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(54) ELECTROMAGNETIC RELAY

(57) An electromagnetic relay, includes a base (1) and a magnetic circuit part (2), the magnetic circuit part (2) includes a bobbin (21) equipped with an iron core (25) and an enameled wire (24), an armature (23) and a yoke (22) connected to the iron core (25), the bobbin (21) is disposed horizontally on the base (1), the armature (23) is arranged at a knife edge of the yoke (22) and is cooperated with a pole surface (251) of the iron core (25), the electromagnetic relay further includes at least three groups of contact units distributed side by side, each group of contact units respectively includes a movable spring part (3) and a stationary spring part (4), the movable spring part (3) and the stationary spring part (4) are respectively arranged on the base (1) and cooperate with each other correspondingly, the armature (23) is connected to the movable spring part (3) of each of the contact unit through the pushing card (5) to drive the movable spring part (3) to move. The electromagnetic relay of the present disclosure not only suitable for three-phase alternating current, but also has a monostable function, and can use the pushing card (5) to achieve mandatory guidance, thereby improving the safety performance of the present disclosure.

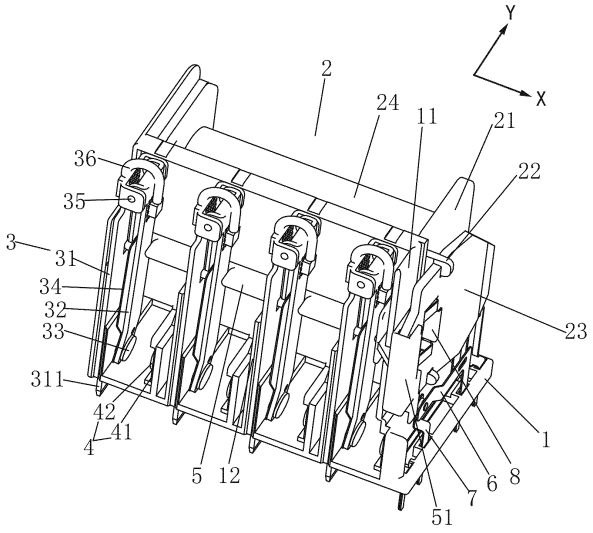

FIG.1

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of an electromagnetic relay, and in particular, to an electromagnetic relay that can be applied to three-phase alternating current.

BACKGROUND

[0002] Relay is an automatic switching element with isolation function, which is widely used in home appliances, remote control, telemetry, communication, automatic control, mechatronics and power electronic equipment and is one of the most important control elements. It plays the role of automatic adjustment, safety protection, and conversion circuit in the control circuit. Electromagnetic relay is a kind of relay that uses electromagnetic force to drive relative movement of mechanical parts to produce a predetermined response. It is generally composed of a magnetic circuit part, a movable spring part, a stationary spring part, a base and a case. The magnetic circuit part includes an iron core, a bobbin wound with an enameled wire, an armature, a yoke, etc. When the coil (i.e., enameled wire) is energized, electromagnetic force is generated, and the armature is attracted and contacts the pole surface at one end of the iron core, thereby driving the movable contacts of the movable spring part contact or separate from the stationary contacts of the stationary spring part; when the current in the coil disappears, the electromagnetic force disappears, and the armature is reset and separated from the pole surface of one end of the iron core, so that the movable contacts of the movable spring part and the stationary contacts of the stationary spring part are separated or contacted. Through the contact or separation of the movable contact and the stationary contact, the purpose of conducting or cutting off the circuit is achieved.

[0003] Electromagnetic relays of related art are generally suitable for single-phase circuits, and only a few electromagnetic relays are suitable for three-phase alternating current. However, some of these electromagnetic relays do not have the function of monostable state, and some do not have the function of forced guidance.

SUMMARY

[0004] According to one aspect of the present disclosure, an electromagnetic relay is provided. The electromagnetic relay includes a base and a magnetic circuit part, the magnetic circuit part includes a bobbin equipped with an iron core and an enameled wire, an armature and a yoke connected to the iron core, the bobbin is disposed horizontally on the base, the armature is disposed at a knife edge of the yoke and is cooperated with a pole surface of the iron core, the electromagnetic relay further includes at least three groups of contact units distributed side by side, each group of contact units respectively includes a movable spring part and a stationary spring part, the movable spring part and the stationary spring part are respectively arranged on the base and cooperate with each other correspondingly, the armature is connected to the movable spring part of each of the contact units through the pushing card to drive the movable spring part to move.

[0005] Further, the magnetic circuit part and each of the contact units are located in different cavities of the base.

[0006] Further, the lead-out terminal of the movable spring part and the lead-out terminal of the stationary spring part are located at opposite ends of the base.

[0007] Further, one end of the pushing card is provided with an insulating connector, the connector is provided with an insertion slot, and one end of the armature away from the pole surface of the iron core is inserted into the insertion slot and is enclosed by the insertion slot.

[0008] Further, a part where the armature cooperates with the pole surface of the iron core is bent toward a side away from the iron core to form an oblique shape.

[0009] Further, the movable spring part is configured to be a structure capable of resisting short-circuit current, the movable spring part comprises a movable spring lead-out sheet, a rigid spring and a flexible connector, the movable spring lead-out sheet is inserted into the base, and a bottom of the movable spring lead-out sheet forms a lead-out terminal of the movable spring part, a top of the rigid spring is rotatably connected with the movable spring lead-out sheet, so that the rigid spring is capable of rotating in a direction away from or close to the movable spring lead-out sheet, a flexible connector is further connected between the top of the rigid spring and a top of the movable spring lead-out sheet; a movable contact is provided at a bottom of the rigid spring on the side opposite to the movable spring lead-out sheet; the pushing card is provided with a plurality of slots at intervals along a length direction of the base, and the plurality of slots correspond to the at least three groups of movable spring parts in a one-to-one correspondence, the rigid spring of each of the movable spring parts is respectively clamped in a corresponding slot.

[0010] Further, the movable spring part 3 further comprises a reaction force spring, the reaction force spring is located between the movable spring lead-out sheet and the rigid spring, and a bottom of the reaction force spring is fixedly connected to the rigid spring, there is a predetermined distance between a top of the reaction force spring and the rigid spring, and the top of the reaction force spring is clamped in the slot.

[0011] Further, the pushing card is provided with a limiting member at one end facing the armature, and the limiting member cooperates with a first partition wall provided on the base to resist a pushing stroke of the pushing card, the first partition wall is located between the armature and the contact unit adjacent to the armature; an end of the pushing card away from the armature coop-

erates with the movable spring lead-out sheet furthest away from the armature to limit the reset stroke of the pushing card.

[0012] Further, the electromagnetic relay further includes an auxiliary movable spring provided with an auxiliary movable contact and an auxiliary stationary spring provided with an auxiliary stationary contact, the auxiliary movable spring and the auxiliary stationary spring are respectively inserted into the base and located on a side of the base where the armature is located; the pushing card or the armature is provided with a driving part cooperating with the auxiliary movable spring to drive the auxiliary movable spring to move; an action state of the auxiliary movable spring is opposite to an action state of the movable spring part.

[0013] Further, a return spring is inserted between the yoke and the base, the return spring restricts the armature and provides the armature to reset; the bobbin is located in a length direction of the base, and the at least three groups of contact units are distributed along the length direction of the base, and the movable spring part of each of the contact units are respectively vertical, and are distributed along a width direction of the base with the bobbin, the pushing card is located in the length direction of the base, the pushing card is limited in an up and down direction by a second partition wall provided on the base between adjacent contact units.

[0014] Compared with related art, the present disclosure has the following beneficial effects:

1. The electromagnetic relay of the present disclosure further includes at least three groups of contact units distributed side by side, each group of contact unit respectively includes a movable spring part and a stationary spring part, and the movable spring part and the stationary spring part are respectively arranged on the base and cooperate with each other correspondingly, the armature is connected to the movable spring part of each contact unit through the pushing card to drive the movable spring part to move, so that the electromagnetic relay of the present disclosure not only suitable for three-phase alternating current, but also has a monostable function, and can use the pushing card to achieve mandatory guidance, thereby improving the safety performance of the present disclosure.

2. Because the magnetic circuit part and the contact units are respectively located in different cavities of the base, the creepage distance and air gap between the magnetic circuit part and the contact unit and between the adjacent contact units of the present disclosure are relatively large, thereby further improving the safety performance of the electromagnetic relay of the present disclosure.

3. The lead-out terminal of the movable spring part and the lead-out terminal of the stationary spring part are located at opposite ends of the base, which can avoid that the lead-out terminal of the movable spring part and the lead-out terminal of the stationary spring part are located at the same side, resulting in congested space, inconvenient wiring and prone to short circuits. Thereby, the safety performance of the electromagnetic relay of the present disclosure is further improved.

4. One end of the pushing card is provided with an insulating connector, and the connector is provided with an insertion slot, the end of the armature away from the pole surface of the iron core is inserted into the insertion slot and is enclosed by the insertion slot, which not only realizes the connection and fixation of the pushing card and the armature, but also can use the connector to increase the creepage distance between the armature and the contact unit. Thereby further improving the safety performance of the electromagnetic relay of the present disclosure.

5. The part where the armature cooperates with the pole surface of the iron core is bent toward a side away from the iron core to form an oblique shape. In this way, the angle of rotation of the armature is greater, so that the stroke of the pushing card 5 is greater. Therefore, the contact gap between the movable spring part and the stationary spring part in the open state is larger, so that the safety performance of the electromagnetic relay of the present disclosure in the open state can be improved.

6. The movable spring part is configured to be a structure which is capable of resisting short-circuit current, so that the electromagnetic relay of the present disclosure also has the function of anti-short circuit current.

7. The electromagnetic relay of the present disclosure also includes an auxiliary movable spring provided with an auxiliary movable contact and an auxiliary stationary spring provided with an auxiliary stationary contact, so that the electromagnetic relay of the present disclosure also has the function of monitoring the action state of the contact unit.

[0015] According to another aspect of the present disclosure, an electromagnetic relay is provided. The electromagnetic relay includes a body, a magnetic circuit part, a contact part, and a pushing card, the magnetic circuit part, the contact part, and the pushing card are respectively installed in the body, the armature of the magnetic circuit part cooperates with a movable spring part of the contact part in linkage through the pushing card; the pushing card is located between the movable spring part and an inner side surface of the body, the pushing card includes a pushing rod that cooperates with the movable spring part and a pushing block that is disposed at one end of the pushing rod and cooperates with the armature, the pushing block is located in the extending direction of the length of the pushing rod.

[0016] Further, the body is further provided with a limiting structure which limits the movement of the pushing card toward the inner side surface.

[0017] Further, the body includes a case and a base, and the base serves as a carrier for the magnetic circuit part and the contact part, the case is connected to the base and contains the magnetic circuit part, the contact part and the pushing card, and the inner side surface is provided on the case; the limiting structure is provided on the base.

[0018] Further, the limiting structure includes at least two limiting components, and each of the limiting components is respectively mounted on the base and limits and protects the pushing card; the base is provided with a retaining wall located between the movable spring part and the magnetic circuit part, each of the limiting components is respectively mounted on the retaining wall, and each of the limiting components is partially blocked on a side of the pushing card close to the inner side surface.

[0019] Further, the retaining wall is provided with a plurality of mounting portions, and at least one end of each of the limiting components is respectively interference-fitted and inserted into a socket provided in the corresponding mounting portion; the limiting component is U-shaped.

[0020] Further, the pushing rod is provided with a first slot for snap-fitting with the movable spring part, and the pushing block is provided with a second slot for snap-fitting with the armature, the notch of the first slot and the notch of the second slot are respectively located on a side of the pushing card facing away from the inner side surface.

[0021] Further, the pushing rod is provided with at least one group of reinforcing structure, the reinforcing structure includes a plurality of reinforcing ribs spaced apart along a length direction of the pushing rod, and each of the reinforcing ribs is located at a width direction of the pushing rod, respectively.

[0022] Further, the movable spring part is provided with a limiting groove for restricting the up and down movement of the pushing card, the limiting groove is respectively penetrated at both ends in the length direction of the pushing rod, and the pushing card is clamped in the limiting groove.

[0023] Further, two opposite sides of the second slot are respectively provided with a first limiting rib and a second limiting rib which are extend in a vertical direction, the surfaces of the first limiting rib and the second limiting rib are arc-shaped, a portion of the armature located in the second slot fits between the first limiting rib and the second limiting rib on two sides of the second slot; there are a plurality of first slots, and the plurality of the first slots are distributed along the length direction of the pushing rod; the movable spring part includes a movable spring lead-out sheet, a rigid spring and a reaction force spring, the movable spring lead-out sheet is mounted on the body, an upper end of the rigid spring is rotatably connected with an upper end of the movable spring lead-out sheet, a movable contact is provided at a lower end of the rigid spring, and a lower end of the reaction force spring is fixed on a side of the rigid spring facing away from the movable contact, and there is a gap between the upper end of the reaction force spring and the rigid spring, the upper end of the reaction force spring and the rigid spring are respectively clamped in the first slot; the pushing rod is provided with a relief groove for avoiding the movable spring lead-out sheet.

[0024] Further, the magnetic circuit part includes an armature, a coil assembly and a yoke connected to the coil assembly, the coil assembly is lying in the body and is arranged side by side with the movable spring part, the armature is movably arranged at a knife edge of the yoke and is fitly installed outside one end of the coil assembly in an axial direction of the coil assembly, and one end of the armature facing an inner side surface is connected to the pushing card 5; there are a plurality of movable spring parts, and the plurality of movable spring parts are distributed at intervals along the length direction of the pushing card.

[0025] Compared with related art, the present disclosure has the following beneficial effects:

1. The pushing card is located between the movable spring part and an inner side surface of the body, and the pushing card includes a pushing rod cooperated with the movable spring part and a pushing block provided at one end of the pushing rod and cooperated with the armature, the pushing block is located in the extending direction of the length of the pushing rod, so that not only the pushing card is more convenient to install, but also the force points of the pushing card and the movable spring part and the force points of the pushing card and the armature are located or substantially located on the same straight line, therefore, the pushing card is not easily deformed during the working process, and the entire electromagnetic relay will not be reduced in service life due to the quality of the pushing card.
2. The setting of the limiting structure can prevent the pushing card from moving in the direction facing the inner side surface, thereby improving the stability of the electromagnetic relay and reducing the failure rate. This is because the inner side surface can limit the position of the pushing card at room temperature, however, the case will expand and contract under extremely high and low temperatures, and the dimensions of the body will fluctuate to a certain extent, if the limiting structure is not provided, the pushing card will easily slide out toward the inner side surface, thereby affecting the electrical and mechanical parameters of the relay. In addition, in the present disclosure, the pushing card is pre-positioned through the limiting structure, so that the relay is more convenient for subsequent assembly. The limiting structure includes the limiting component, which makes the installation of the pushing card more convenient.

The limiting component is installed on the retaining

wall, not only does not interfere with the contact part, but also enables the dimensions of the limiting component to be made smaller, saving materials. In particular, the limiting component is interference-fitted with the mounting portion provided on the retaining wall of the base, so that the limiting component is convenient to install.

4. The pushing rod is provided with the reinforcing structure, so that the pushing card has better strength and is less likely to be deformed.

5. The limiting slot can limit the pushing card in the up and down direction, so that the working state of the pushing card is more stable.

[0026] Hereinafter, the present disclosure will be further described in detail with reference to the accompanying drawings and embodiments; however, an electromagnetic relay applicable to three-phase alternating current of the present disclosure is not limited to the embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

FIG. 1 is a first schematic perspective diagram of an electromagnetic relay (showing the front side, without housing) according to an exemplary embodiment of the present disclosure.

FIG. 2 is a second schematic perspective diagram of an electromagnetic relay (showing the back side, without housing) according to an exemplary embodiment of the present disclosure.

FIG. 3 is a front view (without housing) of an electromagnetic relay according to an exemplary embodiment of the present disclosure.

FIG. 4 is a top view (without housing) of an electromagnetic relay according to an exemplary embodiment of the present disclosure.

FIG. 5 is a right view (without housing) of an electromagnetic relay according to an exemplary embodiment of the present disclosure.

FIG. 6 is a schematic structural diagram of a pushing card according to an exemplary embodiment of the present disclosure.

FIG. 7 is a schematic structural diagram of a restoring spring according to an exemplary embodiment of the present disclosure.

FIG. 8 is an exploded schematic diagram of an electromagnetic relay according to another exemplary embodiment of the present disclosure.

FIG. 9 is a top view of an electromagnetic relay according to another exemplary embodiment of the present disclosure.

FIG. 10 is a cross-sectional view taken along line A-A of FIG. 9.

FIG. 11 is a schematic perspective diagram of an electromagnetic relay (without case) according to another exemplary embodiment of the present disclosure.

FIG. 12 is a schematic perspective diagram of a base according to another exemplary embodiment of the present disclosure.

FIG. 13 is a schematic perspective diagram of a limiting component according to another exemplary embodiment of the present disclosure.

FIG. 14 is a first schematic perspective diagram of a pushing card according to another exemplary embodiment of the present disclosure.

FIG. 15 is a second schematic perspective diagram of a pushing card according to another exemplary embodiment of the present disclosure.

FIG. 16 is a front view of an electromagnetic relay (without the case) according to another exemplary embodiment of the present disclosure.

FIG. 17 is a top view of an electromagnetic relay (without the case) according to another exemplary embodiment of the present disclosure.

FIG. 18 is an enlarged schematic diagram of part B in FIG. 17.

FIG. 19 is a side view of an electromagnetic relay (without the case) according to another exemplary embodiment of the present disclosure.

DETAILED DESCRIPTION

[0028] According to one aspect of the present disclosure, an electromagnetic relay is provided, which can be applied to three-phase alternating current. Please refer to FIGS. 1 to 6, an electromagnetic relay applicable to three-phase alternating current of the present disclosure includes a base 1, a magnetic circuit part 2, and a housing (not shown in the figure), the magnetic circuit part 2 includes a bobbin 21 equipped with an iron core 25 and an enameled wire 24, an armature 23, and a yoke 22 connected to the iron core 25, the bobbin 21 is disposed horizontally on the base 1 and extends along the length direction X of the base 1, the armature 23 is arranged at the knife edge of the yoke 22 and is cooperated with the pole surface 251 of the iron core 25. The iron core 25 is inserted into the bobbin 21 with its two ends exposed, and the enameled wire 24 is wound around the bobbin 21, as shown in FIGS. 2 and 4, the yoke 22 is L-shaped and includes a first yoke portion 221 and a second yoke portion 222. The first yoke portion 221 is perpendicular to the second yoke portion 222, the first yoke portion 221 is fixedly connected to the end of the iron core 25 away from the armature 23 (or, it can also be integrally formed), and the second yoke portion 222 is fitted on the side of the bobbin 21. The electromagnetic relay of the present disclosure also includes at least three groups of contact units distributed side by side, each group of contact units respectively includes a movable spring part 3 and a stationary spring part 4, and the movable spring part 3 and the stationary spring part 4 are respectively arranged on the base 1 and cooperate with each other correspond-

ingly; the armature 23 is connected to the movable spring part 3 of each contact unit through the pushing card 5 to drive the movable spring part 3 to move. The bobbin 21 is specifically located on the base 1 and distributed along the length direction X of the base 1, and the at least three groups of contact units are distributed along the length direction X of the base 1, and the movable spring part 3 of each contact unit is respectively vertical, and are distributed along the width direction Y of the base 1 with the bobbin 21, and the pushing card 5 is arranged along the length direction X of the base 1. The number of the contact units is specifically four groups, but is not limited to this. The housing connects with the base 1, and the magnetic circuit part 2 and the contact units are contained in the housing cavity.

[0029] In this embodiment, the magnetic circuit part 2 and each of the contact units are respectively located in different cavities of the base 1. As shown in FIGS. 1 and 2, the lead-out terminal 311 of the movable spring part 3 and the lead-out terminal 411 of the stationary spring part 4 are located on opposite sides of the base 1. Specifically, the lead-out terminal 311 of the movable spring part 3 and the lead-out terminal 411 of the stationary spring part 4 are located on opposite sides of the base 1 in the width direction Y, in this way, it can be avoided that the lead-out terminals 311 of the movable spring parts 3 and the lead-out terminals 411 of the stationary spring parts 4 are located at the same side, resulting in congested space, inconvenient wiring and prone to short circuits.

[0030] In this embodiment, as shown in FIG. 1, the end of the pushing card 5 close to the armature 23 is integrally formed with an insulating connector 51, as shown in FIG. 6, the connector 51 is provided with an insertion slot 511, and the end of the armature 23 away from the pole surface 251 of the iron core 25 is inserted into the insertion slot 511 and is enclosed by the insertion slot 511. Specifically, as shown in FIG. 6, the insertion slot 511 is U-shaped with at least one end closed, and two opposite slot walls are respectively provided with convex ribs 512, and the surface of each of the convex ribs 512 is arc-shaped. The end of the armature 23 away from the iron core 25 is inserted into the insertion slot 511 to achieve transitional fit with the rib 512, thereby restricting the end of the armature 23 away from the iron core 25 from coming out.

[0031] In this embodiment, the armature 23 is roughly in a shape of a section of a line, and the part where the armature 23 cooperates with the pole surface 251 of the iron core 25 is bent toward a side away from the iron core 25 to form an oblique shape, as shown in FIG. 4. So that the angle of rotation of the armature 23 is greater, so that the stroke of the pushing card 5 is greater. Therefore, the contact gap between the movable spring part 3 and the stationary spring part 4 in the open state is larger, so that the safety performance of the electromagnetic relay of the present disclosure in the open state can be improved.

[0032] In this embodiment, the movable spring part 3 is designed to be a structure capable of resisting short-circuit current, and includes a movable spring lead-out sheet 31 and a movable spring, the movable spring lead-out sheet 31 is inserted into the base 1 and the bottom thereof forms a lead-out terminal 311 of the movable spring part 3, the top of the movable spring is connected with the top of the movable spring lead-out sheet 31, and a movable contact 33 is provided at the bottom of the movable spring at the side facing away from the movable spring lead-out sheet 31. The movable spring is specifically a rigid spring 32 as shown in FIG. 1, but is not limited to this. In other embodiments, the movable spring may also be a resilient spring, the top of the movable spring is fixedly connected to the top of the movable spring lead-out sheet.

[0033] In the embodiment of the present disclosure, the movable spring is used as the rigid spring 32 for description. The top of the rigid spring 32 is rotatably connected with the top of the movable spring lead-out sheet 31 so that the rigid spring 32 can rotate in a direction away from or close to the movable spring lead-out sheet 31. Specifically, as shown in FIG. 1, the top of the rigid spring 32 and the top of the movable spring lead-out sheet 31 are connected by a rotating shaft 35, and a flexible connector 36 is further connected between the top of the rigid spring 32 and the top of the movable spring lead-out sheet 31. As shown in FIGS. 1 and 6, the pushing card 5 is provided with a plurality of slots 54 at intervals along its length direction, and the plurality of slots 54 correspond to the at least three groups of the movable spring parts 3 in a one-to-one correspondence, the movable spring (i.e., the rigid springs 32) of the movable spring parts 3 are respectively clamped in the corresponding slots 54.

[0034] In this embodiment, as shown in FIGS. 1 and 3, the movable spring part 3 further includes a reaction force spring 34, the reaction force spring 34 is located between the movable spring lead-out sheet 31 and the rigid spring 32, and the bottom of the reaction force spring 34 is fixedly connected to the rigid spring 32, there is a predetermined distance between the top of the reaction force spring 34 and the rigid spring 32, and the top of the reaction force spring 34 is clamped in the slot 54. In this way, when the pushing card 5 is pushed, the reaction force spring 34 is pushed to push the rigid spring 32 to move in the direction close to the stationary spring part 4, thereby generating an overstroke. In this embodiment, the bottom of the rigid spring 32 is bent into an oblique shape toward the side away from the stationary spring part 4, which is beneficial to further increase the contact gap between the movable spring part 3 and the stationary spring part 4 in the cut-off state. The movable spring lead-out sheet 31 of each movable spring part 3 are respectively provided with a relief groove for avoiding the pushing card 5. As shown in FIG. 3, the pushing card 5 is provided with a limiting member 53 at one end facing the armature 23, and the limiting member 53 cooperates with the first partition wall 11 provided on the base 1 to resist

the pushing stroke of the pushing card 5, the first partition wall 11 is located between the armature 23 and the contact unit adjacent to the armature 23. The end of the pushing card 5 away from the armature 23 cooperates with the movable spring lead-out sheet 31 furthest away from the armature 23 to limit the reset stroke of the pushing card 5. The pushing stroke refers to the stroke generated by the movement of the pushing card 5 driven by the armature 23 when the armature 23 is attracted to the pole surface 251, the reset stroke refers to the stroke generated by the movement of the pushing card 5 driven by the armature 23 when the armature 23 is separated from the pole surface 251 of the iron core 25. When the limiting member 53 is in contact with the first partition wall 11, the pushing card 5 is pushed to the extreme position, when the end of the pushing card 5 away from the armature 23 is in contact with the movable spring lead-out sheet 31 furthest away from the armature 23, the pushing card 5 is reset to the extreme position. The pushing card 5 is limited in the up and down direction by the second partition wall 12 provided on the base 1 between the adjacent contact units. Specifically, the second partition wall 12 is broken into upper and lower parts at the position of the pushing card 5, which is used to avoid the pushing card 5 and limit the pushing card 5 in the up and down direction, at the same time, the lower part of the second partition wall 12 can support the pushing card 5.

[0035] In this embodiment, as shown in FIG. 2, the electromagnetic relay of the present disclosure further includes an auxiliary movable spring 6 provided with an auxiliary movable contact and an auxiliary stationary spring 7 provided with an auxiliary stationary contact, both them are respectively inserted into the base 1 and located on the side of the base 1 where the armature 23 is located; the pushing card 5 is provided with a driving part 52 which cooperates with the auxiliary movable spring 6 to drive the auxiliary movable spring 6 to move; the action state of the auxiliary movable spring 6 is opposite to the action state of the movable spring part 3. That is, when the movable spring part 3 moves in the direction of attracting and engaging with the stationary spring part 4, the auxiliary movable spring 6 moves in the direction of disconnecting from the auxiliary stationary spring 7, when the movable spring part 3 moves in the direction of disconnecting from the stationary spring part 4, the auxiliary movable spring 6 moves in the direction of attracting and engaging with the auxiliary stationary spring 7. The driving part 52 is specifically located at the bottom of the connector 51. In other embodiments, the driving part 52 is provided on the armature 23.

[0036] In this embodiment, as shown in FIGS. 1-2 and 8, a return spring 8 is inserted between the yoke 22 and the base 1, the return spring 8 restricts the armature 23 and can reset the armature 23. Specifically, as shown in FIGS. 2 and 5, the armature 23 is provided with a through slot 231 between its rotation fulcrum 232 and its an end away from the iron core 25, the return spring 8 includes a first bending portion 81 and a second bending portion 82, the first bending portion 81 extends in a direction away from the pushing card 5, the first bending portion 81 passes through the through slot 231 and rests on the side of the armature 23 facing away from the iron core 25 (i.e., the outer side of the armature 23), so as to further limit the armature 23 and prevent the armature 23 from falling off. The second bending portion 82 of the return spring 8 extends in a direction close to the pushing card 5, the second bending portion 82 passes through the through slot 231 of the armature 23 and then rests on the side of the armature 23 facing away from the iron core 25 (i.e., the outer side of the armature 23) to provide the armature 23 for resetting.

[0037] In this embodiment, as shown in FIG. 2, the stationary spring part 4 includes a stationary spring 41 and a stationary contact 42, the stationary spring 41 is inserted into the bottom of the base 1 from one side of the base 1 along the width direction Y of the base 1, and a stationary contact 42 is provided at one end of the stationary spring 41 facing the movable spring part 3, the end of the stationary spring away from the movable spring part 3 extends below the base 1 to form the lead-out terminal 411 of the stationary spring part 4. The movable spring lead-out sheet 31 is also inserted into the base 1 from the side of the base 1 along the width direction Y of the base 1.

[0038] The electromagnetic relay of the present disclosure can be applied to a three-phase alternating current, and can be applied to a three-phase four-wire circuit, and each group of contact units can reach a current-carrying capacity of 40A, and can resist a short-circuit current of 3 kA.

[0039] When the coil (i.e., the enameled wire 24) is energized, the armature 23 rotates around the knife edge of the yoke 22 (the knife edge is the notch at the end of the second yoke portion 222 away from the first yoke portion 221, and the notch is used to insert the armature 23), attracts and engages with the pole surface 251 of the iron core 25, and at the same time drives the pushing card 5 to move along the length direction X of the base 1, and drives the reaction force spring 34 and the rigid spring 32 of the movable spring part 3 to move to realize the movable contact 33 and the stationary contact 42 are in a close state. When the movable contact 33 and the stationary contact 42 just come into contact, the reaction force spring 34 begins to be plastically deformed, after the armature 23 is in full contact with the pole surface 251 of the iron core 25, the deformation of the reaction force spring 34 ends, and the overstroke is mainly realized by the elastic deformation of the reaction force spring 34. The rigid spring 32 is only responsible for conducting electricity, and is not responsible for deforming to achieve the over-travel function. When the coil (i.e., the enameled wire 24) is de-energized, the armature 23 is reset under the action of the return spring 8, and at the same time drives the pushing card 5 to move in the opposite direction, and drives the reaction force spring 34 and the rigid spring 32 of each movable spring part 3 to move in the

opposite direction, so that the movable contact 33 and the stationary contact 42 are in a cut-off state. When the movable contact 33 of one group of the movable spring part 3 and the corresponding stationary contact are stuck, the pushing card 5 cannot be reset, so that the movable contacts 33 of the remaining groups of the movable spring parts 3 cannot be disconnected from the corresponding stationary contacts, thereby achieving a forced guiding function.

[0040] The disconnection between the auxiliary movable contact and the auxiliary stationary contact is realized by the driving part 52 of the pushing card 5 pushing the head of the auxiliary movable spring 6. The connection between the auxiliary movable contact and the auxiliary stationary contact is realized by the reaction force of the auxiliary movable spring 6. High insulation is achieved between the auxiliary contact part and the main contact part (namely contact unit). The auxiliary contact part can monitor the state of the main contact part, no matter which main contact is stuck, the auxiliary contact can't be closed, so as to realize the blocking function.

[0041] When the current is short-circuited, Holm force will be generated on the surfaces of the movable contact 33 and the stationary contact 42, and the Holm force will cause the movable contact 33 and the stationary contact 42 to repel and separate; the U-shaped structure formed by the movable spring lead-out sheet 31, the movable spring 32 and the flexible connector 36 will generate Lorentz force, the Lorentz force will cause the movable contact 33 to move closer to the stationary contact 42, thereby restricting the movable contact 33 and the stationary contact 42 from repelling each other and separating.

[0042] In order to solve the problem of the easy deformation of the pushing card, and improve the stability of the electromagnetic relay, reduce the failure rate, according to another aspect of the present disclosure, an electromagnetic relay is provided. Please refer to FIGS. 8-19. An electromagnetic relay of the present disclosure includes a body, a magnetic circuit part, a contact part, and a pushing card 5. The body includes a case 9 and a base 1. The magnetic circuit part, the contact part, and the pushing card 5 are respectively installed in the body, and the contact part includes a movable spring part 3 and a stationary spring part 4, the armature 23 of the magnetic circuit part cooperates with the movable spring part 3 of the contact part in linkage through the pushing card 5. As shown in FIG. 10, the pushing card 5 is arranged horizontally, and the pushing card 5 is located between the movable spring part 3 and an inner side surface 91 of the case 9. As shown in FIG. 8, the pushing card 5 includes a pushing rod 55 that cooperates with the movable spring part 3 and a pushing block 56 that cooperates with the armature 23 and is disposed at one end of the pushing rod 55, the pushing block 56 is located in the extending direction of the length of the pushing rod 55. In this way, it not only makes the installation of the pushing card 5 easier, but also makes the part (i.e., the pushing rod 55) where the pushing card 5 cooperates with the movable spring part 3 and the part (i.e., the pushing block 56) where the pushing card 1 cooperates with the armature 23 are not stagger, therefore, it is possible to realize that the force points of the pushing card 5 and the movable spring part 3 and the force points of the pushing card 5 and the armature 23 are located or substantially located on the same straight line.

[0043] In this embodiment, the body includes a case 9 and a base 1, and the base 1 serves as a carrier for the magnetic circuit part and the contact part, the case 9 is connected to the base 1 and contains the magnetic circuit part, the contact part and the pushing card 5, and the inner side surface 91 is provided on the case 9. There are a plurality of movable spring part 3 and a plurality of stationary spring parts 4, and the plurality of movable spring parts and the plurality of stationary spring parts are arranged in a one-to-one correspondence, and the plurality of movable spring parts 3 are distributed at intervals along the length direction of the pushing card 5, and the plurality of movable spring parts 3 are distributed at intervals along the length direction of the pushing card 5. The magnetic circuit part specifically includes the armature 23, the coil assembly 20 and the yoke 22 connected to the coil assembly 20, the coil assembly 20 is lying on the base 1 and extends along the length direction X of the base 1, and is movably arranged at the knife edge of the yoke 22 with the armature 23, the armature 23 is fitly installed outside one end of the coil assembly 20 in the axial direction, and the end of the armature 23 facing the inner side surface is connected to the pushing card 5. Specifically, the coil assembly 20 and the pushing card 5 are respectively located in the length direction X of the base 1, the coil assembly 20 and the movable spring part 3 are distributed along the width direction Y of the base 1. The coil assembly 20 specifically includes an iron core 25, an enameled wire 24, and a bobbin 21. The bobbin 21 is lying on the base 1. The iron core 25 is inserted into the bobbin 21 with its two ends exposed, and the enameled wire 24 is wound around the bobbin 21. As shown in FIG. 17, the yoke 22 is L-shaped, and includes a first yoke portion 2212 and a second yoke portion 222, the first yoke portion 221 is perpendicular to the second yoke portion 222, the first yoke portion 221 is fixedly connected to the end of the iron core 25 away from the armature 23 (or, it can also be integrally formed), and the second yoke portion 222 is fitted on the side of the bobbin 21 close to the movable spring part 3; the armature 23 is specifically limited by a compression spring at the knife edge of the second yoke portion 222 of the yoke 22.

[0044] In this embodiment, the body is further provided with a limiting structure, which limits the movement of the pushing card toward the inner side surface 91. Since the body includes a case 9 and a base 1, the limiting structure is specifically arranged on the base 1. The limiting structure specifically includes at least two limiting components 30, and each limiting component 30 is respectively

mounted on the base 1 and limits and protects the pushing card 5. The number of the limiting component 30 is specifically two, but is not limited thereto. For example, it may also be three, four or more.

[0045] In this embodiment, as shown in FIG. 12, the base 1 has a retaining wall 101 located between the movable spring part 3 and the magnetic circuit part, the limiting components 30 are respectively mounted on the retaining wall 101, and each of the limiting components 30 is partially blocked on the side of the pushing card 5 close to the inner side surface 91. As shown in FIG. 12, the retaining wall 101 is provided with a plurality of column-shaped mounting portions 102, and at least one end of each limiting component 30 is respectively interference-fitted and inserted into the socket 103 provided in the corresponding mounting portion 102. The structure of the limiting component 30 is shown in FIG. 13, the limiting component 30 is substantially U-shaped, and includes a blocking rod 301 and two inserting rods 302 arranged at both ends of the blocking rod 301, when the limiting component 30 is installed on the column-shaped mounting portion 102, the limiting component 30 is in the above-mentioned substantially U-shaped state rotated 90° clockwise, the blocking rod 301 is located in the vertical direction and is cooperated at the side of the pushing rod 55 facing the inner side surface 91, the two inserting rods 302 are respectively located above and below the pushing rod 55, and are respectively inserted into the sockets 103 provided in the corresponding mounting portion 102 in an interference manner. In other embodiments, the limiting component is L-shaped or the like.

[0046] In this embodiment, as shown in FIGS. 14 and 15, the pushing rod 55 is provided with at least one group of reinforcing structure, the reinforcing structure includes a plurality of reinforcing ribs 552 spaced apart along the length direction of the pushing rod 55, and each reinforcing rib 552 is located at the width direction of the pushing rod 55, respectively. Specifically, as shown in FIGS. 14 and 15, the pushing rod 55 includes two groups of reinforcing structures, one of which is located on the upper surface of the inner protrusion of the pushing rod 55, and the other is located on the lower surface of the inner protrusion of the pushing rod 55.

[0047] In this embodiment, the movable spring part 3 is provided with a limiting groove 37 for restricting the up and down movement of the pushing card 5, as shown in FIG. 16, the limiting groove 37 penetrates in the length direction of the pushing card 5, and the pushing rod 55 of the pushing card 5 is partially clamped into the limiting groove 37.

[0048] In this embodiment, the side of the pushing rod 55 of the pushing card 5 facing the inner side surface 91 is flush with the side of the pushing block 56 facing the inner side surface 91, as shown in FIG. 14. The pushing rod 55 is provided with a first slot 551 for snap-fitting with the movable spring part 3, and the pushing block 56 is provided with a second slot 561 for snap-fitting with the armature 23, the notch of the first slot 551 and the notch of the second slot 561 are respectively located on the side of the pushing card 5 facing away from the inner side surface 91, as shown in FIGS. 14 and 15. Because there is a plurality of movable spring parts 3, there is also a plurality of first slots 551, and the first slots 551 and the movable spring parts 3 are arranged in a one-to-one correspondence.

[0049] In this embodiment, as shown in FIG. 14 and FIG. 15, the two opposite sides of the second slot 561 are respectively provided with a first limiting rib 562 and a second limiting rib 563 which are extend in the vertical direction, the surfaces of the first limiting rib 562 and the second limiting rib 563 are arc-shaped, the portion of the armature 23 located in the second slot 561 fits between the first limiting rib 562 and the second limiting rib 563 on the two sides of the second slot 561. So that the armature 23 is made to perform a tangential movement relative to the pushing card 5, and the movement is stable.

[0050] In this embodiment, as shown in FIG. 15, the pushing rod 55 is provided with a partition 553 between the armature 23 and the movable spring part 3 close to the armature 23, so that the partition 553 can be used to increase the air gap and creepage distance between the contact part and the magnetic circuit part of the relay.

[0051] In this embodiment, the movable spring part 3 is configured to be resistant to short-circuit current. Specifically, the movable spring part 3 includes a movable spring lead-out sheet 31, a rigid spring 32 and a reaction force spring 34, the movable spring lead-out sheet 31 is inserted into the base 1, and the bottom of the movable spring lead-out sheet 31 forms the lead-out terminal 311 of the movable spring part 3, and a movable contact 33 is provided at the bottom of the rigid spring 32 on the side opposite to the movable spring lead-out sheet 31. The upper end of the rigid spring 32 is rotatably connected with the upper end of the movable spring lead-out sheet 31 so that the rigid spring 32 can rotate in a direction away from or close to the movable spring lead-out sheet 31. Specifically, the upper end of the rigid spring 32 and the upper end of the movable spring lead-out sheet 31 are connected by a rotating shaft 35, and a flexible connector 36 is further connected between the upper end of the rigid spring 32 and the upper end of the movable spring lead-out sheet 31. The reaction force spring 34 is located between the movable spring lead-out sheet 31 and the rigid spring 32, and the lower end of the reaction force spring 34 is fixed on the side of the rigid spring 32 facing away from the movable contact 33, and there is a gap between the upper end of the reaction force spring 34 and the rigid spring 32. The upper end of the reaction force spring 34 and the rigid spring 32 of each movable spring part 3 are respectively clamped in the corresponding first slot 551. In this way, the pushing card 5 pushes the rigid spring 32 to move closer to the stationary spring part 4 by pushing the reaction force spring 34, thereby generating an overstroke. The pushing rod 55 is provided with a relief groove 554 for avoiding the movable spring

lead-out sheet 31, as shown in FIGS. 14 and 15. Since there is a plurality of movable spring parts 3, there is also a plurality of relief grooves 554, the plurality of relief grooves 554 correspond to the movable spring lead-out sheets 31 of the plurality of movable spring parts 3 in a one-to-one correspondence. The movable spring lead-out sheet 31, the rigid spring 32 and the reaction force spring 34 are respectively provided with the limiting groove 37.

[0052] In this embodiment, as shown in FIGS. 11 and 19, the electromagnetic relay of the present disclosure further includes an auxiliary movable spring 6 provided with an auxiliary movable contact and an auxiliary stationary spring 7 provided with an auxiliary stationary contact, both them are respectively inserted into the base 1 and located on the side where the armature 23 is located; the pushing block 56 of the pushing card 5 is provided with a driving part 564 which cooperates with the auxiliary movable spring 6 to drive the auxiliary movable spring 6 to move; the action state of the auxiliary movable spring 6 is opposite to the action state of the movable spring part 3. That is, when the movable spring part 3 moves in the direction of attracting and engaging with the stationary spring part 4, the auxiliary movable spring 6 moves in the direction of disconnecting from the auxiliary stationary spring 7, when the movable spring part 3 moves in a direction of disconnecting from the stationary spring part 4, the auxiliary moving spring 6 moves in a direction of attracting and engaging with the auxiliary stationary spring 7.

[0053] In an electromagnetic relay of the present disclosure, when the pushing card 5 is installed, the first slot 551 and the limiting groove 37 are used to limit the pushing card 5 in the lateral direction (that is, the length direction X of the base 1) and in the up and down direction, then insert each limiting component 30 to limit the pushing card 5 in the longitudinal direction (that is, the width direction Y of the base 1), so as to prevent the pushing card 5 from sliding out in a direction away from the movable spring part 3.

[0054] In the electromagnetic relay of the present disclosure, because the pushing card 5 is located between the movable spring part 3 and the inner side surface 91 of the case 9, and the pushing block 56 of the pushing card 5 is located in the extending direction of the length of the pushing rod 55, so that the pushing card 5 of the present disclosure is not only easy to install, but also makes the pushing rod 55 and the pushing block 56 of the pushing card 5 not stagger in the length direction of the pushing card 5, ensuring the force points of the pushing card 5 and the movable spring part 3 and the force points of the pushing card 5 and the armature 23 are on the same straight line, therefore, the pushing card 5 is not easily deformed during the working process, and the entire electromagnetic relay will not reduce the service life due to the quality problem of the pushing card 5.

[0055] The setting of the limiting structure can prevent the pushing card 5 from sliding out sideways in the direction away from the movable spring part 3 (that is, toward the inner side surface), thereby improving the stability of the electromagnetic relay and reducing the failure rate. The case 9 of the electromagnetic relay of the present disclosure can limit the position of the pushing card 5 at room temperature. However, the case 9 will expand and contract under extremely high and low temperatures, and the dimensions will fluctuate to a certain extent, if the limiting structure (i.e., limiting component) is not provided, the electrical parameters and mechanical parameters of the relay will be affected. In addition, in the present disclosure, before the housing 9 is installed, if the limiting structure (i.e., the limiting component) is not provided, the position of the pushing card 5 cannot be stabilized, and there are certain difficulties in the assembly process. Therefore, after the limiting structure is provided in the present disclosure, the electromagnetic relay of the present disclosure is not only integrated before the case 9 is installed, but also convenient for assembly, and the movable range of the pushing card 5 in the width direction of the relay is between the movable spring lead-out sheet and the limiting component 30, the limiting component 30 has a good limit effect on the pushing card 5. Even if the dimensions of the case 9 fluctuate, the mechanical and electrical parameters of the entire relay can be stabilized.

[0056] The embodiments described above are only used to further illustrate an electromagnetic relay that can be applied to three-phase alternating current of the present disclosure. However, the present disclosure is not limited to the embodiments, and any simple amendments, equivalent changes, and modifications made to the above embodiments based on the technical essence of the present disclosure fall within the protection scope of the technical solutions of the present disclosure.

Claims

1. An electromagnetic relay, comprising a base (1) and a magnetic circuit part (2), wherein the magnetic circuit part (2) comprises a bobbin (21) equipped with an iron core (25) and an enameled wire (24), an armature (23) and a yoke (22) connected to the iron core (25), the bobbin (21) is disposed horizontally on the base (1), the armature (23) is disposed at a knife edge of the yoke (22) and is cooperated with a pole surface (251) of the iron core (25), **characterized in that**, the electromagnetic relay further comprises at least three groups of contact units distributed side by side, each group of contact units respectively comprises a movable spring part (3) and a stationary spring part (4), the movable spring part (3) and the stationary spring part (4) are respectively arranged on the base (1) and cooperate with each other correspondingly, the armature (23) is connected to the movable spring part (3) of each of the contact units through the pushing card (5) to drive the

movable spring part (3) to move.

2. The electromagnetic relay according to claim 1, **characterized in that**, the magnetic circuit part (2) and each of the contact units are located in different cavities of the base (1).

3. The electromagnetic relay according to claim 1, **characterized in that**, a lead-out terminal (311) of the movable spring part (3) and a lead-out terminal (411) of the stationary spring part (4) are located at opposite sides of the base (1).

4. The electromagnetic relay according to claim 1, **characterized in that**, one end of the pushing card (5) is provided with an insulating connector, the connector is provided with an insertion slot (511), and one end of the armature (23) away from the pole surface (251) of the iron core (25) is inserted into the insertion slot (511) and is enclosed by the insertion slot (511).

5. The electromagnetic relay according to claim 1, **characterized in that**, a part where the armature (23) cooperates with the pole surface (251) of the iron core (25) is bent toward a side away from the iron core (25) to form an oblique shape.

6. The electromagnetic relay according to claim 1, **characterized in that**, the movable spring part (3) is configured to be a structure capable of resisting short-circuit current, the movable spring part (3) comprises a movable spring lead-out sheet (31), a rigid spring (32) and a flexible connector (36), the movable spring lead-out sheet (31) is inserted into the base (1), and a bottom of the movable spring lead-out sheet (31) forms a lead-out terminal (311) of the movable spring part (3), a top of the rigid spring (32) is rotatably connected with the movable spring lead-out sheet (31), so that the rigid spring (32) is capable of rotating in a direction away from or close to the movable spring lead-out sheet (31), a flexible connector (36) is further connected between the top of the rigid spring (32) and a top of the movable spring lead-out sheet (31); a movable contact (33) is provided at a bottom of the rigid spring (32) on a side opposite to the movable spring lead-out sheet (31); the pushing card (5) is provided with a plurality of slots (54) at intervals along a length direction (X) of the base (1), and the plurality of slots (54) correspond to the at least three groups of movable spring parts (3) in a one-to-one correspondence, the rigid spring (32) of each of the movable spring parts (3) is respectively clamped in a corresponding slot (54).

7. The electromagnetic relay according to claim 6, **characterized in that**, the movable spring part (3) further comprises a reaction force spring (34), the reaction force spring (34) is located between the movable spring lead-out sheet (31) and the rigid spring (32), and a bottom of the reaction force spring (34) is fixedly connected to the rigid spring (32), there is a predetermined distance between a top of the reaction force spring (34) and the rigid spring (32), and the top of the reaction force spring (34) is clamped in the slot (54).

8. The electromagnetic relay according to claim 6 or 7, **characterized in that**, the pushing card (5) is provided with a limiting member (53) at one end facing the armature (23), and the limiting member (53) cooperates with a first partition wall (11) provided on the base (1) to resist a pushing stroke of the pushing card (5), the first partition wall (11) is located between the armature (23) and the contact unit adjacent to the armature (23); an end of the pushing card (5) away from the armature (23) cooperates with the movable spring lead-out sheet (31) furthest away from the armature (23) to limit the reset stroke of the pushing card (5).

9. The electromagnetic relay according to claim 1, **characterized in that**, further comprises an auxiliary movable spring (6) provided with an auxiliary movable contact and an auxiliary stationary spring (7) provided with an auxiliary stationary contact, the auxiliary movable spring (6) and the auxiliary stationary spring (7) are respectively inserted into the base (1) and located on a side of the base (1) where the armature (23) is located; the pushing card (5) or the armature (23) is provided with a driving part (52) cooperating with the auxiliary movable spring (6) to drive the auxiliary movable spring (6) to move; an action state of the auxiliary movable spring (6) is opposite to an action state of the movable spring part (3).

10. The electromagnetic relay according to claim 1, **characterized in that**, a return spring (8) is inserted between the yoke (22) and the base (1), the return spring (8) restricts the armature (23) and provides the armature (23) to reset; the bobbin (21) is located in a length direction (X) of the base (1), and the at least three groups of contact units are distributed along the length direction (X) of the base (1), and the movable spring part (3) of each of the contact units are respectively vertical, and are distributed along a width direction (Y) of the base (1) with the bobbin (21), the pushing card (5) is located in the length direction (X) of the base (1), the pushing card (5) is limited in an up and down direction by a second partition wall (12) provided on the base (1) between adjacent contact units.

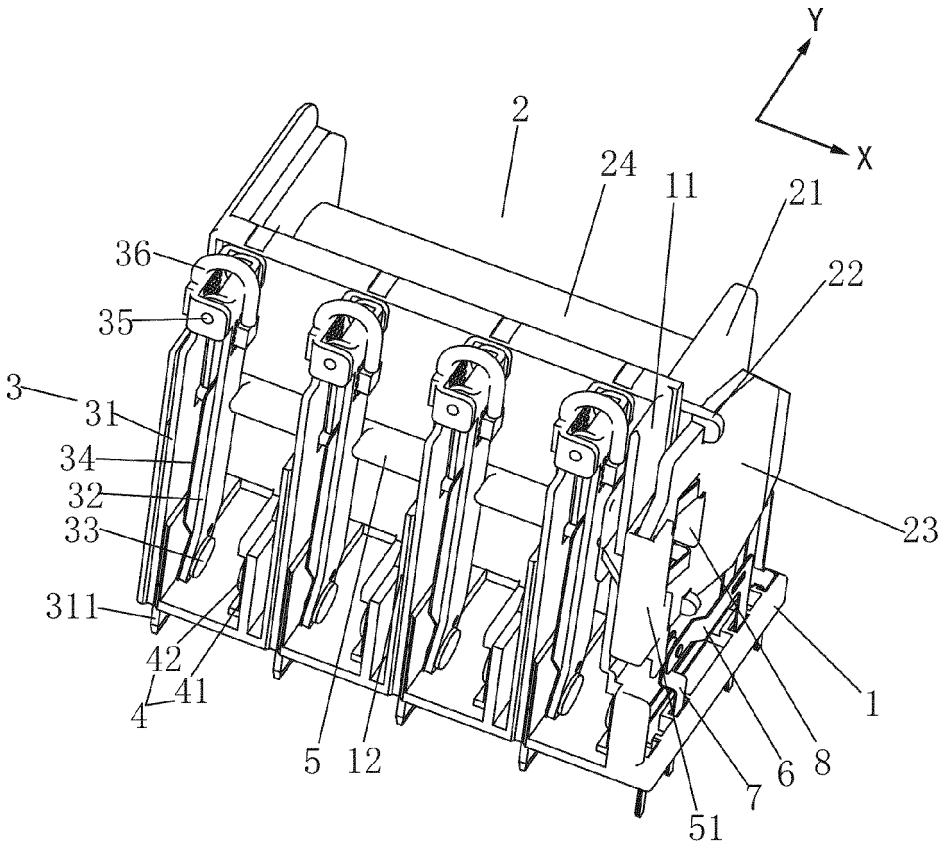
Y
X
2
24
11
21
22
36
35
3
31
34
32
33
311
42
41
4
5
12
23
1
6
8
7
51

FIG.1

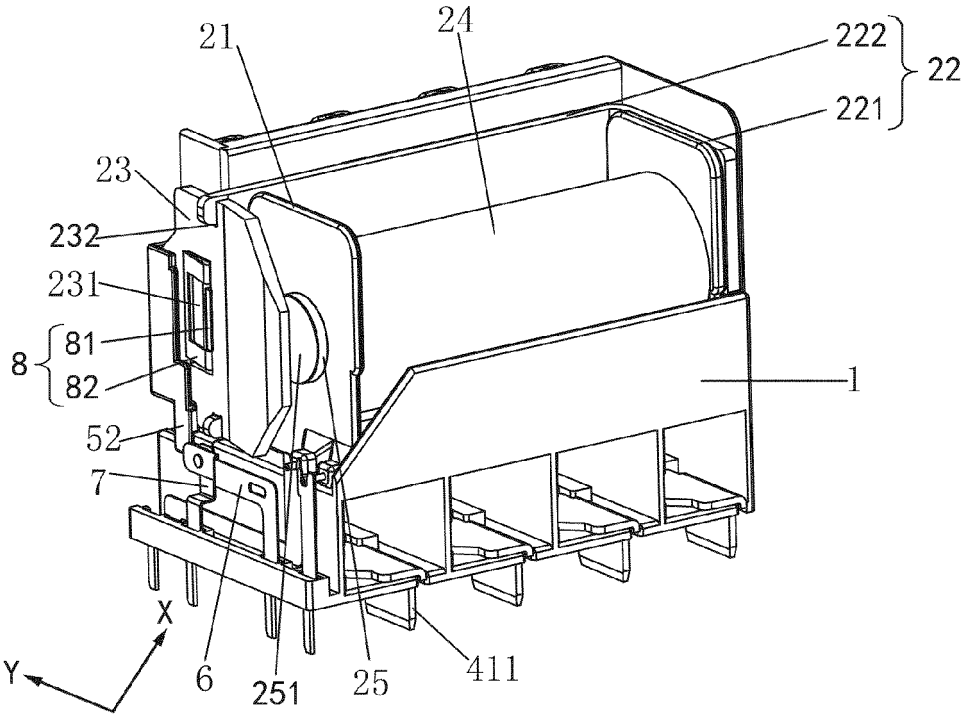
21
24
222
221
22
23
232
231
8
81
82
1
52
7
X
Y
6
251
25
411

FIG.2

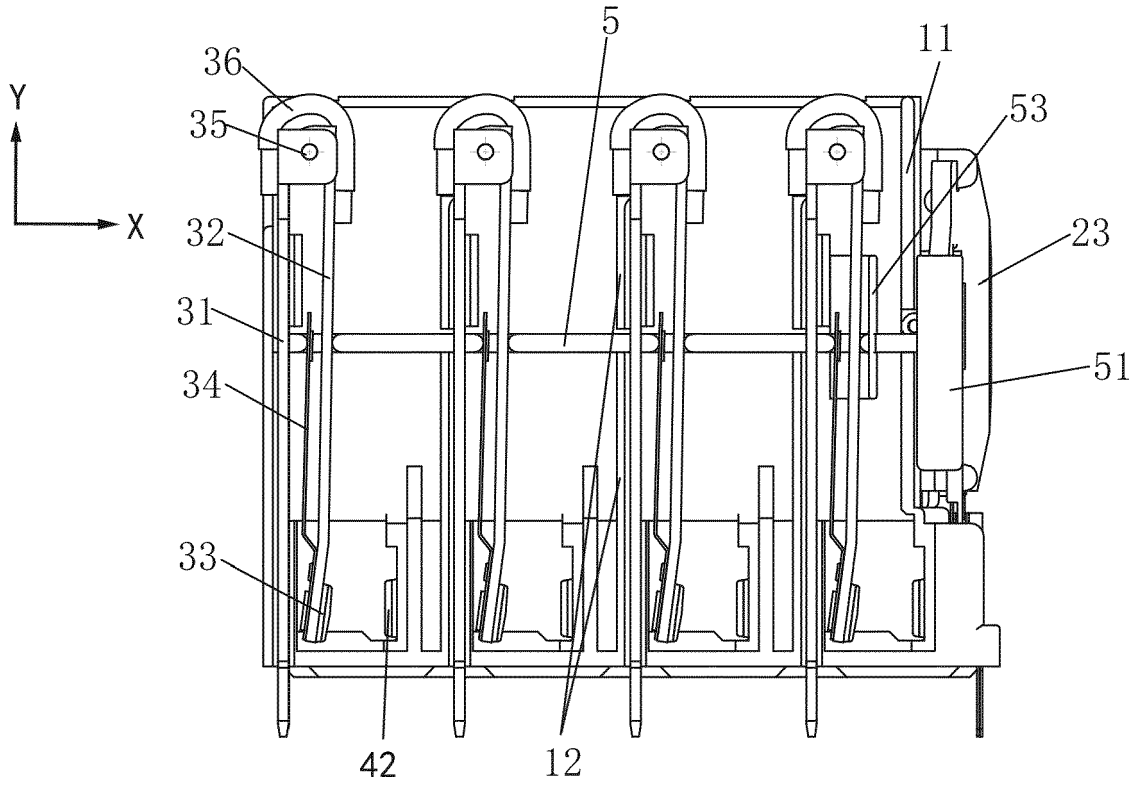

FIG.3

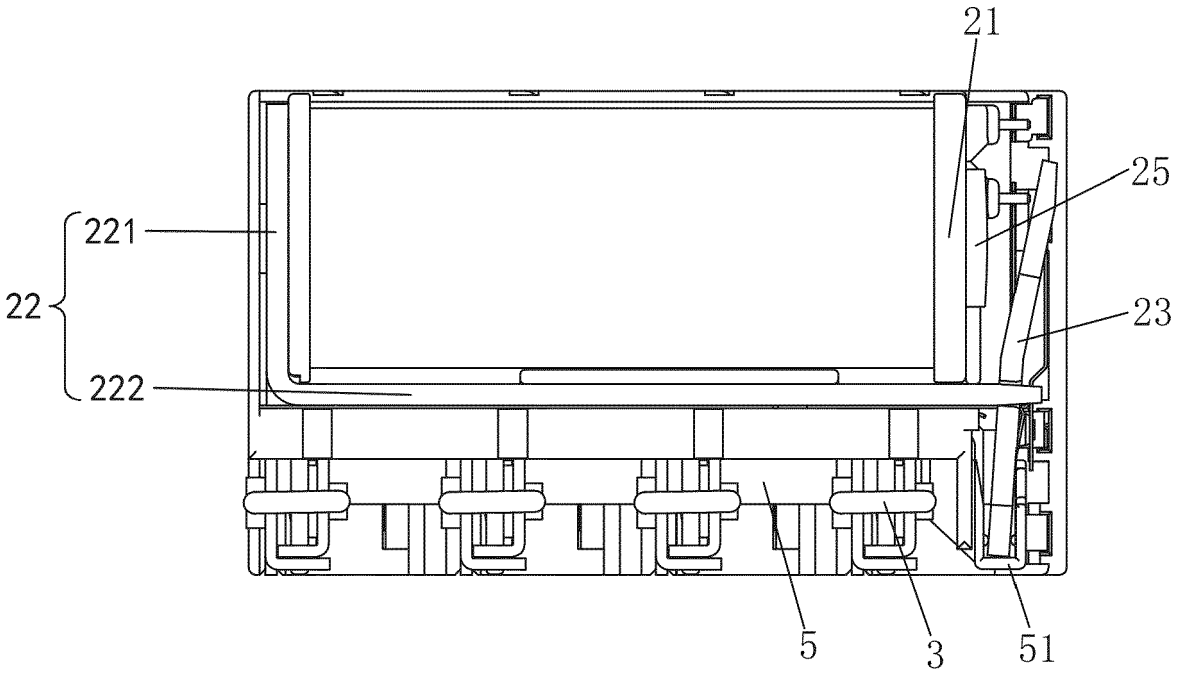

FIG.4

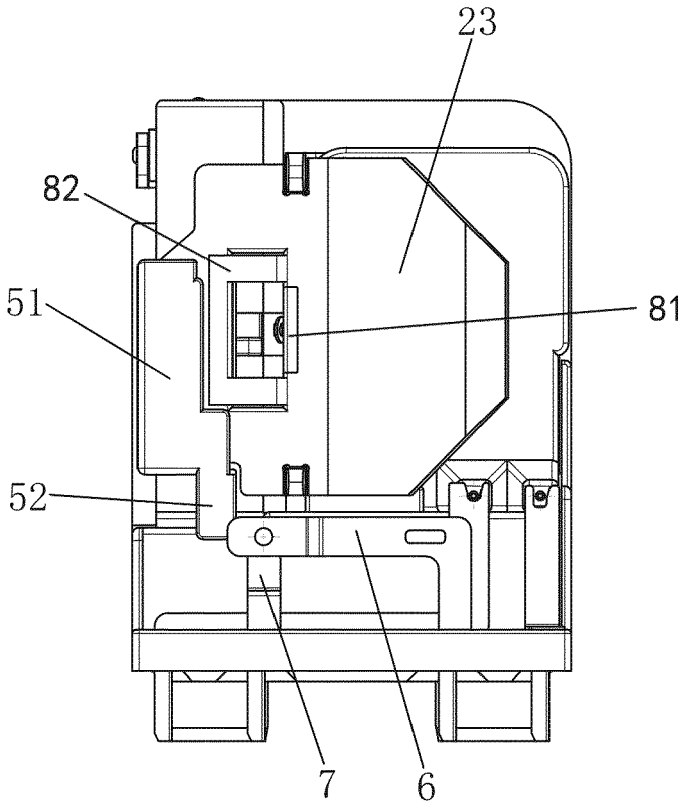

FIG.5

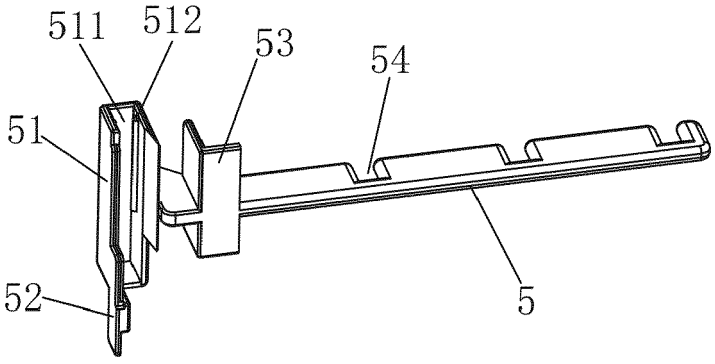

FIG.6

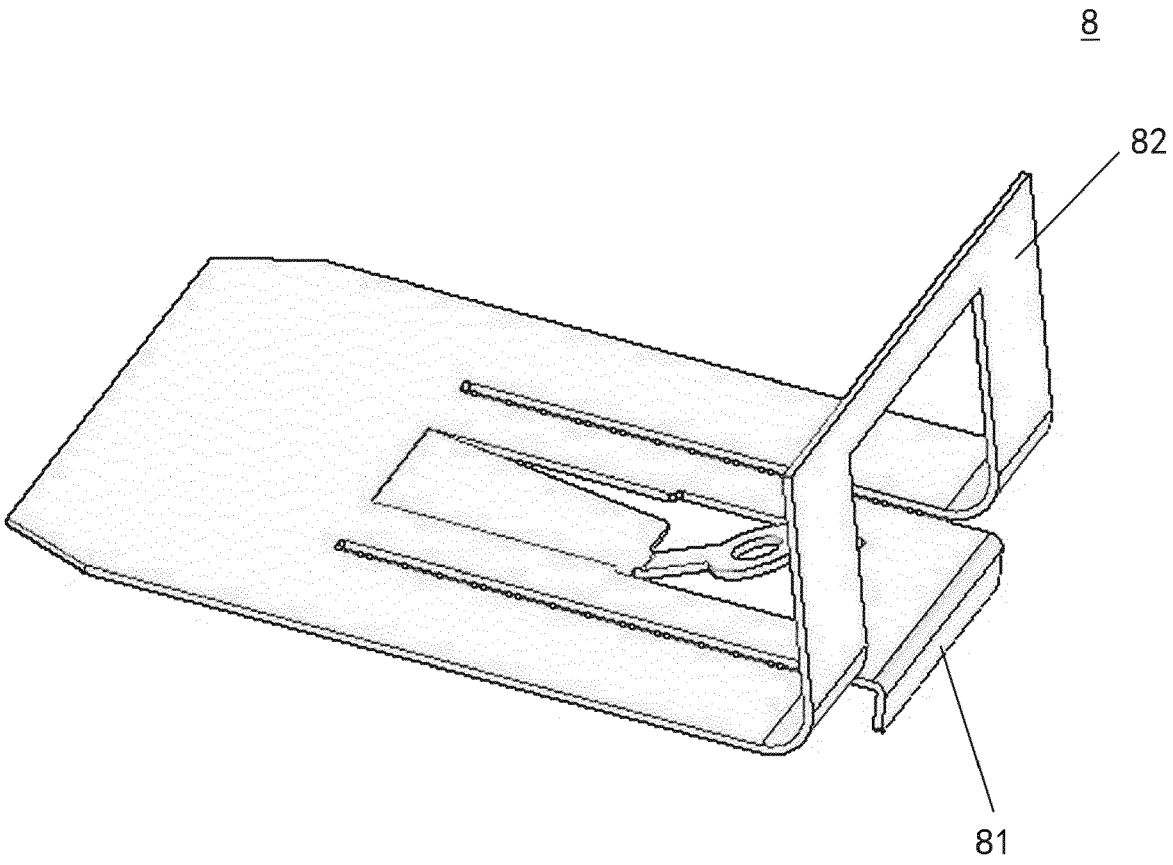

FIG.7

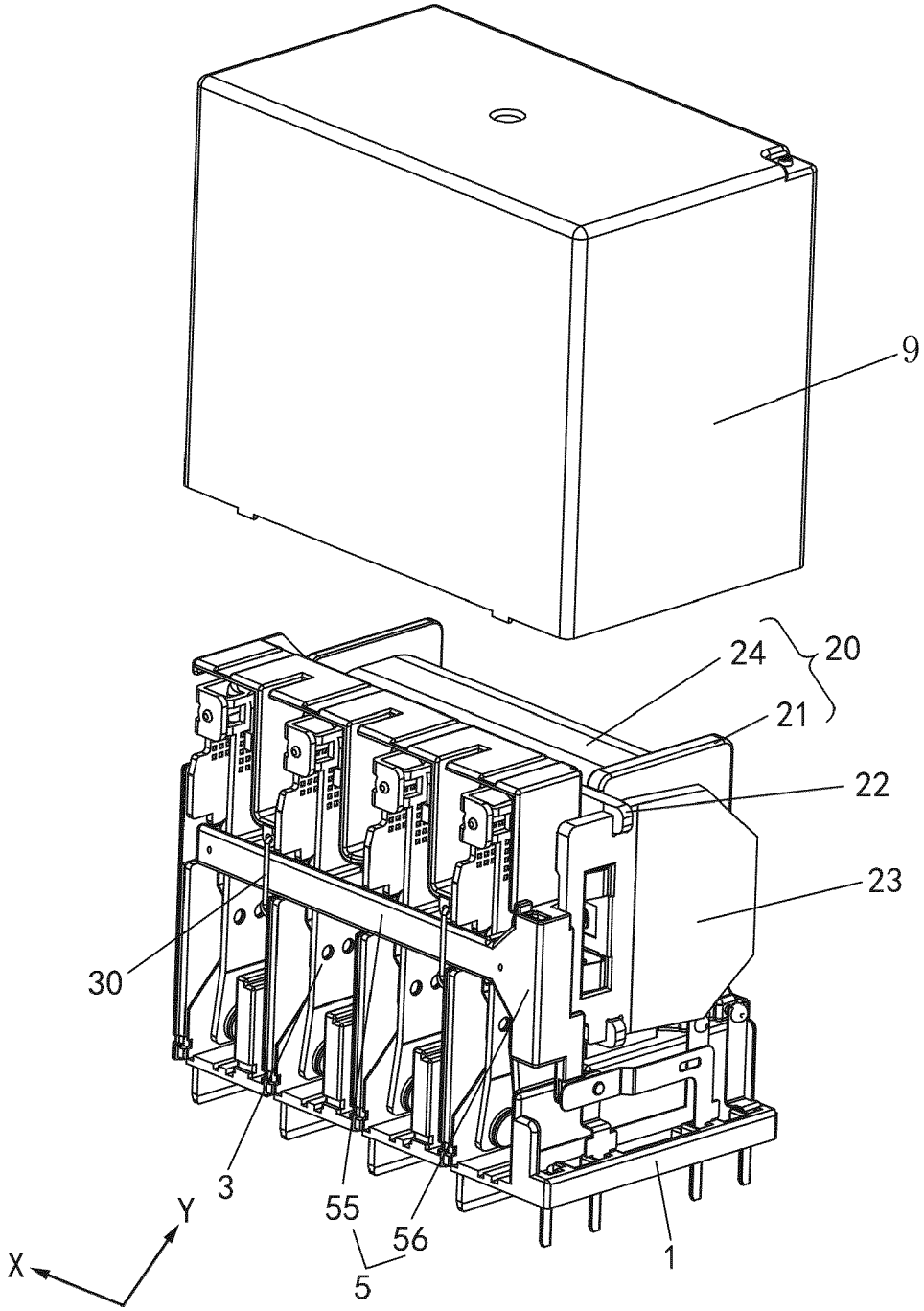

FIG.8

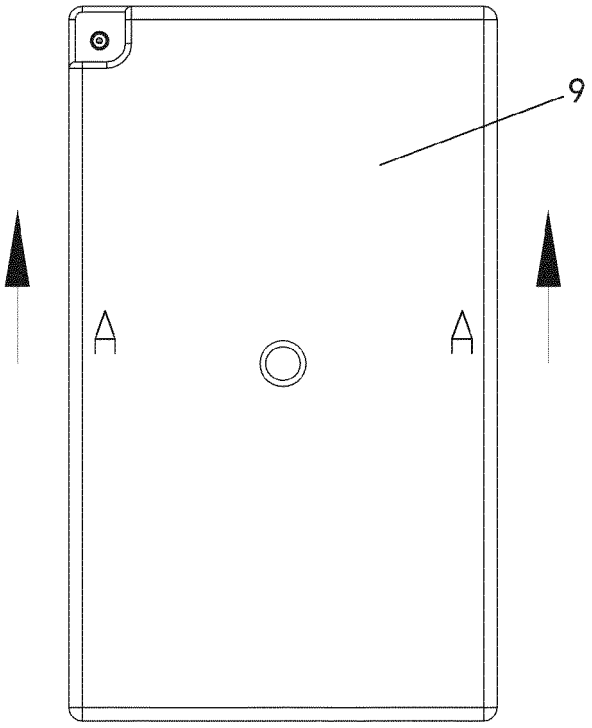

FIG.9

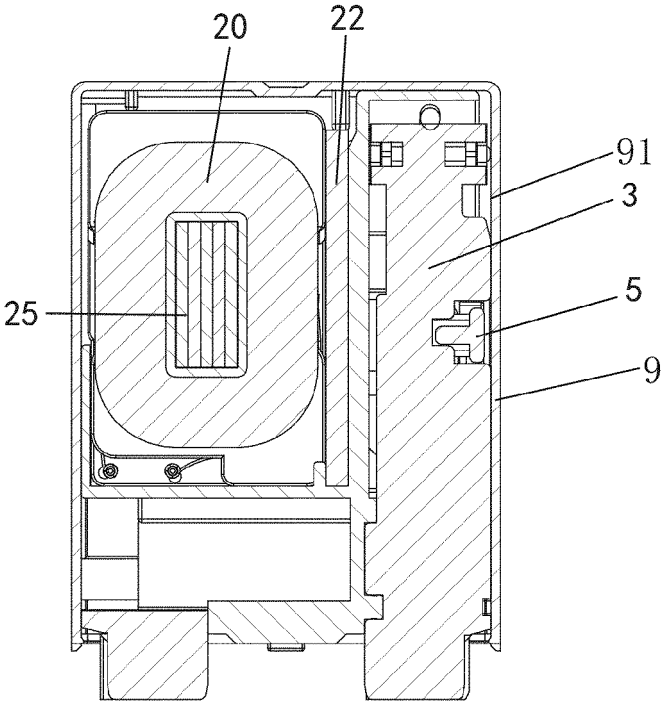

FIG.10

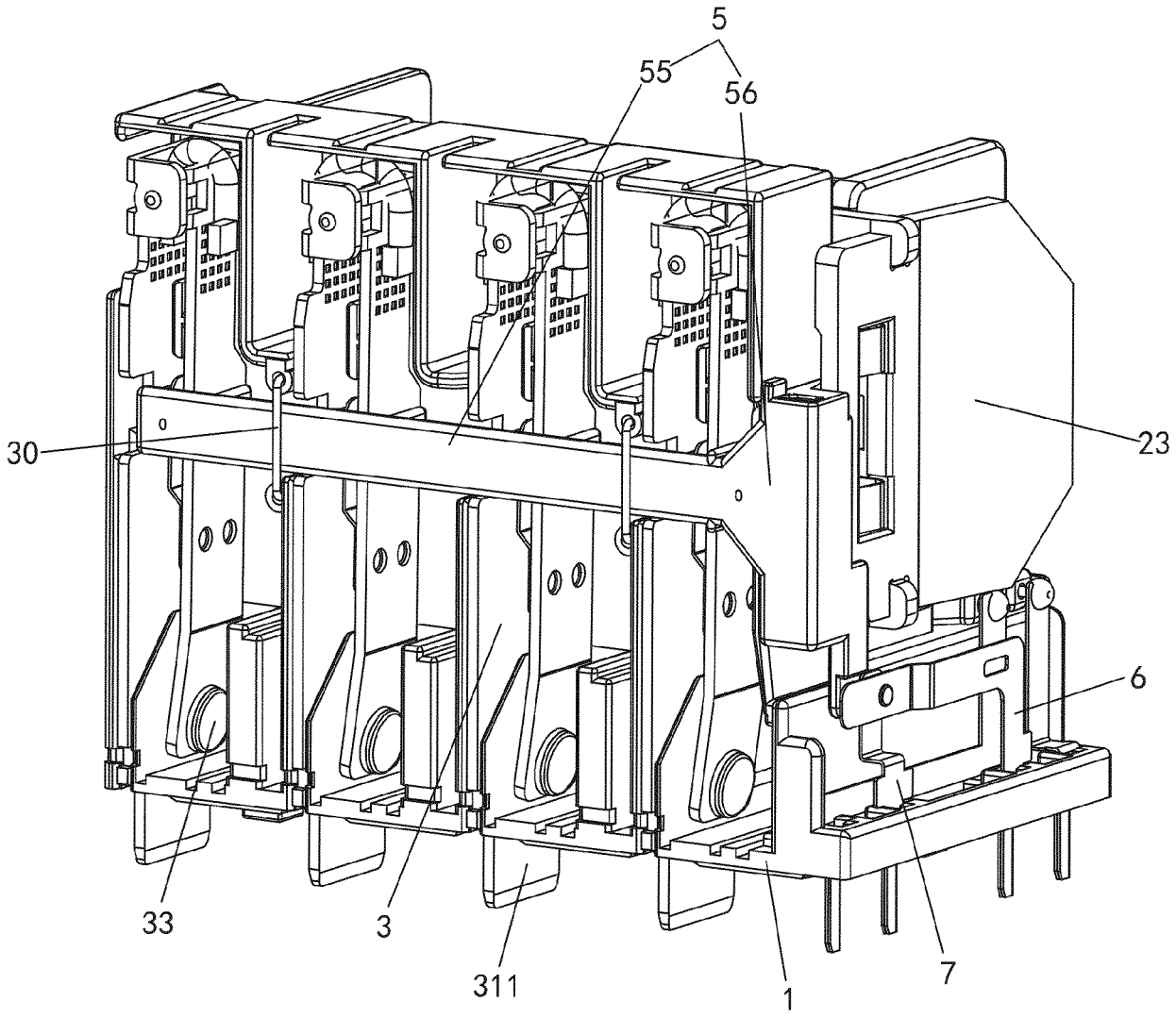

FIG.11

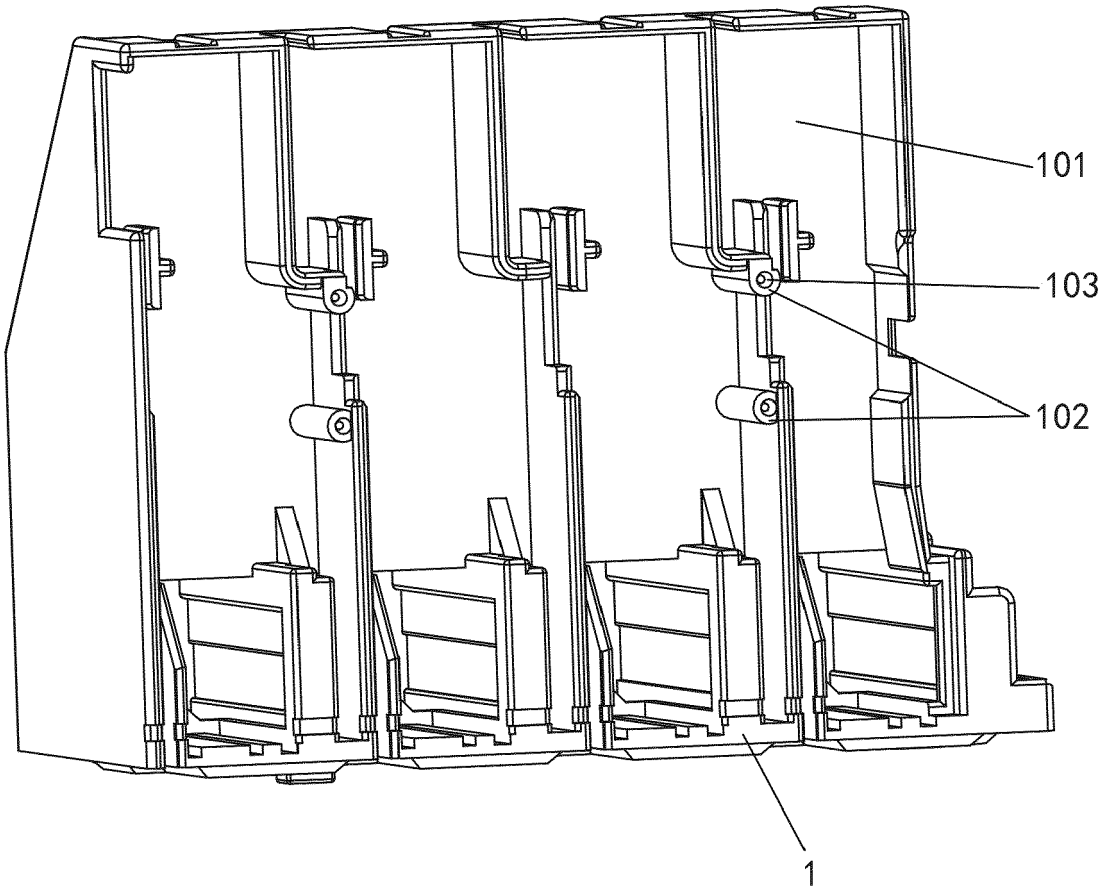

FIG.12

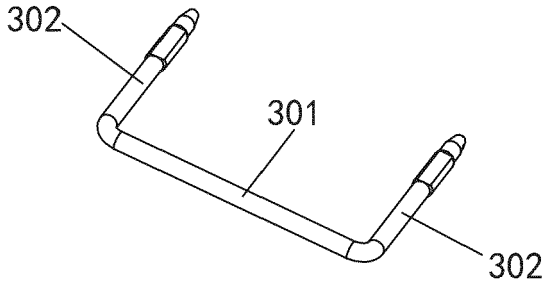

FIG.13

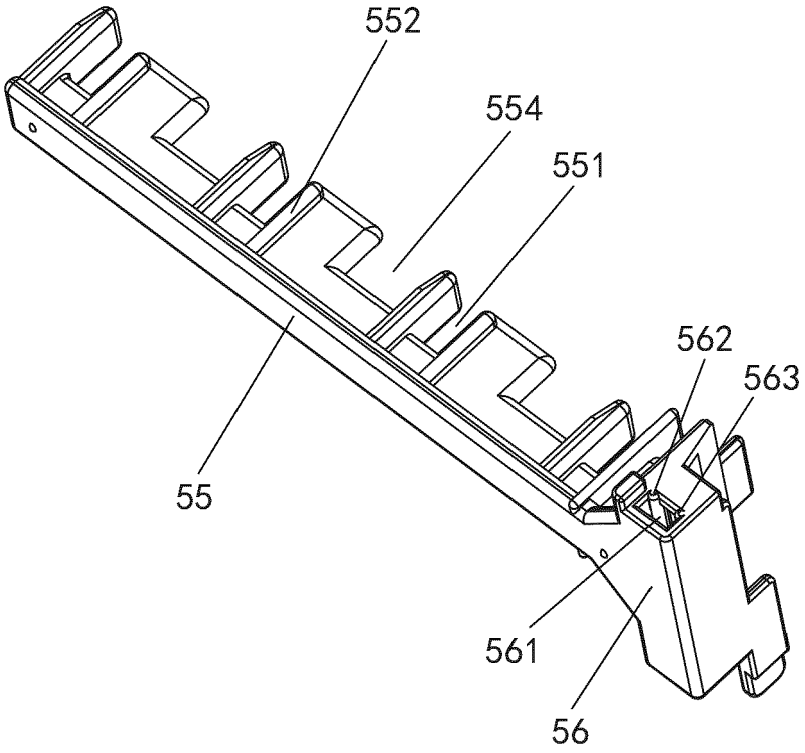

FIG.14

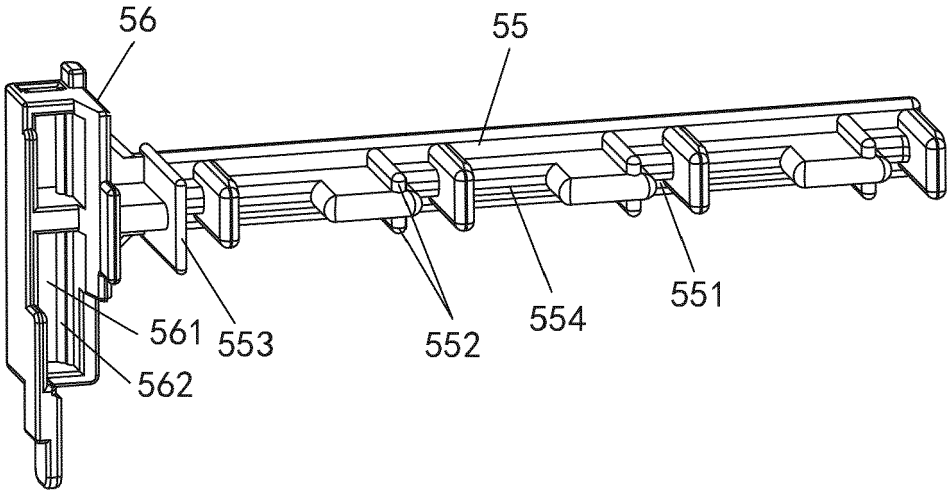

FIG.15

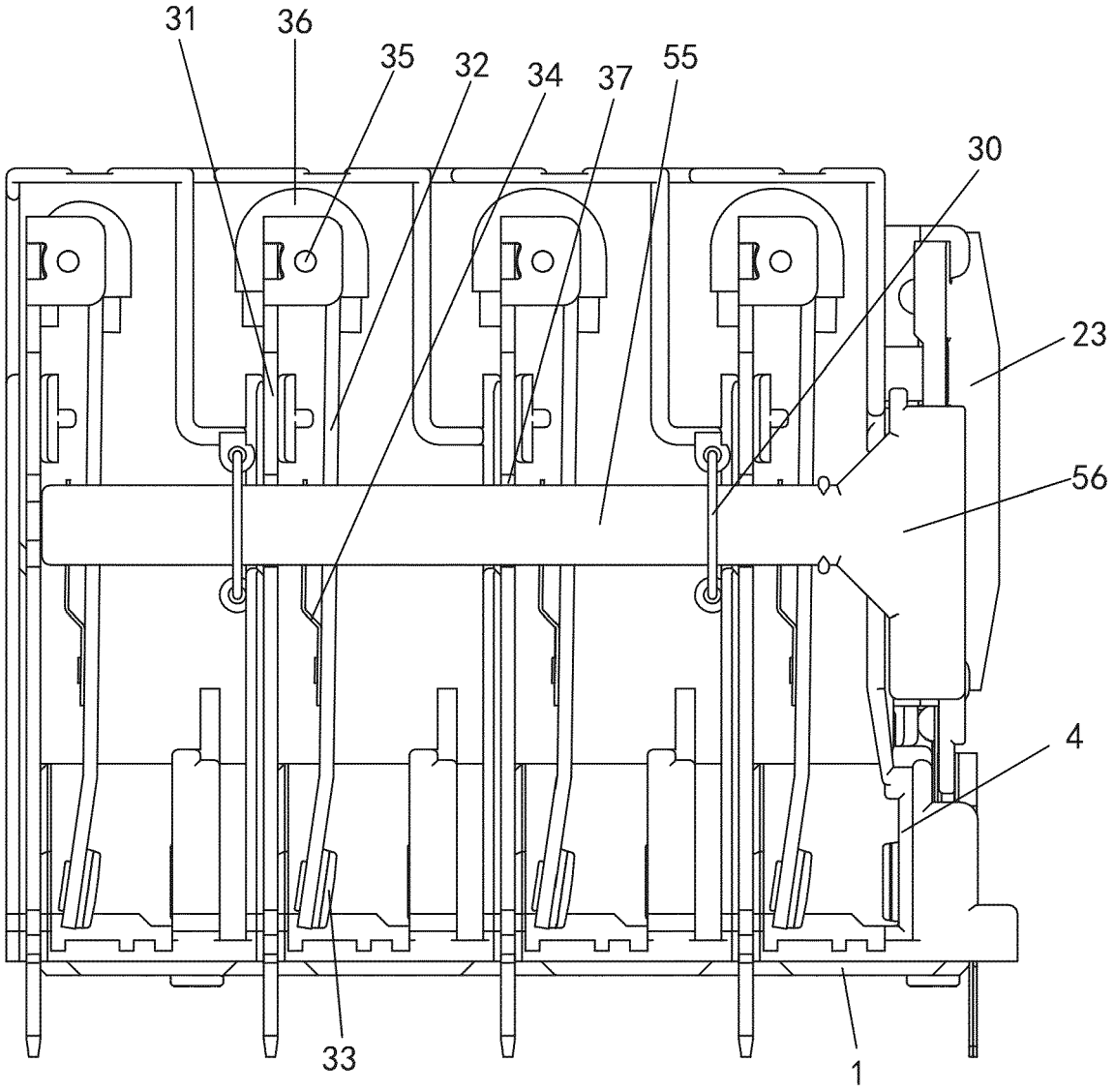

FIG.16

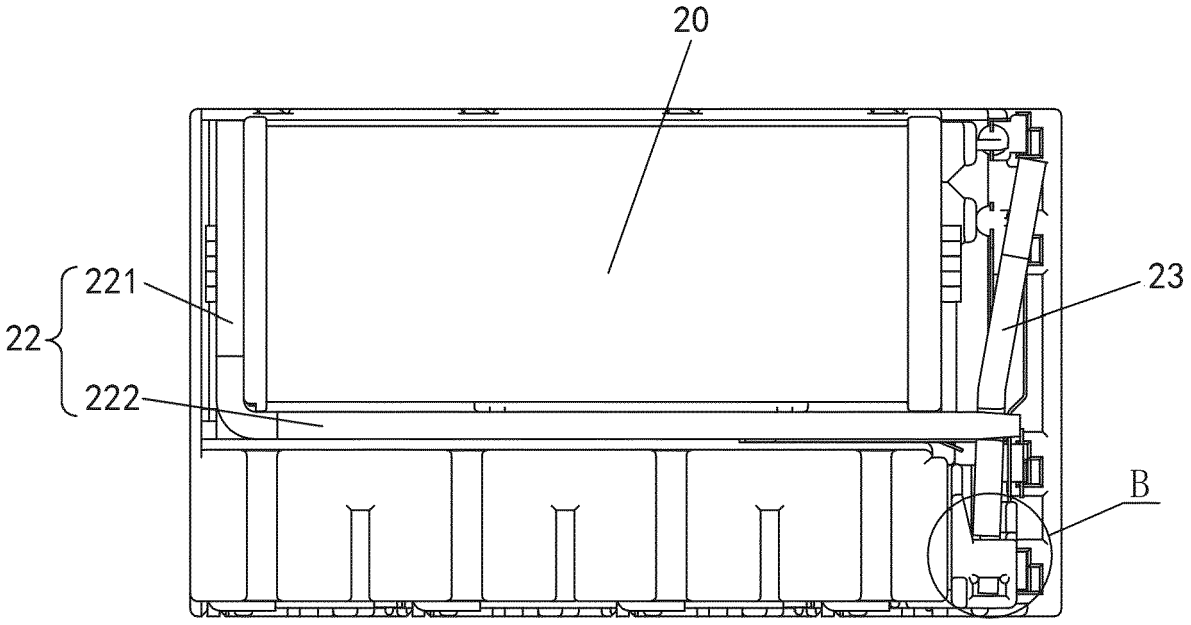

FIG.17

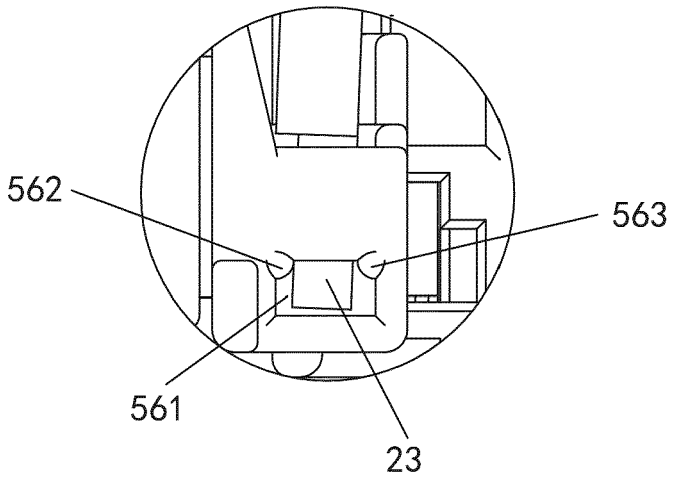

FIG.18

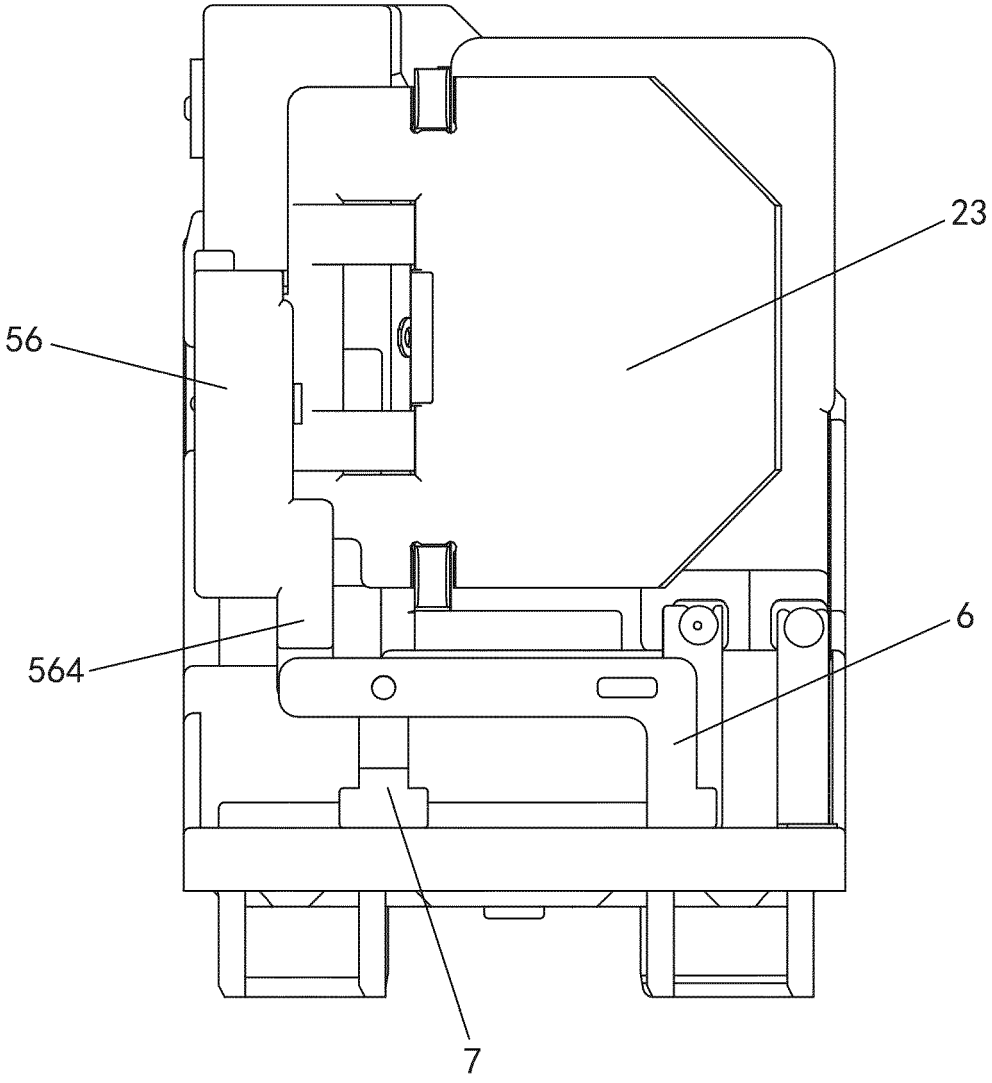

FIG.19

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