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(54) CONTACT SYSTEM AND ELECTRICAL SWITCHING DEVICE

(57) The present invention relates to the field of low-voltage electrical appliances, and in particular, to a contact system and a switching device including the contact system. The contact system includes a main contact structure and at least one group of movable contact structure; the main contact structure includes a main contact; the main contact includes a main touch portion; the movable contact structure includes a movable contact; the movable contact includes a movable touch portion; when the main contact is located at a closed position, the main touch portion and the movable touch portion are engaged to enable the main contact and the movable contact to be closed; the movable contact structure further includes an elastic member cooperating with the movable contact; and in the disconnection process of the main contact from the movable contact, when the main touch portion drives the movable touch portion to move from an initial position to a disengaged position, the elastic member stores energy, such that the main contact continues to move, and the elastic member releases energy to drive the movable touch portion to reset to the initial position. The contact system and the switching device have high disconnection capacity.

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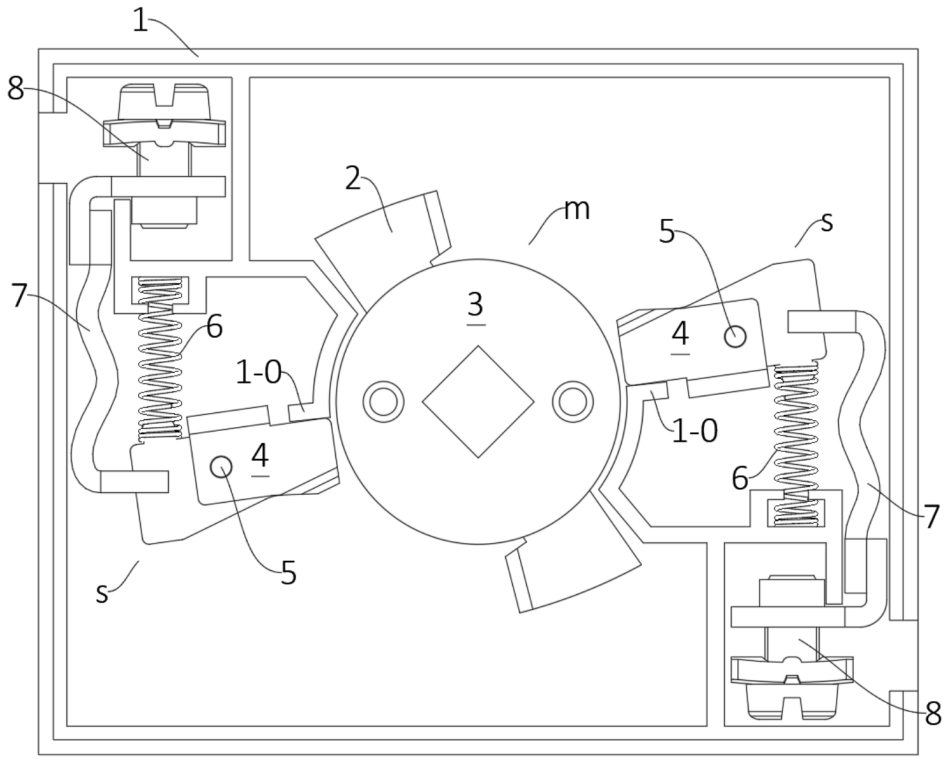

FIG. 1

Description

[0001] The present application claims priority to Chinese Patent Application No. 202310823656.2 filed on July 6, 2023, and Chinese Patent Application No. 202321758907.5 filed on July 6, 2023, both of which are incorporated herein by reference in their entireties.

TECHNICAL FIELD

[0002] The present invention relates to the field of low-voltage electrical appliances, and more particularly, to a contact system and a switching device including the contact system.

BACKGROUND

[0003] A contact system of the existing switching device is mostly implemented by the cooperation of a movable contact and a static contact. The movable contact rotates or moves as a whole to be closed with and disconnected from the static contact, such that a circuit where the switching device is located is turned on and off. The disconnection speed of the movable and static contacts is an important factor affecting the disconnection capacity of the contact system. At present, an energy storage mode of an operating mechanism is mostly used to increase a movement speed of the movable contact, thereby increasing the disconnection speed of the movable and static contact, but the effect is relatively poor due to the limited structural strength and space.

SUMMARY

[0004] An object of the present invention is to overcome at least one defect of the prior art and provide a contact system and a switching device, which have high disconnection capacity.

[0005] In order to achieve the above objective, the present invention provides the following technical solution:

a contact system, comprising a main contact structure and at least one group of movable contact structure, the main contact structure comprises a main contact; the main contact comprises at least one main touch portion; the movable contact structure comprises a movable contact; the movable contact comprises a movable touch portion; when the main contact is located at a closed position, the main touch portion and the movable touch portion are engaged to enable the main contact and the movable contact to be closed;

the movable contact structure further comprises an elastic member cooperating with the movable contact; and

in the disconnection process of the main contact from the movable contact, when the main touch portion drives the movable touch portion to move from an initial position to a disengaged position, the elastic member stores energy, such that the main contact continues to move, and the elastic member releases energy to drive the movable touch portion to reset to the initial position.

[0006] Further, the main contact structure is disposed pivotally or disposed to move as a whole.

[0007] Further, the main contact structure is disposed pivotally and is a rotary contact structure; the main contact is a rotary contact; the main touch portion is a rotary touch portion; when the rotary contact is located at a closed position, the rotary touch portion and the movable touch portion are engaged to enable the rotary contact and the movable contact to be closed; and in the disconnection process of the rotary contact from the movable contact, when the rotary touch portion drives the movable touch portion to move from an initial position to a disengaged position, the elastic member stores energy, such that the rotary contact continues to move, the elastic member releases energy to drive the movable touch portion to reset to the initial position, and the main touch portion and the movable touch portion move away from each other.

[0008] Further, the contact system comprises two groups of movable contact structures; the rotary contact comprises two rotary touch portions disposed at both ends thereof respectively; and when the rotary contact is located at the closed position, the two rotary touch portions are respectively engaged with the two movable touch portions to enable the rotary contact and the movable contact to be closed.

[0009] Further, the movable contact is disposed rotatably or disposed to move as a whole.

[0010] Further, the middle of the movable contact is disposed pivotally; the movable touch portion is disposed at one end of the movable contact, and the other end of the movable contact cooperates with the elastic member; and the movable contact rotates so that the movable touch portion is switched between the initial position and the disengaged position.

[0011] Further, the movable contact moves as a whole within a preset plane, and the movable contact moves as a whole so that the movable touch portion is switched between the initial position and the disengaged position.

[0012] Further, the movable contact structure further comprises a guide rail structure, and the movable contact is disposed to move as a whole along an extension direction of the guide rail structure.

[0013] Further, the movable contact structure further comprises a movable contact shaft which is disposed fixedly; the movable contact comprises a guide plate; a guide rail structure comprises guide rail walls and a guide rail groove formed between two opposite guide rail walls; the movable contact shaft is slidably plugged into the guide rail groove; and the guide plate and the movable contact shaft are disposed on both sides of one guide rail

wall, respectively.

[0014] Further, the movable contact shaft and the guide plate make sliding contact with both sides of the corresponding guide rail wall, respectively.

[0015] Further, the rotary contact structure further comprises a rotating shaft which is disposed pivotally; the rotary contact is plugged into the rotating shaft, and both ends of the rotary contact protrude from both radial sides of the rotating shaft, respectively; and

[0016] the two groups of movable contact structures are mutually centrosymmetric structures with a rotation center of the rotary contact structure as a symmetry center.

[0017] Further, the main touch portion makes plug-in fit with the movable touch portion, such that the main contact structure and the movable contact structure are closed.

[0018] Further, the contact system further comprises at least one group of plug-in structure; the plug-in structure comprises a plug-in plate and a socket, one of which is disposed on the main touch portion and the other is disposed on the movable touch portion; and the plug-in plate is plugged into the socket and is clamped by an inner side wall of the socket, such that the main touch portion and the movable touch portion are engaged.

[0019] Further, the rotary contact structure further comprises a rotating shaft which is disposed to rotate around its own axis; the rotating shaft comprises a rotating shaft seat and a rotating shaft cover which are spliced oppositely in its axial direction; the rotating contact is clamped between the rotating shaft seat and the rotating shaft cover and comprises rotary touch portions which are disposed on both radial sides of the rotating shaft and cooperate with the movable contact; the rotating shaft further comprises a plug portion disposed at its axial end; the plug portion comprises a main plug and a secondary plug; the main plug is disposed on one side of the rotating shaft cover away from the rotating shaft seat; the secondary plug is disposed on one side of the rotating shaft seat facing the rotating shaft cover; the secondary plug passes through a rotating shaft cover hole of the rotating shaft cover and is disposed side by side with the main plug; the rotating shaft further comprises a jack portion disposed at its other axial end; and the jack portion is adapted to the plug portion.

[0020] A switching device includes the above-mentioned contact system.

[0021] According to the contact system of the present invention, after the main touch portion drives the movable touch portion to the disengaged position, the main contact continues to move, and the elastic member releases energy to drive the movable touch portion to quickly reset to the initial position. In this case, the main touch portion and the movable touch portion generally move in opposite directions, so that a distance between the main touch portion and the movable touch portion is rapidly widened, and an electric arc generated by the disconnection of the main contact from the movable contact can be quickly lengthened, which can significantly improve the arc-extinguishing capacity and the disconnection capacity of the contact system and achieve rapid opening.

[0022] In addition, the rotary contact cooperates with two groups of movable contacts to form a dual-breakpoint structure form, which is conducive to further improving the disconnection capacity.

[0023] In addition, the two groups of movable contact structures adopt a centrosymmetric structure, which is conducive to reducing the structure types and the production cost. Further, there is no need to discriminate the two groups of movable contact structures during the installation process, which is conducive to improving the assembly efficiency.

[0024] The present invention provides a switching device, which includes the above-mentioned contact system and has high disconnection capacity.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a schematic structural diagram of a switching device of the present invention, in which a mode B is adopted for a main contact and a movable contact of a contact system, the movable contact is disposed pivotally, the movable contact and the movable contact are in a disconnected state, and a first setting mode is adopted for a plug-in structure;

FIG. 2 is a schematic structural diagram of a switching device of the present invention, in which a mode B is adopted for a main contact and a movable contact of a contact system, the movable contact is disposed pivotally, the movable contact and the movable contact are in a closed state, and a first setting mode is adopted for a plug-in structure;

FIG. 3 is a schematic structural diagram of a switching device of the present invention, in which a mode B is adopted for a main contact and a movable contact of a contact system, the movable contact is disposed pivotally, a main touch portion drives a movable touch portion to move to a disengaged position, and a first setting mode is adopted for a plug-in structure;

FIG. 4 is a schematic structural diagram of the main contact structure in FIGS. 1-3 in the present invention, in which a main touch portion is a plug-in plate;

FIG. 5 is a schematic structural diagram of a main contact of the main contact structure in FIG. 4 in the present invention;

FIG. 6 is a schematic structural diagram of the movable contact in FIGS. 1-3 in the present invention, in which a cross-section is of a U-shaped structure;

FIG. 7 is a schematic structural diagram of a switching device of the present invention, in which a mode B is adopted for a main contact and a movable contact of a contact system, the movable contact is disposed pivotally, the movable contact and the

movable contact are in a closed state, and a second setting mode is adopted for a plug-in structure;
FIG. 8 is a schematic structural diagram of the main contact structure in FIG. 7 in the present invention;
FIG. 9 is a schematic structural diagram of the movable contact in FIG. 7 in the present invention;
FIG. 10 is a schematic structural diagram of a switching device of the present invention, in which a mode B is adopted for a main contact and a movable contact of a contact system, the movable contact is disposed to move as a whole, the movable contact and the movable contact are in a closed state, and a first setting mode is adopted for a plug-in structure;
FIG. 11 is a schematic diagram of a three-dimensional structure of a switching device of the present invention, in which a mode B is adopted for a main contact and a movable contact of a contact system, the movable contact is disposed to move as a whole, the movable contact and the movable contact are in a closed state, and a first setting mode is adopted for a plug-in structure;
FIG. 12 is a schematic structural diagram of a switching device of the present invention, in which a mode B is adopted for a main contact and a movable contact of a contact system, the movable contact is disposed to move as a whole, a main touch portion drives a movable touch portion to move to a disengaged position, and a first setting mode is adopted for a plug-in structure;
FIG. 13 is a schematic structural diagram of a switching device of the present invention, in which a mode B is adopted for a main contact and a movable contact of a contact system, the movable contact is disposed to move as a whole, the main contact and the movable contact are in a disconnected state, and a first setting mode is adopted for a plug-in structure;
FIG. 14 is a schematic structural diagram of the movable contact in FIGS. 10-13 in the present invention;
FIG. 15 is a schematic structural diagram of a movable contact structure of a plug-in structure which adopts a third setting mode in the present invention;
FIG. 16 is a schematic structural diagram of a main contact of the plug-in structure which adopts the third setting mode in the present invention;
FIG. 17 is a schematic structural diagram of a movable contact structure of a plug-in structure which adopts a fourth setting mode in the present invention;
FIG. 18 is a schematic structural diagram of a main contact of the plug-in structure which adopts the fourth setting mode in the present invention;
FIG. 19 is a schematic structural diagram of a rotary contact structure in the present invention, in which a structure of a jack portion is shown;
FIG. 20 is a schematic structural diagram of a rotary contact structure in the present invention, in which a structure of a plug portion is shown; and
FIG. 21 is an exploded view of a rotary contact structure in the present invention.

Reference symbols represent the following components:

[0026]

1-housing;
1-0-positioning stopper; g-guide rail structure; 1-1-guide rail groove; 1-2-guide rail wall;
m-main contact structure;
2-main contact; 2-0-main touch portion; 2-1-main contact blade; 2a-first main contact plate; 2b-second main contact plate; 2c-third main contact plate;
3-rotating shaft; 3g-jack portion; 3p-plug portion; 31-rotating shaft seat; 31-0-seat body; 31-00-seat body trunk; 31-01-seat body end plate; 31-010-avoidance notch; 31-1-secondary plug; 31-2-clamping hole; 31-3-rotating shaft seat groove; 31-5-main jack; 31-6-secondary jack; 33-rotating shaft cover; 33-0-cover plate; 33-1-rotating shaft cover hole; 33-2-main plug; 33-3-clamping hook;
s-movable contact structure;
4-movable contact; 4-1-movable touch portion; 4-2-movable contact shaft hole; 4-3-movable contact limiting protrusion; 4-4-guide plate; 4-5-movable contact hanging spring portion;
5-movable contact shaft;
6-elastic member;
c-socket;
7-flexible wire;
8-wiring terminal; and
9-spring fixing shaft.

DETAILED DESCRIPTION

[0027] The specific implementation of a switching device of the present invention will be further described below in conjunction with the embodiments given in accompanying drawings. The switching device of the present invention is not limited to the description of the following embodiments.

[0028] The switching device of the present invention includes a contact system. The contact system includes a main contact structure m and at least one group of movable contact structure s. The main contact structure m and the movable contact structure s are closed and disconnected, such that a circuit where the switching device is located is turned on and off. Further, the switching device further includes an operating mechanism. The operating mechanism is in transmission connection with the main contact structure m to drive the main contact structure m and the movable contact structure s to be closed and disconnected. Further, the switching device further includes a housing 1 for accommodating the contact system. Further, when the switching device of the present invention is a rotary disconnecting switch, the housing 1 is a housing of a switching unit of the rotary

disconnecting switch; or when the switching device of the present invention is a circuit breaker, the housing 1 is a circuit breaker housing; or when the switching device of the present invention is a change-over switch, the housing 1 is a change-over switch housing.

[0029] As shown in FIGS. 1-3, 7, and 11-14, the main contact structure m includes a main contact 2. The main contact 2 includes at least one main touch portion 2-0. The movable contact structure s includes a movable contact 4. The movable contact 4 includes a movable touch portion 4-1. When the main contact 4 is located at a closed position, the main touch portion 2-0 and the movable touch portion 4-1 are engaged to enable the main contact 2 and the movable contact 4 to be closed. Further, the movable contact structure s further includes an elastic member 6 cooperating with the movable contact 4. During the disconnection process of the main contact 2 from the movable contact 4, the main touch portion 2-0 drives the movable touch portion 4-1 to move from an initial position to a disengaged position. Meanwhile, the movable contact 4 enables the elastic member 6 store energy, and the main contact 2 continues to move. Then, the movable touch portion 4-1 is disengaged from the main touch portion 2-0, and the elastic member 6 releases energy and drives the movable touch portion 4-1 to reset to the initial position. That is, during the movement process of the main contact 2 from a closed position to a disconnected position, the main touch portion 2-0 moves from the closed position to a intermediate position and drives the movable touch portion 4-1 to move from the initial position to the disengaged position. Meanwhile, the movable contact 4 enables the elastic member 6 to store energy, the elastic member 6 stores energy to the maximum when the movable touch portion 4-1 is located at the disengaged position, and the main contact 2 continues to move towards the disconnected position. Then, the movable touch portion 4-1 is disengaged from the main touch portion 2-0, and the elastic member 6 releases energy and drives the movable touch portion 4-1 to reset to the initial position, while the main contact 2 continues to move to the disconnected position. According to the contact system, after the main touch portion 2-0 drives the movable touch portion 4-1 to move to the disengaged position, the main contact 2 continues to move, and the elastic member 6 drives the movable touch portion 4-1 to quickly reset to the initial position. In this case, the main touch portion 2-0 and the movable touch portion 4-1 generally move in opposite directions, so that a distance between the main touch portion 2-0 and the movable touch portion 4-1 is rapidly widened, and an electric arc generated by the disconnection of the main contact 2 from the movable contact 4 can be quickly lengthened, which can significantly improve the arc-extinguishing capacity and the disconnection capacity of the contact system and achieve rapid opening. It needs to be pointed out that, in the process of the main touch portion 2-0 driving the movable touch portion 4-1 to move from the initial position to the disengaged position, the main touch portion 2-0 and the movable touch portion 4-1 do not remain relatively stationary, but move and/or rotate relative to each other until the main touch portion 2-0 cannot drive the movable touch portion 4-1 to continue to move, so that the elastic member 6 further stores energy. When the main contact 2 and the movable contact 4 are in a closed state, and when the main contact 2 and the movable contact 4 are disconnected and the movable contact 4 is in a stationary state, the position where the movable touch portion 4-1 is located is the initial position. The position that the movable touch portion 4-1 can reach, under the driving of the main touch portion 2-0, to the farthest point from the initial position is the disengaged position. When the movable touch portion 4-1 moves to the disengaged position, the movable contact 4 enables the elastic member 6 to store energy to the maximum. The position where the main contact 2 and the movable contact 4 are in a closed state is the closed position. The final position where the main contact 2 and the movable contact 4 remain stationary after being disconnected is the disconnected position. The intermediate position is a position that the main contact 2 passes through during the movement from the closed position to the disconnected position.

[0030] As shown in FIGS. 1-3, 7, and 10-13, the contact system further includes wiring terminals 8, which are in one-to-one cooperation with the movable contacts 4, and the movable contacts 4 are electrically connected to the wiring terminals 8 through flexible wires 7.

[0031] As other embodiments, the movable contacts 4 are electrically connected to the wiring terminals 8 through rigid couplings.

[0032] Specifically, in the contact system, the main contact 2 and the movable contact 4 have at least the following three configuration modes.

[0033] Mode A: the contact system is provided with a group of main contact structure m and at least one group of movable contact structure s, wherein the main contact 2 in the main contact structure m is provided with a main touch portion 2-0; the movable contact 4 in the movable contact structure s is provided with a movable touch portion 4-1; and when the main contact 2 moves to be switched between the closed position and the disconnected position, the main touch portion 2-0 and the movable touch portion 4-1 are engaged and disengaged.

[0034] Mode B: the contact system is provided with a group of movable contact structure and two groups of movable contact structures s, wherein the main contact 2 in the main contact structure m is provided with two main touch portions 2-0; the movable contacts 4 in the two groups of movable contact structures s are provided with a movable touch portion 4-1, respectively; the main contact 2 moves to be switched between the closed position and the disconnected position, such that the two main touch portions 2-0 are engaged with and disengaged from the two movable touch portions 4-1, respectively; and when the two main touch portions 2-0 are respectively engaged with the two movable touch portions 4-1,

the three are connected in series.

[0035] Specifically, as shown in FIGS. 1-2, 7 and 10-13, the main contact 2 includes two main touch portions 2-0 which are respectively disposed at both ends thereof. The contact system includes two groups of movable contact structures s. The two groups of movable contact structures s are disposed on both sides of the main contact structure m, respectively. The two groups of main touch portions 2-0 are respectively used to be engaged with and disengaged from the movable touch portions 4-1 of the two groups of movable contacts 4. The contact system adopts a dual-breakpoint structure form, which is conducive to further improving the disconnection capacity and arc-extinguishing capacity of the contact system. Further, the two groups of movable contacts 4 are electrically connected to the two groups of wiring terminals 8 through two flexible wires 7, respectively.

[0036] Mode C: the contact system is provided with a group of movable contact structure and two groups of movable contact structures s, wherein the main contact 2 in the main contact structure m is provided with a main touch portion 2-0; the movable contacts 4 in the two groups of movable contact structures s are provided with a movable touch portion 4-1, respectively; the main touch portion 2-0 moves to be switched between two working positions, so as to be engaged with and disengaged from the two movable touch portions 4-1, respectively; that is, when the main touch portion 2-0 is engaged with one movable touch portion 4-1, the main touch portion 2-0 is disengaged from the other movable touch portion 4-1.

[0037] The contact systems in Mode A and Mode B are preferably applied to a rotary disconnecting switch, a circuit breaker, etc.

[0038] The contact system in Mode C is preferably applied to a change-over switch.

[0039] Further, the main contact structure m is disposed pivotally or disposed to move as a whole.

[0040] Further, the movable contact 4 is disposed pivotally or disposed to move as a whole.

[0041] Specifically, the main contact structure m and the movable contact structure s have the following four movement modes.

[0042] Mode 1: the main contact structure m is disposed pivotally, the movable contact 4 is disposed pivotally, and the main contact structure m rotates so that the main touch portion 2-0 and the movable touch portion 4-1 are engaged and disengaged, that is, the main contact 2 and the movable contact 4 are closed and disconnected; when the main contact structure m rotates from the closed position to the disconnected position, the main contact structure m rotates from the closed position to the intermediate position, and the main touch portion 2-0 drives the movable touch portion 4-1 to rotate around a rotation center of the movable contact 4, so that the entire movable contact 4 rotates, and the movable touch portion 4-1 rotates from the initial position to the disengaged position; meanwhile, the movable contact 4 enables the elastic member 6 store energy, and when the movable touch portion 4-1 rotates to the disengaged position, the elastic member 6 stores energy to the maximum; after the main touch portion 2-0 is disengaged from the movable touch portion 4-1, the elastic member 6 releases energy to drive the movable touch portion 4-1 to rotate from the disengaged position to the initial position; and meanwhile, the main contact structure m continues to rotate to the disconnected position, and the movable touch portion 4-1 rotates in the opposite direction to the main touch portion 2-0.

[0043] The following is an embodiment in Mode 1.

[0044] As shown in FIGS. 1-3, and 7, the main contact structure m is disposed pivotally, the movable contact 4 in the movable contact structure s is disposed pivotally, and the main contact structure m rotates such that the main touch portion 2-0 is engaged with and disengaged from the movable touch portion 4-1, that is, the main contact 2 and the movable contact 4 are closed and disconnected.

[0045] As shown in FIGS. 1-3, and 7, the middle of the movable contact 4 is disposed pivotally, the movable touch portion 4-1 is disposed at one end of the movable contact 4, and the other end of the movable contact 4 cooperates with the elastic member 6. Further, the elastic member 6 is a pressure spring, and the elastic member 6 and the main touch portion 2-0 are located on both sides of the movable contact 4, respectively.

[0046] As shown in FIGS. 1-3, and 7, the movable contact 4 further includes a movable contact limiting protrusion 4-3; the movable touch portion 4-1 and the movable contact limiting protrusion 4-3 are located at both ends of the movable contact 4, respectively; and the elastic member 6 is a pressure spring, one end of which is disposed to sleeve the movable contact limiting protrusion 4-3, and the other end is disposed on the housing 1.

[0047] As shown in FIGS. 1-3, and 7, the movable contact structure s further includes a movable contact shaft 5 which is disposed fixedly, and the movable contact 4 is disposed pivotally through the movable contact shaft 5. Further, the movable contact shaft 5 is fixedly disposed on the housing 1, and the movable contact 4 is provided with a movable contact shaft hole 4-2 for the movable contact shaft 5 to pass through.

[0048] As shown in FIGS. 1-3, and 7, the elastic member 6 is a pressure spring; the elastic member 6 acts on the movable contact 4, such that one end of the movable contact 4 provided with the movable touch portion 4-1 is abutted against a positioning stopper 1-0, that is, the movable touch portion 4-1 is kept at the initial position; and the positioning stopper 1-0 and the elastic member 6 are located on the same side of the movable contact 4. Further, the positioning stopper 1-0 is a retaining rib disposed on the housing 1.

[0049] As other embodiments, the elastic member 6 is a tension spring, and the positioning stopper 1-0 and the elastic member 6 are located on both sides of the movable contact 4. It should be pointed out that the arrangement position of the elastic member 6 may be adjusted by a person skilled in the art according to actual needs, and

the possible arrangement positions of the elastic member 6 will not be listed here.

[0050] As other embodiments, the positioning stopper 1-0 is canceled. Instead, the movable contact shaft 5 is provided with a shaft limiting plane, a hole limiting plane is disposed in the movable contact shaft hole 4-2 of the movable contact 4, and the elastic member 6 acts on the movable contact 4, such that the hole limiting plane is in limiting fit with the shaft limiting plane, and the movable contact 4 is positioned at the initial position. The hole limiting plane and the shaft limiting plane can be implemented by the prior art, and will not be described here. Of course, there are various other modes to position the movable contact 4 at the initial position under the action of the elastic member 6, which will not be described here one by one, but all fall within the protection scope of the present application.

[0051] Specifically, as shown in FIGS. 1-3, and 7, the main contact 2 includes two main touch portions 2-0 which are respectively disposed at both ends thereof. The two groups of movable contacts 4 are disposed pivotally on both radial sides of the main contact structure m, respectively. The main contact structure m rotates to be switched between the closed position and the disconnected position, such that the two main touch portions 2-0 are engaged with and disengaged from the movable touch portions 4-1 of the two movable contacts 4. The two groups of movable contact structures s are mutually centrosymmetric structures with a rotation center of the main contact structure m as a symmetry center. The two groups of movable contact structures s adopt a centrosymmetric structure, which is conducive to reducing the structure types and the production cost. Further, there is no need to discriminate the two groups of movable contact structures s during the installation process, which is conducive to improving the assembly efficiency. Further, the two groups of wiring terminals 8 are mutually centrosymmetric structures with the rotation center of the main contact structure m as a symmetry center.

[0052] Mode 2: the main contact structure m is disposed pivotally, the movable contact 4 is disposed to move as a whole on a preset plane, and the main contact structure m rotates so that the main touch portion 2-0 and the movable touch portion 4-1 are engaged and disengaged, that is, the main contact 2 and the movable contact 4 are closed and disconnected; when the main contact structure m rotates from the closed position to the disconnected position, the main touch portion 2-0 rotates from the closed position to the intermediate position, and the movable touch portion 4-1 enables the movable contact 4 to move as a whole, such that the movable contact 4 moves from the initial position 1 to the disengaged position; in this case, the elastic member 6 stores energy to the maximum; after the main touch portion 2-0 is disengaged from the movable touch portion 4-1, the elastic member 6 releases energy to drive the movable touch portion 4-1 to move back to the initial position; and meanwhile, the main contact structure m continues to rotate to the disconnected position.

[0053] The following is an embodiment in Mode 2.

[0054] As shown in FIGS. 10-13, the main contact structure m is disposed pivotally, the movable contact 4 is disposed to move as a whole on the preset plane, and the main contact structure m rotates such that the main touch portion 2-0 and the movable touch portion 4-1 are engaged and disengaged, that is, the main contact 2 and the movable contact 4 are closed and disconnected.

[0055] As shown in FIGS. 10-13, the movable contact 4 is disposed to move as a whole in an extension direction of the guide rail structure g which is disposed fixedly. Further, the guide rail structure g is preferably a linear guide rail structure, which is preferably disposed on the housing 1. Of course, the guide rail structure may also be an arc-shaped guide rail structure.

[0056] As shown in FIGS. 10-13, the elastic member 6 is a tension spring, and the elastic member 6 and the main touch portion 2-0 are located on both sides of the movable contact 4, respectively. Further, the movable contact 4 includes a movable contact hanging spring portion 4-5, one end of the elastic member 6 is hung on the movable contact hanging spring portion 4-5, and the other end of the elastic member 6 is disposed fixedly. Further, one end of the elastic member 6 which is fixedly disposed is fixed on the housing 1 through a spring fixing shaft 9. Further, a geometric axis of the elastic member 6 coincides with an extension path of the guide rail structure g.

[0057] As shown in FIGS. 10-13, the guide rail structure g includes guide rail walls 1-2 and a guide rail groove 1-1 formed between the two opposite guide rail walls 1-2. The movable contact 4 further includes a guide plate 4-4, the movable contact shaft 5 is slidably plugged into the guide rail groove 1-1, the guide plate 4-4 and the movable contact shaft 5 are respectively located on both sides of one guide rail wall 1-2, and the guide plate 4-4 and the movable contact shaft 5 make sliding contact with both sides of the guide rail wall 1-2. That is, the movable contact shaft 5 makes sliding contact with the inner side of the guide rail wall 1-2, and the guide plate 4-4 makes sliding fit with the outer side of the guide rail wall 1-2 to ensure that the movable contact 4 slides reliably and stably along the extension direction of the guide rail structure g. Further, the movable touch portion 4-1 and the guide plate 4-4 are located on both radial sides of the movable contact shaft 5, respectively. That is, the movable touch portion 4-1 and the guide plate 4-4 are respectively located at both ends of the movable contact 4, and a movable contact shaft hole 4-2 is provided in the middle of the movable contact 4.

[0058] As shown in FIGS. 10-13, the elastic member 6 is a tension spring; the elastic member 6 acts on the movable contact 4, such that the movable contact 4 is abutted against a positioning stopper 1-0. That is, the movable touch portion 4-1 of the movable contact 4 is kept at the initial position; and the positioning stopper 1-0 and the elastic member 6 are located on the same side of

the movable contact 4. Further, the positioning stopper 1-0 is a retaining rib disposed on the housing 1.

[0059] As other embodiments, the elastic member 6 is a pressure spring, and the elastic member 6 and the positioning stopper 1-0 are located on both sides of the movable contact 4. It should be pointed out that the arrangement position of the elastic member 6 may be adjusted by a person skilled in the art according to actual needs, and the possible arrangement positions of the elastic member 6 will not be listed here.

[0060] As other embodiments, the movable contact structure s is not provided with the positioning stopper 1-0. Instead, when the movable contact 4 is located at the initial position, the elastic member 6 acts on the movable contact 4, so that the movable contact shaft 5 is abutted against one end of the guide rail structure g.

[0061] In Mode 1 and Mode 2, the main contact structure m is disposed pivotally. Therefore, the main contact structure m may also be referred to as a rotary contact structure, the main contact 2 may also be referred to as a rotary contact, and the main touch portion 2-0 may also be referred to as a rotary touch portion.

[0062] Mode 3: the main contact structure m and the movable contact 4 are both disposed to move as a whole on the preset plane, and the movable contact structure m moves facing the movable contact 4 and in an opposite direction to the movable contact 4, so that the main touch portion 2-0 and the movable touch portion 4-1 are engaged and disengaged, that is, the main contact 2 and the movable contact 4 are closed and disconnected; when the main contact structure m moves from the closed position to the disconnected position, the main contact structure m moves from the closed position to the intermediate position, and the main touch portion 2-0 drives the movable contact 4 to move as a whole from the initial position to the disengaged position through the movable touch portion 4-1; meanwhile, the elastic member 6 stores energy to the maximum; after the main touch portion 2-0 is disengaged from the movable touch portion 4-1, the elastic member 6 releases energy to drive the movable touch portion 4-1 to move back to the initial position; and meanwhile, the main contact structure m continues to move to the disconnected position, and the main touch portion 2-0 moves in the opposite direction to the movable touch portion 4-1.

[0063] Mode 4: the main contact structure m is disposed to move as a whole on the preset plane, the movable contact 4 is disposed pivotally, and the main contact structure m moves as a whole close to and away from the movable contact 4, such that the main touch portion 2-0 and the movable touch portion 4-1 are engaged and disengaged, that is, the main contact 2 and the movable contact 4 are closed and disconnected; when the main contact structure m moves from the closed position to the disconnected position, the main contact structure m moves as a whole from the closed position to the intermediate position, and the main touch portion 2-0 drives the movable touch portion 4-1 to rotate around a rotation center of the movable contact 4, so that the entire movable contact 4 rotates; meanwhile, the movable contact 4 enables the elastic member 6 store energy, and when the movable touch portion 4-1 rotates to the disengaged position, the elastic member 6 stores energy to the maximum; the main contact structure m continues to move from the intermediate position to the disconnected position, such that the main touch portion 2-0 is disengaged from the movable touch portion 4-1; and the elastic member 6 releases energy to drive the movable touch portion 4-1 to rotate reversely and reset to the initial position, and the main contact structure m continues to move to the disconnected position.

[0064] In the switching device of the present invention, a movement mode of the main contact structure m and the movable contact structure s of the contact system is preferably Mode 1 or Mode 2. Further, in Mode 1 and Mode 2, the main contact structure m further includes a rotating shaft 3 which is disposed pivotally, the main contact structure m is disposed pivotally through the rotating shaft 3, the main contact 2 is plugged into the rotating shaft 3, and the main touch portion 2-0 protrudes from one radial side of the rotating shaft 3.

[0065] As shown in FIGS. 1-18, the main touch portion 2-0 makes plug-in fit with the movable touch portion 4-1. Therefore, the main touch portion 2-0 is engaged with the movable touch portion 4-1, which achieves a simple structure and reliable contact and is conducive to simplifying the structure. Further, the contact system further includes at least one group of plug-in structure. The plug-in structure includes a plug-in plate and a socket c, one of which is disposed on the main touch portion 2-0 and the other is disposed on the movable touch portion 4-1. The plug-in plate is disposed in the socket c and is clamped by an inner side wall of the socket c, such that the main touch portion 2-0 and the movable touch portion 4-1 are engaged. Further, the main contact 2 includes two main touch portions 2-0 disposed at both ends thereof, and the two main touch portions 2-0 cooperate with the movable touch portions 4-1 of the two groups of movable contacts 4.

[0066] Specifically, the main touch portions 2-0 make plug-in fit with the movable touch portions 4-1 through a group of plug-in structure.

[0067] A first setting mode of the plug-in structure is shown in FIGS. 1-6: the main touch portion 2-0 is a plug-in plate, a cross-section of the movable touch portion 4-1 is of a U-shaped structure, the socket c is formed in the middle of the U-shaped structure, and the plug-in plate is plugged into the socket. Further, the movable contact 4 is formed by bending a metal sheet, such that the cross-section of the formed movable touch portion 4-1 is of a U-shaped structure.

[0068] A second setting mode of the plug-in structure is shown in FIGS. 7-9: the main touch portion 2-0 includes two main contact blades 2-1 which are disposed oppositely, a socket c is formed between the two main contact blades 2-1, the movable touch portion 4-1 is a plug-in

plate, and the plug-in plate is plugged into the socket c and clamped by the inner side wall of the socket c. The main contact 2 includes two main contact plates which are spaced in parallel, namely a first main contact plate 2a and a second main contact plate 2b. The main contact blades 2-1 are disposed at both ends of the first main contact plate 2a and the second main contact plate 2b, respectively.

[0069] Specifically, the main touch portions 2-0 make plug-in fit with the movable touch portions 4-1 through multiple groups of plug-in structures. Further, the main touch portion 2-0 is provided with a plug-in plate and a socket c, which are a movable plug-in plate and a movable socket, and at least one side wall of the movable socket functions as the movable plug-in plate. The movable touch portion 4-1 is provided with a plug-in plate and a socket c, which are a static plug-in plate and a static socket, and at least one side wall of the static socket functions as the static plug-in plate. The main touch portion 2-0 makes plug-in fit with the movable touch portion 4-1, the movable plug-in plate is plugged into the static socket, the static plug-in plate is plugged into the movable socket, and the side wall of the movable socket and the side wall of the static socket are alternately arranged.

[0070] A third setting mode of the plug-in structure is shown in FIGS. 15-16: the main touch portion 2-0 includes two main contact blades 2-1 which are disposed oppositely, the two main contact blades 2-1 function as two movable plug-in plates, and a movable socket is formed between the two main contact blades; the movable touch portion 4-1 includes two static sockets, and the side wall between the two static sockets functions as a static plug-in plate; and when the main touch portion 2-0 is engaged with the movable touch portion 4-1, the two main contact blades 2-1 are respectively plugged into the two static sockets, the static plug-in plate is plugged into the movable socket, and two side walls on both sides of the two static sockets are clamped on both sides of the two main contacts 2-1. Further, the main contact 2 includes two main contact plates which are spaced in parallel, namely a first main contact plate 2a and a second main contact plate 2b, respectively. The main contact blades 2-1 are disposed at both ends of the first main contact plate 2a and the second main contact plate 2b, respectively.

[0071] A fourth implementation mode of the plug-in structure is shown in FIGS. 17-18: the main touch portion 2-0 includes three main contact blades 2-1 which are spaced side by side, a movable socket is formed between every two adjacent main contact blades 2-1, and the main contact blade 2-1 in the middle functions as the movable plug-in plate; a cross-section of the movable touch portion 4-1 is of a U-shaped structure, a socket c, which is a static socket, is formed in the middle of the U-shaped structure, and the side walls on both sides of the static socket function as static plug-in plates; and when the main touch portion 2-0 is engaged with the movable touch portion 4-1, one movable plug-in plate is plugged into the static socket, the two static plug-in plates are plugged into the two movable sockets, and the two main contact blades 2-1 are clamped on both sides of the movable touch portion 4-1. Further, the main contact 2 includes three main contact plates which are sequentially spaced side by side, namely a first main contact plate 2a, a third main contact plate 2c and a second main contact plate 2b. The main contact blades 2-1 are disposed at both ends of the three main contact plates, respectively. The main contact blade 2-1 of the second main contact plate 2c functions as the movable plug-in plate.

[0072] It should be pointed out that the engagement of the main touch portion 2-0 and the movable touch portion 4-1 is not limited to plug-in fit. For example, the main touch portion 2-0 may also cooperate with the movable touch portion 4-1 through a buckle structure. The buckle structure includes a first structure and a second structure which cooperate with each other. The first structure and the second structure which are in buckle fit are released from buckle fit when they are pulled by a predetermined external force. For example, the first structure and the second structure are two half-arrow clamping hooks which cooperate with each other; or the first structure is two elastic clamping arms disposed on the movable touch portion 4-1, each elastic clamping arm is of a >-shaped structure, and the tips of the >-shaped structures of the two elastic clamping arms are opposite to each other; and the second structure is two protrusions disposed on the main touch portion 2-0, and when the main contact 2 and the movable contact 4 are closed, the two protrusions enter between the free ends of the two elastic clamping arms, squeeze between the tips of the >-shaped structures of the two elastic clamping arms, and enter between the other ends of the two elastic clamping arms.

[0073] An embodiment of the rotary contact structure is shown in FIGS. 19-21.

[0074] In the rotary contact structure in the present embodiment, the rotating shaft 3 includes a rotating shaft seat 31 and a rotating shaft cover 33 that are spliced oppositely along its axial direction, and the rotary contact is clamped between the rotating shaft seat 31 and the rotating shaft cover 33 and includes at least one rotary touch portion which protrudes from the radial side of the rotating shaft 3 and cooperates with the movable contact 4. Further, the rotary contact includes two rotary touch portions disposed at both ends thereof. The two rotary touch portions are a first rotary touch portion and a second rotary touch portion, respectively. The two rotary touch portions are used to be closed with and disconnected from the two movable contacts 4 disposed on both radial sides of the rotary contact structure, respectively. The two movable contacts 4 are a first movable contact used to be closed with and disconnected from the first rotary touch portion and a second movable contact used to be closed with and disconnected from the second rotary touch portion, respectively. The rotary contact

structure and the two movable contacts 4 form a contact system with dual breakpoints, which is conducive to improving the disconnection capacity of the contact system and the switching device.

[0075] Further, the rotating shaft includes a plug portion 3p disposed at its radial end. The plug portion 3p is used to make plug-in transmission connection with an external structure. The plug portion 3p includes a main plug 33-2 and a secondary plug 31-1. The main plug 33-2 is disposed on a side of the rotating shaft cover 33 away from the rotating shaft seat 31. The secondary plug 31-1 is disposed on a side of the rotating shaft seat 31 facing the rotating shaft cover 33. The secondary plug 31-1 passes through a rotating shaft cover hole 33-1 of the rotating shaft cover 33 and forms the plug portion 3p side by side with the main plug 33-2. The "external structure" may be an output shaft of the operating mechanism; or the "external structure" refers to a plurality of rotary contact structures which are disposed in linkage side by side along their axial direction, and the plug portion 3p of one rotating shaft 3 makes plug-in transmission connection with the adjacent rotating shaft 3, so as to achieve the linkage of each rotary contact structure, that is, to achieve the synchronous closure and disconnection of each contact system. The plug portion 3p is composed of the main plug 33-2 disposed on the rotating shaft cover 33 and the secondary plug 31-1 disposed on the rotating shaft seat 31, which improves the structural strength of the plug portion 3p, ensures the reliability of its plug-in connection with the external structure, ensures the movement synchronization of the rotating shaft cover 33 and the rotating shaft seat 31 in the rotation process of the rotating shaft 3, and ensures the synchronization of the rotation of each rotary contact structure while being in plug-in connection with the adjacent rotating shaft 3. Further, a rotation axis of the rotating shaft 3 passes through the middle of the main plug 33-2, and the secondary plug 31-1 is spaced in parallel from the rotation axis of the rotating shaft 3. Further, the secondary plug 31-1 is spaced from the main plug 33-2. That is, a gap is provided between the secondary contact 31-1 and the main plug 33-2. The width of this gap can be adjusted according to actual needs.

[0076] Further, a cross-section of the main plug 33-2 is a long strip structure. A center point of the long strip structure is preferably located on the rotation axis of the rotating shaft 3. The length of the long strip structure is 20%-70% of a maximum outer diameter of the rotating shaft seat 31. Further, the length of the long strip structure is 25%-65% of the maximum outer diameter of the rotating shaft seat 31. Therefore, the structural strength of the main plug 33-2 is ensured, and the structural design of the rotating shaft cover 33 is facilitated.

[0077] Further, the rotating shaft 3 further includes a jack portion 3g disposed at its other axial end. The jack portion 3g is adapted to the plug portion 3p. That is, the shape of the jack portion 3g matches the shape of the plug portion 3p. The jack portion and the plug portion may make plug-in fit with each other when they are located on two different structures (e.g., two rotating shafts 3), respectively. When the plurality of rotary contact structures are arranged in linkage side by side along their axial direction, the plug portion 3p of one rotating shaft 3 in two adjacent rotating shafts 3 makes plug-in fit with the jack portion 3g of the other rotating shaft 3, thereby simplifying the connection structure and operation of each rotary contact structure, and ensuring the connection strength and movement consistency of each rotating shaft 3. Further, the jack portion 3g includes a main jack 31-5 and a secondary jack 31-6, the main jack 31-5 is adapted to the main plug 33-2, and the secondary jack 31-6 is adapted to the secondary plug 31-1. Further, the rotation axis of the rotating shaft 3 passes through the middle of the main jack 31-5, and the secondary jack 31-6 is spaced in parallel from the rotation axis of the rotating shaft 3. Further, the secondary jack 31-6 is spaced from the main jack 33-5. That is, a partition wall is provided between the secondary jack 31-6 and the main jack 33-5. The width of this partition wall can be adjusted according to actual needs.

[0078] Specifically, the plug portion 3p includes two groups of secondary plugs 31-1 and a group of main plugs 33-2, the two groups of secondary plugs 31-1 are respectively disposed on both sides of the main plug 33-2, and a gap is provided between the secondary plug 31-1 and the main plug 33-2. The jack portion 3g includes two groups of secondary jacks 31-6 and a group of main jacks 31-5, the two groups of secondary jacks 31-6 are respectively disposed on both sides of the main jack 31-5, and a partition wall is provided between the secondary jack 31-6 and the main jack 31-5.

[0079] As other embodiments, the plug portion 3p includes two groups of main plugs 33-2 and a group of secondary plugs 31-1, the rotation axis of the rotating shaft 3 (also the rotation axis of the rotary contact structure) passes through the middle of the secondary plug 31-1, the two groups of main plugs 33-2 are respectively disposed on both sides of the secondary plug 31-1, the rotating shaft cover 33 is provided with a rotating shaft cover hole 33-1 for the secondary plug 31-1 to pass through, and the rotating shaft cover hole 33-1 is located between the two groups of main plugs 33-2.

[0080] Further, in the radial direction of the rotating shaft 3, the two groups of secondary plugs 31-1 are symmetrically disposed on both sides of the main plug 33-2; and in the radial direction of the rotating shaft 3, the two groups of secondary jacks 31-6 are symmetrically disposed on both sides of the main jack 31-5.

[0081] Further, a cross-section of the secondary plug 31-1 is a fan-shaped structure. A pair of opposite side surfaces of the main plug 33-2 (i.e., two large side surfaces of the main plug 33-2, which face both sides of the two secondary plugs 31-1, respectively) are provided with a plurality of grooves extending along the axial direction of the rotating shaft 3, such that the cross-section of the main plug 33-2 is similar to a fishbone-

shaped structure. Therefore, when the plug portions 3p of the two adjacent rotating shafts 3 cooperate with the jack portions 3g, the linkage and synchronization of the two rotating shafts 3 are ensured. A cross-section of the secondary jack 31-6 is a fan-shaped structure. Further, the side surfaces of the main jack 31-5, which face the two secondary jacks 31-6 respectively, are provided with convex ribs (not shown) extending along the axial direction of the rotating shaft 3. The convex ribs are adapted to the grooves.

[0082] Further, the rotating shaft cover 33 further includes a cover plate 33-0. The main plug 33-2 is disposed on a side of the cover plate 33-0 away from the rotating shaft seat 31 (also on a side of a seat body 31-0 of the cover plate 33-0 away from the rotating shaft seat 31). The cover plate 33-0 is provided with two groups of rotating shaft cover holes 33-1. The two groups of rotating shaft cover holes 33-1 are respectively provided on both sides of the main plug 33-2 for the two groups of secondary plugs 31-1 to pass through. The rotating shaft seat 31 further includes a seat body 31-0. The secondary plug 31-1 is disposed on a side of the seat body 31-0 facing the rotating shaft cover 33 (also a side of the seat body 31-0 facing the cover plate 33-0). The cover plate 33-0 is preferably of a circular plate structure, and the seat body 31-0 is preferably of a cylindrical structure.

[0083] Further, the jack portion 3g is disposed on a side of the seat body 31-0 away from the rotating shaft cover 33 (also on a side of the seat body 31-0 away from the cover plate 33-0). Further, the rotating shaft seat 31 further includes an axial protrusion. The axial protrusion is disposed on a side of the seat body 31-0 away from the rotating shaft cover 33. The axial protrusion and the plug portion 3p protrude in opposite directions along a circumferential direction of the rotating shaft 3, respectively. The jack portion 3g is disposed on the axial protrusion.

[0084] As shown in FIGS. 3-5, the rotating shaft 3 further includes a buckle structure. The rotating shaft seat 31 is connected to the rotating shaft cover 33 through the buckle structure, which simplifies the assembly operation between the rotating shaft seat 31 and the rotating shaft cover 33 and improves the assembly efficiency.

[0085] Further, the buckle structure includes a clamping hook 33-3 and a clamping hole 31-2. The clamping hook 33-3 is disposed on a side of the rotating shaft cover 33 facing the rotating shaft seat 31. The clamping hole 31-2 is provided on the rotating shaft seat 31. Further, the clamping hook 33-3 is disposed on a side of the cover plate 33-0 facing the rotating shaft seat 31, and the clamping hole 31-2 is provided on the seat body 31-0. Further, the clamping hook 33-3 is a half-arrow clamping hook.

[0086] Specifically, as shown in FIG. 5, the rotating shaft seat 31 and the rotating shaft cover 33 are connected through four groups of buckle structures, and the four groups of buckle structures are located at four vertices of a quadrilateral. It should be pointed out that the number of the buckle structures can be increased or decreased as needed.

[0087] The rotary contact further includes a rotary contact trunk clamped between the rotating shaft seat 31 and the rotating shaft cover 33, and the rotary touch portion is connected to the rotary contact trunk. Further, the two rotary touch portions are respectively connected to both ends of the rotary contact trunk and are respectively located on both radial sides of the rotating shaft 3.

[0088] The rotating shaft seat 31 is provided with a rotating shaft seat groove 31-3 for accommodating the rotary contact trunk. The rotary contact trunk is disposed in the rotating shaft seat groove 31-3. The rotating shaft cover 33 and the rotating shaft seat 31 are spliced to clamp the rotating contact trunk. Further, the rotary contact makes limiting fit with the rotating shaft 3 to prevent the rotary contact 32 from moving along the radial direction of the rotating shaft 3, resulting in the failure of the closure of the rotary touch portion and the movable contacts 4. Specifically, the rotating contact further includes a rotary contact limiting portion disposed on the rotary contact trunk. The rotary contact limiting portion makes limiting fit with the side wall of the rotating shaft seat groove 31-3 to prevent the rotary contact from moving along an extension direction of the rotating shaft seat groove 31-3, that is, to prevent the rotary contact from moving along the radial direction of the rotating shaft 3. Further, the rotary contact limiting portion is an arc-shaped protrusion disposed on a side edge of the rotary contact trunk, and the side wall of the rotating shaft seat groove 31-3 is provided with a corresponding matching arc-shaped groove. Further, the rotating shaft seat groove 31-3 is disposed at one end of the seat body 31-0 of the rotating shaft seat 31 facing the rotating shaft cover 33. Further, the rotating shaft seat groove 31-3 is disposed at one end of the seat body trunk 31-00 of the seat body 31-0 facing the rotating shaft cover 33.

[0089] Further, the seat body 31-0 of the rotating shaft seat 31 includes a seat body trunk 31-00 and a seat body end plate 31-01 which are disposed coaxially. An axis of the seat body trunk 31-00 and the seat body end plate 31-01 coincides with the rotation axis of the rotating shaft 3. An outer diameter of the seat body trunk 31-00 is less than an outer diameter of the seat body end plate 31-01. The secondary plug 31-1 is disposed on a side of the seat body trunk 31-00 facing the rotating shaft cover 33. The cover plate 33-0 of the rotating shaft cover 33 and the seat body end plate 31-01 are opposite to each other and located outside both axial ends of the seat body trunk 31-00. The cover plate 33-0 has the same outer diameter as the seat body end plate 31-01. The main plug 33-2 is disposed on a side of the end plate 33-0 away from the rotating shaft seat 31. The rotary touch portion is at least partially located between the seat body end plate 31-01 and the cover plate 33-0. That is, a circular groove located on the outer circumferential side of the seat body trunk 31-00 is formed between the seat body end plate 31-01 and the cover plate 33-0. The rotary touch portion

is at least partially located in the annular groove and is obscured by the seat body end plate 31-01 and the cover plate 33-0. Avoidance notches 31-010 for avoiding the movable contacts 4 is disposed at the edge of the seat body end plate 31-01 and/or the cover plate 33-0. During assembly, the movable contact 4 can enter between the seat body end plate 31-01 and the cover plate 33-0 through the avoidance notch 31-010 to cooperate with the rotary touch portion located in the annular groove, thereby simplifying the assembly operation. Specifically, the seat body end plate 31-01 is provided with two avoidance notches 31-010. The two avoidance notches 31-010 are located at both radial ends of the seat body end plate 31-01 and are respectively used to avoid the movable contacts 4 that cooperate with the two rotary touch portions of the rotary contact.

[0090] It should be explained that, in the description of the present invention, the terms such as "up", "down", "left", "right", "inner" and "outer" indicating the directional or positional relations on the basis of the directional or positional relations shown in the drawings are only used for conveniently describing the present invention and simplifying the description, not indicate or imply that the referred devices or elements must have a specific orientation and be configured and operated in a specific direction; therefore, they cannot be construed as a limitation on the present invention.

[0091] 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 contact system, comprising a main contact structure (m) and at least one group of movable contact structure (s), wherein the main contact structure (m) comprises a main contact (2); the main contact (2) comprises at least one main touch portion (2-0); the movable contact structure (s) comprises a movable contact (4); the movable contact (4) comprises a movable touch portion (4-1); when the main contact (2) is located at a closed position, the main touch portion (2-0) and the movable touch portion (4-1) are engaged to enable the main contact (2) and the movable contact (4) to be closed;

   the movable contact structure (s) further comprises an elastic member (6) cooperating with the movable contact (4); and
   in the disconnection process of the main contact (2) from the movable contact (4), when the main touch portion (2-0) drives the movable touch portion (4-1) to move from an initial position to a disengaged position, the elastic member (6) stores energy, such that the main contact (2) continues to move, and the elastic member (6) releases energy to drive the movable touch portion (4-1) to reset to the initial position.

2. The contact system according to claim 1, wherein the main contact structure (m) is disposed pivotally or disposed to move as a whole.

3. The contact system according to claim 2, wherein the main contact structure (m) is disposed pivotally and is a rotary contact structure; the main contact (2) is a rotary contact; the main touch portion (2-0) is a rotary touch portion; when the rotary contact is located at a closed position, the rotary touch portion and the movable touch portion (4-1) are engaged to enable the rotary contact and the movable contact (4) to be closed; and in the disconnection process of the rotary contact from the movable contact (4), when the rotary touch portion drives the movable touch portion (4-1) to move from an initial position to a disengaged position, the elastic member (6) stores energy, such that the rotary contact continues to move, the elastic member (6) releases energy to drive the movable touch portion (4-1) to reset to the initial position, and the main touch portion (2-0) and the movable touch portion (4-1) move away from each other.

4. The contact system according to claim 3, wherein the contact system comprises two groups of movable contact structures (s); the rotary contact comprises two rotary touch portions disposed at both ends thereof respectively; and when the rotary contact is located at the closed position, the two rotary touch portions are respectively engaged with the two movable touch portions (4-1) to enable the rotary contact and the movable contact (4) to be closed.

5. The contact system according to claim 1, wherein the movable contact (4) is disposed rotatably or disposed to move as a whole.

6. The contact system according to claim 5, wherein the middle of the movable contact (4) is disposed pivotally; the movable touch portion (4-1) is disposed at one end of the movable contact (4), and the other end of the movable contact (4) cooperates with the elastic member (6); and the movable contact (4) rotates so that the movable touch portion (4-1) is switched between the initial position and the disengaged position.

7. The contact system according to claim 5, wherein the movable contact (4) moves as a whole within a

preset plane, and the movable contact (4) moves as a whole so that the movable touch portion (4-1) is switched between the initial position and the disengaged position.

8. The contact system according to claim 7, wherein the movable contact structure (s) further comprises a guide rail structure (g), and the movable contact (4) is disposed to move as a whole along an extension direction of the guide rail structure (g).

9. The contact system according to claim 8, wherein the movable contact structure (s) further comprises a movable contact shaft (5) which is disposed fixedly; the movable contact (4) comprises a guide plate (4-4); a guide rail structure (g) comprises guide rail walls (1-2) and a guide rail groove (1-1) formed between two opposite guide rail walls (1-2); the movable contact shaft (5) is slidably plugged into the guide rail groove (1-1); and the guide plate (4-4) and the movable contact shaft (5) are disposed on both sides of one guide rail wall (1-2), respectively.

10. The contact system according to claim 9, wherein the movable contact shaft (5) and the guide plate (4-4) make sliding contact with both sides of the corresponding guide rail wall (1-2), respectively.

11. The contact system according to claim 3, wherein the rotary contact structure further comprises a rotating shaft (3) which is disposed pivotally; the rotary contact is plugged into the rotating shaft (3), and both ends of the rotary contact protrude from both radial sides of the rotating shaft (3), respectively; and
the two groups of movable contact structures (s) are mutually centrosymmetric structures with a rotation center of the rotary contact structure as a symmetry center.

12. The contact system according to claim 1, wherein the main touch portion (2-0) makes plug-in fit with the movable touch portion (4-1), such that the main contact structure (m) and the movable contact structure (s) are closed.

13. The contact system according to claim 12, wherein the contact system further comprises at least one group of plug-in structure; the plug-in structure comprises a plug-in plate and a socket (c), one of which is disposed on the main touch portion (2-0) and the other is disposed on the movable touch portion (4-1); and the plug-in plate is plugged into the socket (c) and is clamped by an inner side wall of the socket (c), such that the main touch portion (2-0) and the movable touch portion (4-1) are engaged.

14. The contact system according to claim 3, wherein the rotary contact structure further comprises a rotating shaft (3) which is disposed to rotate around its own axis; the rotating shaft (3) comprises a rotating shaft seat (31) and a rotating shaft cover (33) which are spliced oppositely in its axial direction; the rotating contact is clamped between the rotating shaft seat (31) and the rotating shaft cover (33) and comprises rotary touch portions which are disposed on both radial sides of the rotating shaft (3) and cooperate with the movable contact (4); the rotating shaft (3) further comprises a plug portion (3p) disposed at its axial end; the plug portion (3p) comprises a main plug (33-2) and a secondary plug (31-1); the main plug (33-2) is disposed on one side of the rotating shaft cover (33) away from the rotating shaft seat (31); the secondary plug (31-1) is disposed on one side of the rotating shaft seat (31) facing the rotating shaft cover (33); the secondary plug (31-1) passes through a rotating shaft cover hole (33-1) of the rotating shaft cover (33) and is disposed side by side with the main plug (33-2); the rotating shaft (3) further comprises a jack portion (3g) disposed at its other axial end; and the jack portion (3g) is adapted to the plug portion (3p).

15. A switching device, the switching device comprising the contact system according to any one of claims 1 to 14.

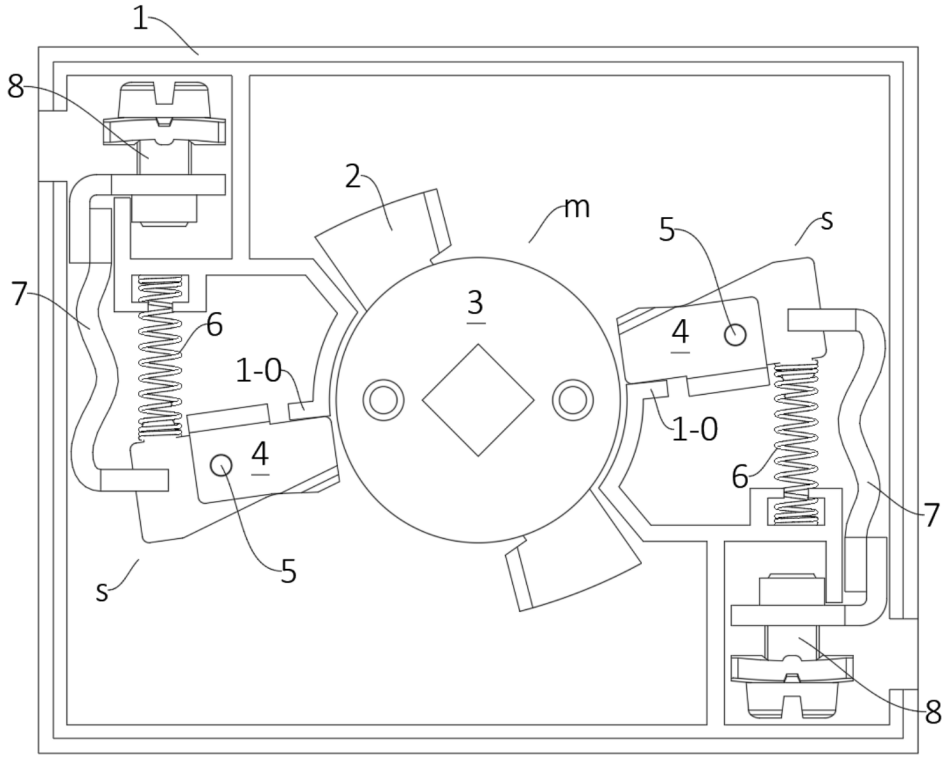

FIG. 1

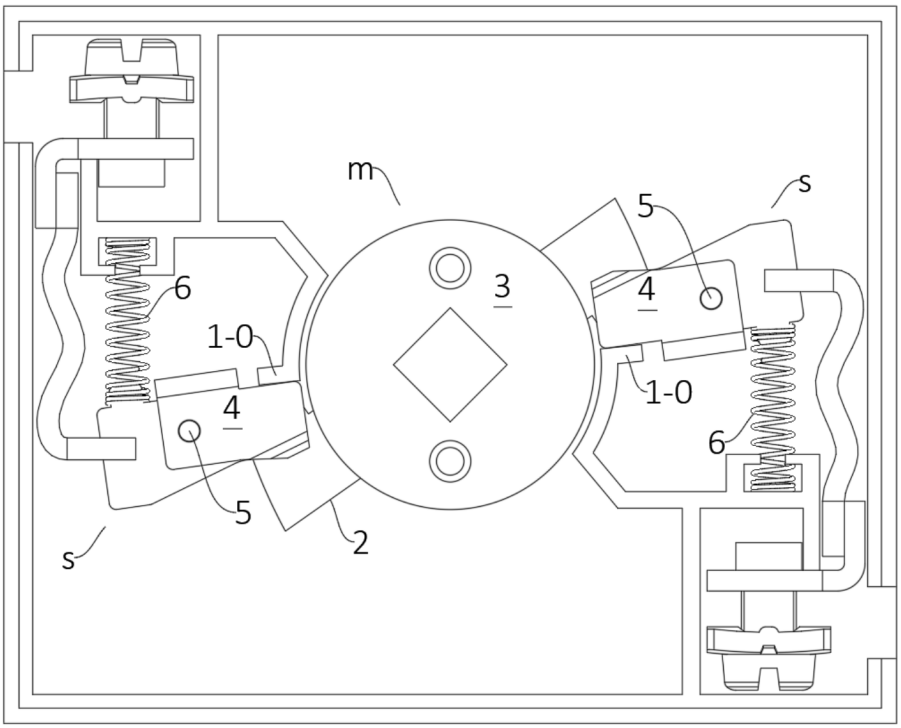

FIG. 2

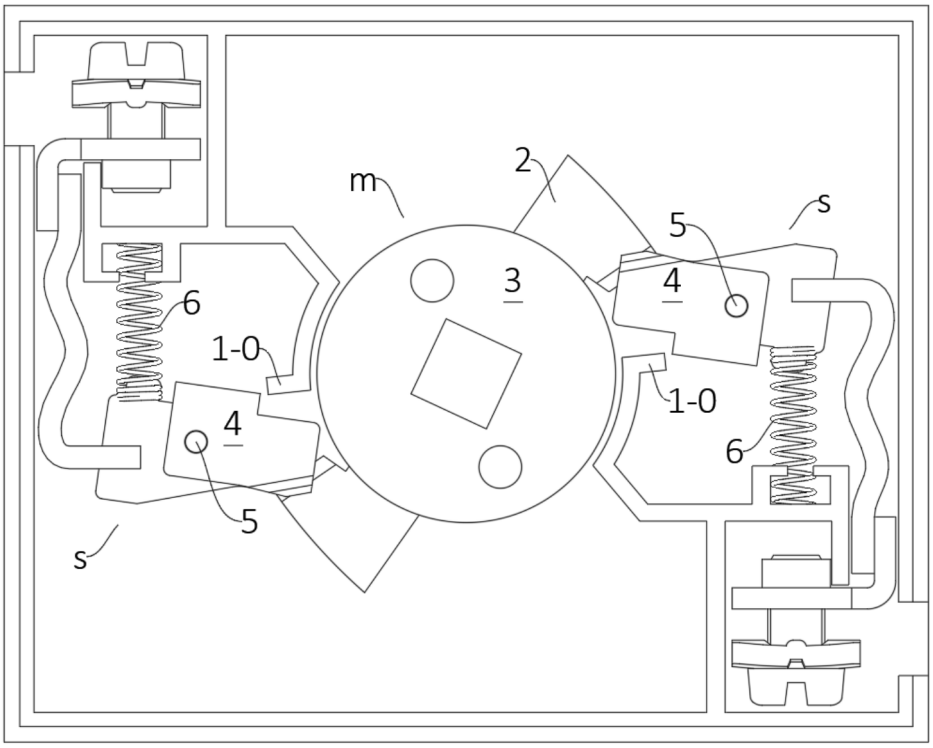

FIG. 3

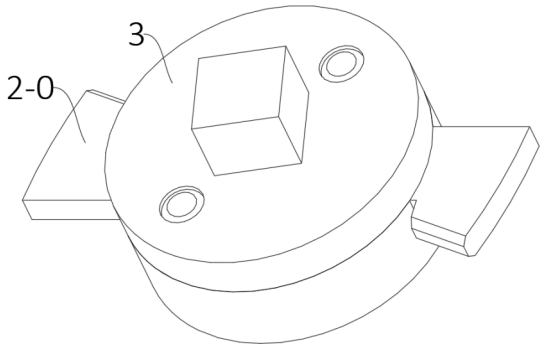

FIG. 4

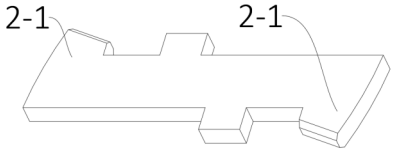

FIG. 5

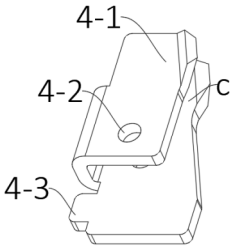

FIG. 6

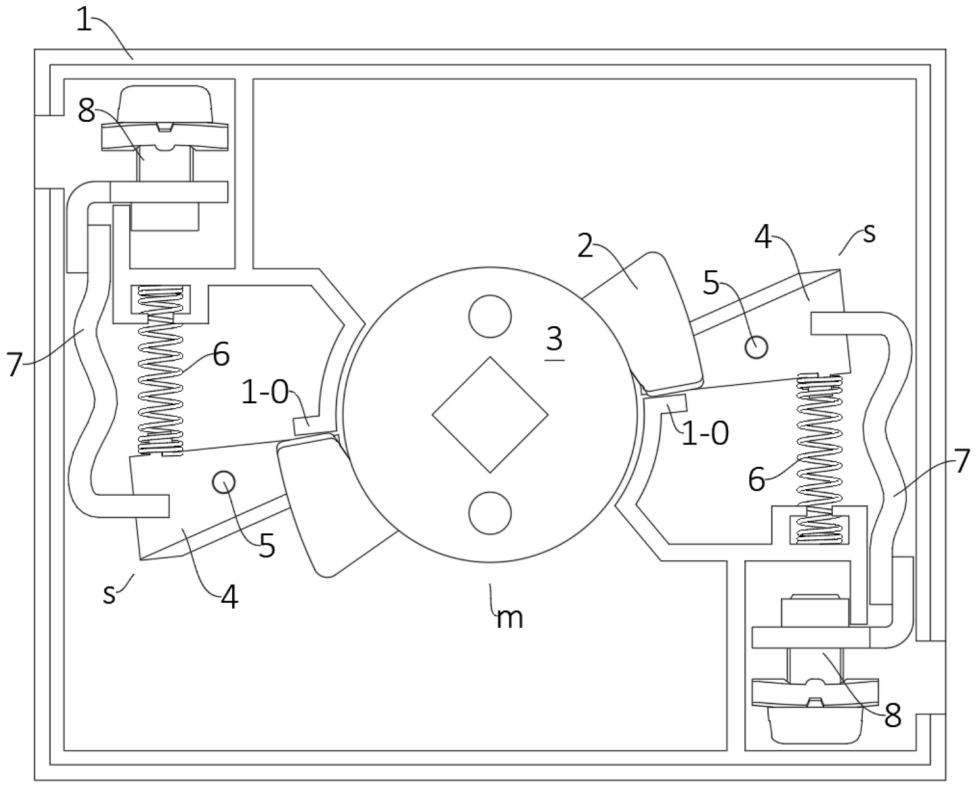

FIG. 7

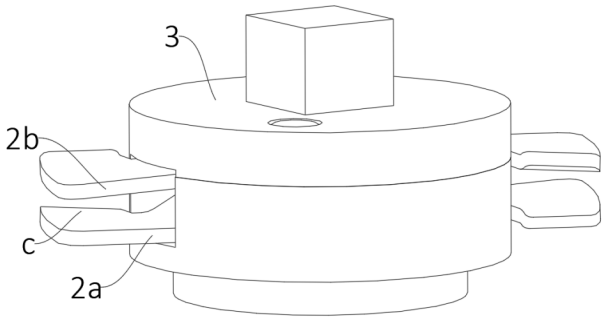

FIG. 8

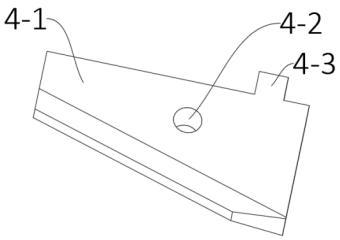

FIG. 9

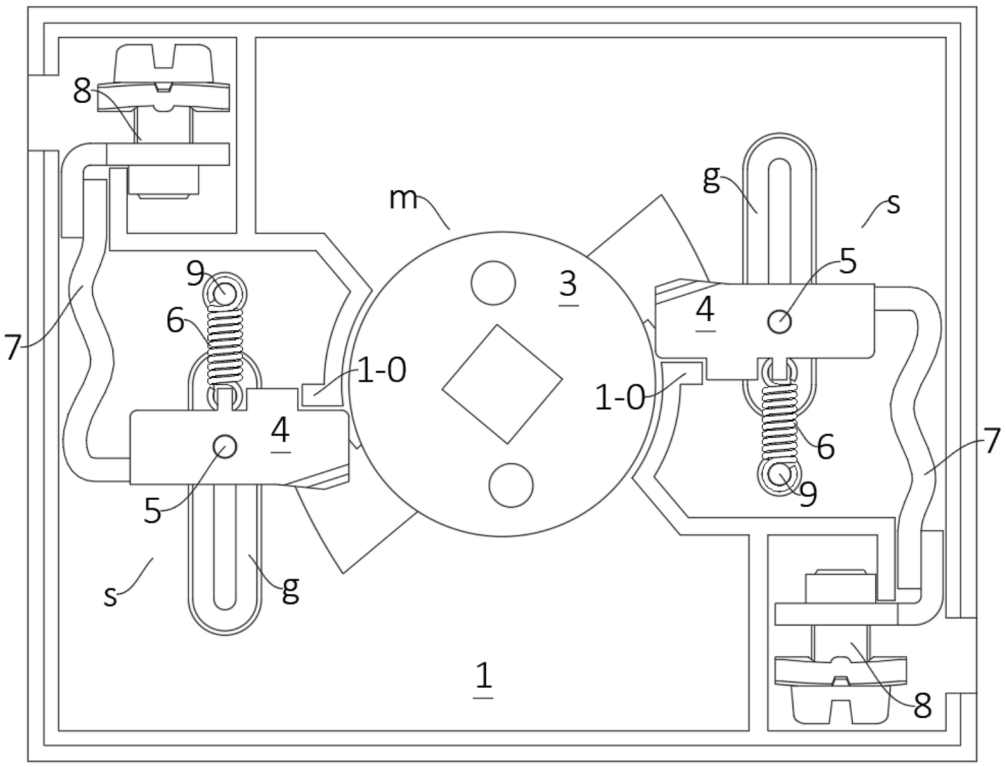

FIG. 10

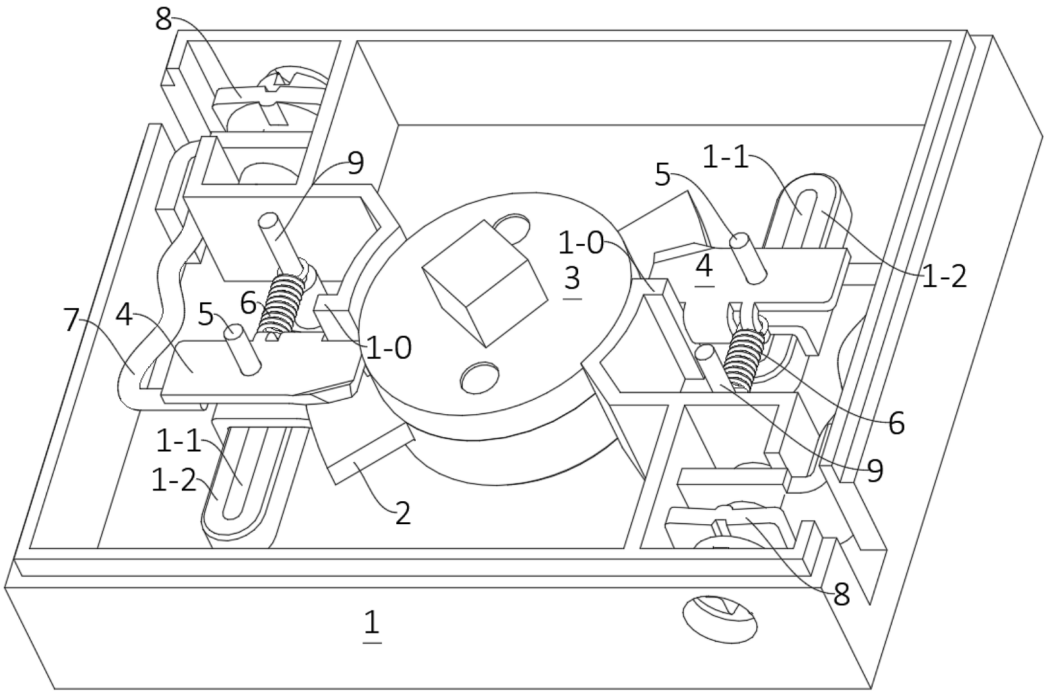

FIG. 11

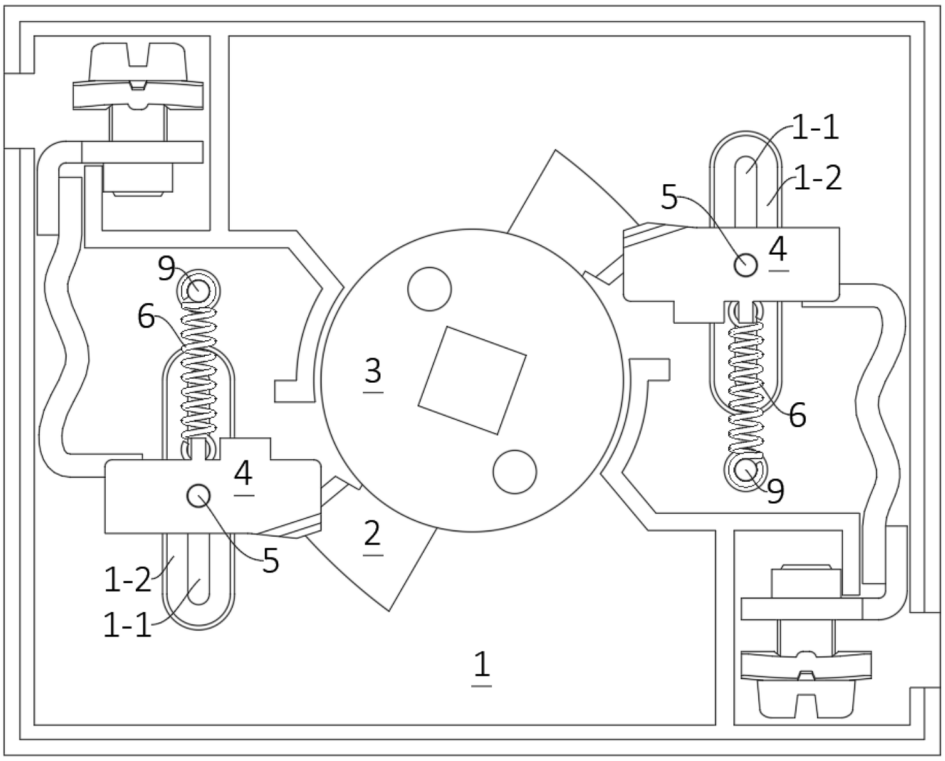

FIG. 12

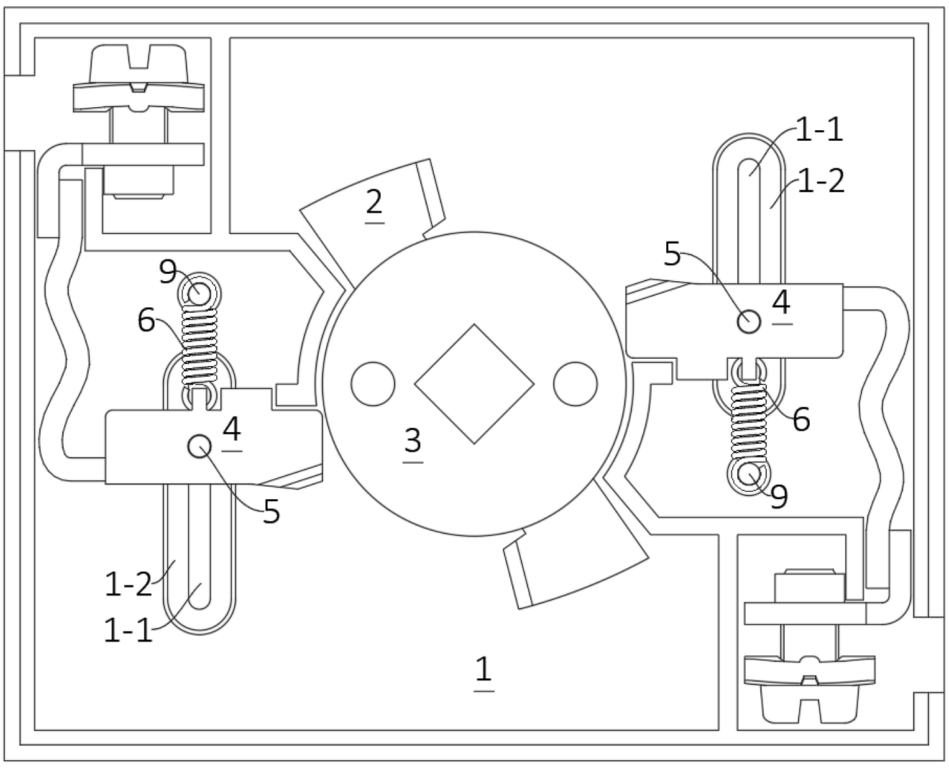

FIG. 13

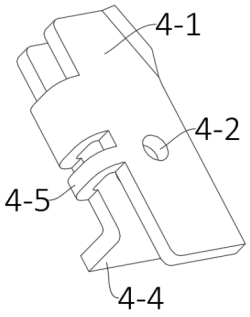

FIG. 14

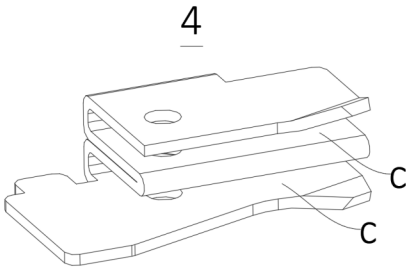

FIG. 15

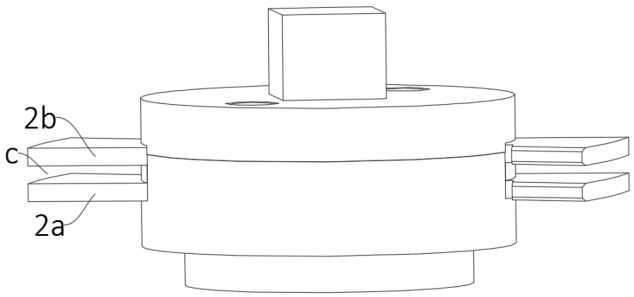

FIG. 16

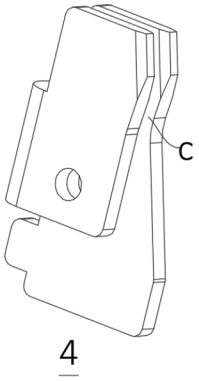

FIG. 17

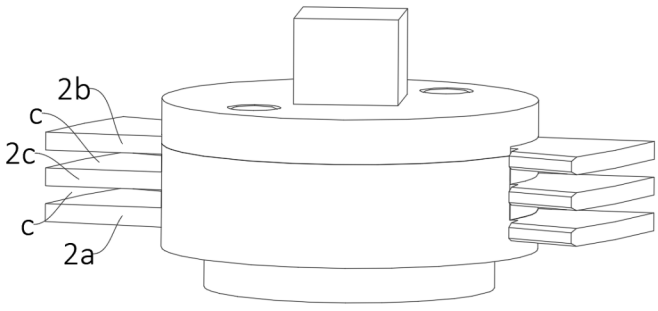

FIG. 18

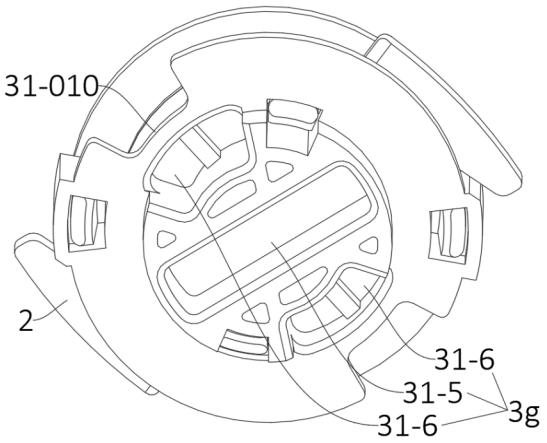

FIG. 19

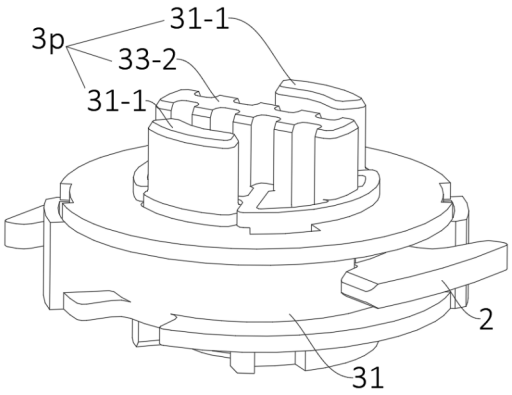

FIG. 20

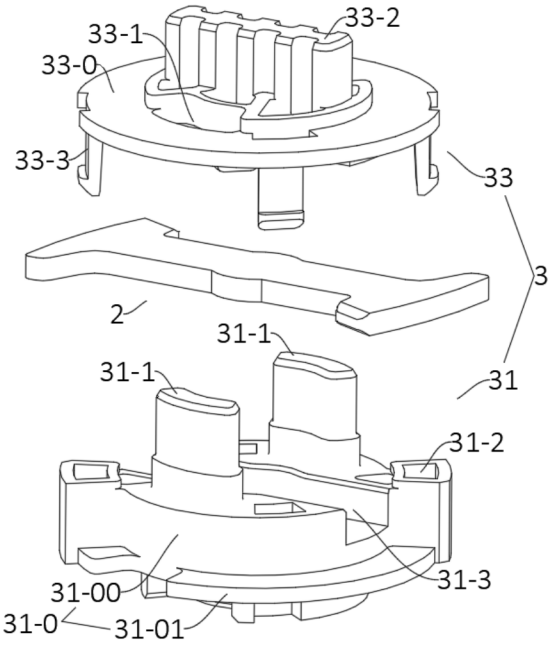

FIG. 21

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2024/103285

A. CLASSIFICATION OF SUBJECT MATTER

H01H50/54(2006.01)i; H01H50/60(2006.01)i; H01H19/14(2006.01)i; H01H19/04(2006.01)i; H01H9/30(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)

IPC: 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, VEN, CNTXT, WOTXT, EPTXT, USTXT, CNKI, IEEE: 开关, 接触, 触头, 触点, 弹性件, 弹簧, 储能, 蓄能, 分断, 脱离, 动作, switch, contact+, elastic, spring, energy storage, break+, act+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 220710172 U (SHANGHAI CHINT INTELLIGENT TECHNOLOGY CO., LTD.) 02 April 2024 (2024-04-02) description, paragraphs 57-78, and figures 3-7	1-6, 11-15
PX	CN 220774234 U (SHANGHAI CHINT INTELLIGENT TECHNOLOGY CO., LTD.) 12 April 2024 (2024-04-12) description, paragraphs 58-102, and figures 1-18	1-13, 15
A	CN 207966821 U (SHENYANG SIWO ELECTRICAL EQUIPMENT CO., LTD.) 12 October 2018 (2018-10-12) description, paragraphs 24-32, and figures 1-7	1-15
A	CN 208077849 U (ZHEJIANG CHINT ELECTRICS CO., LTD.) 09 November 2018 (2018-11-09) entire document	1-15
A	CN 101958211 A (SHANGHAI NOARK ELECTRIC CO., LTD.) 26 January 2011 (2011-01-26) entire document	1-15

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

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"E" earlier application or patent but published on or after the international filing date
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"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
23 September 2024	**09 October 2024**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2024/103285

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2016181031 A1 (REDARC TECHNOLOGIES PTY LTD.) 23 June 2016 (2016-06-23) entire document	1-15

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2024/103285

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 220710172 U	02 April 2024	None	
CN 220774234 U	12 April 2024	None	
CN 207966821 U	12 October 2018	None	
CN 208077849 U	09 November 2018	None	
CN 101958211 A	26 January 2011	CN 101958211 B	19 December 2012
US 2016181031 A1	23 June 2016	AU 2015268682 A1	07 July 2016
		AU 2015268682 B2	23 July 2020
		US 9805885 B2	31 October 2017

Form PCT/ISA/210 (patent family annex) (July 2022)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202310823656 **[0001]**
- CN 202321758907 **[0001]**