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(71) Applicant: **Etman Electric (Changzhou) Co., Ltd.**
Changzhou City, Jiangsu 320400 (CN)

(72) Inventor: **LIU, Feng**
Changzhou
Jiangsu 213176 (CN)

(74) Representative: **Bayramoglu et al.**
Mira Office
Kanuni Sultan Süleyman Boulevard 5387
Street Beytepe, floor 12, no:50
06800 Cankaya, Ankara (TR)

(54) RESIDUAL CURRENT DEVICE OF 2P2 ANALOG-TO-DIGITAL ELECTROMAGNETIC RESIDUAL CURRENT CIRCUIT BREAKER WITH OVERCURRENT PROTECTION

(57) The present invention relates to a current leakage protection apparatus of a 2P2M electromagnetic residual current circuit breaker with overcurrent protection (RCBO), including a housing, a current leakage tripping action mechanism, and a test circuit mechanism. The test circuit mechanism includes a conductivity test torsion spring, a hinging and linking shaft, and a test button. One end of the conductivity test torsion spring abuts against the test button. The housing is provided with a linkage hole in a direction of a movable contact of the circuit breaker. The other end of the conductivity test torsion spring is embedded in the linkage hole. The housing is provided with a test resistor. The present invention has the following advantages. The current leakage protection apparatus of a 2P2M electromagnetic RCBO improves a structure of a test circuit. Compared with a test circuit module in the prior art, the structure is simple and there is a small quantity of components. In this way, mounting space and costs are reduced, and it's easier for workers to perform overall assembly.

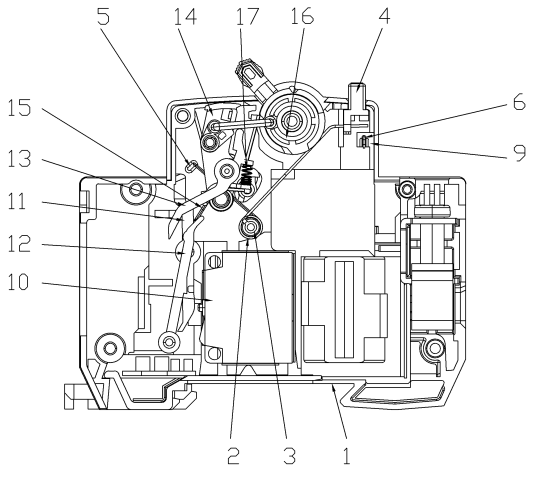

Fig. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to the technical field of circuit breakers, and specifically, to a current leakage protection apparatus of a 2P2M electromagnetic residual current circuit breaker with overcurrent protection (RCBO).

BACKGROUND

[0002] RCBO, also called earth leakage circuit breaker or ground fault circuit interrupter, is mainly used to protect a person in danger when current leakage occurs in a device, and may be used to protect a line or a motor to avoid overload or short circuit, or may be used in normal cases when a line is infrequently converted and started. The RCBO usually includes a housing. A circuit breaker apparatus and a current leakage protection apparatus are distributed in the housing. The circuit breaker apparatus is used to control connection or disconnection of a movable contact and a fixed contact when short circuit or overload occurs or a line is infrequently started. The current leakage protection apparatus is used to control the connection or disconnection of the movable contact and the fixed contact when current leakage occurs.

[0003] The current leakage protection apparatus is used to control a latch to perform tripping when current leakage occurs. The current leakage protection apparatus in the prior art includes a housing. A control board, a current leakage tripping action mechanism and a test circuit mechanism are disposed in the housing. The test circuit mechanism is mainly used to simulate current leakage to check whether on or off of the circuit breaker is normal.

[0004] The test circuit module in the prior art usually adopts multiple test springs and test resistors, and these components are tiled in the housing. During assembly, mounting and placement of the current leakage tripping action mechanism need to be considered, so that the overall structure of the current leakage protection apparatus is complicated and there are lots of components. Consequently, layout and assembly are complicated.

SUMMARY

[0005] In order to overcome the deficiencies of the prior art, the present invention provides a current leakage protection apparatus of a 2P2M electromagnetic RCBO, to improve a structure of a test circuit. Compared with a test circuit module in the prior art, the structure is simple and there are a small quantity of components. In this way, mounting space and costs are reduced, and it's easier for workers to perform overall assembly.

[0006] To achieve the foregoing objectives, the present invention provides the following technical solutions. A current leakage protection apparatus of a 2P2M electromagnetic RCBO is provided, including a housing, where a current leakage tripping action mechanism and a test circuit mechanism are disposed in the housing; the test circuit mechanism includes a conductivity test torsion spring; a hinging and linking shaft is hinged to the middle part of the conductivity test torsion spring, and one end of the hinging and linking shaft is fixed to the housing; a test button is movably embedded in an upper part of the housing; one end of the conductivity test torsion spring extends towards the test button and abuts against the test button; the housing is provided with a linkage hole in a direction of a movable contact of the circuit breaker; the other end of the conductivity test torsion spring opposite to the end abutting against the test button is embedded in the linkage hole and extends towards an outer side of the linkage hole; a test resistor is disposed under the test button on the housing, and the conductivity test torsion spring is intermittently conductively connected to the test resistor through the test button.

[0007] In the foregoing technical solutions, the structure of the test circuit is improved. Compared with the test circuit module in the prior art, the test resistor may be intermittently connected to the circuit breaker module through merely the conductivity test torsion spring, so that the structure is simple and there is a small quantity of components. In this way, mounting space and costs are reduced, and it's easier for workers to perform the overall assembly. Besides, there is no welding point in the foregoing test circuit, so that compared with the prior art in which welding is required, the processing is simplified and the manufacturing period is shortened.

[0008] The foregoing current leakage protection apparatus of a 2P2M electromagnetic RCBO may further be set as follows. A latching position that configured to guide the conductivity test torsion spring is disposed between the test button and the hinging and linking shaft on the housing.

[0009] In the foregoing technical solutions, the conductivity test torsion spring may be limited by disposing the latching position, to prevent the conductivity test torsion spring from displacement, thereby improving work stability of the conductivity test torsion spring.

[0010] The foregoing current leakage protection apparatus of a 2P2M electromagnetic RCBO may further be set as follows. The periphery of the hinging and linking shaft is provided with an anti-sliding protrusion along an axial direction of the hinging and linking shaft.

[0011] In the foregoing technical solutions, the anti-sliding protrusion may increase friction between the conductivity test torsion spring and the hinging and linking shaft, to prevent the conductivity test torsion spring from being separated from the hinging and linking shaft.

[0012] The foregoing current leakage protection apparatus of a 2P2M electromagnetic RCBO may further be set as follows. A mounting position for mounting the test resistor in a concealed way is disposed under the test button on the housing, and a support frame configured to fix and support a lead of the test resistor is disposed

at an end of the mounting position on the housing.

[0013] In the foregoing technical solutions, the mounting position is disposed to mount the test resistor on the housing in a concealed way, so that space is properly used and overall layout of the current leakage protection apparatus is simple. The support frame is further disposed to fix a lead end of the test resistor, so that when the test button is pressed, the conductivity test torsion spring may be conductively connected to the test resistor accurately.

[0014] The foregoing current leakage protection apparatus of a 2P2M electromagnetic RCBO may further be set as follows. The current leakage tripping action mechanism includes a current leakage tripping device mounted in the housing and a first transmission rod with one end intermittently linked to a side of the current leakage tripping device; the middle part of the first transmission rod is movably hinged to the housing, and one end of the first transmission rod adjacent to the current leakage tripping device abuts against and is linked to a second transmission rod; one end of the second transmission rod is hinged to the housing, and the other end of the second transmission rod abuts against and is linked to a third transmission rod; the middle part of the third transmission rod is hinged to the housing, a current leakage tripping rod is coaxially hinged to a position where the third transmission rod is hinged to the housing, and the other end of the third transmission rod opposite to the end linked to the second transmission rod is linked to the current leakage tripping rod; the current leakage tripping rod is linked to a current leakage reset torsion spring, two ends of the current leakage reset torsion spring respectively abut against the current leakage tripping rod and the first transmission rod, and the other end of the current leakage tripping rod opposite to the end linked with the first transmission rod is linked to a current leakage operation handle.

[0015] In the foregoing technical solutions, a current leakage tripping force is stably transmitted, and there is no need to perform welding because there is no welding point.

[0016] The foregoing current leakage protection apparatus of a 2P2M electromagnetic RCBO may further be set as follows. A flexible connection assembly is disposed between the current leakage tripping device and the third transmission rod.

[0017] In the foregoing technical solutions, the flexible connection assembly is disposed, so that the current leakage tripping device and the third transmission rod adaptively rotate under the joint action of each other, to transform a rigid connection into a flexible connection. In this way, friction is reduced, and work fluency is better and there is no abnormal sound.

[0018] The foregoing current leakage protection apparatus of a 2P2M electromagnetic RCBO may further be set as follows. The flexible connection assembly includes a spring with two ends oppositely fixed to the current leakage tripping rod and the third transmission rod, respectively.

[0019] In the foregoing technical solutions, the spring is disposed, so that the current leakage tripping device and the third transmission rod adaptively rotate under the joint action of each other, to transform a rigid connection into a flexible connection. In this way, friction is reduced, and work fluency is better and there is no abnormal sound.

[0020] The present invention is further described in detail below with reference to the accompanying drawings and embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

FIG. 1 is a schematic structural diagram of a front view according to an embodiment of the present invention;

FIG. 2 is a schematic diagram of a front view of a test circuit mechanism according to an embodiment of the present invention; and

FIG. 3 is a schematic diagram of a rear view of an assembled circuit breaker apparatus according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0022] The technical solutions in embodiments of the present invention will be described below clearly and completely with reference to the accompanying drawings in the embodiments of the present invention. Apparently, the described embodiments are merely a part rather than all of the embodiments of the present invention. All other embodiments derived from the embodiments in the present invention by a person of ordinary skill in the art without creative work shall fall within the protection scope of the present invention.

[0023] A current leakage protection apparatus of a 2P2M electromagnetic RCBO shown in FIG. 1 to FIG. 3 includes a housing 1. A current leakage tripping action mechanism and a test circuit mechanism are disposed in the housing 1. The test circuit mechanism includes a conductivity test torsion spring 2. A hinging and linking shaft 3 is hinged to the middle part of the conductivity test torsion spring 2. One end of the hinging and linking shaft 3 is fixed to the housing 1. A test button 4 is movably embedded in an upper part of the housing 1. One end of the conductivity test torsion spring 2 extends towards the test button 4 and abuts against the test button 4. The housing 1 is provided with a linkage hole 5 in a direction of a movable contact of the circuit breaker. The other end of the conductivity test torsion spring 2 opposite to the end abutting against the test button 4 is embedded in the linkage hole 5 and extends towards an outer side of the linkage hole 5. A test resistor 6 is disposed under the test button 4 on the housing 1. The conductivity test torsion spring 2 is intermittently conductively connected to the

test resistor 6 through the test button 4.

[0024] A latching position 7 that configured to guide the conductivity test torsion spring 2 is disposed between the test button 4 and the hinging and linking shaft 3 on the housing 1. The periphery of the hinging and linking shaft 3 is provided with an anti-sliding protrusion 31 along an axial direction of the hinging and linking shaft 3. A mounting position 8 for mounting the test resistor 6 in a concealed way is disposed under the test button 4 on the housing 1. A support frame 9 configured to fix and support a lead of the test resistor 6 is disposed at an end of the mounting position 8 on the housing 1.

[0025] Working principles of the test circuit mechanism are as follow. The test button 4 is pressed, so that one end of the conductivity test torsion spring 2 contacts with a lead end of the test resistor 6. Because the other end of the conductivity test torsion spring 2 is conductively connected to the circuit breaker apparatus, the test circuit is on. The test resistor 6 is intermittently connected to the circuit breaker module through merely the conductivity test torsion spring 2, so that the structure is simple and there are a small quantity of components. In this way, mounting space and costs are reduced, and it's easier for workers to perform overall assembly.

[0026] As shown in FIG. 1, the current leakage tripping action mechanism includes a current leakage tripping device 10 mounted in the housing 1 and a first transmission rod 11 with one end intermittently linked to a side of the current leakage tripping device 10. The middle part of the first transmission rod 11 is movably hinged to the housing 1. An end of the first transmission rod 11 adjacent to the current leakage tripping device 10 abuts against and is linked to a second transmission rod 12. One end of the second transmission rod 12 is hinged to the housing 1, and the other end of the second transmission rod 12 abuts against and is linked to a third transmission rod 13. The middle part of the third transmission rod 13 is hinged to the housing 1. A current leakage tripping rod 14 is coaxially hinged to a position where the third transmission rod 13 is hinged to the housing 1. The other end of the third transmission rod 13 opposite to the end linked to the second transmission rod 12 is linked to the current leakage tripping rod 14. The current leakage tripping rod 14 is linked to a current leakage reset torsion spring 15. Two ends of the current leakage reset torsion spring 15 respectively abut against the current leakage tripping rod 14 and the first transmission rod 11. The other end of the current leakage tripping rod 14 opposite to the end linked with the first transmission rod 11 is linked to a current leakage operation handle 16. A flexible connection assembly is disposed between the current leakage tripping device 10 and the third transmission rod 13. The flexible connection assembly includes a spring 17 with two ends oppositely fixed to the current leakage tripping rod 14 and the third transmission rod 13, respectively.

[0027] Working principles of the current leakage tripping device are as follows. When, for example, current leakage occurs, the current leakage tripping device 10 drives the first transmission rod 11, and the first transmission rod 11 drives the second transmission rod 12 to rotate around a hinge axis of the second transmission rod 12. Further, an end of the second transmission rod 12 pushes the third transmission rod 13. The third transmission rod 13 presses the current leakage tripping rod 14 through the spring 17, and the current leakage tripping rod 14 drives the circuit breaker apparatus, so that power is off (where the spring 598 rotates, so that a current leakage flexible linkage block is tripped, and the current leakage tripping rod resets under action of the reset spring, to toggle the first push pole, so that power is off).

Claims

1. A current leakage protection apparatus of a 2P2M electromagnetic residual current circuit breaker with overcurrent protection (RCBO), comprising a housing, wherein a current leakage tripping action mechanism and a test circuit mechanism are disposed in the housing; the test circuit mechanism comprises a conductivity test torsion spring; a hinging and linking shaft is hinged to a middle part of the conductivity test torsion spring, and one end of the hinging and linking shaft is fixed to the housing; a test button is movably embedded in an upper part of the housing; one end of the conductivity test torsion spring extends towards the test button and abuts against the test button; the housing is provided with a linkage hole in a direction of a movable contact of the circuit breaker; the other end of the conductivity test torsion spring opposite to the end abutting against the test button is embedded in the linkage hole and extends towards an outer side of the linkage hole; a test resistor is disposed under the test button on the housing, and the conductivity test torsion spring is intermittently conductively connected to the test resistor through the test button.

2. The current leakage protection apparatus of the 2P2M electromagnetic RCBO according to claim 1, wherein a latching position configured to guide the conductivity test torsion spring is disposed between the test button and the hinging and linking shaft on the housing.

3. The current leakage protection apparatus of the 2P2M electromagnetic RCBO according to claim 1 or 2, wherein a periphery of the hinging and linking shaft is provided with an anti-sliding protrusion along an axial direction of the hinging and linking shaft.

4. The current leakage protection apparatus of the 2P2M electromagnetic RCBO according to claim 1, wherein a mounting position for mounting the test resistor in a concealed way is disposed under the test button on the housing, and a support frame con-

figured to fix and support a lead of the test resistor is disposed at an end of the mounting position on the housing.

5. The current leakage protection apparatus of the 2P2M electromagnetic RCBO according to claim 1, wherein the current leakage tripping action mechanism comprises a current leakage tripping device disposed in the housing and a first transmission rod with one end intermittently linked to a side of the current leakage tripping device; a middle part of the first transmission rod is movably hinged to the housing, and one end of the first transmission rod adjacent to the current leakage tripping device abuts against and is linked to a second transmission rod; one end of the second transmission rod is hinged to the housing, and the other end of the second transmission rod abuts against and is linked to a third transmission rod; a middle part of the third transmission rod is hinged to the housing, a current leakage tripping rod is coaxially hinged to a position where the third transmission rod is hinged to the housing, and the other end of the third transmission rod opposite to the end linked to the second transmission rod is linked to the current leakage tripping rod; the current leakage tripping rod is linked to a current leakage reset torsion spring, two ends of the current leakage reset torsion spring respectively abut against the current leakage tripping rod and the first transmission rod, and the other end of the current leakage tripping rod opposite to the end linked with the first transmission rod is linked to a current leakage operation handle.

6. The current leakage protection apparatus of the 2P2M electromagnetic RCBO according to claim 5, wherein a flexible connection assembly is disposed between the current leakage tripping device and the third transmission rod.

7. The current leakage protection apparatus of the 2P2M electromagnetic RCBO according to claim 6, wherein the flexible connection assembly comprises a spring with two ends oppositely fixed to the current leakage tripping rod and the third transmission rod, respectively.

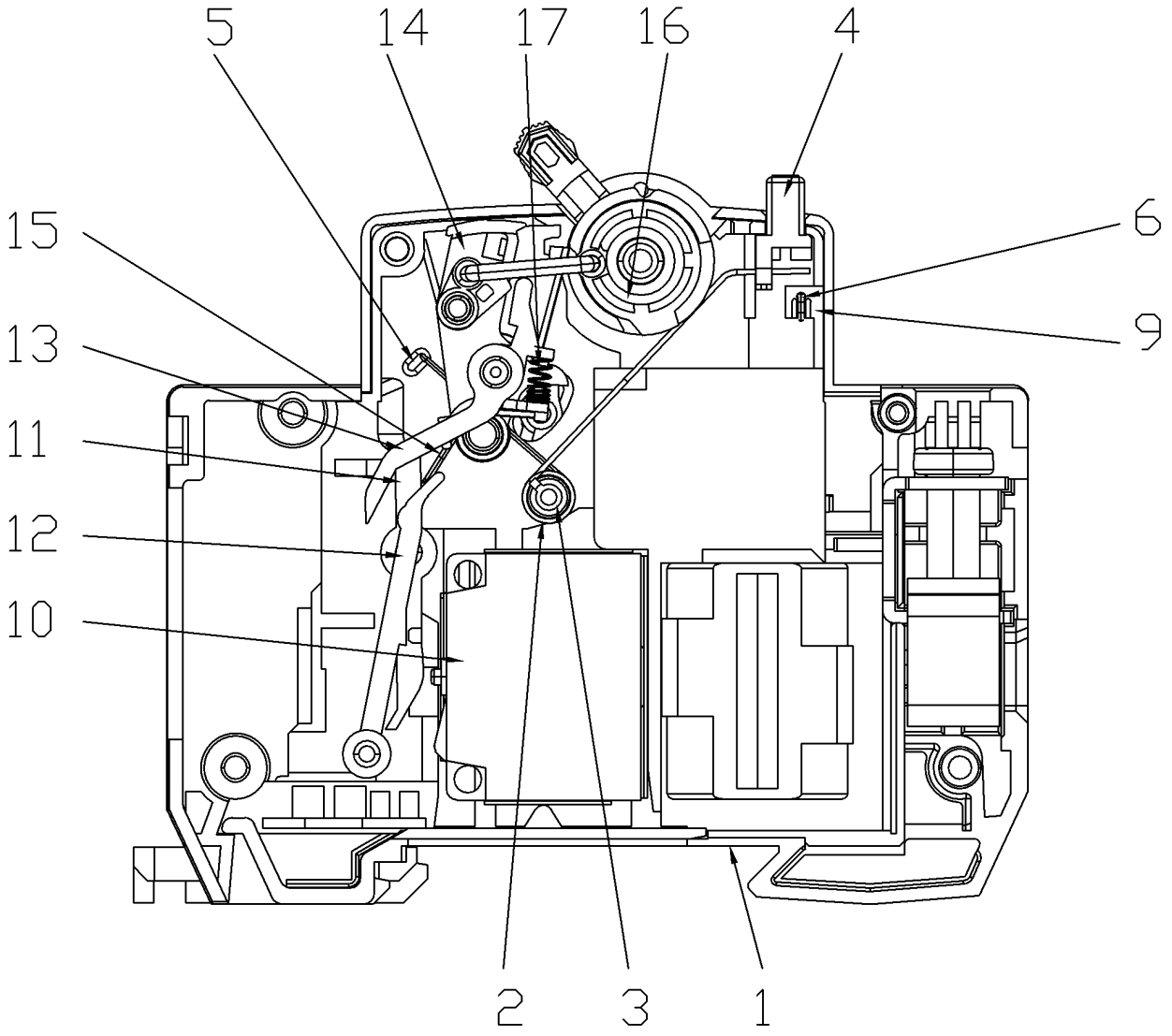

Fig. 1

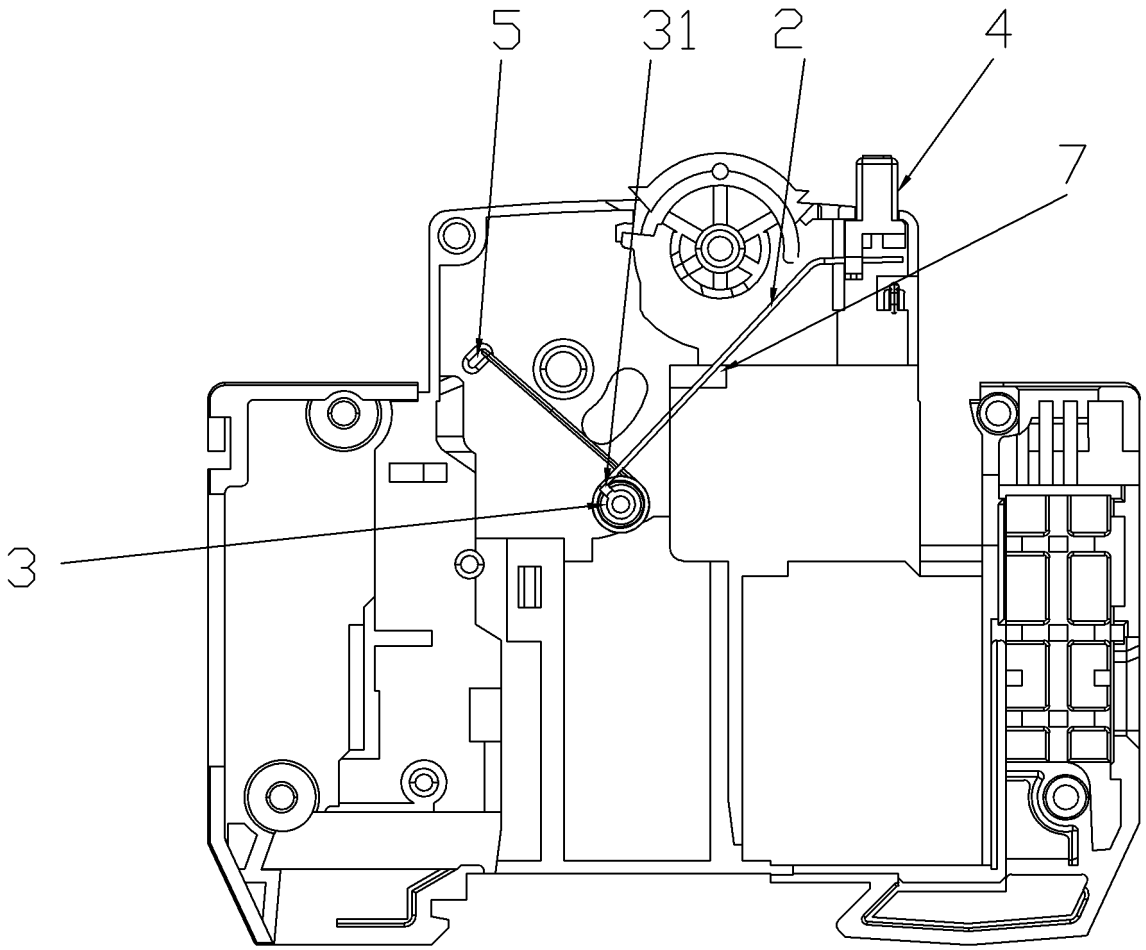

Fig. 2

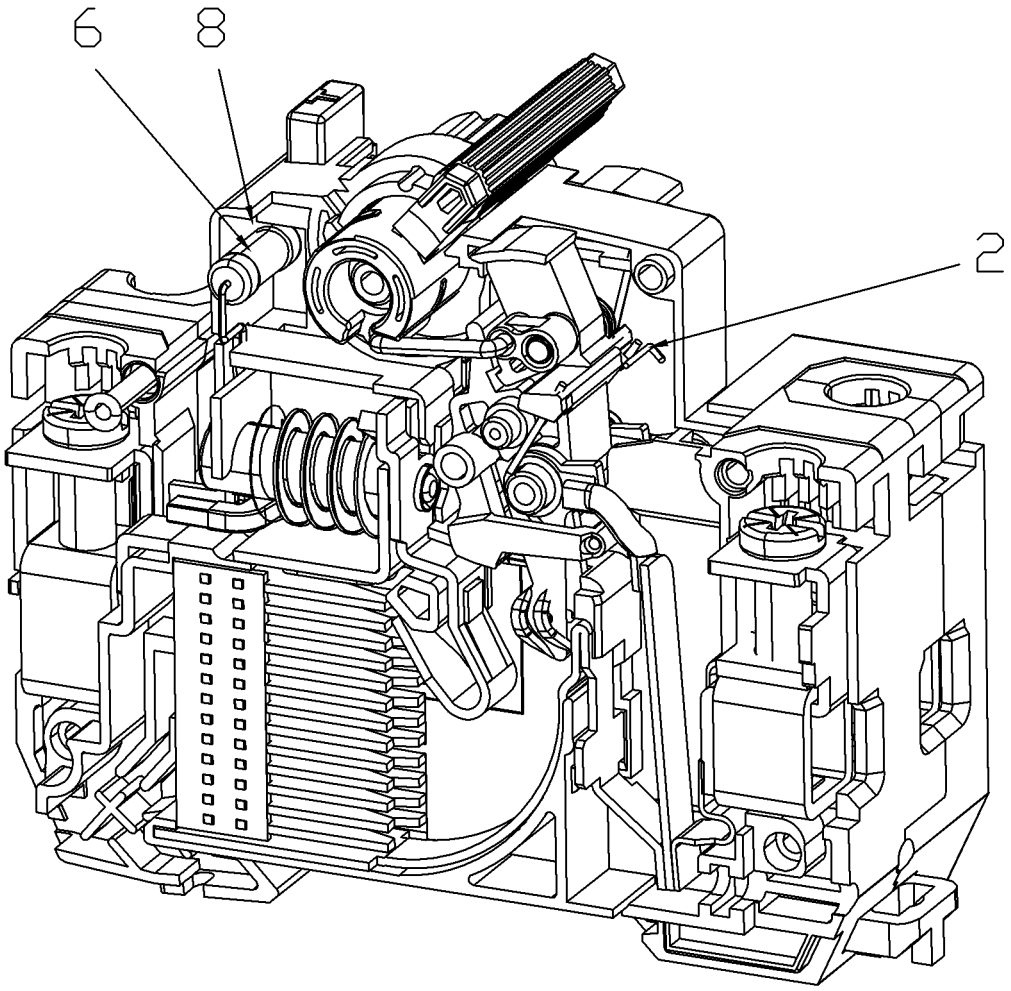

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/114979

A. CLASSIFICATION OF SUBJECT MATTER

H01H 71/00(2006.01)i; H01H 71/02(2006.01)i; H01H 71/10(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01H

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

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

CNABS; CNTXT; CNKI; SIPOABS; DWPI; USTXT; WOTXT; EPTXT: 英特曼电工, 漏电保护断路器, 漏电断路器, 漏电保护器, 断路器, 开关, 试验扭簧, 测试, 簧, 轴, 杆, 试验按钮, 试验电阻, 凸条, 脱扣, breaker, interrupt+, switch+, leakage, RCBO, torsion spring, test, shaft, rod, lever, trip+, try

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 112951665 A (ETMAN ELECTRIC (CHANGZHOU) CO., LTD.) 11 June 2021 (2021-06-11) claims 1-10, description paragraphs [0033]-[0042], figures 1-15	1-7
X	CN 203787366 U (ZHEJIANG CHINT ELECTRIC APPLIANCE CO., LTD.) 20 August 2014 (2014-08-20) description, paragraphs [0021]-[0030], and figures 1-4	1-7
X	CN 111128616 A (SHANGHAI ELECTRICAL APPARATUS RESEARCH INSTITUTE (GROUP) CO., LTD. et al.) 08 May 2020 (2020-05-08) description, paragraphs [0034]-[0050], and figures 1-12	1-7
A	CN 207264994 U (ZHEJIANG KAIFA ELECTRIC CO., LTD.) 20 April 2018 (2018-04-20) entire document	1-7
A	CN 111640628 A (WENZHOU JINXU ELECTRIC CO., LTD.) 08 September 2020 (2020-09-08) entire document	1-7

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

Date of the actual completion of the international search	Date of mailing of the international search report
03 December 2021	**21 December 2021**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/114979

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 112951665 A	11 June 2021	None	
CN 203787366 U	20 August 2014	None	
CN 111128616 A	08 May 2020	CN 211529896 U	18 September 2020
CN 207264994 U	20 April 2018	None	
CN 111640628 A	08 September 2020	None	

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