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(54) FUSE DEVICE WITH MICRO-POWERED SWITCH

(57) Disclosed is a fuse device with a micro-powered switch comprising a micro-powered switch (2), a fuse device interlocking mechanism (5), a fuse wire striker pin assembly (6) and a connecting rod (7), wherein the fuse wire striker pin assembly (6) comprises a main shaft (601), striker pin pieces (602) and trigger pieces (603); the striker pin pieces (602) and the trigger pieces (603) are radially fixed on the main shaft (601), and can axially move around the main shaft (601); and when one or more fuse wires are not installed, or when one or more fuse wires have fused, the fuse device interlocking mechanism (5) cooperates with the fuse wire striker pin assembly (6) and drives the connecting rod (7) to trigger the micro-powered switch (2), whereby the switch device cannot close. The fuse device with a micro-powered switch has a simpler structure, effectively reducing production costs, and the modularised assembly saves on assembly time.

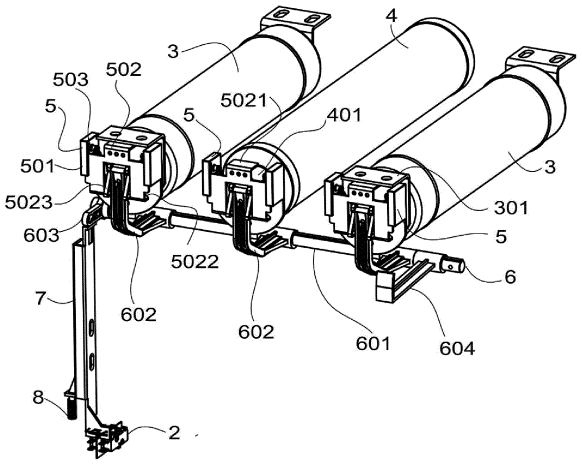

Fig. 2A

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Description

FIELD

[0001] The present disclosure generally relates to a technical field of electric power product, and specifically to the technical field of high voltage switching device. In particular, the present disclosure relates to the technical field of a fuse device, a fuse wire mounting interlocking device, and a transmission system of the fuse wire fused by a strike pin.

BACKGROUND

[0002] In an electric power system, a switching device is used to control an ON/OFF operation of a protected element. Typically, three-phase fuse wires are configured as a short-circuit protection device. On one hand, in order to ensure safety, when at least one phase of fuse wires are absent, a closing operation of the switching device would not be allowed, and thereby a fuse wire mounting interlocking mechanism is needed to perform this function. On the other hand, when overcurrent or short circuit occurs in the system, the opening operation is performed for the fault current based on the characteristics of the fuse wires themselves. However, when one or two phases of fuse wires are fused by these currents, the other two or one phase of fuse wires are still conductive, resulting in phase-loss operation which may cause various damages to a user's device. Therefore, there is still a need for an interlocking device for fusing fuse wires, to trigger the switching device to complete the opening operation.

[0003] Figs. 1A-1B illustrate a brief structural diagram of the traditional fuse wire mounting interlocking and fusing device, wherein Fig. 1A is a front stereoscope view, and Fig. 1B is a rear stereoscopic view. The state as shown is a state without mounting three phases of fuse wires. The fuse wire mounting interlocking device 93 is coupled to the three-phase fusing linkage 94. When fuse wires are not mounted, the fuse wire mounting piece 9301 is lifted up by the tension spring 9302, to simultaneously move the three-phase fusing linkage 94 upwardly and then overcome the resistance of the return leaf spring 9501 to rotate the rotation shaft 95 along a direction as shown by the arrow in Fig. 1A. Subsequently, the bushing 9502 on the shaft 95 is rotated to switch on the microswitch, such that the switching device performs an OPEN operation.

[0004] When a German Standard (DIN) fuse is mounted, the fuse will press down the tongue 9312 of the fuse wire mounting piece 9301; and when a British Standard (BS) fuse is mounted, the fuse will press down the protrusion 9311 of the fuse wire mounting piece 9301. In the two cases above, the fuse wire mounting piece 9301 will move downwardly by a certain distance. Due to the displacement of the fuse wire mounting piece 9301, the three-phase fusing linkage 94 moves downwardly accordingly. As such, the rotation shaft 95 is rotated by the return leaf spring 9501 in a reverse direction of the rotation direction as shown by the arrow in Fig. 1A. In this way, the bushing 9502 would naturally be disengaged from the microswitch. Consequently, the switching device can implement the normal CLOSE operation.

[0005] When at least one phase of fuse is fused by the short-circuit current, the strike pin of the fuse wire will be triggered to be ejected out and will directly act on the crank 9303 to lift the crank 9303 up. Since the pin 9401 of the three-phase fusing linkage 94 is lap-connected to the crank 9303, the three-phase fusing linkage 94 is lifted up to rotate the rotation shaft 95 in the direction as shown by the arrow in Fig. 1 by overcoming the retention force of the return leaf spring 9501. The bushing 9502 sleeved on the rotation shaft 95 rotates along with the rotation shaft 95 to switch on the microswitch, causing the switching device OPEN and thus protecting the electric power system.

[0006] However, the aforementioned fuse device incurs a complicated structure and high costs; and the complicated structure brings about labor-intensive mounting and long time for mounting.

SUMMARY

[0007] In order to solve the problems of the fuse device with a microswitch in the prior art, such as a complicated structure, high costs, long time for mounting, and the like, the present disclosure provides a fuse device with a microswitch, comprising: a microswitch, a fuse device interlocking mechanism, a fuse wire strike pin component, and a linkage, wherein the fuse wire strike pin component comprises a main shaft, a strike pin piece and a trigger piece; wherein the strike pin piece and the trigger piece are radially fixed on the main shaft, and axially movable along the main shaft; and when one or more fuse wires are not mounted, or one or more fuse wires have been fused, the fuse device interlocking mechanism cooperates with the fuse wire strike pin component, to drive the linkage to trigger the microswitch, causing the switching device not to close.

[0008] According to an optimum embodiment of the present disclosure, the fuse device interlocking mechanism comprises a mounting bracket, an interlocking plate and a tension spring; and when a fuse is mounted, the interlocking plate moves in a direction in which the tension spring is extended under an action of the fuse.

[0009] According to an optimum embodiment of the present disclosure, the interlocking plate comprises at least one slide rail and at least one projection for mounting the fuse.

[0010] According to an optimum embodiment of the present disclosure, the fuse wire strike pin component further comprises a fuse state indicator fixed on the main shaft.

[0011] According to an optimum embodiment of the present disclosure, one end of the linkage is coupled to

the trigger piece, and the linkage moves vertically with a rotation of the trigger piece driven by the main shaft.

[0012] According to an optimum embodiment of the present disclosure, the fuse device with the microswitch further comprises a return spring which acts on the linkage and keeps the linkage in contact with the trigger piece.

[0013] According to an optimum embodiment of the present disclosure, when at least one phase of fuse wires are not mounted, the strike pin piece is pushed away under an action of the interlocking plate, causing the main shaft to rotate together and simultaneously causing the trigger piece mounted thereon to rotate in a same direction, such that a link-motion of the linkage driven by the trigger piece triggers the microswitch, causing the switching device not to close.

[0014] According to an optimum embodiment of the present disclosure, the link-motion of the linkage compresses the return spring.

[0015] According to an optimum embodiment of the present disclosure, the strike pin piece is provided thereon with at least one protrusion which cooperates with the slide rail; when at least one phase of fuse wires are not mounted, the interlocking plate is at a position where the tension spring is reset under an action of the tension spring; when all fuse wires are mounted, the interlocking plate moves in a direction in which the tension spring is extended, and the strike pin piece drives the protrusion to rotate along the guide rail in a direction away from the main shaft under an action of the return spring.

[0016] According to an optimum embodiment of the present disclosure, when at least one phase of fuse wires is pulled out, the interlocking plate moves in a direction in which the tension spring is reset, and the strike pin piece rotates in a direction approaching the main shaft with a movement of the protrusion along the guide rail, further causing the linkage to move.

[0017] According to an optimum embodiment of the present disclosure, when at least one fuse wire has been fused, a strike pin of the fuse wire is ejected out and acts on the strike pin piece, causing the strike pin piece to rotate in a direction away from the fuse wire while driving the main shaft and the trigger piece to rotate in a same direction.

[0018] According to an optimum embodiment of the present disclosure, the interlocking plate is mounted thereon with a fuse wire mounting indicator indicating whether a fuse wire is mounted.

[0019] According to an optimum embodiment of the present disclosure, the strike pin piece and the trigger piece are coupled via a convex structure and a concave structure.

[0020] As compared to the traditional design, the fuse wire mounting interlock and the strike pin system device according to the present disclosure have a simpler structure, effectively reducing production costs, and may save assembling time by the modularized assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

Figs. 1A-1B illustrate structural diagrams of a fuse device with a microswitch when being located at a testing position;

Figs. 2A-2C illustrate structural diagrams of an optimum embodiment of a fuse device with a microswitch of the present disclosure, wherein Fig. 2A is a schematic diagram of a stereoscopic structure, Fig. 2B is a top view, and Fig. 2C is an axonometrical drawing;

Fig. 3 illustrates a structural diagram of the optimum embodiment of a fuse device with a microswitch of the present disclosure when at least one phase of fuse wires is not mounted;

Fig. 4 illustrates a structural diagram of the optimum embodiment of a fuse device with a microswitch of the present disclosure when at least one phase of fuse wires has been fused;

Fig. 5 illustrates a diagram of a fuse device interlocking mechanism according to the optimum embodiment of a fuse device with a microswitch of the present disclosure;

Figs. 6A-6B illustrate schematic diagrams of a fuse state indicator according to the optimum embodiment of the fuse device with the microswitch of the present disclosure, wherein Fig. 6A illustrates that fuse wires are not mounted or fuse wires have been fused, and Fig. 6B illustrates that fuse wires have been mounted;

Figs. 7A-7C illustrate schematic diagrams of a fuse wire strike pin component according to the optimum embodiment of the fuse device with the microswitch of the present disclosure, wherein Fig. 7A illustrates a diagram of a stereoscopic structure, and Figs. 7B-7C illustrate diagrams of partial enlargements; and

Figs. 8A-8C illustrate structural diagrams of a strike pin piece of a fuse wire strike pin component according to a further optimum embodiment of a fuse device with a microswitch of the present disclosure, wherein Figs. 8A, 8B and 8C illustrate structural diagrams of a strike pin piece after different numbers of fuse wires have been fused and the strike pin has been ejected, respectively.

DETAILED DESCRIPTION OF EMBODIMENTS

[0022] Reference will be made to drawings to give detailed description of optional embodiments of the present

disclosure.

[0023] Figs. 2A-2C are structural diagrams of an optimum embodiment of a fuse device with a microswitch of the present disclosure, wherein Fig. 2A is a schematic diagram of a stereoscope structure, Fig. 2B is a top view, and Fig. 2C is an axonometric view.

[0024] According to the optimum embodiment of the present disclosure, the fuse device with a microswitch comprises a fuse device interlocking mechanism 5, a fuse wire strike pin component 6, a linkage 7 and a microswitch 2.

[0025] When one or more fuse wires are not mounted, or one or more fuse wires have been fused, the fuse device interlocking mechanism 5 cooperates with the fuse wire strike pin component 6, to drive the linkage 7 to trigger the microswitch 2, thus causing the switching device not to close.

[0026] Fig. 5 illustrates a structural diagram of a fuse device interlocking mechanism 5 of a fuse device with a microswitch according to the optimum embodiment of the present disclosure. The fuse device interlocking mechanism 5 comprises a mounting bracket 501, an interlocking plate 502, and a tension spring 503. The interlocking plate 502 is provided thereon with a first projection 5021 for mounting a British Standard (BS) fuse, and a second projection 5022 for mounting a German Standard (DIN) fuse. Once the BS or DIN fuse is mounted, the interlocking plate 502 moves a certain distance toward a direction in which the tension spring is extended, i.e., the downward direction as shown in Figs. 2A-2C and Fig. 5, under an action of the fuse. At this time, the tension spring 503 is extended into an energy storage state. The interlocking plate 502 has at least one slide rail 5023. As shown, the slide rail 5023 is inclined, and the slide rail 5023 becomes closer to the fuse wires in a direction in which the tension spring 503 is extended to a reset position.

[0027] The mounting bracket 501 is provided thereon with at least one projecting rod 5011. In the meantime, the interlocking plate 502 is provided thereon with at least one fixing hole 5024, for mounting the tension spring 503. The interlocking plate 502 is able to move vertically relative to the mounting bracket 501 through a guide slot 5012.

[0028] According to the optimum embodiment of the present disclosure, as shown in Fig. 5 and Fig. 2A, a British Standard (BS) fuse 3 and a German Standard (DIN) fuse 4 may be mounted in the fuse device with a microswitch. A fixed end 301 of the BS fuse 3 and a fixed end 401 of the DIN fuse 4 are provided for being fixedly mounted to the first projection 5021 and the second projection 5022 of the fuse device, respectively.

[0029] As shown in Figs. 2A-2C and Fig. 3, according to the optimum embodiment of the present disclosure, the fuse wire strike pin component 6 of the fuse device with a microswitch comprises a main shaft 601, a strike pin piece 602, a trigger piece 603, and a fuse state indicator 604. The strike pin piece 602, the trigger piece 603, and the fuse state indicator 604 are fixed radially to the main shaft 601, and are axially movable along the main shaft 601.

[0030] One end of the linkage 7 is coupled to the trigger piece 603. The linkage 7 moves vertically as the trigger piece 603 is rotating with the main shaft 601. Under an action of a return spring 8, the linkage 7 always has a tendency to contact the trigger piece 603.

[0031] Fig. 3 illustrates the optimum embodiment of a fuse device with a microswitch according to the present disclosure. When at least one phase of fuse wires are not mounted, the strike pin piece 602 is pushed away under an action of the interlocking plate 502, causing the main shaft 601 to rotate together in the direction toward outside of the paper. In the meantime, the main shaft 601 drives the trigger piece 603 and the fuse state indicator 604 mounted thereon to rotate in the same direction, such that the trigger piece 603 triggers a link-motion of the linkage 7, causing the return spring 8 to be compressed. The linkage 7 directly triggers the microswitch, causing the switching device not to close. The fuse state indicator 604 may provide the state of the whole switch to an observer.

[0032] The strike pin piece 602 is provided thereon with at least one protrusion 6021. The interlocking plate 502 is provided thereon with at least a slide rail 5023. The protrusion 6021 cooperates with the slide rail 5023. When at least one phase of fuse wires is not mounted, the interlocking plate 502 is at an upper position under an action of the tension spring 503. After all fuse wires are mounted, the interlocking plate 502 will move downwardly by a certain distance. At this time, the protrusion 6021 of the strike pin piece 602 will, under an action of the return spring 8, rotate along the slide rail 5023 in a direction away from the main shaft 601 (i.e., the direction toward inside of the paper).

[0033] Reversibly, when any phase of fuse wires is pulled out, the interlocking plate 502 will move upwardly, and the strike pin piece 602 is pushed out in the direction approaching the main shaft 601 (i.e., the direction toward outside of the paper) with the rotation of the protrusion 6021 along the slide rail 5032. In this way, the linkage 7 is driven to move and the return spring 8 is compressed.

[0034] Fig. 4 illustrates the optimum embodiment of a fuse device with a microswitch according to the present disclosure. When at least one fuse wire has been fused, the strike pin 402 of the fuse wire will be ejected out and acts directly on the strike pin piece 602, causing the strike pin piece 602 to rotate in the direction away from the fuse wire (i.e., the direction toward outside of the paper) and simultaneously driving the main shaft 601, the fuse state indicator 604, and the trigger piece 603 to rotate in the same direction. In the meantime, the trigger piece 603 drives the linkage 7 and the return spring 8 to move, such that the microswitch coupled to the linkage 7 can be triggered to open the three-phase circuit of the switching device.

[0035] Figs. 6A-6B schematic diagrams of a fuse wire

state indicator of a fuse device with a microswitch according to the optimum embodiment of the present disclosure, wherein Fig. 6A illustrates that fuse wires are not mounted or the fuse wires have been fused, and Fig. 6B illustrates that fuse wires are mounted. Optionally, a fuse wire mounting indicator 9 may be mouned on the interlocking plate 502 to indicate whether a fuse wire is mounted. Compared to the case where the fuse wires are not mounted, the interlocking plate 502 moves a distance of S after the fuse wires are mounted.

[0036] Figs. 7A-7C illustrate a schematic diagram of a fuse wire strike pin component of a fuse device with a microswitch according to the optimum embodiment of the present disclosure, wherein Fig. 7A illustrates a diagram of a stereoscopic structure, and Figs. 7B-7C illustrate diagrams of partial enlargements. The fuse wire strike pin component 6 comprises a main shaft 601, a strike pin piece 602, a trigger piece 603, and a fuse state indicator 604. The strike pin piece 602, the trigger piece 603, and the fuse state indicator 604 are fixed radially onto the main shaft 601. A preferred solution is that: the strike pin piece 602, the trigger piece 603, and the fuse state indicator 604 are coupled to the main shaft 601 by a convex structure 6011 and a concave structure 6022 to be fixed radially and movable axially, as shown.

[0037] The strike pin piece 602 is provided thereon with at least one projection 6021 feature for cooperatively moving along the slide rail 5023.

[0038] Alternatively, the concave feature of the strike pin piece 602 may be designed as a broad concave structure 6023 as shown in Figs. 8A-8C, increasing a space for displacement, such that the strike pin piece 602 of each phase can perform actions independently, without impacting each other. It is possible, therefore, to indicate precisely which phase of the fuse wires is not mounted or has been fused. Figs. 8A, 8B and 8C illustrate structural diagrams of a strike pin piece after different numbers of fuse wires have been fused and the strike pin has been ejected, respectively.

[0039] As compared to the traditional design, the fuse wire mounting interlocking and the strike pin system device according to the present disclosure have a simpler structure, effectively reducing production costs, and may save assembling time by the modularized components.

[0040] Although optimum embodiments of the disclosure and drawings are provided for illustration, those skilled in the art may make various substitution, changes and modification without departing from the spirit and scope of the present disclosure and the appended claims. Therefore, the present disclosure is not be limited to the disclosure of the optimum embodiments and drawings as illustrated above as examples, and the protection scope thereof should be subjected to the scope defined hereinafter in the appended claims.

Claims

1. A fuse device with a microswitch, comprising a microswitch (2), wherein the fuse device further comprises a fuse device interlocking mechanism (5), a fuse wire strike pin component (6), and a linkage (7); wherein the fuse wire strike pin component (6) comprises a main shaft (601), a strike pin piece (602) and a trigger piece (603); and the strike pin piece (602) and the trigger piece (603) are radially fixed on the main shaft (601), and axially movable along the main shaft (601); and
wherein, when one or more fuse wires are not mounted, or one or more fuse wires have been fused, the fuse device interlocking mechanism (5) cooperates with the fuse wire strike pin component (6), to drive the linkage (7) to trigger the microswitch (2), causing the switching device not to close.

2. The fuse device with a microswitch of claim 1, wherein the fuse device interlocking mechanism (5) comprises a mounting bracket (501), an interlocking plate (502) and a tension spring (503); and when a fuse is mounted, the interlocking plate (502) moves in a direction in which the tension spring is extended under an action of the fuse.

3. The fuse device with a microswitch of claim 2, wherein the interlocking plate (502) comprises at least one slide rail (5023) and at least one projection (5021, 5022) for mounting the fuse.

4. The fuse device with a microswitch of claim 1, wherein the fuse wire strike pin component (6) further comprises a fuse state indicator (604) fixed on the main shaft (601).

5. The fuse device with the microswitch of claim 1, wherein one end of the linkage (7) is coupled to the trigger piece (603), and the linkage (7) moves vertically with a rotation of the trigger piece (603) driven by the main shaft (601).

6. The fuse device with a microswitch of claim 1, wherein the fuse device with a microswitch further comprises a return spring (8) which acts on the linkage (7) and keeps the linkage (7) in contact with the trigger piece (603).

7. The fuse device with a microswitch of claim 1, wherein, when at least one phase of fuse wires are not mounted, the strike pin piece (602) is pushed away under an action of the interlocking plate (502), causing the main shaft (601) to rotate together and simultaneously causing the trigger piece (603) mounted thereon to rotate in a same direction, such that a linkmotion of the linkage (7) driven by the trigger piece (603) triggers the microswitch (2), causing the

switching device not to close.

8. The fuse device with a microswitch of claim 7, wherein the link-motion of the linkage (7) compresses the return spring (8).

9. The fuse device with a microswitch of claim 1, wherein the strike pin piece (602) is provided thereon with at least one protrusion (6021) which cooperates with the slide rail (5023); when at least one phase of fuse wires are not mounted, the interlocking plate (502) is at a position where the tension spring (503) is reset under an action of the tension spring (503); when all fuse wires are mounted, the interlocking plate (502) moves in a direction in which the tension spring (503) is extended, and the strike pin piece (602) drives the protrusion (6021) to rotate along the guide rail (5023) in a direction away from the main shaft (601) under an action of the return spring (8).

10. The fuse device with a microswitch of claim 9, wherein, when at least one phase of fuse wires are pulled out, the interlocking plate (502) moves in a direction in which the tension spring (503) is reset, and the strike pin piece (602) rotates in a direction approaching the main shaft (601) with a movement of the protrusion (6021) along the guide rail (5023), causing the linkage (7) to move.

11. The fuse device with a microswitch of claim 1, wherein, when at least one fuse wire has been fused, a strike pin (402) of the fuse wire is ejected out and acts on the strike pin piece (602), causing the strike pin piece (602) to rotate in a direction away from the fuse wire while driving the main shaft (601) and the trigger piece (603) to rotate in a same direction.

12. The fuse device with a microswitch of claim 1, wherein the interlocking plate (502) is mounted thereon with a fuse wire mounting indicator (9) indicating whether a fuse wire is mounted.

13. The fuse device with a microswitch of claim 9, wherein the strike pin piece (602) and the trigger piece (603) are coupled via a convex structure and a concave structure.

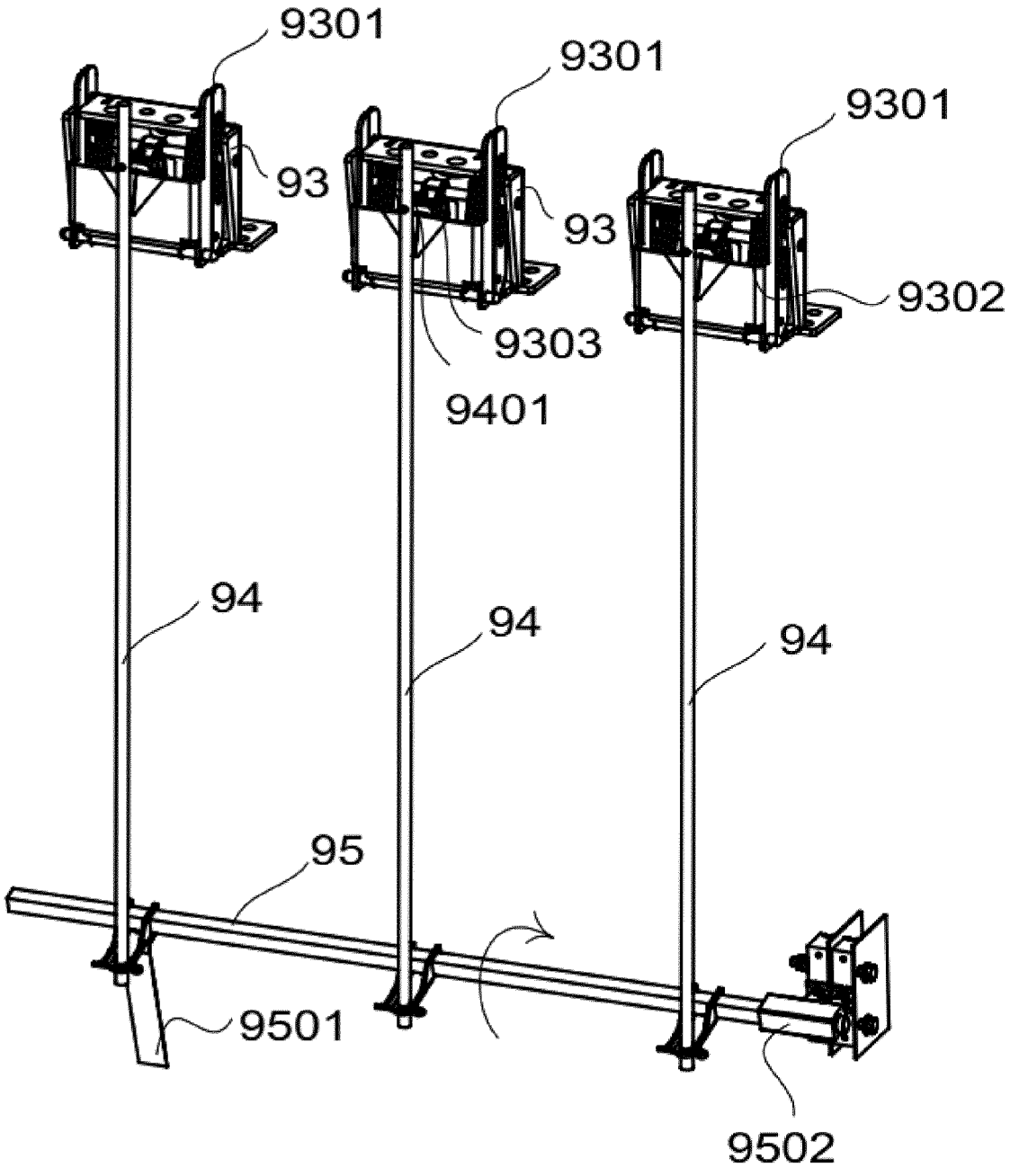


Fig. 1A

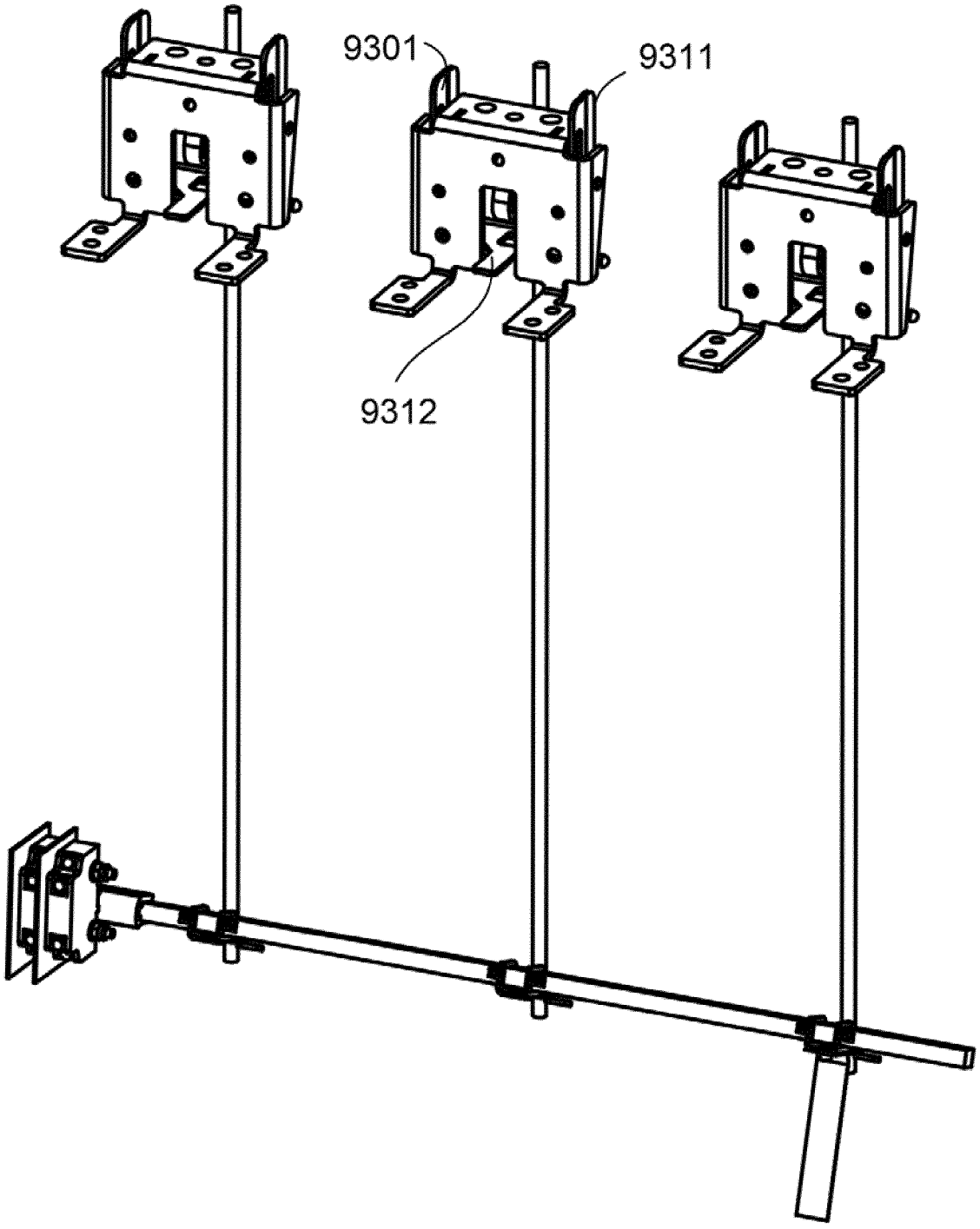
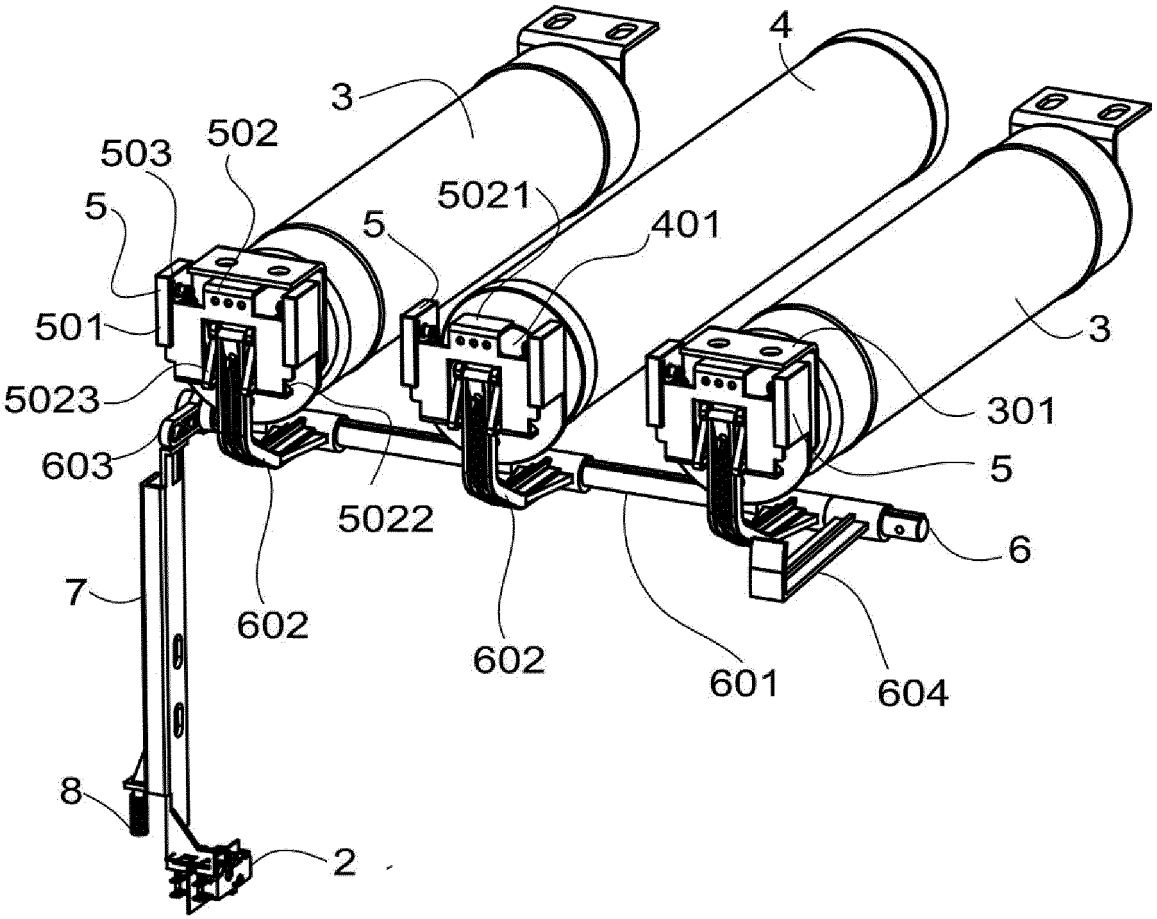


Fig. 1B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3
503
502
5021
5
5
401
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603
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5022
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602
602
601
604
8
2

Fig. 2A

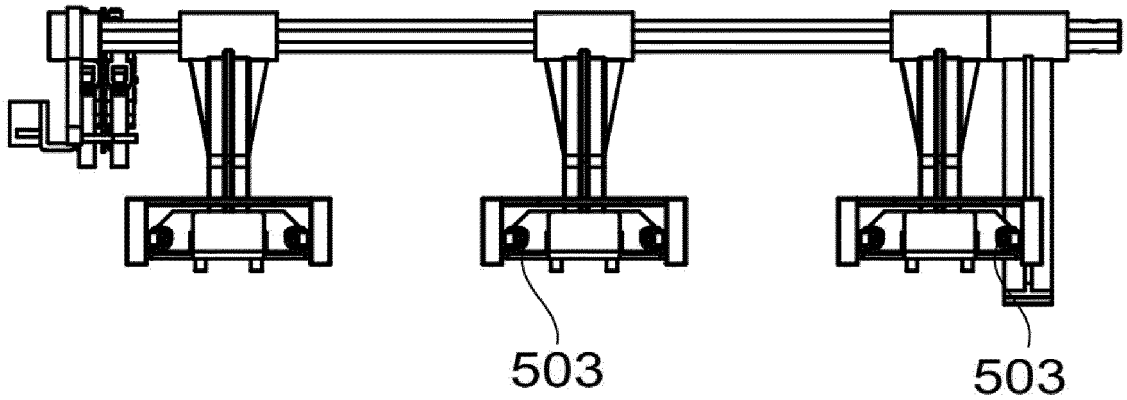

503
503

Fig. 2B

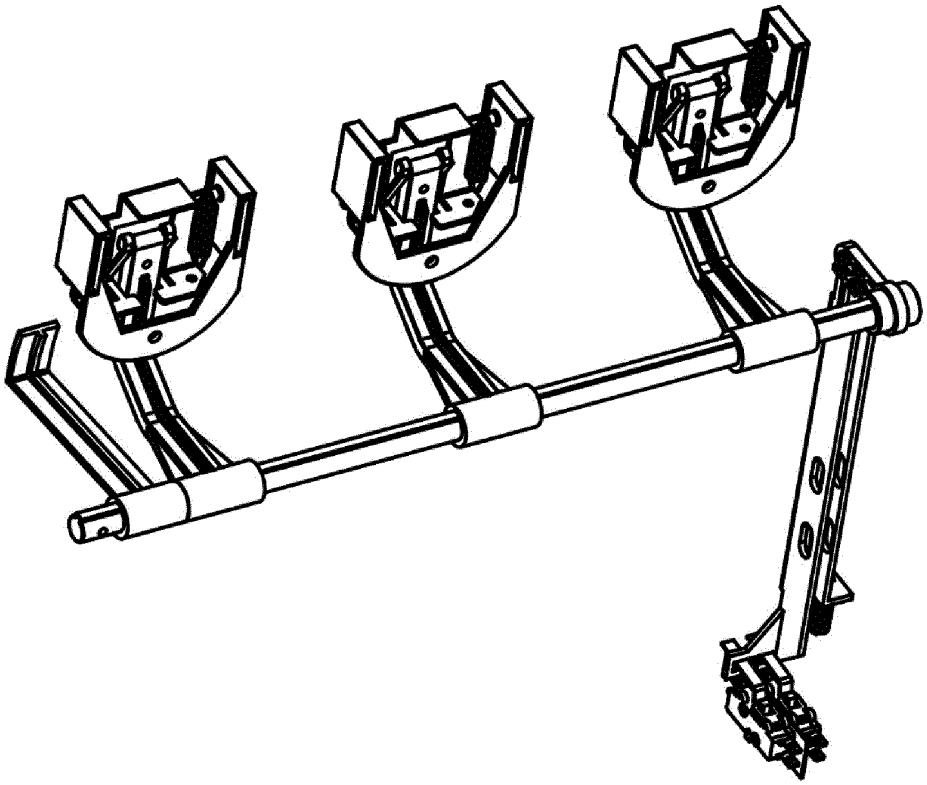


Fig. 2C

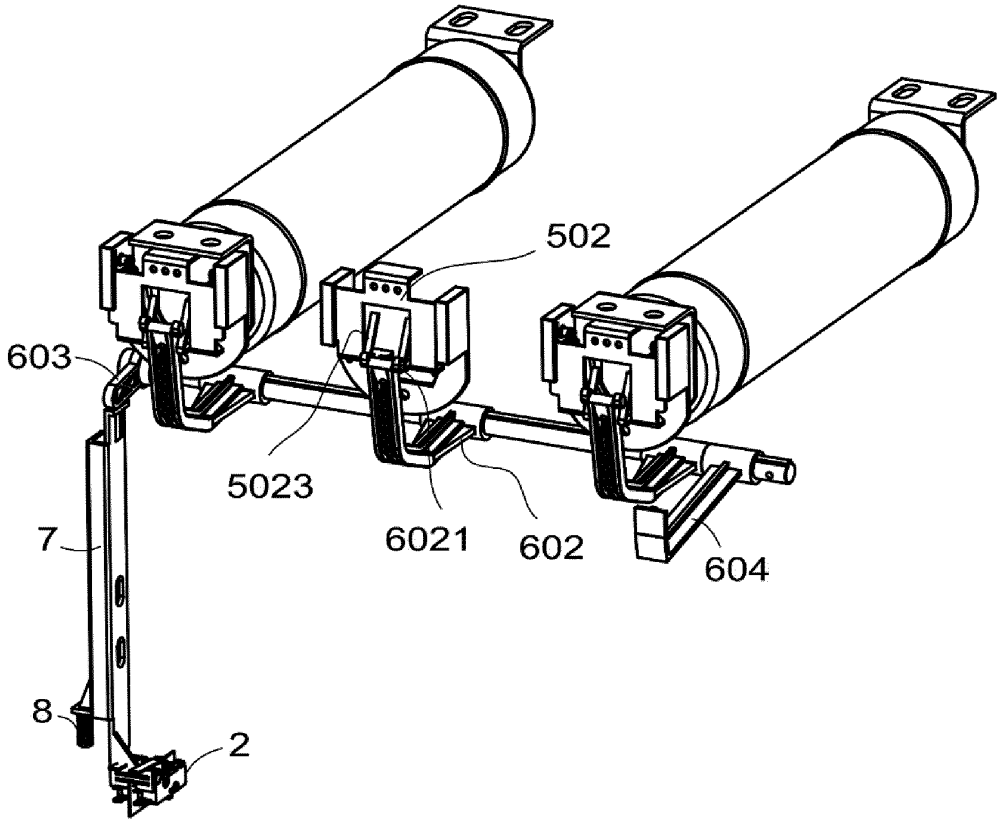
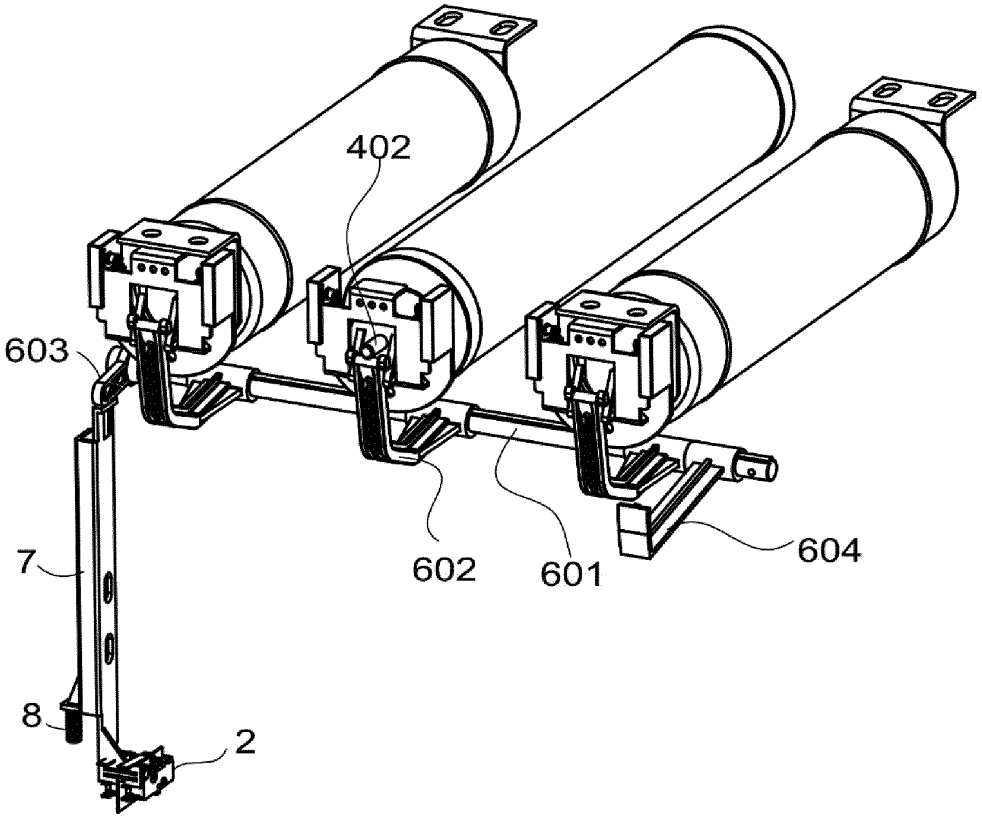


Fig. 3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603
7
602
601
604
8
2

Fig. 4

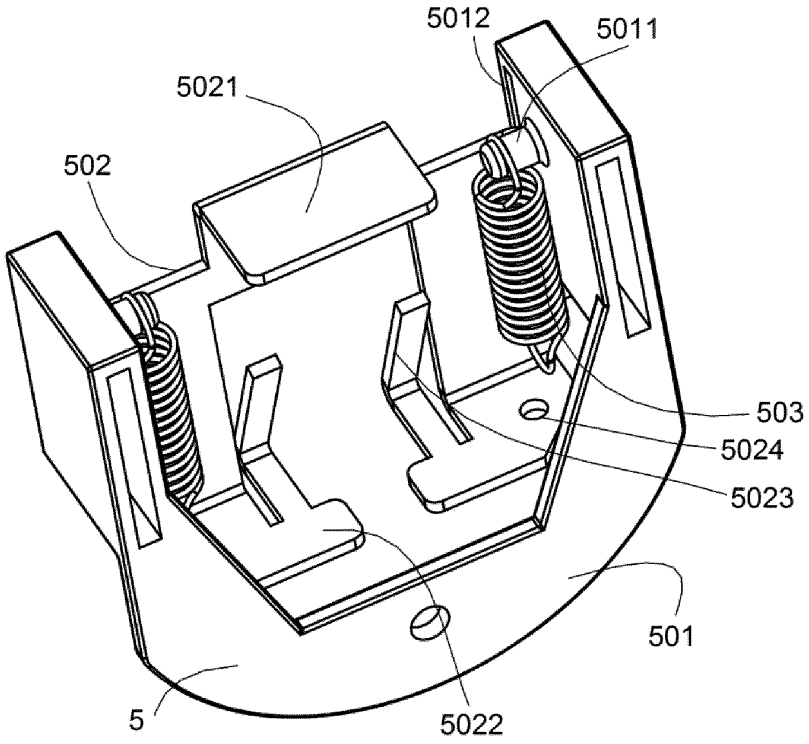
5012
5011
5021
502
503
5024
5023
501
5
5022

Fig. 5

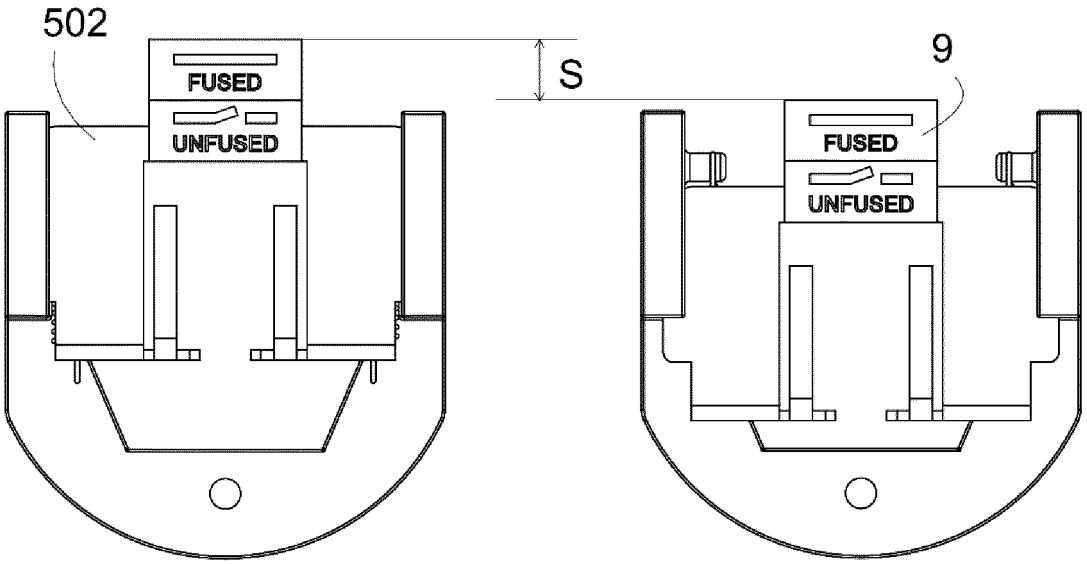

Fig. 6A

Fig. 6B

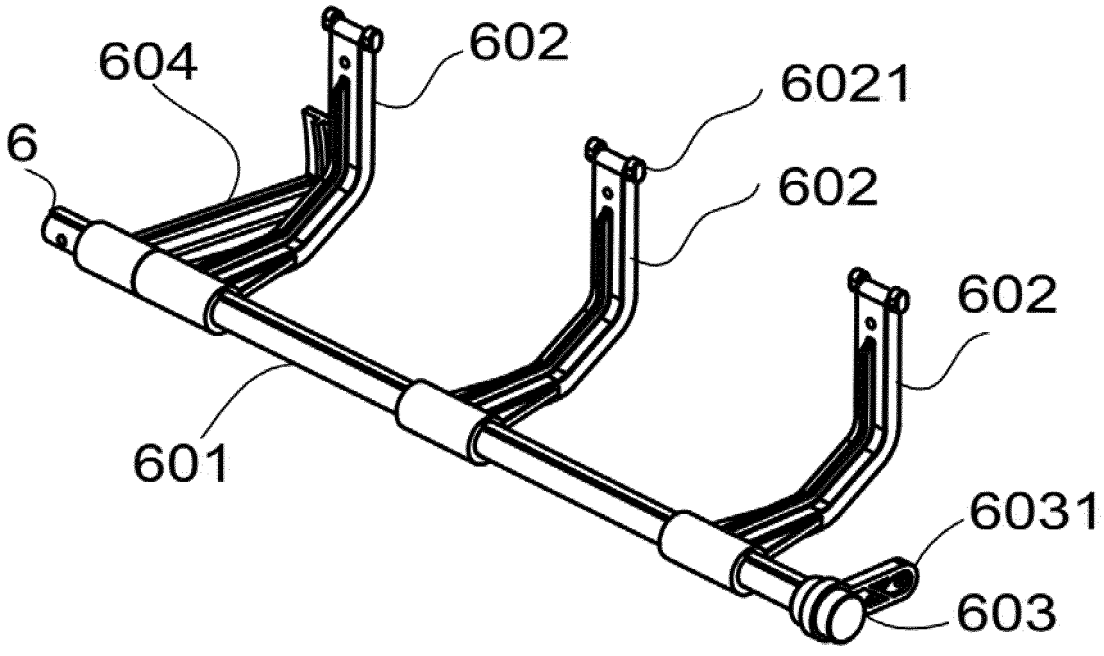

Fig. 7A

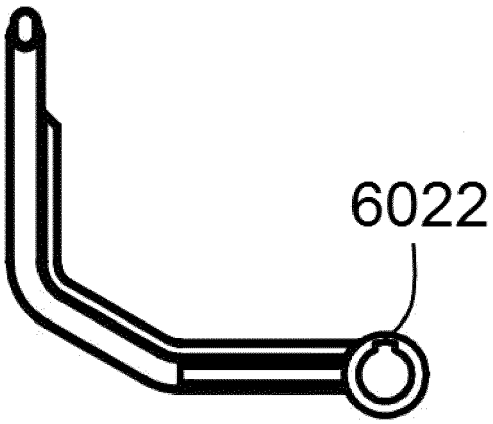

Fig. 7B

Fig. 7C

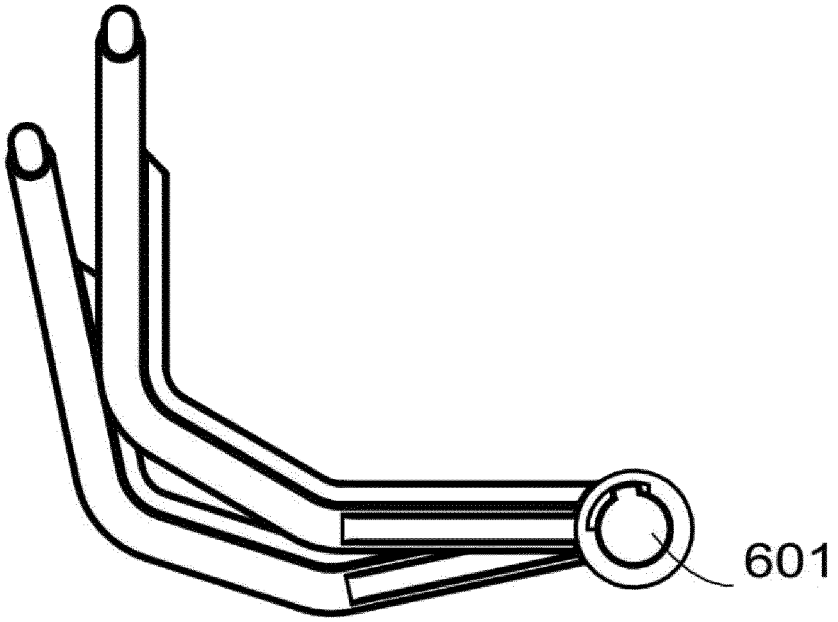

Fig. 8A

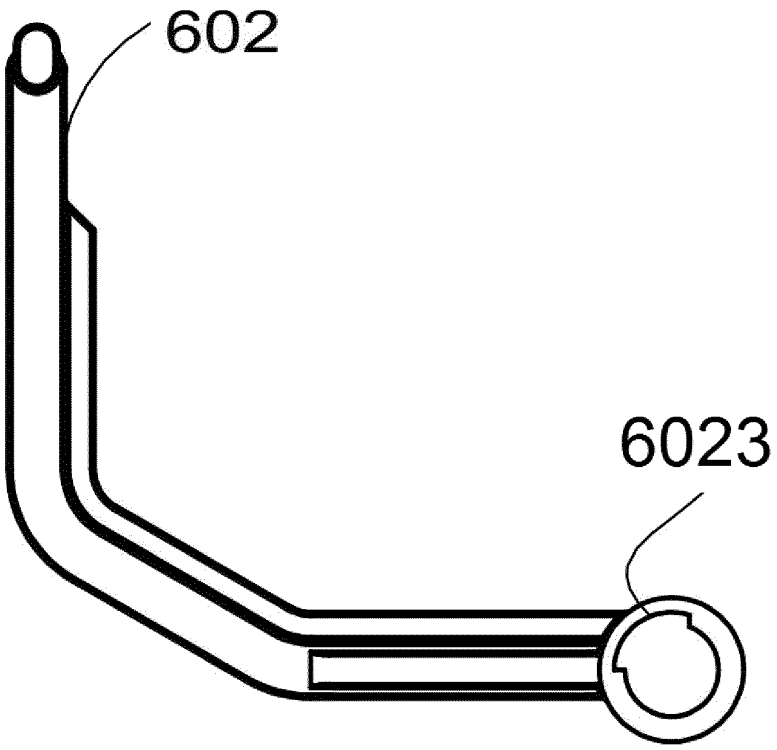

Fig. 8B

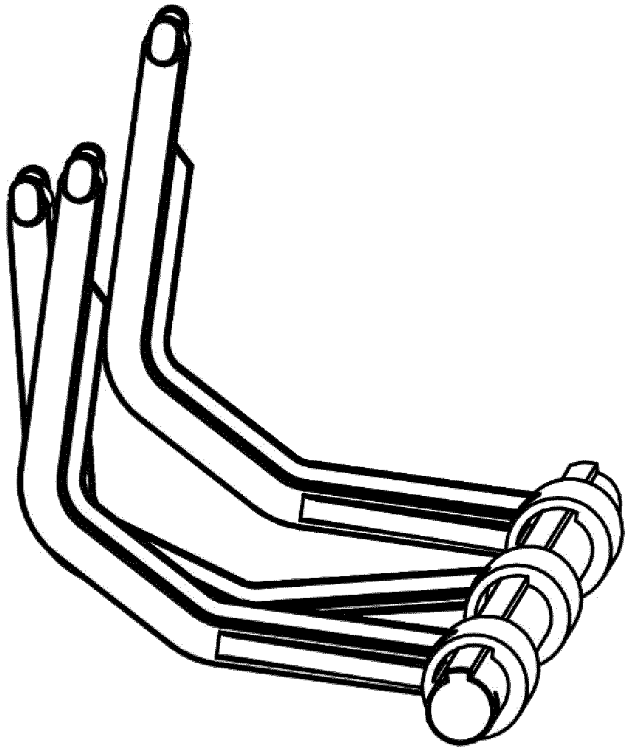

Fig. 8C

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/087485

A. CLASSIFICATION OF SUBJECT MATTER

H01H 9/20 (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)

WPI; EPODOC; CNKI; CNPAT: 高压, 开关, 熔丝, 熔断, 缺相, 联锁, 连锁, 过流, 过电流, 短路, 关合, 闭合, 合闸, 导通, 断开, 切断, 分闸, 连杆, 弹簧, 弹性, 转轴, 旋转, 撞针, 撞击器, high, voltage, fuse, switch, phase, loss, fault, failure, close, cut, off, link, rod, shaft, axle, axis, spring, elastic, rotat+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 202839370 U (XIAMEN HENGYUANXIN ELECTRIC EQUIPMENT CO., LTD.), 27 March 2013 (27.03.2013), description, paragraphs [0003]-[0010], and figures 1-2	1-13
A	CN 204029700 U (ZHEJIANG SYHARI ELECTRICAL CO., LTD.), 17 December 2014 (17.12.2014), entire document	1-13
A	CN 1128894 A (XIANGSHAN HIGH VOLTAGE ELECTRIC APPLIANCES FACTORY, NINGBO TIAN'AN GROUP), 14 August 1996 (14.08.1996), entire document	1-13
A	CN 204289302 U (CHANGSHU SWITCHGEAR MFG. CO., LTD. (FORMER CHANGSHU SWITCHGEAR PLANT)), 22 April 2015 (22.04.2015), entire document	1-13
A	CN 205984715 U (ANHUI HUADIAN WUHU POWER GENERATION CO., LTD.), 22 February 2017 (22.02.2017), entire document	1-13
A	US 5532668 A (FENNELL, R.B.), 02 July 1996 (02.07.1996), entire document	1-13

☐ 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
05 February 2018	24 February 2018

Name and mailing address of the ISA	Authorized officer
State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	WU, Lili Telephone No. (86-10) 53961512

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/087485

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 202839370 U	27 March 2013	None	
CN 204029700 U	17 December 2014	None	
CN 1128894 A	14 August 1996	CN 1050687 C	22 March 2000
CN 204289302 U	22 April 2015	None	
CN 205984715 U	22 February 2017	None	
US 5532668 A	02 July 1996	None	

Form PCT/ISA/210 (patent family annex) (July 2009)