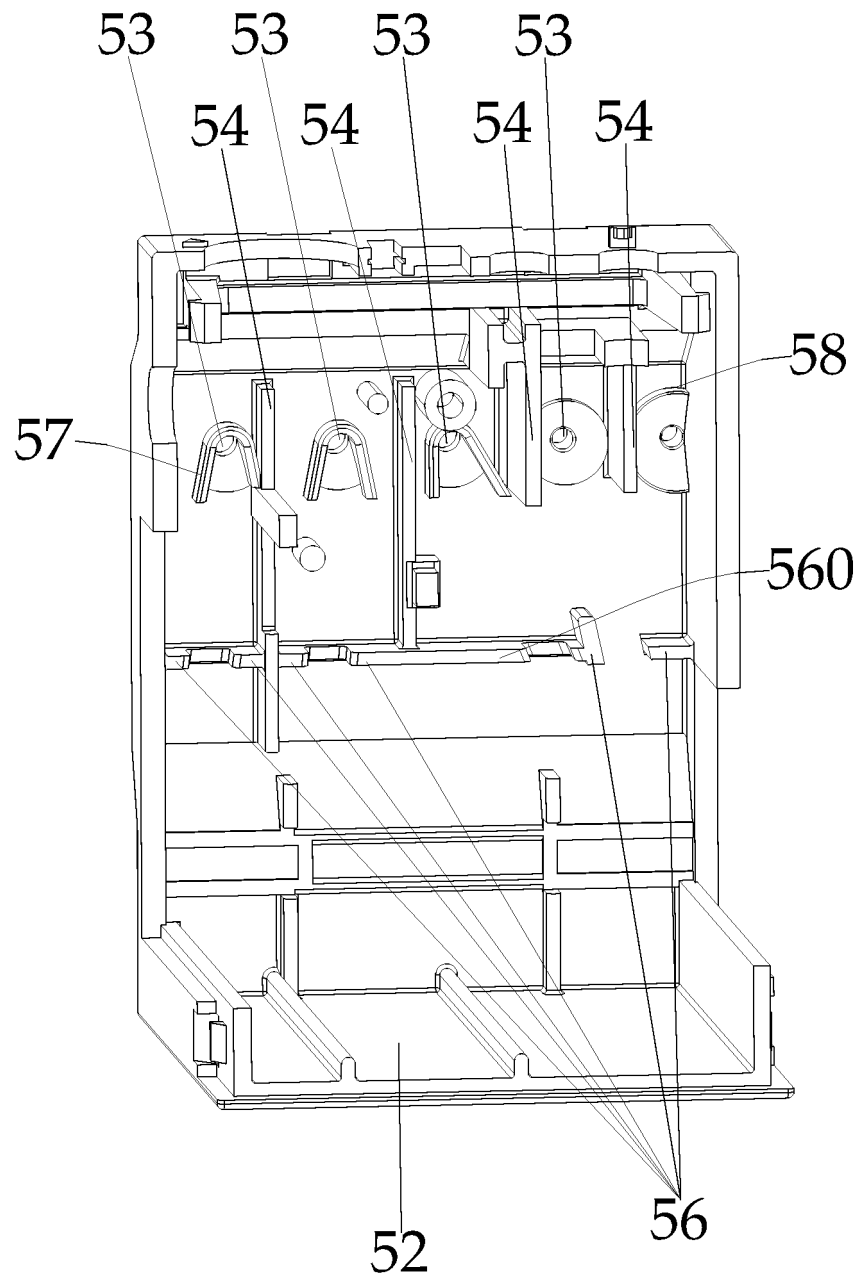


FIG.13

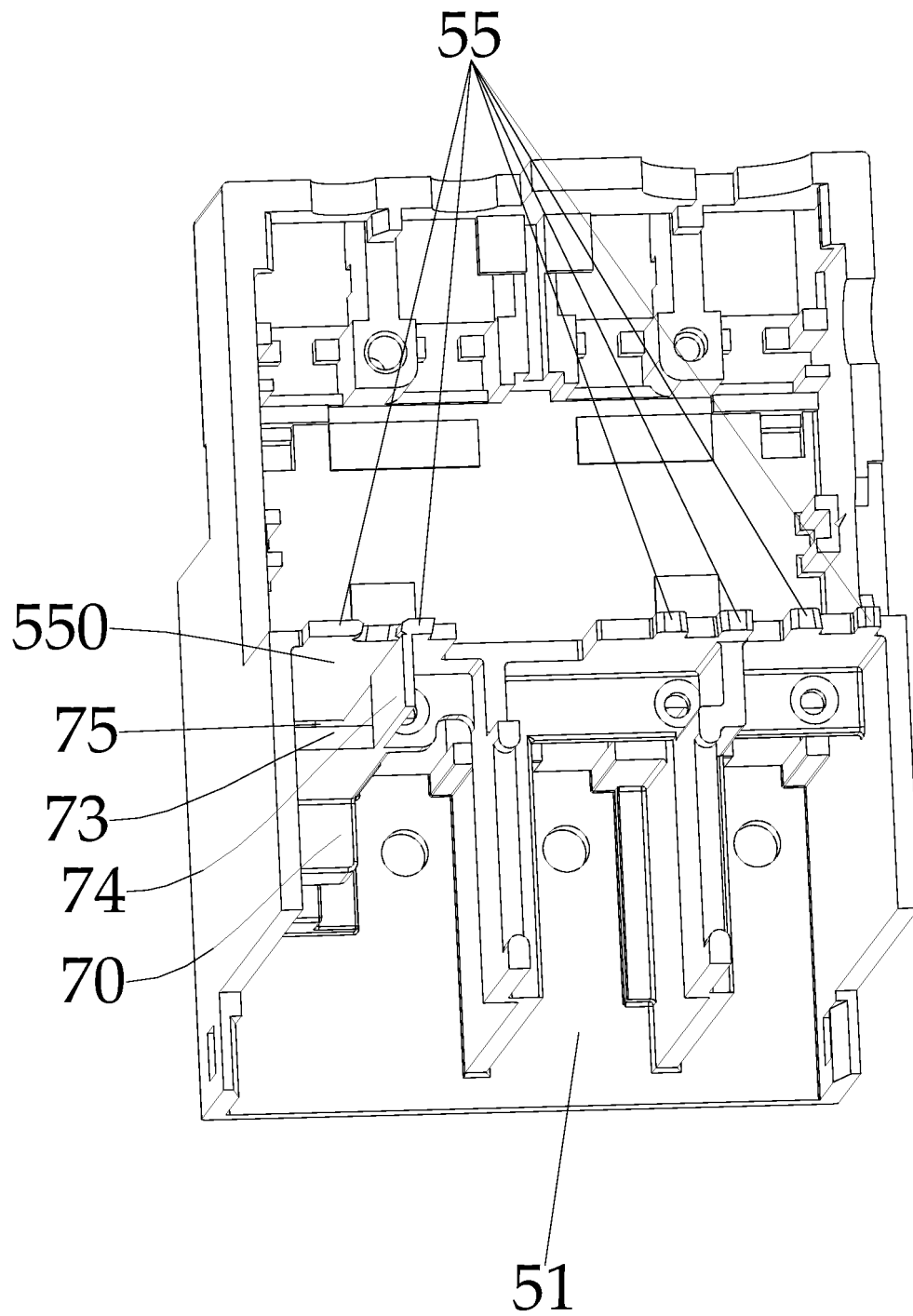


FIG.14

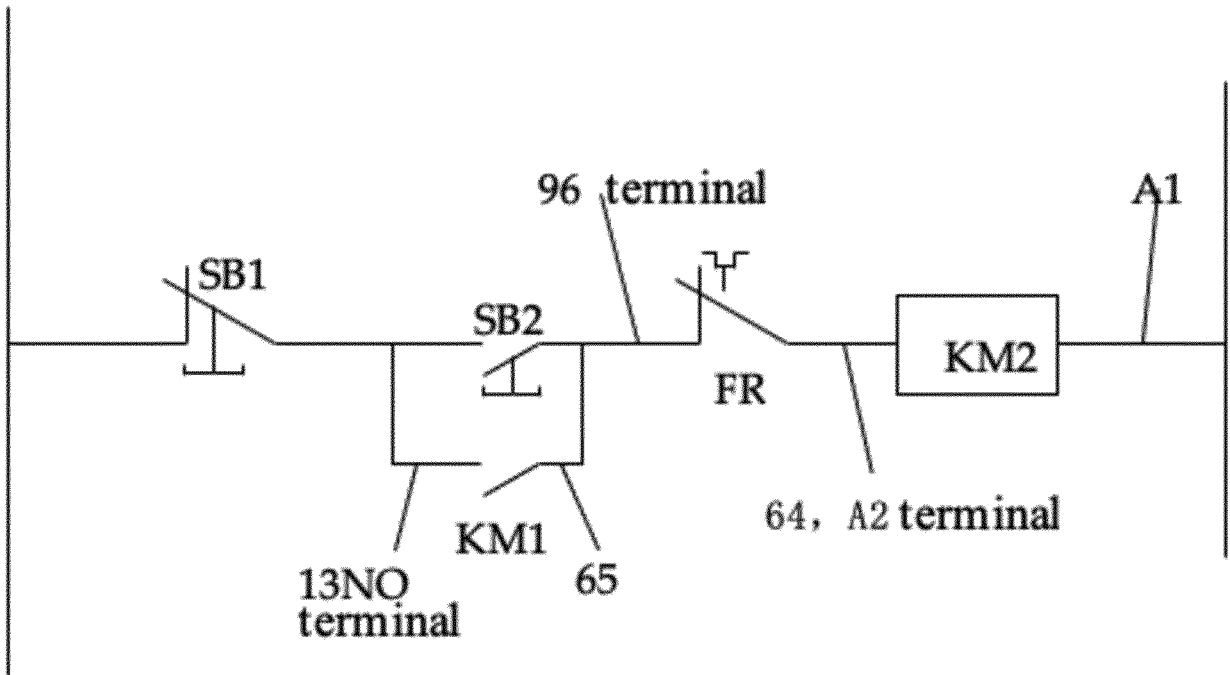


FIG.15

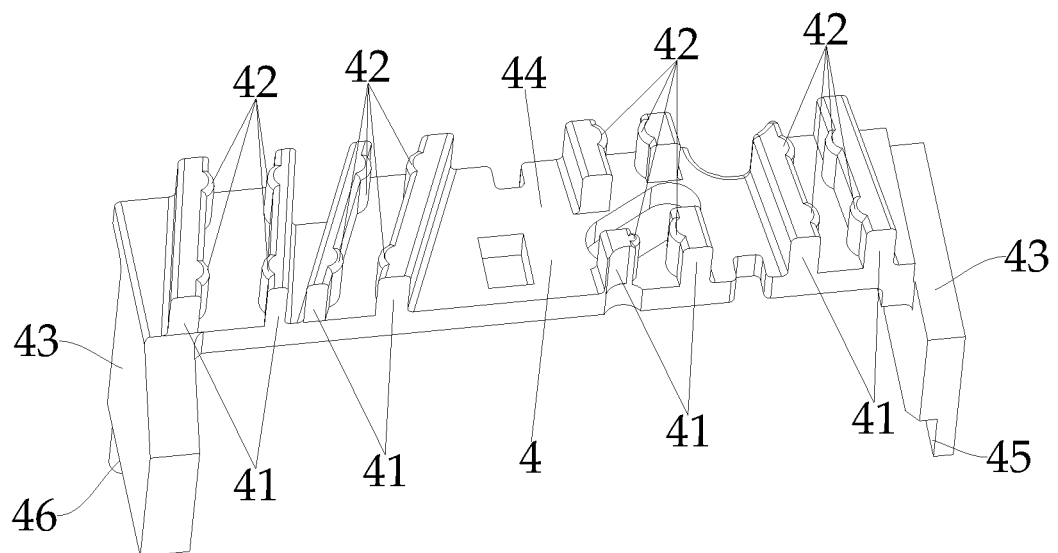


FIG.16

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/084652

A. CLASSIFICATION OF SUBJECT MATTER

H01H 61/01(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)

CNABS; CNTXT; DWPI; VEN; USTXT; WOTXT; EPTXT; CNKI; IEEE: 热, 过载, 继电器, 接触器, 线圈, 控制, 电路, 线, 操作, 端子, thermal, overload, relay, contactor, coil, control, circuit, line, operation, terminal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	CN 217009076 U (ZHEJIANG CHINT ELECTRICS CO., LTD.) 19 July 2022 (2022-07-19) description, paragraphs 32-61, and figures 1-15	1-11, 15
Y	CN 101847549 A (FUJI ELECTRIC FA COMPONENTS & SYSTEMS CO., LTD.) 29 September 2010 (2010-09-29) description, paragraphs 39-76, and figures 1-9	1-15
Y	KR 20030071305 A (LG INDUSTRIAL SYSTEMS CO., LTD.) 03 September 2003 (2003-09-03) description, page 2, the 11th-to-last line to page 3, line 18, and figures 1-6	1-15
Y	CN 2870148 Y (DELIXI GROUP CORP. LTD.) 14 February 2007 (2007-02-14) page 3, the 10th-to-last line to page 4, line 18, and figures 1-5	1-15
A	CN 1501420 A (LG INDUSTRIAL SYSTEM CO., LTD.) 02 June 2004 (2004-06-02) entire document	1-15
A	CN 201270227 Y (PU XINGHUA) 08 July 2009 (2009-07-08) entire document	1-15

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

* Special categories of cited documents:

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“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

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“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

21 July 2022

Date of mailing of the international search report

02 August 2022

Name and mailing address of the ISA/CN

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Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2022/084652

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 217009076 U	19 July 2022	None	
CN 101847549 A	29 September 2010	US 2010245021 A1	30 September 2010
		FR 2943844 A1	01 October 2010
		JP 2010232058 A	14 October 2010
		DE 102010002338 A1	30 September 2010
KR 20030071305 A	03 September 2003	KR 100463603 B1	29 December 2004
CN 2870148 Y	14 February 2007	None	
CN 1501420 A	02 June 2004	KR 20040042627 A	20 May 2004
		EP 1420433 A1	19 May 2004
		US 2004095223 A1	20 May 2004
		JP 2004172122 A	17 June 2004
CN 201270227 Y	08 July 2009	None	

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