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(54) MAGNETIC LATCHING RELAY CAPABLE OF RESISTING SHORT-CIRCUIT CURRENT

(57) Disclosed is a magnetic latching relay capable of resisting a short-circuit current. The magnetic latching relay comprises a contact portion. The contact portion is comprised of two sets of movable spring portions (1, 2) substantially parallel to each other. The movable spring portions comprise movable leafs (11, 21), movable contacts (12, 22), movable spring tabs (13, 23), and stationary contacts (14, 24). Each of both movable leafs (11, 21) is disposed with a first bending portion (111, 211) having one surface raised and the other surface recessed in a thickness direction. Both of the first bending portions (111, 211) are raised in the same direction, and the curve of the first bending portion (211) of one movable leaf (21) is smaller than the curve of the first bending portion (111) of the other movable leaf (11), such that the raised portion of the first bending portion (211) of one movable leaf (21) can fit in the recessed portion of the first bending portion (111) of the other movable leaf (11), such that the effective length of each movable leaf is increased while the distance between two movable leafs (11, 21) is reduced. The magnetic latching relay of the present disclosure can increase electromagnetic attraction between two sets of movable spring portions, so as to effectively increase a contact pressure between contacts, thereby resisting a short-circuit current.

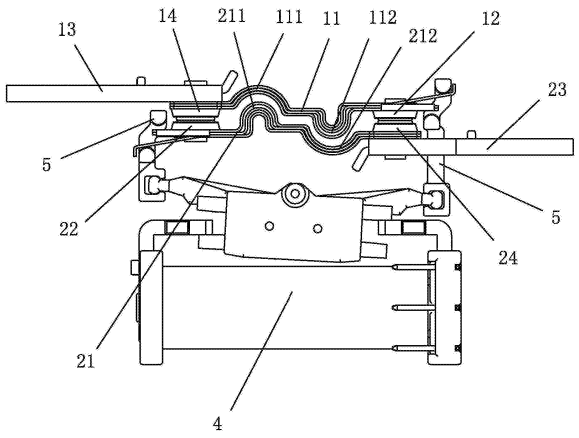

Fig.3

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the priority to Chinese application No. 201710213323.2, filed on April 1, 2017, which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of relay technology, and more particularly, to a magnetic latching relay capable of resisting a short-circuit current.

BACKGROUND

[0003] The structure of the existing magnetic latching relay is composed of a magnetic circuit system, a contact system, a push mechanism and a base. The magnetic circuit system generally consists of two substantially symmetrical magnetic circuits, including a stationary magnetizer component, a movable magnetizer component and a coil. The contact system includes a moving spring portion, a stationary spring portion, and the push mechanism is generally carried by the push block. When the relay is inputted forward pulse voltage, the magnetic circuit system works and the push block pushes the moving spring portion to make the static and movable contacts contact with each other, and the relay works. The coil is inputted with the reverse pulse voltage, the magnetic circuit system works, the push block pushes the moving spring portion to make the static and movable contacts to be disconnected, and the relay returns.

[0004] The main application area of the magnetic latching relay is power metering. The main functions are switching and metering. With the power grid reforms of countries around the world move forward, cases of electric meter explosions and fires caused by short-circuit currents have occasionally occurred, causing huge personal safety problems and property losses. In this context, the world's major power companies, meter companies have introduced relevant standards or cited industry standards to regulate the ability of magnetic latching relays in electric energy meter to resist a short-circuit current, which improving the operating safety of smart meters. In order to ensure personal safety and safety of electrical device, the magnetic latching relay is required to have the function of withstanding and turning on the short-circuit current. According to the operating characteristics of the power grid and based on the consideration of personal and equipment safety, there are three working conditions for magnetic latching relay to resist the short-circuit, details as follow:

[0005] Case 1: When the front end of the electric meter (upstream of the power grid) is in short-circuit condition, the characteristics is that latching relay contacts will close (the electric meter is turned on) and the short-circuit current is high which is called "safe withstand short-circuit current" at the moment,, and it is required that the magnetic latching relay is "no explosion, no fire and no spatter" when or after subjected to a short-circuit current.

[0006] Case 2: The back end of the electric meter (downstream of the power grid) is short-circuit, characterized by the magnetic latching relay contacts closing (the electric meter is turned off), and the short-circuit current is smaller. The short-circuit current at this time is called "function withstand short-circuit current", and it is required that the magnetic latching relay is "in normal function after subjected to a short-circuit current.

[0007] Case 3: When back end of the electric meter (downstream of the power grid) is in short-circuit condition, characteristics is that latching relay contacts is open (the electric meter is turned off), and the short-circuit current is lower, and it is required that the magnetic latching relay is "in normal function" after supported with short-circuit current.

[0008] Under three operating conditions, the magnitude of the short-circuit current varies greatly. For example, "safety withstand short-circuit current" of IEC62055-31 standard UC2 grade is 4.5KA, which is 1.8 times of "function withstand short-circuit current" or "function turning on short-circuit current". The UC3 grade "safety withstand short-circuit current" is 6KA, which is twice as much as the "function withstand short-circuit current" or "function making short-circuit current". Another example, the ANSI C12.1 standard 200A rated current level "safety withstand short circuit current" peak is 24KA, which is 3.4 times of the "function withstand short circuit current" whose peak is 7KA

[0009] To develop a magnetic latching relay product capable of resisting a short-circuit current, it is necessary to increase the closing pressure of the moving and stationary contacts to counteract the electric repulsion when the short-circuit current passes through the contacts. Increasing the closing pressure of the moving and stationary contacts will inevitably increase the external dimensions of the product and increase the power consumption of the coil control portion, which fails to meet the requirements of the customer for miniaturization and low power consumption. At the same time, product costs will rise sharply, which results in a decline in the market competitiveness of the product.

[0010] In order to solve the technical problems described above the existing magnetic latching relay utilizes the principle of Lorentz force in structural design, and the electromagnetic force generated by the one times short-circuit current on the movable spring piece (moving spring piece) to resist the electric repulsion generated by the short-circuit current between the moving and stationary contacts. When designing a specific scheme, the magnitude of the short-circuit current is closely related to the distance between the two spring pieces. The effect of resisting the short-circuit current is closely related to the amount of spring piece deformation (rigidity). Since "safety withstand short-circuit current" is quite different

from "function withstand short-circuit current" or "function turning on short-circuit current", design schemes that meet the "safety withstand short-circuit current" are not necessarily compatible with "function withstand short-circuit current" or "function turning on short-circuit current" and vice versa. Similarly, design schemes that meet the UC3 standard may not be necessarily backward compatible with the UC2 standard.

[0011] There are two main technical routes in the prior art for solving the function of the magnetic latching relay to resist a short-circuit current. Both use one time short-circuit current to flow through the movable spring piece (ie, the moving spring piece) and the movable spring piece lead-out piece (ie, the moving spring lead-out piece), and the electromagnetic force generated on the movable spring piece (ie, the moving spring piece) resists the electric repulsion generated by the short-circuit current between the moving and stationary contacts. The short-circuit current flowing through the stationary spring piece (ie, the stationary spring piece) does not participate in the function of resisting the electric repulsion between the contacts. The anti-short circuit current structure of the first type of magnetic latching relay is "the electromagnetic force generated when the moving spring lead-out piece and the moving spring piece are opposite in direction of current is used to resist the electric power generated when the moving and stationary contacts pass a large current". The anti-short circuit current structure of the second type of magnetic latching relay is "using the electromagnetic force generated by the same current direction in the parallel circuit to increase the pressure between the moving and stationary contacts and to achieve the function of resisting the short circuit current". One of the schemes for resisting the short-circuit current structure is disclosed as in Chinese patent CN201210306861.9, the two sets of moving springs are designed in parallel, and the current same direction attracting principle is used to increase the contact pressure of the contacts. However, the shortcomings of this structure are: The moving spring piece has a short effective length and a large reaction force. The distance between the two sets of moving spring portions is smaller at a position away from the contact and at the position near the contact is larger, which resulting in a smaller electromagnetic attraction at the contact position, and having the disadvantage of uneven electromagnetic attraction distribution. Moreover, since a bending is placed at a position close to the contact, a structure similar to the seesaw is caused, and instead, the spring piece at the position of the contact is easily turned outward, and the pressure of the contact is reduced. The second scheme for resisting the short-circuit current structure is disclosed as in Chinese patent CN201280008648.2, the two sets of moving springs will also designed in parallel, the current same direction attracting principle is used to increase the contact pressure of the contacts. However, the shortcomings of this structure are: The effective length of the moving spring piece is short, the reaction force is large, and the distance between the two sets of moving spring portions is large due to the spacing of the moving and stationary contacts, which resulting in less electromagnetic attraction. Moreover, the spring piece of this structure has small elasticity and a small pressure on the contacts.

SUMMARY

[0012] One object of the present disclosure is to overcome the deficiencies of the prior art and to provide a magnetic latching relay capable of resisting a short-circuit current. It is based on increasing the pressure between the moving and stationary contacts by using the electromagnetism suction generated by the same current direction in the parallel circuit. Through improving the structure of the contact portion, the electromagnetic suction between the two sets of moving spring portions can be increased, thereby the contact pressure between the contacts can be effectively increased to resist the short-circuit current.

[0013] The technical solution adopted by the present disclosure to solve the technical problem thereof is: a magnetic latching relay capable of resisting short-circuit current, comprising:

contact portion, composed of two sets of moving spring portions which are substantially parallel to each other;

the two sets of moving spring portions respectively includes a moving spring piece, a moving contact, a moving spring lead-out piece and a stationary contact; the moving contact is connected to one end of the moving spring piece, the other end of the moving spring piece is connected to one end of the moving spring lead-out piece, and the stationary contact is connected to one end of the moving spring lead-out piece; two moving contacts of the moving spring portion respectively correspond to two stationary contacts to form a parallel circuit structure when the moving and stationary contacts are in contact;

each of the two moving spring pieces is provided with a first bent portion which is convex on one side of the thickness and concave on the other side, and the protruding directions of the two first bent portions are the same, the bending of the first bent portion of one moving spring piece is smaller than the bending of the first bent portion of the other moving spring piece, such that the protrusion of the first bent portion of one moving spring can fit into the recess of the first bent portion of the other moving spring piece, thereby the effective length of each moving spring pieces is increased while reducing the distance between the two moving spring pieces.

[0014] Each of the two moving spring pieces is provided with a second bent portion which is convex on one side of the thickness and concave on the other side, and

the protruding directions of the two second bent portions are the same, the bending of the second bent portion of the other moving spring piece is smaller than the bending of the second bent portion of one moving spring piece, such that the protrusion of the second bent portion of the other moving spring piece can fit into the recess of the second bent portion of one moving spring piece to reduce the distance between the two moving spring pieces and increase the effective length of each moving spring pieces.

[0015] The first bent portion and the second bent portion are all arc shapes.

[0016] The shape of the first bent portions and the second bent portions of the two moving spring pieces may substantially be U-shaped, n-shaped or C-shaped, and the center line of the opening of the U-shaped, n-type or C-shaped of the bent portion is substantially perpendicular to a flat spring piece of the moving spring piece.

[0017] In the two moving spring pieces, the distance from a flat spring piece between the first bent portion and the second bent portion of one moving spring piece to a flat spring piece between the first bent portion and the second bent portion of the other moving spring piece is smaller than the distance between the flat spring pieces at the contact position of the two moving spring pieces.

[0018] The distance from the flat spring piece between the first bent portion and the second bent portion of one moving spring piece to the flat spring piece between the first bent portion and the second bent portion of the other moving spring piece is roughly equal to the distance between the two first bent portions and the second bent portions.

[0019] In the same set moving spring portion, the stationary contact is connected at the junction of the other end of the moving spring piece and one end of the moving spring lead-out piece.

[0020] In the same moving spring piece, the protruding direction of the first bent portion is opposite to the protruding direction of the second bent portion.

[0021] In the same moving spring piece, the first bent portion and the second bent portion are respectively located at both ends of the moving spring piece.

[0022] The moving spring piece and the moving spring lead-out piece are two separate parts.

[0023] The moving spring piece and the moving spring lead-out piece are an integrated structure.

[0024] The moving spring piece is formed by a single spring piece.

[0025] The moving spring piece is composed of two or more spring pieces stacked in the thickness direction.

[0026] The lengths and shapes of the moving spring pieces of the two sets of moving spring portions having the first bent portions and the second bent portions are completely the same.

[0027] Further includes a base, the moving spring lead-out pieces of the contact portion are inserted on the base, and the two moving spring lead-out pieces are respectively located on both sides of the base, one of the moving spring lead-out pieces is a current lead-in end, and the other moving spring lead-out piece is a current lead-out end; each end of the two moving spring lead-out pieces is respectively fitted in the base, and the other ends of the two moving spring lead-out pieces respectively extend outside of the base.

[0028] The two moving spring lead-out pieces are respectively provided with a positioning protrusion for matching with the base in the thickness direction, and the base is provided with a slot for matching with the positioning protrusion of the corresponding moving spring lead-out piece.

[0029] A positioning tongue piece extends outwardly from one end of each of the moving spring lead-out piece, the positioning tongue piece inclines at an angle with respect to the moving spring lead-out piece to avoid the bent portion of the moving spring piece.

[0030] The thickness of the positioning tongue piece is smaller than the thickness of the moving spring lead-out piece.

[0031] The vertical distance of the extension line of the opposite sides of the two moving spring lead-out pieces is 4.6 mm, and the tolerance range is -0.1 to +0.5 mm; in the two moving spring lead-out pieces, the size of the opposite side of one moving spring lead-out piece closer to a parallel side wall of the base to the outer surface of the parallel side wall is 5.1 mm, and the tolerance range is -0.5 to +0.5mm.

[0032] Further includes a rotary magnetic circuit portion and a push block, the rotary magnetic circuit portion respectively matches with the ends of the two moving spring pieces through the push block, such that the two moving contacts are respectively brought into contact with the two stationary contacts when the rotary magnetic circuit portion rotates towards to one side, and the two moving contacts are respectively separated from the two stationary contacts when the rotary magnetic circuit portion rotates toward to the other side.

[0033] Compared with the prior art, the beneficial effects of the present disclosure are:

1. Due to the present disclosure adopts that each of the two moving spring pieces is provided with a first bent portion which is convex on one side of the thickness and concave on the other side, the protruding directions of the two first bent portions are the same, the bending of the first bent portion of one moving spring piece is smaller than the bending of the first bent portion of the other moving spring piece, so that the protrusion of the first bent portion of the one moving spring can fit into the recess of the first bent portion of the other moving spring piece, thereby the effective length of each moving spring pieces is increased while reducing the distance between the two moving spring pieces. In the structure of the present disclosure, on one hand, the spring piece bending is used to increase the elasticity of the moving spring piece, thereby increasing the contact pressure; on

the other hand, the special structure of the bent portion (the convex fits in the recess) is used to short the distance between the two moving spring pieces, thereby increasing the suction force. At the same time, since the spring piece is bent, the effective length of the moving spring piece is longer, thereby further increasing the suction force and making the suction force larger.

2. Due to the present disclosure adopts that a first bent portion and a second bent portion are respectively disposed in the two moving spring pieces, and the first bent portion and the second bent portion have the same protruding direction in the two moving spring pieces, while in the same moving spring, the protruding direction of the first bent portion is opposite to the protruding direction of the second bent portion. In the structure of the present disclosure, since each moving spring piece is provided with two bendings, the elasticity of the moving spring piece can be greatly increased, thereby greatly increasing the contact pressure, such that the effective length of the moving spring piece is further increased. Thereby the suction force is further increased, so that the suction force is increased larger. Moreover, not only the distance between the two bent positions of the two moving spring pieces can be reduced, but also the distance between the two bendings of the two moving spring pieces can be reduced, thereby further increasing the suction force.

3. Due to the present disclosure adopts that a first bent portion and a second bent portion are respectively disposed in the two moving spring pieces and the lengths and shapes of the two sets of moving spring portions having the first bent portion and the second bent portion are completely the same. In the structure of the present disclosure, the two sets of moving spring pieces have the same length and the same shape, which is convenient for manufacturing and ensures the consistency of the performance of the two sets of moving springs.

4. The present disclosure adopts that a moving spring lead-out piece has a positioning protrusion for matching with the base in the thickness direction, a positioning tongue piece extends outwardly at one end of the moving spring lead-out piece, and the positioning tongue piece inclines at an angle with respect to the moving spring lead-out piece to avoid the bent portion of the moving spring piece. In the structure of the present disclosure, through the reasonable positioning for the moving spring lead-out piece, it avoids the disadvantages of the product function failure due to the looseness and falling off of the moving spring lead-out piece because of the unreliable positioning during the use of the product. The looseness and falling off of the moving spring lead-out piece are due to the external stress of temperature and vibration shock.

[0034] The present disclosure will be further described in detail below with reference to the accompanying drawings and embodiments. However, a magnetic latching relay capable of resisting a short-circuit current of the present disclosure is not limited to the embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035]

Fig. 1 is a structure schematic view showing a contact portion of the present disclosure;

Fig. 2 is a structure schematic perspective view showing the cooperation among the contact portion and a magnetic circuit portion and a push block of the present disclosure;

Fig. 3 is a structure schematic view showing the cooperation among the contact portion and the magnetic circuit portion and the push block (contacts closing) of the present disclosure;

Fig. 4 is a structure schematic view showing the cooperation among the contact portion and the magnetic circuit portion and the push block (contact turning off) of the present disclosure;

Fig. 5 is a structure schematic perspective view showing the moving spring portion of the present disclosure;

Fig. 6 is a front view showing the moving spring portion of the present disclosure;

Fig. 7 is a top view showing the moving spring portion of the present disclosure;

Fig. 8 is a structure schematic perspective disassemble view showing the moving spring portion of the present disclosure;

Fig. 9 is a front view showing the perspective structure disassemble state of the moving spring portion of the present disclosure;

Fig. 10 is a structure schematic perspective view showing the cooperation among the contact portion and the magnetic circuit portion and the push block and the base of the present disclosure; and

Fig. 11 is a top view showing the cooperation among the contact portion and the magnetic circuit portion and the push block and the base of the present disclosure.

DETAILED DESCRIPTION

Embodiments

[0036] Referring to Fig. 1 to Fig. 11, a magnetic latching relay capable of resisting a short-circuit current according to the present disclosure includes a contact portion. The contact portion is composed of two sets of moving spring portions 1, 2 which are substantially parallel to each other. The moving spring portion 1 includes a moving spring piece 11, a moving contact 12, a moving spring lead-out piece 13 and a stationary contact 14. The moving spring

portion 2 includes a moving spring piece 21, a moving contact 22, a moving spring lead-out piece 23 and a stationary contact 24. The moving contact 12 is connected to one end of the moving spring piece 11, the other end of the moving spring piece 11 is connected to one end of the moving spring lead-out piece 13, and the stationary contact 14 is connected to one end of the moving spring lead-out piece 13. In the present embodiment, the stationary contact 14 is connected at the junction of the other end of the moving spring piece 11 and one end of the moving spring lead-out piece 13. Similarly, the moving contact 22 is connected to one end of the moving spring piece 21, and the other end of the moving spring piece 21 is connected to one end of the moving spring lead-out piece 23, the stationary contact 24 is connected to one end of the moving spring lead-out piece 23, and the stationary contact 24 is connected at the junction of the other end of the moving spring piece 21 and one end of the moving spring lead-out piece 23. The two moving contacts of the moving spring portion correspond to the two stationary contacts respectively. That is, the moving contact 12 of the moving spring portion 1 and the stationary contact 24 of the moving spring portion 2 are in a correspondingly engaged position, and the moving contact 22 of the moving spring portion 2 and the stationary contact 14 of the moving spring portion 1 are in a correspondingly engaged position to form a parallel circuit structure when the moving and stationary contacts are in contact. Each of the two moving springs is provided with a first bent portion which is convex on one side of the thickness and concave on the other side. The moving spring piece 11 is provided with a first bent portion 111, and the first bent portion 111 is in an arc shape. The moving spring piece 21 is provided with a first bent portion 211, and the first bent portion 211 has an arc shape. The first bent portion 111 of the moving spring piece 11 and the first bent portion 211 of the moving spring piece 21 have the same protruding direction. The bending of the first bent portion 211 of the moving spring piece 21 is smaller than the bending of the first bent portion 111 of the other moving spring piece 11, such that the protrusion of the first bent portion 211 of one moving spring piece 21 can fit into the recess of the first bent portion 111 of the other moving spring piece 11. Thereby, compared with the provision of the two flat moving spring pieces in parallel of the relate technology, the effective length of each of the moving spring pieces is increased while reducing the distance between the two moving spring pieces 11, 12.

[0037] The two moving spring pieces are each further provided with a second bent portion which is convex on one side of the thickness and concave on the other side. That is, the moving spring piece 11 is provided with a second bent portion 112, and the second bent portion 112 has an arc shape; the moving spring piece 21 is provided with a second bent portion 212, and the second bending 212 has an arc shape. The second bent portion 112 of the moving spring piece 11 and the second bent portion 212 of the moving spring piece 21 have the same protruding direction. The bending of the second bent portion 112 of the moving spring piece 11 is smaller than the bending of the second bent portion 212 of one moving spring piece 21, such that the protrusion of the second bent portion 112 of the other moving spring piece 11 can fit into the recess of the second bent portion 212 of one moving spring piece 21. In the same moving spring piece, the protruding direction of the first bent portion is opposite to the protruding direction of the second bent portion. In the moving spring piece 11, the protruding direction of the first bent portion 111 is opposite to the protruding direction of the second bent portion 112. In the moving spring piece 21, the protruding direction of the first bent portion 211 is opposite to the protruding direction of the second bent portion 212. Moreover, in the same moving spring piece, the first bent portion and the second bent portion are located at both ends of the moving spring piece respectively. Since the protrusion of the first bent portion 211 of the moving spring piece 21 fits into the recess of the first bent portion 111 of the moving spring piece 11, and the protrusion of the second bent portion 112 of the moving spring piece 11 fits into the recess of the second bent portion 212 of the moving spring piece 21 to reduce the distance between the two moving spring pieces and increase the effective length of each moving spring piece.

[0038] The shape of the first bent portion and the second bent portion of the two moving spring pieces may substantially be U-shaped, n-shaped or C-shaped, and the center line of the opening of U-shaped, n-type or C-shaped of the bent portion is substantially perpendicular to the flat spring piece of the moving spring piece. The shape of the U-shaped, n-shaped or C-shaped all conforms to concave on one side of the thickness and concave on the other side.

[0039] In the two moving spring pieces, among them, the distance from the flat spring piece between the first bent portion and the second bent portion of one moving spring piece to the flat spring piece between the first bent portion and the second bent portion of the other moving spring piece is smaller than the distance between the flat spring pieces at the contact position of the two moving spring pieces. A portion between the first bent portion 111 and the second bent portion 112 of the moving spring piece 11 is a flat spring piece 113, and a portion between the first bent portion 211 and the second bent portion 212 of the moving spring piece 21 is a flat spring piece 213. The distance from the flat spring piece 113 of the moving spring piece 11 to the flat spring piece 213 of the moving spring piece 21 is smaller than the distance between the flat spring pieces at the contact position of the two moving spring pieces (For example, the distance between the spring piece at the moving contact 12 and the spring piece at the stationary contact 24, and may also be the distance between the spring piece at the moving contact 22 and the spring piece at the stationary contact 14).

[0040] In the present embodiment, among them, the

distance from the flat spring piece between the first bent portion and the second bent portion of one moving spring piece to the flat spring piece between the first bent portion and the second bent portion of the other moving spring piece is substantially equal to the distance between the two first bent portions and the distance between the two second bent portions. That is to say, the distance from the first bent portion 111 of the moving spring piece 11 to the first bent portion 211 of the moving spring piece 21, the distance from the second bent portion 112 of the moving spring piece 11 to the second bent portion 212 of the moving spring piece 21, and the distance from the flat spring piece 113 of the moving spring 11 to the flat spring piece 213 of the moving spring piece 21 are roughly equal to each other.

[0041] In the present embodiment, the moving spring piece 11 and the moving spring lead-out piece 13 are two separate parts. The moving spring piece 21 and the moving spring lead-out piece 23 are also two separate parts. Of course, the moving spring piece and the moving spring lead-out piece can also be an integrated structure.

[0042] In the present embodiment, the moving spring piece 11 is formed by stacking three spring pieces in the thickness direction, and the moving spring piece 21 is also formed by stacking three spring pieces in the thickness direction. Of course, the moving spring piece can also be formed by a single spring piece.

[0043] In the present embodiment, the lengths and shapes of the moving spring pieces 11, 12 of the two sets of moving spring portions having the first bent portion and the second bent portion are completely the same. That is to say, after the moving spring piece 11 and the moving spring piece 12 are assembled, the matching shape of the first bent portion 111 of the moving spring piece 11 and the first bent portion 211 of the moving spring piece 21 as well as the matching shape of the second bent portion 212 of the moving spring piece 21 and the second bent portion 112 of the moving spring piece 11 are in a central symmetry structure. In other words, after the matching shape of the first bent portion 111 of the moving spring piece 11 and the first bent portion 211 of the moving spring piece 21 rotates by 180 degrees around the symmetry center, which is the same as the matching shape of the second bent portion 212 of the moving spring piece 21 and the second bent portion 112 of the moving spring piece 11.

[0044] The present disclosure includes a base 3, the moving spring lead-out pieces 13, 23 of the contact portion are respectively inserted on the base 3, and the two moving spring lead-out pieces 13, 23 are respectively located on both sides of the base 3. Among them, one of the moving spring lead-out pieces is a current lead-in end, and the other moving spring lead-out piece is a current lead-out end. Each end of the moving spring lead-out pieces 13, 23 fits in the base 3, and each other end of the moving spring lead-out pieces 13, 23 extends outside the base 3.

[0045] In the present embodiment, the moving spring lead-out piece 13 is provided with a positioning protrusion 131 for matching with the base in the thickness direction. The positioning protrusion 131 locates on the opposite side corresponding to the fixed stationary contact 14 and locates closer to the outside than the stationary contact 14 in position. The base 3 is provided with a slot 31 for matching with the positioning protrusion 131 of the moving spring lead-out piece 13. The moving spring lead-out piece 23 is provided with a positioning protrusion 231 for matching with the base in the thickness direction. The positioning protrusion 231 locates on the same side corresponding to the fixed stationary contact 24 and locates closer to the outside than the stationary contact 24 in position. The base 3 is also provided with a slot 32 for matching with the positioning protrusion 231 of the moving spring lead-out piece 23.

[0046] In the present embodiment, a positioning tongue piece 132 extends outwardly from one end of the moving spring lead-out piece 13. The positioning tongue piece 132 inclines at an angle with respect to the moving spring lead-out piece 13 to avoid the bent portion 111 of the moving spring piece 11. The thickness of the positioning tongue piece 132 is smaller than the thickness of the moving spring lead-out piece 13. The base 3 is provided with a slot 33 for matching with the positioning tongue piece 132 of the moving spring lead-out piece 13. A positioning tongue piece 232 extends outwardly from one end of the moving spring lead-out piece 23. The positioning tongue piece 232 inclines at an angle with respect to the moving spring lead-out piece 23 to avoid the bent portion 211 of the moving spring piece 21. The thickness of the positioning tongue piece 232 is smaller than the thickness of the moving spring lead-out piece 23. The base 3 is provided with a slot 34 for matching with the positioning tongue piece 232 of the moving spring lead-out piece 23.

[0047] In the present embodiment, the vertical distance of the extension lines of the opposite sides of the two moving spring lead-out pieces is 4.6 mm, and the tolerance range is -0.1 to +0.5 mm. That is, the vertical distance of the extension line of the opposite side 133 of the moving spring lead-out piece 13 to the opposite side 233 of the moving spring lead-out piece 23 is 4.6 mm (may also be the vertical distance from the extension line of the opposite side 233 of the moving spring lead-out piece 23 to the opposite side 133 of the moving spring lead-out piece 13, or the vertical distance from the extension line of the opposite side 133 of the moving spring lead-out piece 13 to the extension line of the opposite side 233 of the moving spring lead-out piece 23). The size of 4.6mm defines the distance between the two moving spring lead-out pieces, and also defines the distance between the contacts. In the two moving spring lead-out pieces, the size of the opposite side of a moving spring lead-out piece closer to the parallel side wall of the base to the outer surface of the parallel side wall is 5.1 mm, and the tolerance range is -0.5 to +0.5mm. In the moving spring lead-out piece 13 and the moving spring lead-out

piece 23, closer to the parallel side wall 35 of the base 3 is the moving spring lead-out piece 13. Therefore, the size of the opposite side 133 of the moving spring lead-out piece 13 to the outer surface of the parallel side wall 35 is 5.1 mm, and the tolerance range is -0.5 to +0.5 mm. The size of 5.1 mm reflects the distance of the moving spring lead-out piece 13 to one side of the base, which determines the position at which the moving spring lead-out piece 13 leads out from the base. The size of 4.6mm and the size of 5.1mm can reflect the position of the other moving spring lead-out piece 23 leaded out from the base, thus determining the main physical dimensions of the relay.

[0048] The present disclosure includes a rotary magnetic circuit portion 4 and a push block 5. The rotary magnetic circuit portion 4 and the push block 5 are respectively mounted in the base 3. The rotary magnetic circuit portion 4 respectively matches with the ends of the two moving spring pieces 11,21 through the push block 5, such that the two moving contacts 12, 22 are respectively brought into contact with the two stationary contacts 24, 14 when the rotary magnetic circuit portion rotates to one side, and the two moving contacts 12, 22 are respectively separated from the two stationary contacts 24, 14 when the rotary magnetic circuit portion rotates toward the other side.

[0049] A magnetic latching relay capable of resisting short-circuit current according to the present disclosure adopts that each of the two moving spring pieces 11 and 21 is provided with a first bent portion 111, 211 which is convex on one side of the thickness and concave on the other side. The first bent portions 111 and 211 are in arc shapes, and the protruding directions of the two first bent portions 111 and 211 are the same. Among them, the bending of the first bent portion 211 of one moving spring piece 21 is smaller than the bending of the first bent portion 111 of the other moving spring piece 11, such that the protrusion of the first bent portion 211 of the one moving spring piece 21 can fits into the recess of the first bent portion 111 of the other moving spring piece 11. Thereby, the effective length of each of the moving spring pieces is increased while reducing the distance between the two moving spring pieces. In the structure of the present disclosure, on one hand, the spring piece bending is used to increase the elasticity of the moving spring piece, thereby increasing the contact pressure; on the other hand, the special structure of the bent portion (the convex fits in the recess) is used to short the distance between the two moving spring pieces, thereby increasing the suction force. At the same time, since the spring piece is bent, the effective length of the moving spring piece is longer, thereby further increasing the suction force and making the suction force larger.

[0050] A magnetic latching relay capable of resisting short-circuit current according to the present disclosure adopts that the first bent portions 111, 211 and the second bent portions 112, 212 are respectively disposed in the two moving spring pieces 11, 21, and the first bent portions 111, 211 and the second bent portions 112, 212 are all arc shapes. The first bent portion and the second bent portion have the same convex direction in the two moving spring pieces, while in the same moving spring, the protruding direction of the first bent portion is opposite to the protruding direction of the second bent portion. In the structure of the present disclosure, since each moving spring piece is provided with two bendings, the elasticity of the moving spring piece can be greatly increased, thereby greatly increasing the contact pressure, such that the effective length of the moving spring piece is further increased. Thereby the suction force is further increased, such that the suction force is increased larger. Moreover, not only the distance between the two bent positions of the two moving spring pieces can be reduced, but also the distance between the two bent portions of the two moving spring pieces can be reduced, thereby further increasing the suction force.

[0051] A magnetic latching relay capable of resisting a short-circuit current according to the present disclosure adopts that a first bent portion and a second bent portion are respectively disposed in the two moving spring pieces and the length and shape of the two sets of moving spring portions having the first bent portion and the second bent portion are completely the same. In the structure of the present disclosure, the two sets of moving spring pieces have the same length and the same shape, which is convenient for manufacturing and ensures the consistency of the performance of the two sets of moving springs.

[0052] A magnetic latching relay capable of resisting short-circuit current according to the present disclosure adopts positioning protrusions 131 and 231 for matching with the base are disposed in the thickness direction of the moving spring lead-out pieces 13 and 23. Positioning tongue pieces 132, 232 extends outwardly at one end of the moving spring lead-out pieces 13, 23, and the positioning tongue pieces 132, 232 inclines at an angle with respect to the moving spring lead-out pieces 13, 23 to avoid the bent portion of the moving spring piece. In the structure of the present disclosure, through the reasonable positioning for the moving spring lead-out piece, it avoids the disadvantages of the product function failure due to the looseness and falling off of the moving spring lead-out piece because of the unreliable positioning during the use of the product. The looseness and falling off of the moving spring lead-out piece are due to the external stress of temperature and vibration shock.

[0053] The above described are only preferred embodiments of the disclosure and are not intended to limit the disclosure in any way. Although the disclosure has been described as above in the preferred embodiments, it is not intended to limit the disclosure. Any person skilled in the art can make many possible variations and modifications to the technical solutions of the present disclosure or modify to equivalent embodiments by using the above-disclosed technical contents without departing from the scope of the technical solutions of the present disclosure. Therefore, any simple modifications, equivalent changes

and modifications to the above embodiments in accordance with the technology substance of the present disclosure without departing from the technical solution of the present disclosure should all fall within the scope of the present disclosure.

Claims

1. A magnetic latching relay capable of resisting short-circuit current, comprising:

   contact portion, composed of two sets of moving spring portions which are substantially parallel to each other;
   wherein the two sets of moving spring portions respectively comprises a moving spring piece, a moving contact, a moving spring lead-out piece and a stationary contact; the moving contact is connected to one end of the moving spring piece, the other end of the moving spring piece is connected to one end of the moving spring lead-out piece, and the stationary contact is connected to one end of the moving spring lead-out piece; two moving contacts of the moving spring portion respectively correspond to two stationary contacts to form a parallel circuit structure when the moving and stationary contacts are in contact;
   wherein each of the two moving spring pieces is provided with a first bent portion which is convex on one side of the thickness and concave on the other side, and the protruding directions of the two first bent portions are the same, wherein the bending of the first bent portion of one moving spring piece is smaller than the bending of the first bent portion of the other moving spring piece, such that the protrusion of the first bent portion of one moving spring can fit into the recess of the first bent portion of the other moving spring piece, thereby the effective length of each moving spring pieces is increased while reducing the distance between the two moving spring pieces.

2. A magnetic latching relay capable of resisting a short-circuit current according to claim 1, wherein each of the two moving spring pieces is provided with a second bent portion which is convex on one side of the thickness and concave on the other side, and the protruding directions of the two second bent portions are the same, the bending of the second bent portion of the other moving spring piece is smaller than the bending of the second bent portion of one moving spring piece, such that the protrusion of the second bent portion of the other moving spring piece can fit into the recess of the second bent portion of one moving spring piece to reduce the distance between the two moving spring pieces and increase the effective length of each moving spring pieces.

3. The magnetic latching relay capable of resisting a short-circuit current according to claim 2, wherein the first bent portion and the second bent portion are all arc shapes.

4. The magnetic latching relay capable of resisting a short-circuit current according to claim 2, wherein the shape of the first bent portions and the second bent portions of the two moving spring pieces may substantially be U-shaped, n-shaped or C-shaped, and the center line of the opening of the U-shaped, n-type or C-shaped of the bent portion is substantially perpendicular to a flat spring piece of the moving spring piece.

5. The magnetic latching relay capable of resisting a short-circuit current according to claim 2, wherein in the two moving spring pieces, the distance from a flat spring piece between the first bent portion and the second bent portion of one moving spring piece to a flat spring piece between the first bent portion and the second bent portion of the other moving spring piece is smaller than the distance between the flat spring pieces at the contact position of the two moving spring pieces.

6. The magnetic latching relay capable of resisting a short-circuit current according to claim 5, wherein the distance from the flat spring piece between the first bent portion and the second bent portion of one moving spring piece to the flat spring piece between the first bent portion and the second bent portion of the other moving spring piece is roughly equal to the distance between the two first bent portions and the second bent portions.

7. A magnetic latching relay capable of resisting a short-circuit current according to claim 1, wherein in the same set of moving spring portion, the stationary contact is connected at the junction of the other end of the moving spring piece and one end of the moving spring lead-out piece.

8. The magnetic latching relay capable of resisting a short-circuit current according to claim 2, wherein in the same moving spring piece, the protruding direction of the first bent portion is opposite to the protruding direction of the second bent portion.

9. The magnetic latching relay capable of resisting a short-circuit current according to claim 2, wherein in the same moving spring piece, the first bent portion and the second bent portion are respectively located at both ends of the moving spring piece.

10. The magnetic latching relay capable of resisting a short-circuit current according to claim 1 or 2, wherein the moving spring piece and the moving spring lead-out piece are two separate parts.

11. The magnetic latching relay capable of resisting a short-circuit current according to claim 1 or 2, wherein the moving spring piece and the moving spring lead-out piece are assembled in an integrated structure.

12. The magnetic latching relay capable of resisting a short-circuit current according to claim 1 or 2, wherein the moving spring piece is formed by a single spring piece.

13. The magnetic latching relay capable of resisting a short-circuit current according to claim 1 or 2, wherein the moving spring piece is composed of two or more spring pieces stacked in the thickness direction.

14. The magnetic latching relay capable of resisting a short-circuit current according to claim 2 or 3 or 8, wherein the lengths and shapes of the moving spring pieces of the two sets of moving spring portions having the first bent portions and the second bent portions are completely the same.

15. The magnetic latching relay capable of resisting a short-circuit current according to claim 2, wherein further comprises a base, the moving spring lead-out pieces of the contact portion are inserted on the base, and the two moving spring lead-out pieces are respectively located on both sides of the base, wherein one of the moving spring lead-out pieces is a current lead-in end, and the other moving spring lead-out piece is a current lead-out end; each end of the two moving spring lead-out pieces is respectively fitted in the base, and the other ends of the two moving spring lead-out pieces respectively extend outside of the base.

16. The magnetic latching relay capable of resisting a short-circuit current according to claim 15, wherein the two moving spring lead-out pieces are respectively provided with a positioning protrusion for matching with the base in the thickness direction, and the base is provided with a slot for matching with the positioning protrusion of the corresponding moving spring lead-out piece.

17. The magnetic latching relay capable of resisting a short-circuit current according to claim 16, wherein a positioning tongue piece extends outwardly from one end of each of the moving spring lead-out piece, the positioning tongue piece inclines at an angle with respect to the moving spring lead-out piece to avoid the bent portion of the moving spring piece.

18. The magnetic latching relay capable of resisting a short-circuit current according to claim 17, wherein the thickness of the positioning tongue piece is smaller than the thickness of the moving spring lead-out piece.

19. The magnetic latching relay capable of resisting a short-circuit current according to claim 15, wherein the vertical distance of the extension line of the opposite sides of the two moving spring lead-out pieces is 4.6 mm, and the tolerance range is -0.1 to +0.5 mm; in the two moving spring lead-out pieces, the size of the opposite side of one moving spring lead-out piece closer to a parallel side wall of the base to the outer surface of the parallel side wall is 5.1 mm, and the tolerance range is -0.5 to +0.5mm.

20. The magnetic latching relay capable of resisting a short-circuit current according to claim 2, wherein further comprises a rotary magnetic circuit portion and a push block, the rotary magnetic circuit portion respectively matches with the ends of the two moving spring pieces through the push block, such that the two moving contacts are respectively brought into contact with the two stationary contacts when the rotary magnetic circuit portion rotates towards to one side, and the two moving contacts are respectively separated from the two stationary contacts when the rotary magnetic circuit portion rotates toward to the other side.

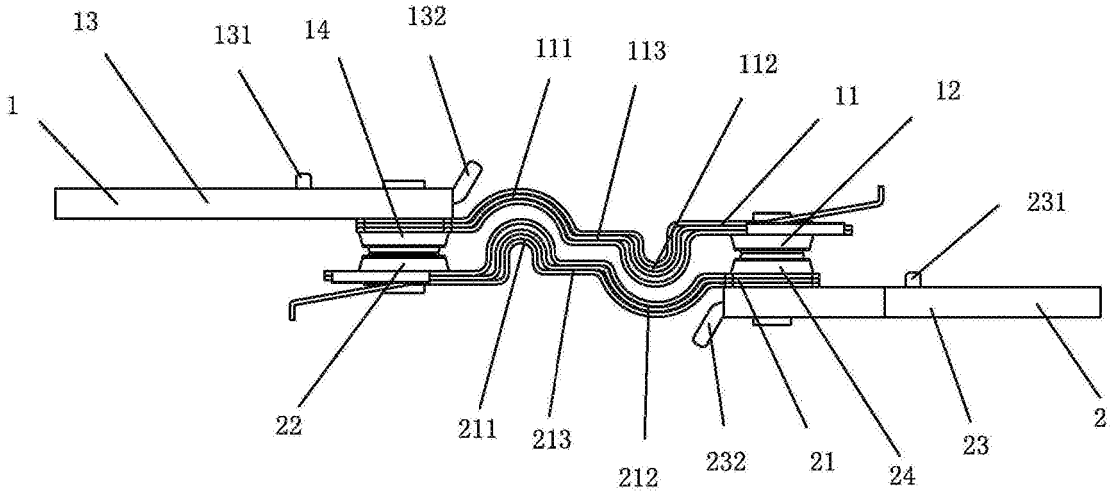
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Fig.1

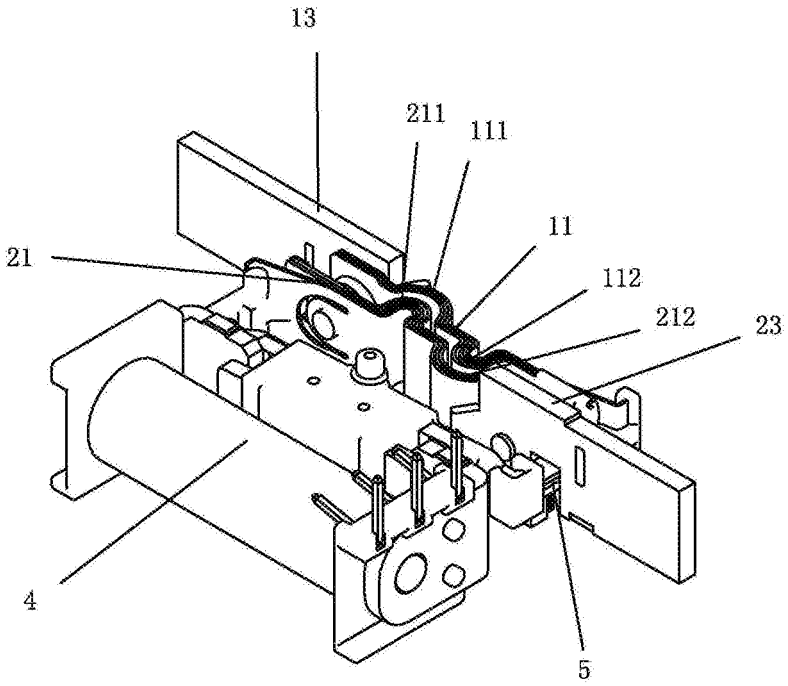
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Fig.2

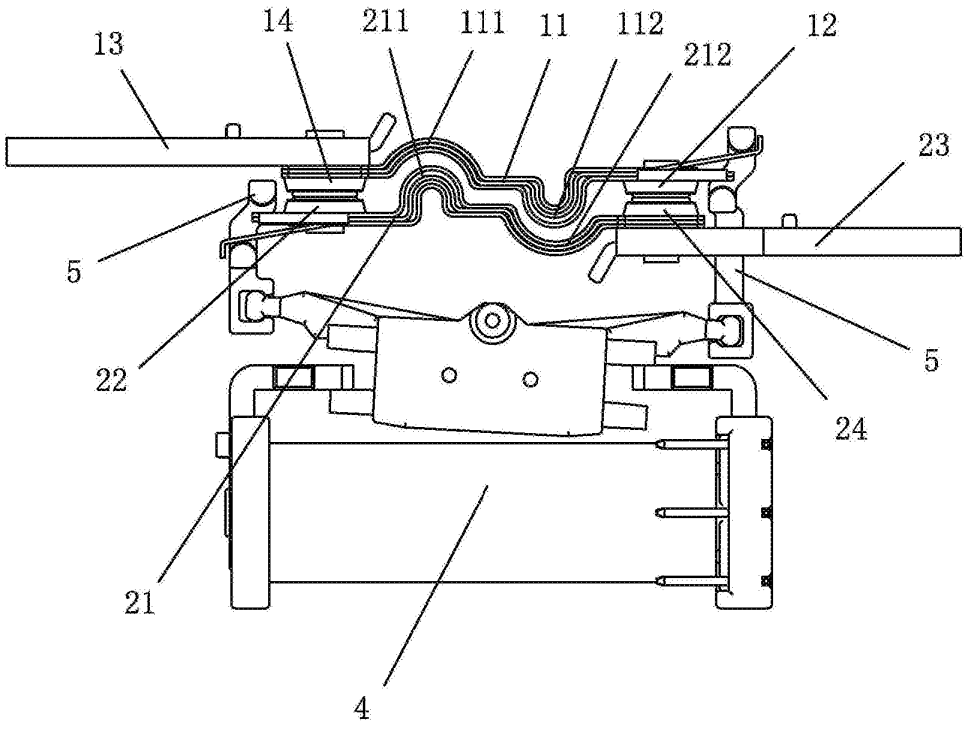
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Fig.3

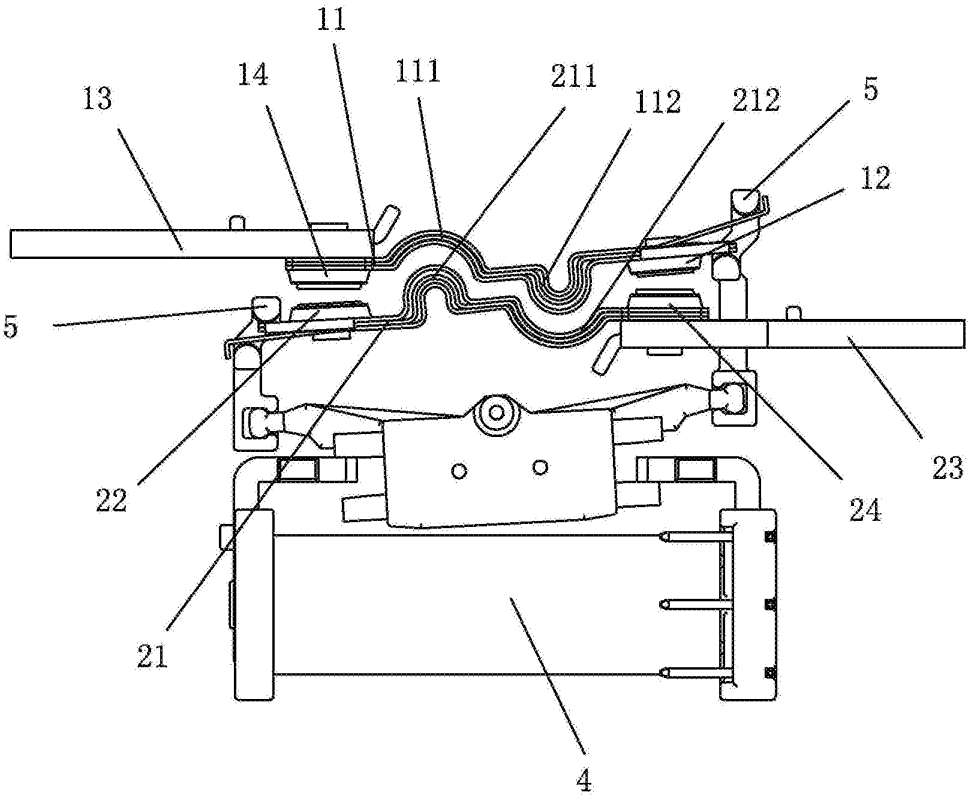
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Fig.4

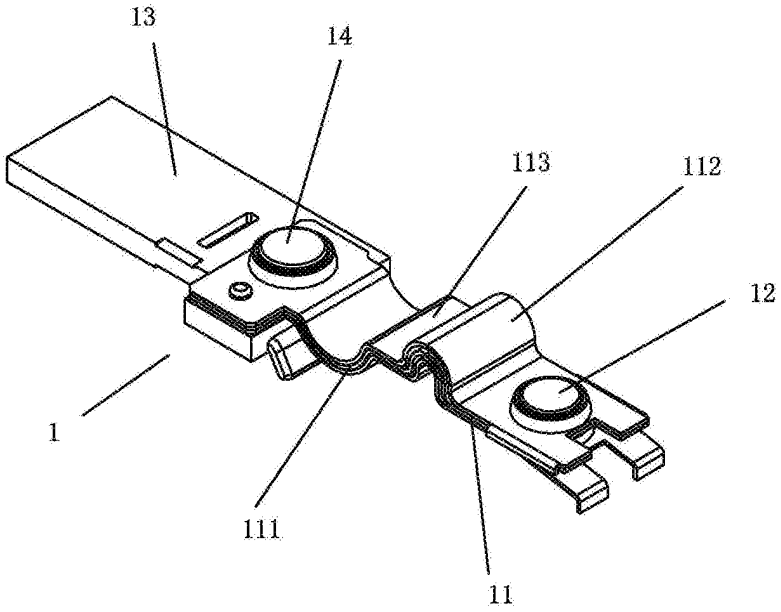

Fig.5

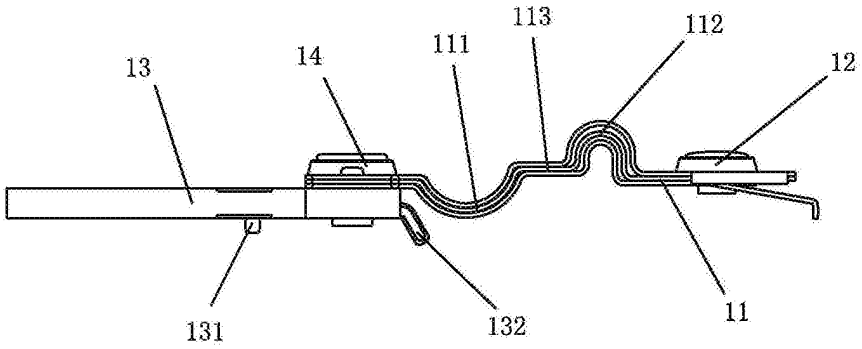

Fig.6

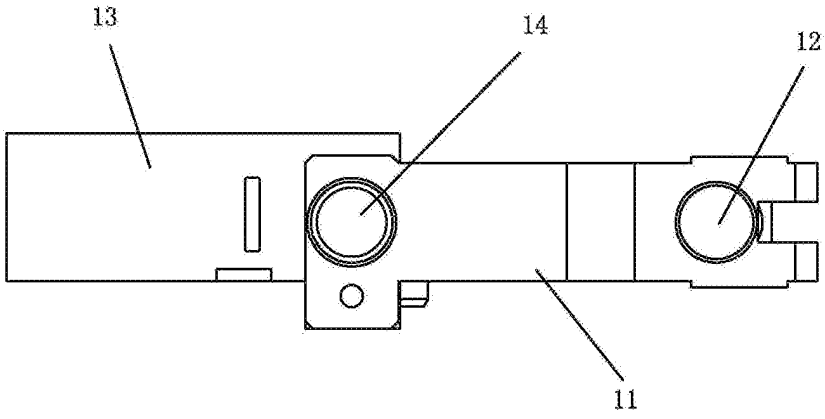

Fig.7

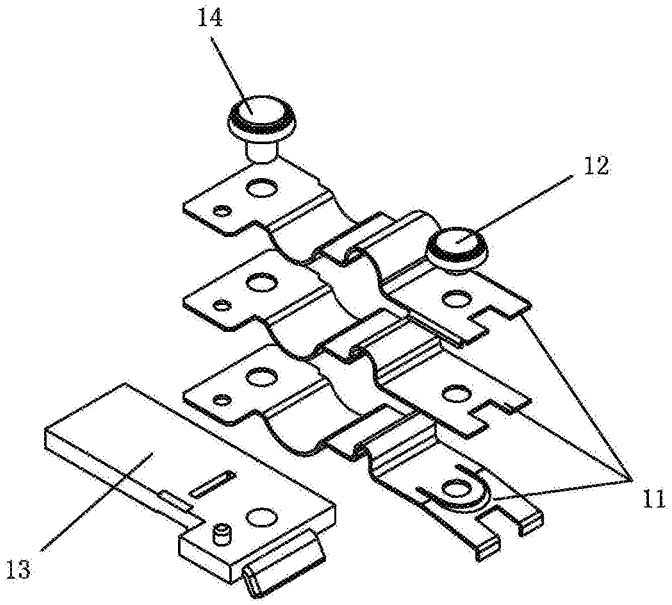

Fig.8

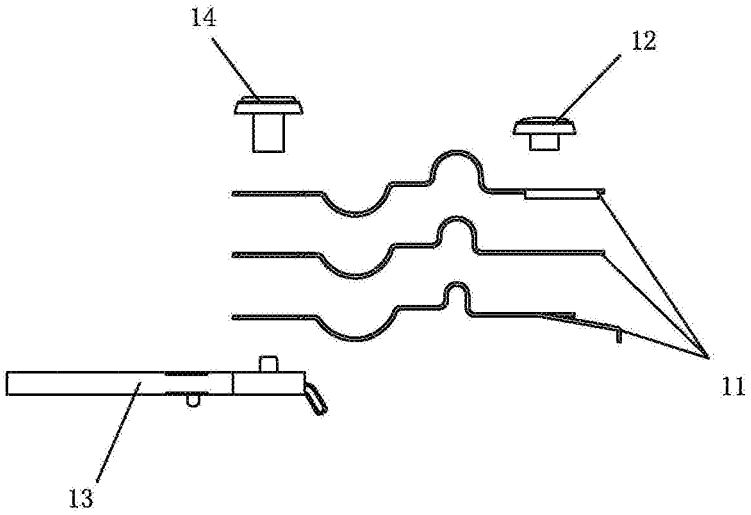

Fig.9

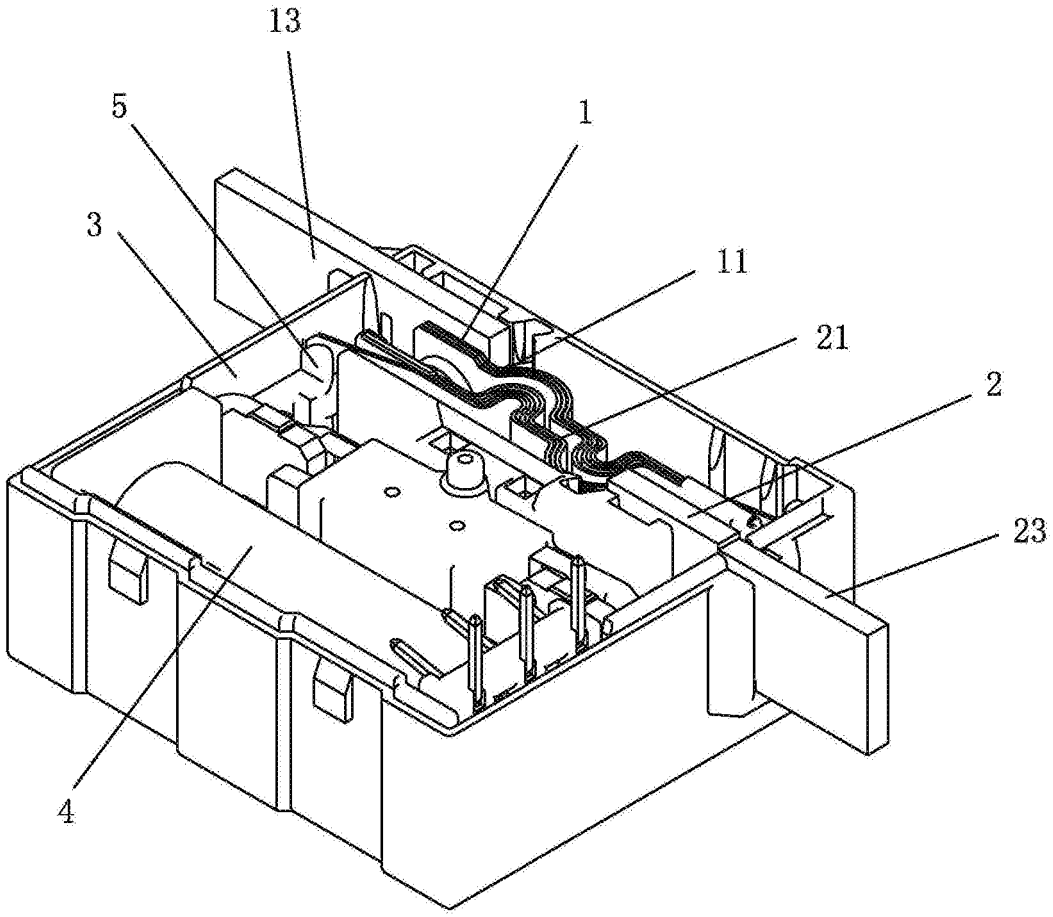

Fig.10

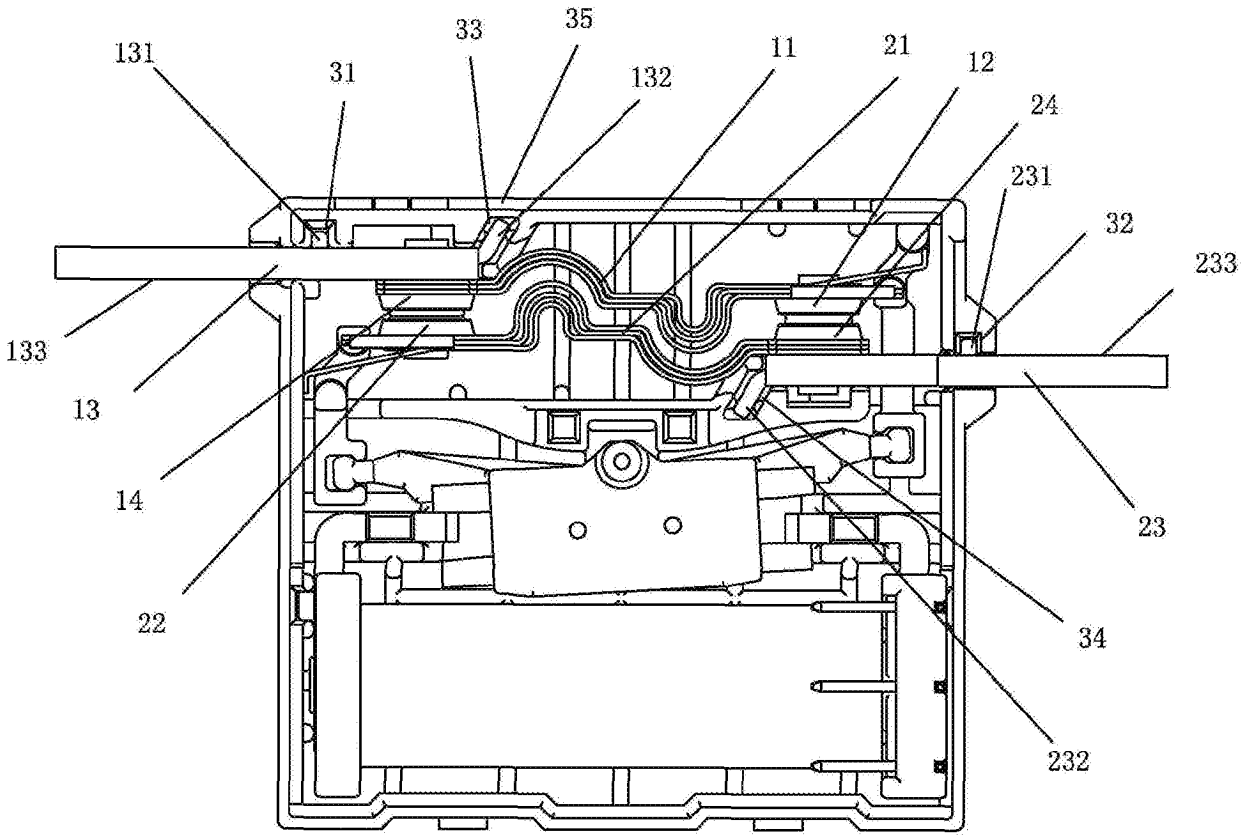

Fig.11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2018/081417

A. CLASSIFICATION OF SUBJECT MATTER

H01H 50/58 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01H

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

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

DWPI, CNABS, SIPOABS, CNTXT, CNKI: 短路电流, 磁保持继电器, 接触部分, 动簧部分, 动簧片, 动触点, 动簧引出片, 静触点, 折弯, 凸出, 凹入, 有效长度, short-circuit current, magnetic latching relay, contact part, moving reed part, moving reed piece, moving contact, moving reed leading-out piece, static contact, bending, protrusion, recession, effective length

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 106971913 A (XIAMEN HONGFA ELECTRIC POWER CONTROLS CO., LTD.), 21 July 2017 (21.07.2017), claims 1-20, description, paragraphs [0011]-[0066], and figures 1-11	1-20
PX	CN 206657780 U (XIAMEN HONGFA ELECTRIC POWER CONTROLS CO., LTD.), 21 November 2017 (21.11.2017), claims 1-20, description, paragraphs [0011]-[0066], and figures 1-11	1-20
A	CN 106504949 A (XIAMEN HONGFA ELECTRIC POWER CONTROLS CO., LTD.), 15 March 2017 (15.03.2017), description, paragraphs [0012]-[0090], and figures 1-9	1-20
A	CN 104362044 A (ZHEJIANG CHINT ELECTRICS CO., LTD.), 18 February 2015 (18.02.2015), entire document	1-20
A	CN 203415505 U (CHANGSHA ZOMKUN ELECTRICAL TECHNOLOGY CO., LTD.), 29 January 2014 (29.01.2014), entire document	1-20
A	US 7439834 B2 (UCHIYA THERMOSTATIC CO., LTD.), 21 October 2008 (21.10.2008), entire document	1-20

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 May 2018	30 May 2018
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer HAN, Beibei Telephone No. 86-(10)-62082327

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2018/081417

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 106971913 A	21 July 2017	None	
CN 206657780 U	21 November 2017	None	
CN 106504949 A	15 March 2017	None	
CN 104362044 A	18 February 2015	CN 104362044 B	18 January 2017
CN 203415505 U	29 January 2014	None	
US 7439834 B2	21 October 2008	DE 102005051679 A1	01 February 2007
		JP 2007018942 A	25 January 2007
		JP 4116022 B2	09 July 2008
		US 2007008053 A1	11 January 2007

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201710213323 **[0001]**
- CN 201210306861 **[0011]**
- CN 201280008648 **[0011]**