(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
20 August 2009 (20.08.2009)

PCT

(10) International Publication Number
WO 2009/100681 A1

(51) International Patent Classification:
H01H 71/04 (2006.01)

(21) International Application Number:
PCT/CN2009/070414

(22) International Filing Date:
13 February 2009 (13.02.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
200810005635.5 14 February 2008 (14.02.2008) CN

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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(54) Title: CIRCUIT BREAKER READY-TO-CLOSE INDICATOR COMPONENT

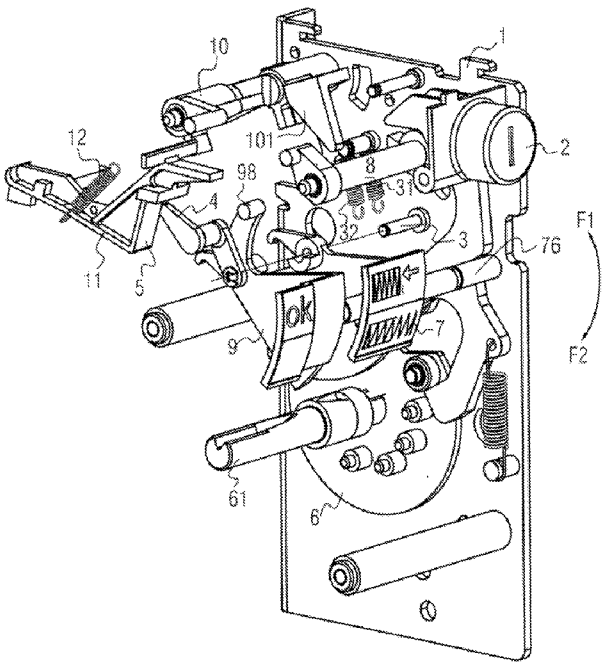

FIG. 2

(57) Abstract: A circuit breaker ready-to-close indicator component includes an energy storage/release indicator and an OK indicator The OK indicator and the energy storage/release indicator are coaxially disposed on a shaft The OK indicator has a first semi-axle in a partially cylindrical shape The energy storage/release indicator has a second semi-axle matching with the first semi-axle in shape The energy storage/release indicator drives the OK indicator to move in a first direction by the shape matching between the first semi-axle and the second semi-axle When moving in a second direction opposite to the first direction, the OK indicator and the energy storage/release indicator can be separated from each other The structure realizes reliable, safe, and stable linkage and separation through the two matching semi-axles

WO 2009/100681 A1

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

CIRCUIT BREAKER READY-TO-CLOSE INDICATOR COMPONENT

Technical field

The present invention relates to a circuit breaker ready-to-close indicator, and more particularly to a safety indicating component disposed on a circuit breaker operating mechanism and displaying whether a circuit breaker is in a closable state through a window.

Background art

The circuit breaker is an important part in electric equipment. In the prior art, in order to display whether the circuit breaker is in a closable state, a visualized closable state indicator usually needs to be provided.

Chinese Patent CN 2550895 Y has disclosed a structure named "Visualized Closable State Indicator of Circuit Breaker Operating Mechanism". As shown in FIG. 1, the structure includes a side plate 1 installed with various operating mechanisms, a closing button 2 for closing a circuit breaker, a cam 6 connected to an energy storage mechanism via a connecting rod, an energy storage/release indicator 7 for indicating an energy storing state, an OK indicator 9 for indicating whether the circuit breaker is ready to close, a push rod 11, a closing semi-axle 8, and an opening semi-axle 10.

A shaft 3 is fixed on the side plate 1. The energy storage/release indicator 7 is supported on the shaft 3. A portion of a smaller diameter is formed on an end portion of the shaft 3, and is inserted into an axle hole of the OK indicator 9. To enable the energy storage/release indicator 7to limit the rotation of the OK indicator 9, an end on the energy storage/release indicator 7 is further provided with a contact piece 72 for contacting a chassis of the OK indicator 9.

The contact piece 72 for driving the OK indicator 9 to move

correspondingly must be disposed on the energy storage/release indicator 7 of the above structure. The driving is completely caused by a friction force generated by the contact between the contact piece 72 and the chassis of the OK indicator 9. If contamination of oil stain and dust exists between the contact piece 72 and the chassis of the OK indicator 9, the friction force therebetween is suddenly increased or decreased, which easily causes a linkage failure, unclear state indication, and other disadvantageous influences.

Contents of the invention

Accordingly, the present invention is directed to a safety indicating device displaying whether a circuit breaker is in a closable state through a window, so as to reduce or prevent the aforementioned problems.

The technical problem may be solved through the following technical solution of the present invention. A circuit breaker ready-to-close indicator component is provided. The circuit breaker ready-to-close indicator component includes an energy storage/release indicator for indicating an energy storing state and an OK indicator for indicating whether the circuit breaker is ready to close. The OK indicator and the energy storage/release indicator are coaxially disposed on a shaft. The OK indicator includes a first semi-axle in a partially cylindrical shape. The energy storage/release indicator includes a second semi-axle matching the first semi-axle in shape. The first semi-axle and the second semi-axle are matched together, and are inserted on the shaft. The energy storage/release indicator drives the OK indicator to move in a first direction through the shape matching between the first semi-axle and the second semi-axle. When the energy storage/release indicator moves in a second direction opposite to the first direction, the OK indicator remains still. The second semi-axle is of a partially cylindrical shape.

In an embodiment of the present invention, the first semi-axle has a columnar axle portion and a semi-axial portion with more than a half removed,

and the second semi-axle of the energy storage/release indicator has a columnar axle portion and a semi-axial portion with more than a half removed.

The semi-axial portion of the first semi-axle and the semi-axial portion of the second semi-axle match each other in shape, and have an angle gap when matched together.

Preferably, the OK indicator has a travel limiting hole fitted on a positioning axle, for limiting travels of the OK indicator in the first direction and the second direction through the positioning axle.

The circuit breaker may be in the following several different states: a non-energy storing closed state, an energy storing closed state, a non-energy storing open state, and an energy storing open state. In practice, the circuit breaker can be closed only if the following three conditions are satisfied. (1) The operating mechanism must be in an energy storing state. (2) The circuit breaker must be at an open. (3) The opening fastener must be at a free position. Only if the above three conditions are satisfied, the ready-to-close indicator component in the present invention indicates a closable state.

The above structure realizes reliable, safe, and stable linkage and separation through the two matching semi-axles.

Description of figures

FIG. 1 is a three-dimensional exploded view of a circuit breaker closed state indicating device according to the prior art;

FIG. 2 is a three-dimensional exploded view of a circuit breaker ready-to-close indicator component according to a preferred embodiment of the present invention;

FIG. 3 is a three-dimensional view of an energy storage/release indicator in the circuit breaker ready-to-close indicator component shown in FIG. 2;

FIG. 4 is a three-dimensional view of an OK indicator 9 in the circuit breaker ready-to-close indicator component shown in FIG. 2;

FIGs. 5a, 5b, and 5c are respectively a front view, a side view, and a perspective view of the circuit breaker ready-to-close indicator component indicating that energy is stored and an opening switch is in an open state;

FIGs. 6a, 6b, and 6c are respectively a front view, a side view, and a perspective view of the circuit breaker ready-to-close indicator component indicating that energy is released and the opening switch is in the open state; and

FIGs. 7a, 7b, and 7c are respectively a front view, a side view, and a perspective view of the circuit breaker ready-to-close indicator component indicating that the energy storage is completed and the opening switch is in the open state.

Mode of carrying out the invention

FIG. 2 is a three-dimensional exploded view of a circuit breaker ready-to-close indicator component according to the present invention. In order to show the indicator structure more clearly, a side plate at the left side of the indicator is removed, and only a side plate 1 at the right side of the indicator is taken for example.

As shown in FIG. 2, the side plate 1 is provided thereon with a closing button 2 for closing a circuit breaker, a cam 6 connected to an energy storage mechanism via a connecting rod, an energy storage/release indicator 7 for indicating an energy storing state, an OK indicator 9 for indicating whether the circuit breaker is ready to close, a push rod 11, a closing semi-axle 8, and an opening semi-axle 10. The OK indicator 9 and the energy storage/release indicator 7 are coaxially disposed on a shaft 3.

FIG. 3 is a three-dimensional view of the energy storage/release indicator 7, and FIG. 4 is a three-dimensional view of the OK indicator 9. As shown in FIGs. 3 and 4, the OK indicator 9 has a first semi-axle 91 in a partially cylindrical shape, and the energy storage/release indicator 7 has a second semi-axle 71 matching the first semi-axle 91 in shape. The energy

storage/release indicator 7 drives the OK indicator 9 to move in a first direction F1 shown in FIG. 2 through the shape matching between the first semi-axle 91 and the second semi-axle 71, that is, the OK indicator 9 and the energy storage/release indicator 7 may rotate together in a counter-clockwise direction shown in FIG. 2 through the first semi-axle 91 and the second semi-axle 71 thereof matching each other. Moreover, when moving in a second direction F2 opposite to the first direction F1, the OK indicator 9 and the energy storage/release indicator 7 may be separated from each other, that is, as the first semi-axle 91 of the OK indicator 9 and the second semi-axle 71 of the energy storage/release indicator 7 matching each other have an angle gap therebetween, when the energy storage/release indicator 7 rotates in a clockwise direction shown in FIG. 2, the OK indicator 9 may not rotate with the energy storage/release indicator 7 in the clockwise direction shown in FIG. 2, which will be described in detail below.

As shown in FIG. 3, the energy storage/release indicator 7 is generally of a sector cylindrical plane structure having an arc indicating surface 73 thereon. The indicating surface 73 has a mark denoting that the energy storage is completed on an upper portion. As shown in the figure, the mark includes an icon denoting that a spring has been compressed and a word “charged” denoting that the energy storage is completed. The indicating surface 73 has a mark denoting energy release on a lower portion thereof. As shown in the figure, the mark includes an icon denoting that the spring has been released. Certainly, those skilled in the art shall understand that the above marks are schematic and may be changed as desired. For example, the above word “charged” may be changed to “energy storage” and the like.

The second semi-axle 71 of the energy storage/release indicator 7 has a columnar axle portion 74 and a semi-axial portion 75 with substantially more than a half removed.

As shown in FIG. 4, the OK indicator 9 is generally of a sector

cylindrical plane structure having an arc indicating surface 93 thereon. The indicating surface 93 has a mark denoting that the circuit breaker is ready to close on an upper portion thereof. As shown in the figure, the mark includes a word “ok” denoting that is the circuit breaker is ready to close. The indicating surface 93 has a blank mark denoting that the circuit breaker is not ready to close on a lower portion thereof. Certainly, those skilled in the art shall understand that the above marks are schematic and may be changed may be changed. For example, the above word “ok” may be changed to “close” and the like.

The first semi-axle 91 of the OK indicator 9 has a columnar axle portion 94 and a semi-axial portion 95 with substantially more than a half removed. As shown in FIG. 4, the OK indicator 9 further has a travel limiting hole 96 fitted on a positioning axle 76, for limiting travels of the OK indicator 9 in the first direction F1 and the second direction F2 through the positioning axle 76.

As can be seen from the above illustration with reference to FIGs. 3 and 4, the OK indicator 9 and the energy storage/release indicator 7 have the first semi-axle 91 and the second semi-axle 71 matching each other in shape. The semi-axial portions 75 and 95 of the two semi-axles are matched together, and are inserted on the shaft 3. Further, the semi-axial portions 75 and 95 are both in a partially cylindrical shape smaller than a half of a cylinder, and thus have an angle gap therebetween. When used together, one side of the two semi-axles may be pressed against each other. For example, a semi-axial surface 951 of the semi-axial portion 95 of the first semi-axle 91 and a semi-axial surface 751 of the semi-axial portion 75 of the second semi-axle 71 are pressed against each other. Therefore, when the energy storage/release indicator 7 rotates in the counter-clockwise direction shown in FIG. 2, the semi-axial surface 751 of the energy storage/release indicator 7 pushes the semi-axial surface 951 of the OK indicator 9, so the OK indicator 9 will rotate with the energy storage/release indicator 7 in the counter-clockwise direction shown in FIG. 2. When the

energy storage/release indicator 7 rotates in the clockwise direction shown in FIG. 2, as the angle gap exists between the first semi-axle 91 of the OK indicator 9 and the matching second semi-axle 71 of the energy storage/release indicator 7, the OK indicator 9 may not rotate with the energy storage/release indicator 7 in the clockwise direction shown in FIG. 2.

Moreover, as shown in FIG. 4, the travel limiting hole 96 on the OK indicator 9 can limit travels of the OK indicator 9 in the first direction F1 (the counter-clockwise direction shown in FIG. 2) and the second direction F2 (the clockwise direction shown in FIG. 2). Therefore, when the OK indicator 9 rotates with the energy storage/release indicator 7 in the counter-clockwise direction shown in FIG. 2, the OK indicator 9 will stop rotating when reaching an upper limit of the travel of the OK indicator 9 limited by the positioning axle 76. Meanwhile, as the semi-axial surface 951 of the semi-axial portion 95 of the first semi-axle 91 and the semi-axial surface 751 of the semi-axial portion 75 of the second semi-axle 71 are pressed against each other, the energy storage/release indicator 7 will stop rotating correspondingly. In this way, the movement of the OK indicator 9 and the energy storage/release indicator 7 in the first direction F1 (the counter-clockwise direction shown in FIG. 2) can be limited at the same time simply by the travel limiting hole 96 on the OK indicator 9, thereby preventing the OK indicator 9 and the energy storage/release indicator 7 from excessively rotating, which enhances the system reliability.

Compared with the prior art shown in FIG. 1, the above structure realizes reliable, safe, and stable linkage and separation through the two matching semi-axles.

An operating process of the circuit breaker ready-to-close indicator component of the present invention is illustrated in detail below with reference to the accompanying drawings.

FIGs. 5a, 5b, and 5c are respectively a front view, a side view, and a

perspective view of the circuit breaker ready-to-close indicator component indicating that energy is stored and an opening switch is in an open state.

Before the above state shown in the figures, an circuit breaker operating mechanism (not shown) stores energy, and meanwhile drives the cam 6 to rotate in the clockwise direction (based on the side view of FIG. 5b) to a position shown in the figure by a camshaft 61. At this time, the energy storage is completed.

At this time, a contact finger 7a of the energy storage/release indicator 7 at an edge of the cam 6 enters a notch 62 of the cam 6 under a counter force of a spring 31 (see FIG. 2), and thus the energy storage/release indicator 7 rotates downwards (in the clockwise direction in FIG. 2, i.e., the second direction) to a position shown in the figure. A casing of the circuit breaker has a window (not shown) corresponding to the position. The mark denoting that the energy storage is completed on the upper portion of the indicating surface 73 of the energy storage/release indicator 7 is exactly presented in the window, while the mark denoting energy release on the lower portion of the indicating surface 73 is located at a lower portion of the window and blocked by the casing, such that the user sees the mark denoting that the energy storage is completed at this time.

Meanwhile, if an under-voltage tripper (not shown) inside the circuit breaker has electricity or an electronic tripping device (not shown) is in a normal state, the opening semi-axle 10 does not trip, that is, a fastening plate 101 on the opening semi-axle 10 does not contact a fastening arm 4 on the OK indicator 9 at this time. Therefore, the OK indicator 9 in a free state rotates downwards (in the clockwise direction in FIG. 2, i.e., the second direction) to a position shown in the figure under a counter force of a spring 32. The casing of the circuit breaker has a window (not shown) corresponding to the position. The mark denoting that the circuit breaker is ready to close on the upper portion of the indicating surface 93 of the OK indicator 9 is exactly presented in the window, while the mark denoting that the circuit breaker is not ready to close on the

lower portion of the indicating surface 93 is located at a lower portion of the window and blocked by the casing, such that the user sees the sign denoting that the circuit breaker is ready to close at this time.

In this state, a contact pin 98 (see FIGs. 2 and 4) of the OK indicator 9 does not contact an end face 5 of the push rod 11. Therefore, the push rod 11 in a free state contacts the closing button 2 to the right (based on the side view of FIG. 5b) under a counter force of a spring 12.

At this time, the circuit breaker ready-to-close indicator component displays the marks denoting that the energy storage is completed and the circuit breaker is ready to close respectively. If the operator applies a force to press the closing button 2, the closing button 2 pushes the push rod 11 to move leftwards by overcoming the acting force of the spring 12 and drive the closing semi-axle 8 to trip, i.e., activate the closing switch and close the contact head to under the counter force of the energy storage spring, such that the circuit breaker is in a closed state, thereby achieving a transition from an open state to the closed state.

FIGs. 6a, 6b, and 6c are respectively a front view, a side view, and a perspective view of the circuit breaker ready-to-close indicator component indicating that energy is released and the opening switch is in the open state.

Based on the state shown in FIGs. 5a, 5b, and 5c, when the circuit breaker releases energy from the above state, the cam 6 rotates to a position shown in the figures in a counter-clockwise direction driven by the connecting rod (not shown) of the operating mechanism. At this time, the energy storage/release indicator 7 originally in the notch 62 of the cam 6 rotates upwards (in the clockwise direction in FIG. 2, i.e., the second direction) to the position shown in the figures by overcoming the counter force of the spring 31 (see FIG. 2) with the shaft 3 (see FIG. 2) as a pivot. As a result, the mark denoting that the energy storage is completed on the upper portion of the indicating surface 73 of the energy storage/release indicator 7 moves upwards to

leave the window on the casing, while the mark denoting energy release on the lower portion of the indicating surface 73 enters the window of the casing, such that the user sees the mark denoting energy release at this time.

Meanwhile, the OK indicator 9 rotates upwards with the energy storage/release indicator 7 to the position shown in the figures as the semi-axial surface 751 (see FIG. 3) of the energy storage/release indicator 7 pushes the semi-axial surface 951 (see FIG. 4) of the OK indicator 9. As a result, the mark denoting that the circuit breaker is ready to close on the upper portion of the indicating surface 93 of the OK indicator 9 moves upwards to leave the window on the casing, while the mark denoting that the circuit breaker is not ready to close on the lower portion of the indicating surface 93 enters the window of the casing, such that the user sees the mark denoting that the circuit breaker is not ready to close at this time. In this embodiment, the mark denoting that the circuit breaker is not ready to close is a blank.

In the state shown in the figures, since the OK indicator 9 reaches the upper limit to the travel of the OK indicator 9 limited by the positioning axle 76, the semi-axial surface 951 (see FIG. 4) of the semi-axial portion 95 of the first semi-axle 91 in turn limits the semi-axial surface 751 (see FIG. 3) of the semi-axial portion 75 of the second semi-axle 71, such that the energy storage/release indicator 7 stops rotating, thereby preventing the OK indicator 9 and the energy storage/release indicator 7 from excessively rotating, which enhances the system stability.

In this state, since the OK indicator 9 moves upwards with the shaft 3 (see FIG. 2) as the pivot, the contact pin 98 thereof contacts the end face 5 (see FIG. 2) of the push rod 11, such that the push rod 11 moves leftwards (based on the side view of FIG. 6b) by overcoming the counter force of the spring 12 to leave the contact surface with the closing semi-axle 8 and leave the contact with the closing button 2.

At this time, the circuit breaker ready-to-close indicator component

displays the marks that energy is released and the circuit breaker is not ready to close (energy is released and the circuit breaker is in the open state). If the operator applies a force to press the closing button 2, the closing button 2 cannot contact the push rod 11, such that the closing semi-axle 8 cannot trip to activate the closing switch.

FIGs. 7a, 7b, and 7c are respectively a front view, a side view, and a perspective view of the circuit breaker ready-to-close indicator component indicating that energy storage is completed and the opening switch is in the open state.

Based on the state shown in FIGs. 6a, 6b, and 6c, when the circuit breaker operating mechanism (not shown) stores energy again, and meanwhile drives the cam 6 to rotate in the clockwise direction (based on the side view of FIG. 7b) to the position shown in the figures by the camshaft 61, the energy storage is completed.

At this time, the energy storage/release indicator 7 originally at the edge of the cam 6 rotates downwards (in the clockwise direction in FIG. 7b, i.e., the second direction) to the position shown in the figures under the counter force of the spring 31 (see FIG. 2). The mark denoting that the energy storage is completed on the upper portion of the indicating surface 73 of the energy storage/release indicator 7 is exactly presented in the window, while the mark denoting energy release on the lower portion of the indicating surface 73 is located at the lower portion of the window and blocked by the casing, such that the user sees the mark denoting that energy storage is completed at this time.

Meanwhile, if the under-voltage tripper (not shown) inside the circuit breaker lacks electricity or the electronic tripping device (not shown) is in an abnormal state, the opening semi-axle 10 trips, that is, the fastening plate 101 on the opening semi-axle 10 contacts the fastening arm 4 on the OK indicator 9 at this time, thereby restraining the OK indicator 9 from rotating clockwise downwards with the energy storage/release indicator 7 by overcoming the

counter force of the spring 32. Moreover, since the first semi-axle 91 (see FIG. 4) of the OK indicator 9 and the second semi-axle 71 (see FIG. 3) of the energy storage/release indicator 7 matching each other have the angle gap therebetween, the OK indicator 9 may not rotate with the energy storage/release indicator 7 in the clockwise direction shown in FIG. 2. The user still sees the mark denoting that is the circuit breaker is not ready to close through the window at this time.

In this state, since the contact pin 98 (see FIGs. 2 and 4) of the OK indicator 9 is pressed against the end face 5 of the push rod 11, the push rod 11 cannot move rightwards to contact the closing button 2 under the counter force of the spring 12.

At this time, the circuit breaker ready-to-close indicator component displays the marks denoting that the energy storage is completed and the circuit breaker is not ready to close. If the operator applies a force to press the closing button 2, the closing button 2 cannot contact the push rod 11, such that the closing semi-axle 8 cannot trip to activate the closing switch.

The above technical solution is applicable to a universal circuit breaker operating mechanism as a safety indicating device before the operating mechanism closes the circuit breaker. The present invention has a compact structure, is convenient in use and operation, is convenient for maintenance and easy for manufacture, and improves safety performance of the circuit breaker during the use.

The detailed illustration provided above is merely directed to a feasible embodiment of the present invention, but the embodiment is not intended to limit the scope of the present invention. It will be apparent to those skilled in the art that various modifications and variations can be made to the structure of the present invention without departing from the scope or spirit of the invention. In view of the foregoing, it is intended that the present invention cover modifications and variations of this invention provided they fall within the scope of the following claims and their equivalents.

Claims

1.A circuit breaker ready-to-close indicator component which includes an energy storage/release indicator (7) for indicating an energy storing state and an OK indicator (9) for indicating whether a circuit breaker is ready to close, the OK indicator (9) and the energy storage/release indicator (7) are coaxially disposed on a shaft (3), characterized in that, the OK indicator (9) has a first semi-axle (91) in a partially cylindrical shape, the energy storage/release indicator (7) has a second semi-axle (71) matching the first semi-axle (91) in shape, the first semi-axle (91) and the second semi-axle (71) are matched together, and are inserted on the shaft (3), the energy storage/release indicator (7) drives the OK indicator (9) to move in a first direction (F1) by the shape matching between the first semi-axle (91) and the second semi-axle (71), and when the energy storage/release indicator (7) moves in a second direction (F2) opposite to the first direction (F1), the OK indicator (9) can remain still.

2.The circuit breaker ready-to-close indicator component according to claim 1, characterized in that the second semi-axle (71) is in a partially cylindrical shape.

3.The circuit breaker ready-to-close indicator component according to claim 1 or 2, characterized in that the first semi-axle (91) has a columnar axle portion (94) and a semi-axial portion (95) with more than a half removed, and the second semi-axle (71) of the energy storage/release indicator (7) has a columnar axle portion (74) and a semi-axial portion (75) with more than a half removed.

4.The circuit breaker ready-to-close indicator component according to claim 3, characterized in that the semi-axial portion (95) of the first semi-axle (91) and the semi-axial portion (75) of the second semi-axle (71) match each other in shape, and have an angle gap when matched together.

5.The circuit breaker ready-to-close indicator component according to

claim 1, characterized in that the OK indicator (9) has a travel limiting hole (96) fitted on a positioning axle (76) for limiting travels of the OK indicator (9) in the first direction (F1) and the second direction (F2) through the positioning axle (76).

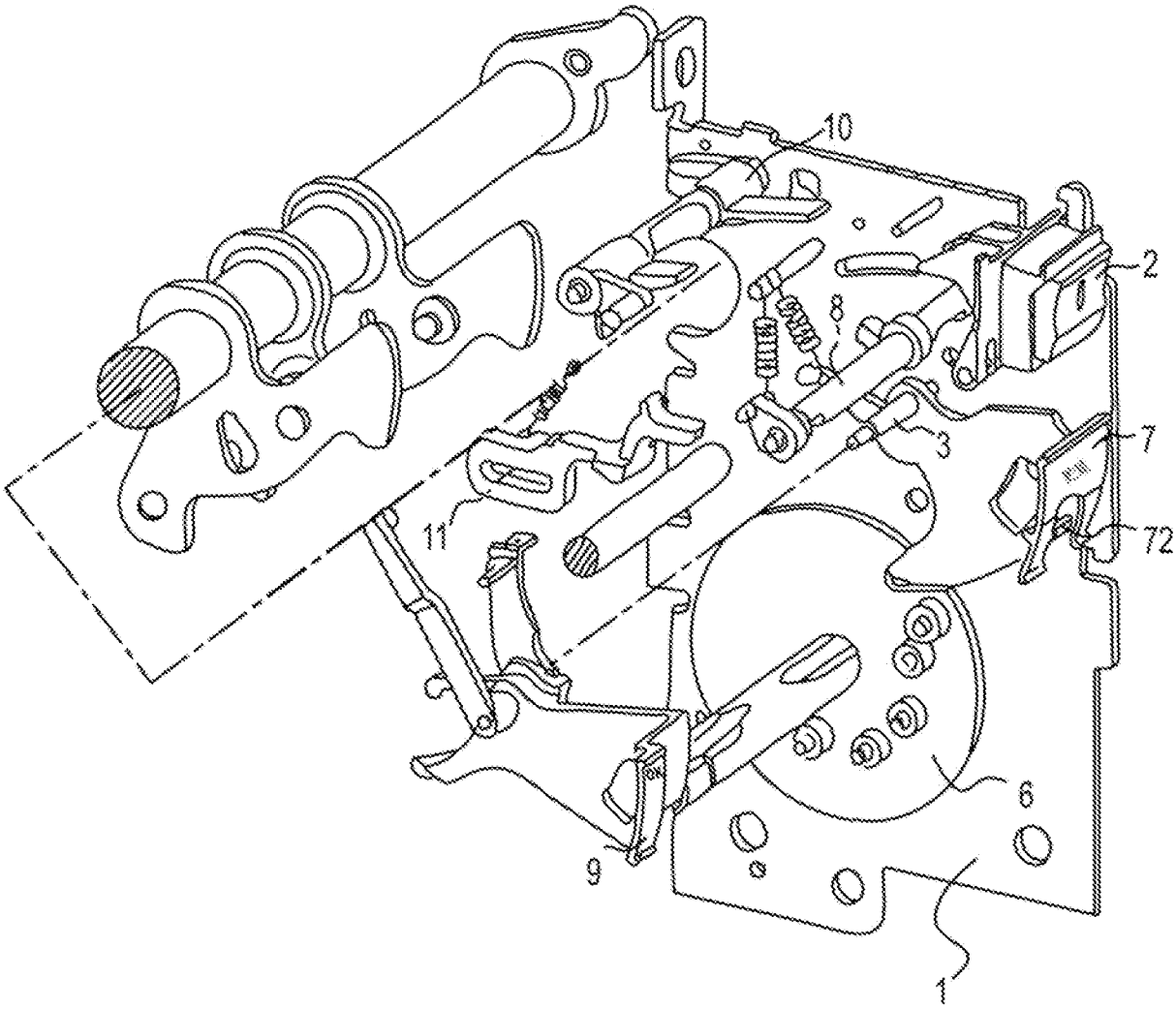

FIG. 1

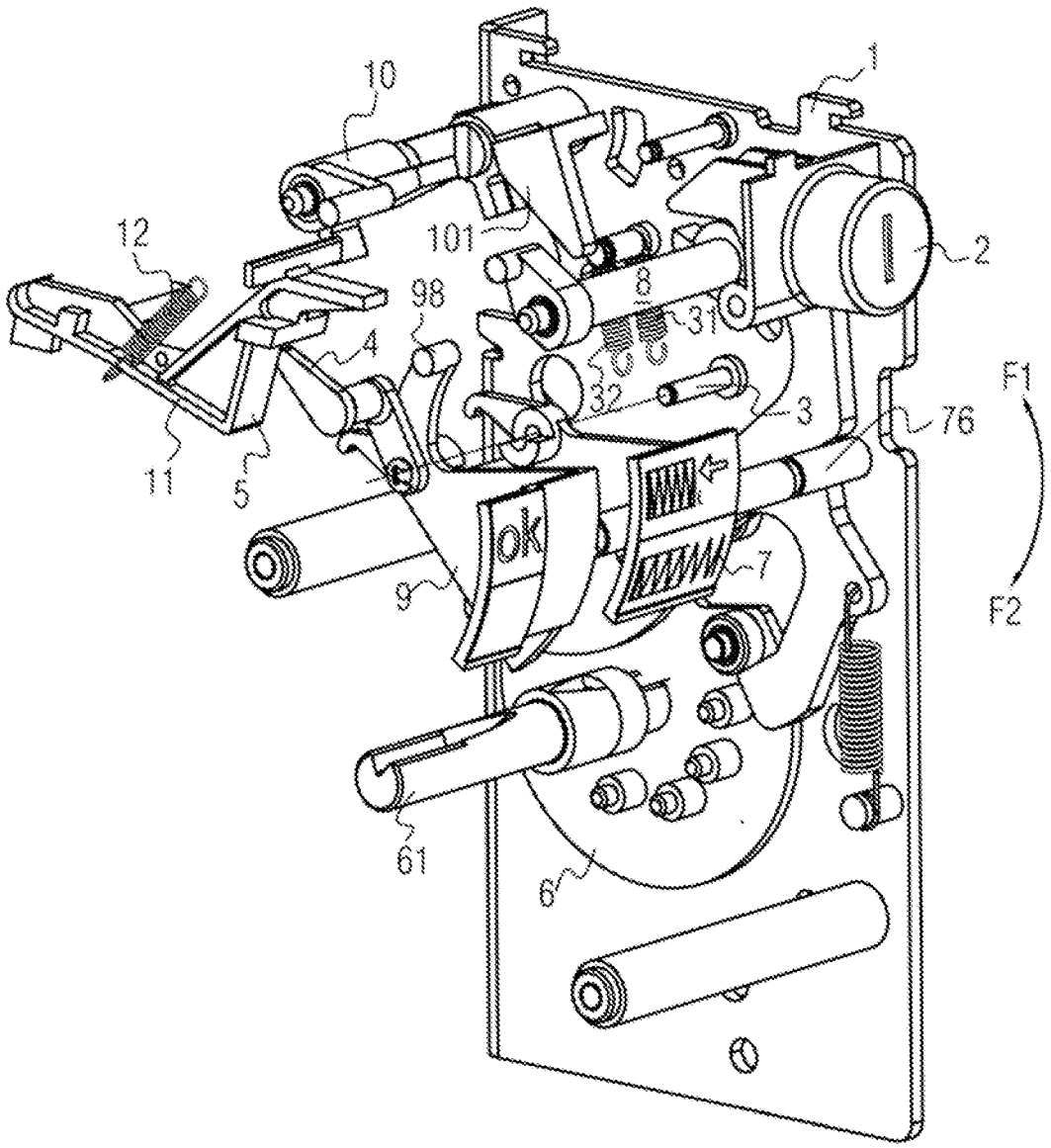

FIG. 2

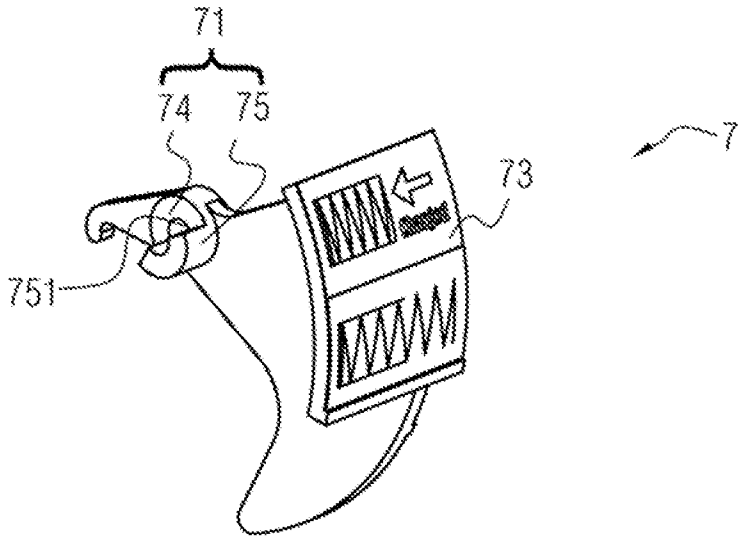

FIG. 3

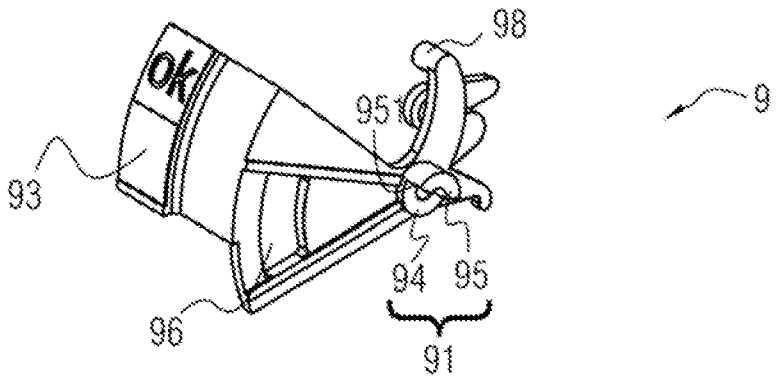

FIG. 4

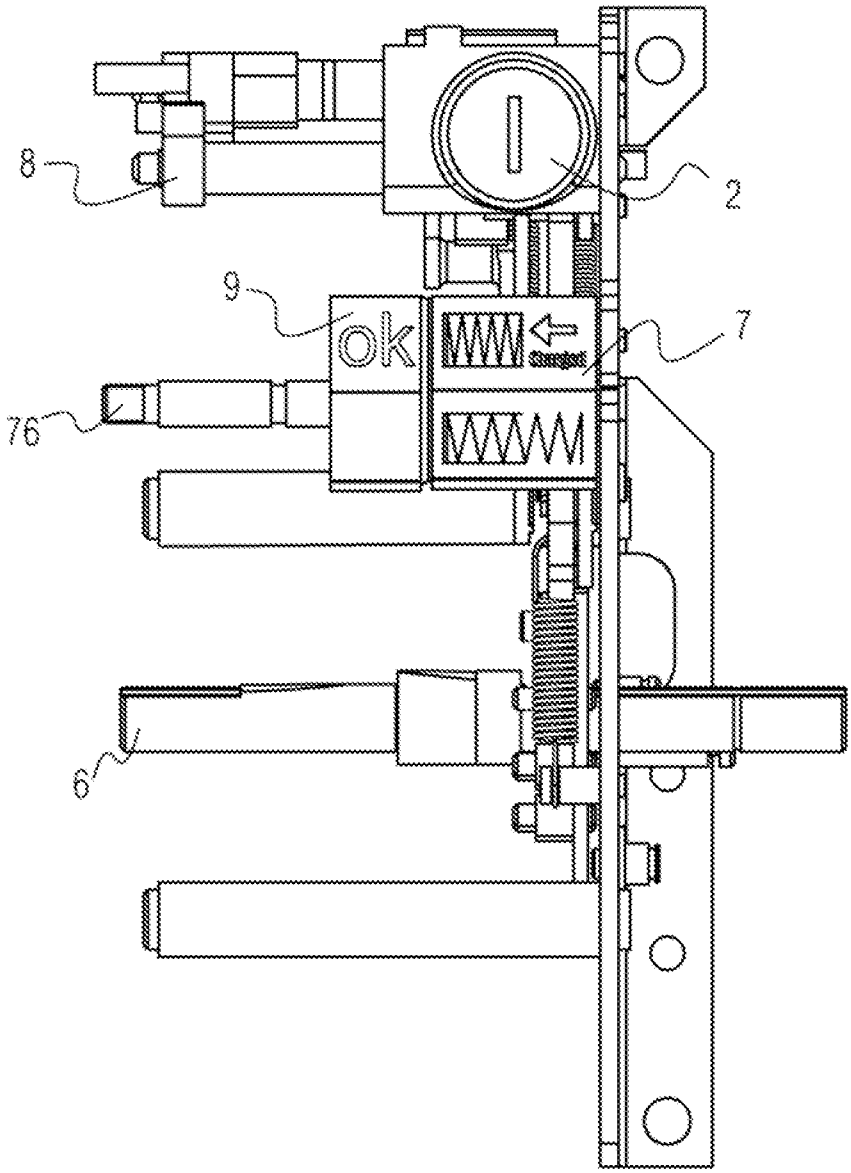

FIG. 5a

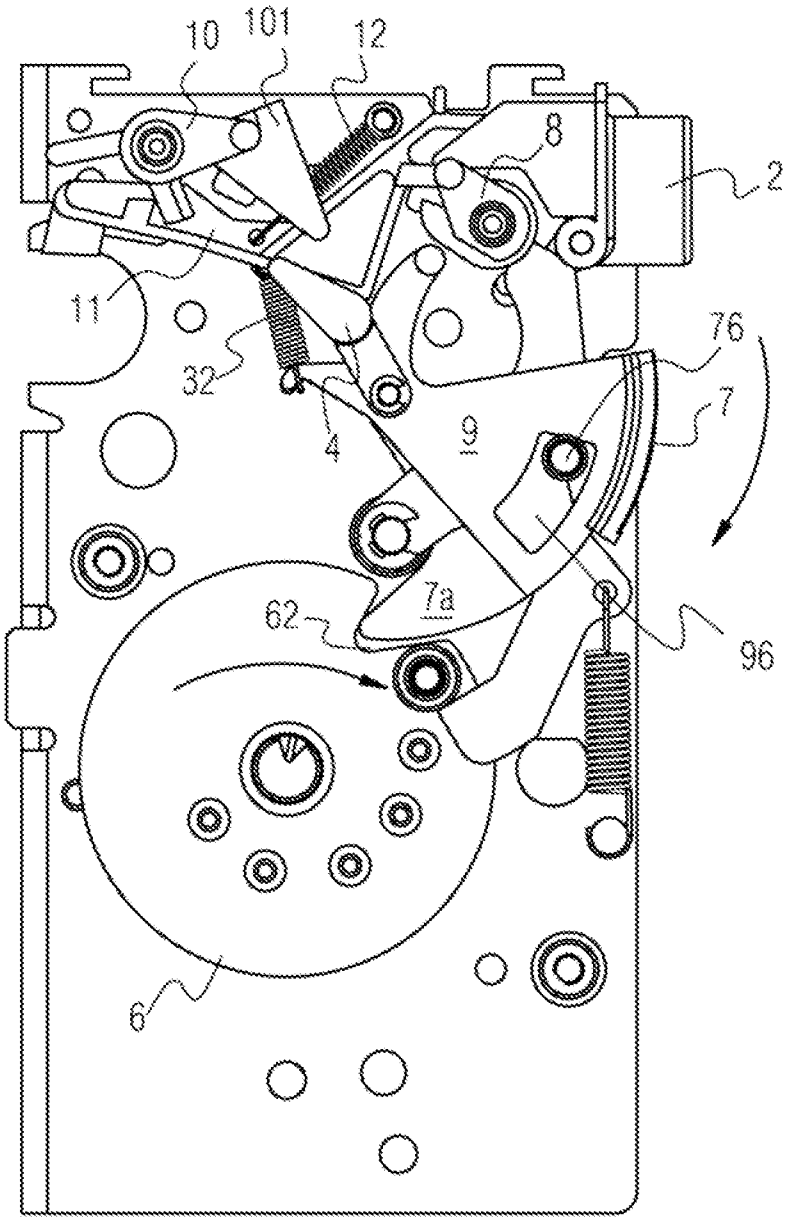

FIG. 5b

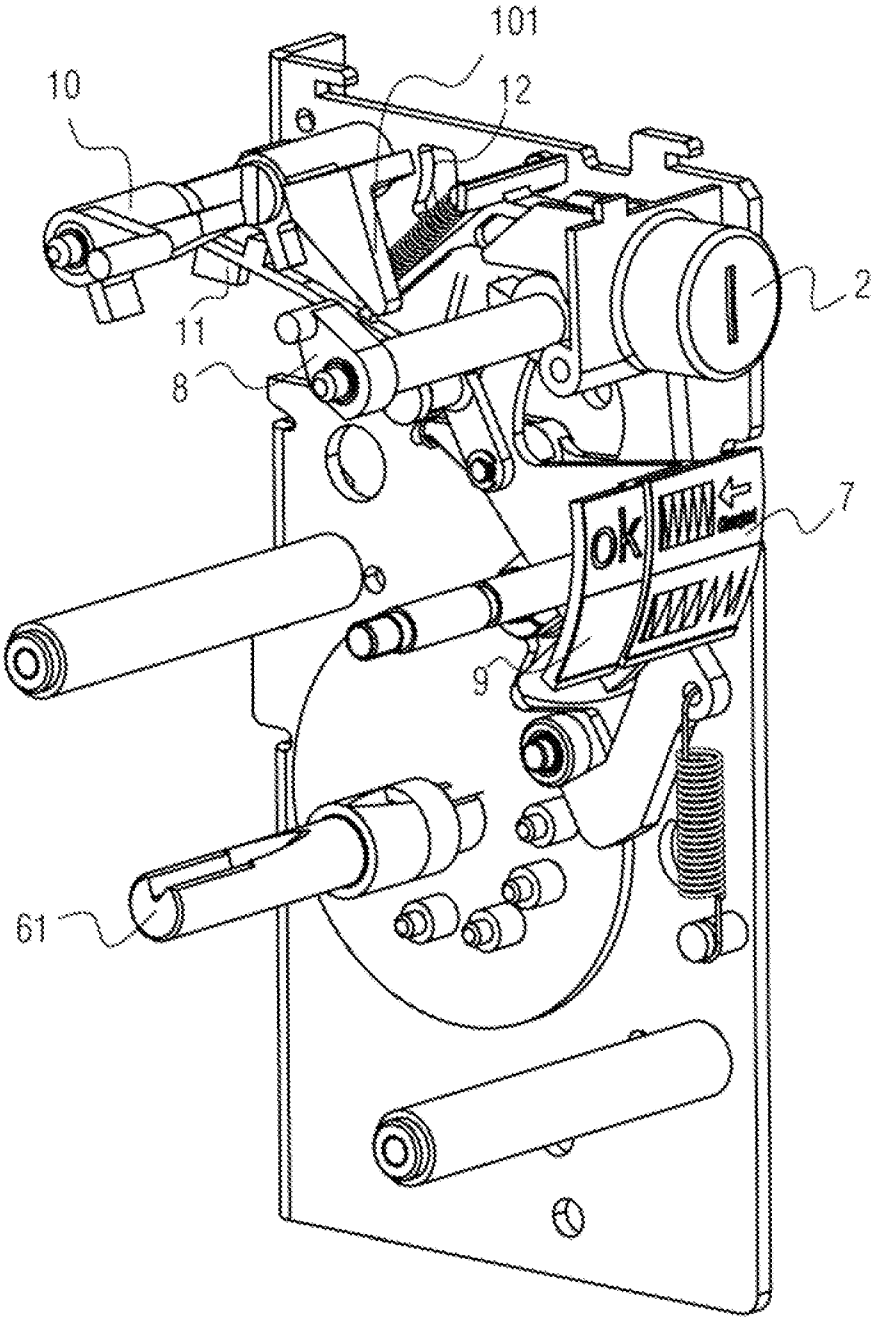

FIG. 5c

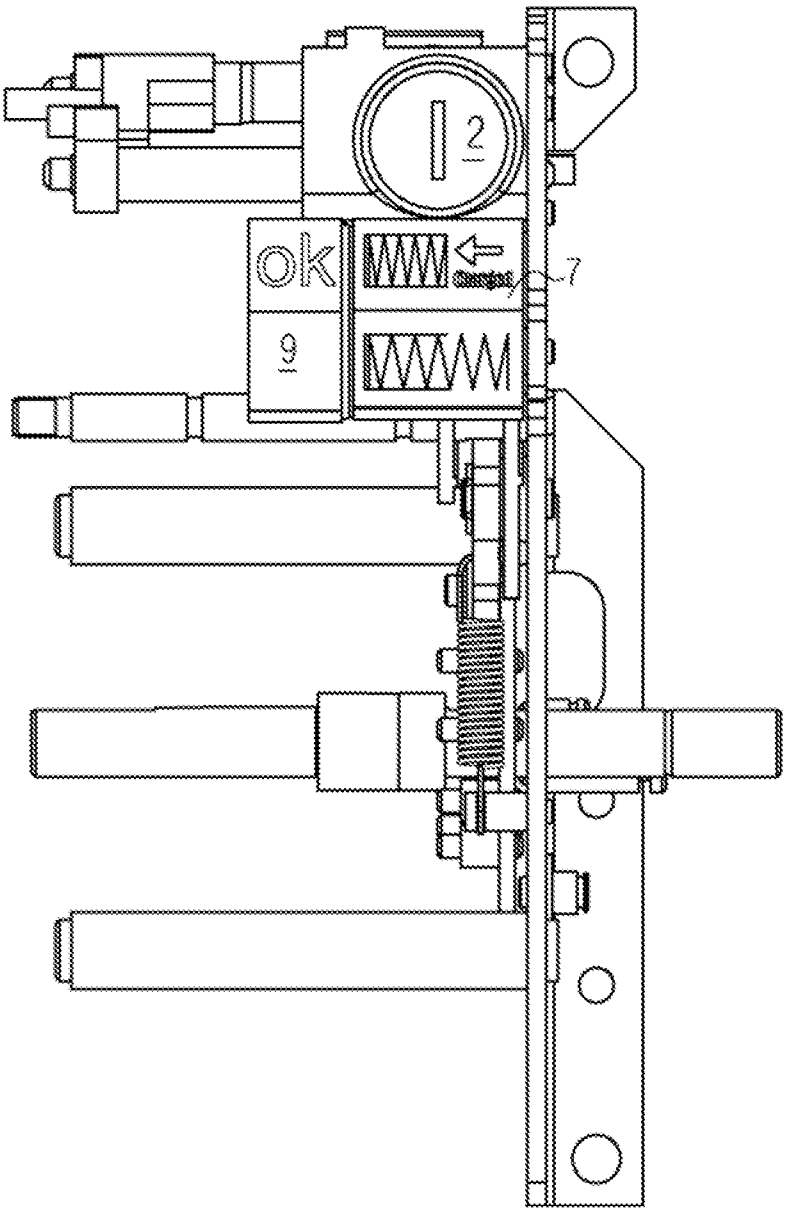

FIG. 6a

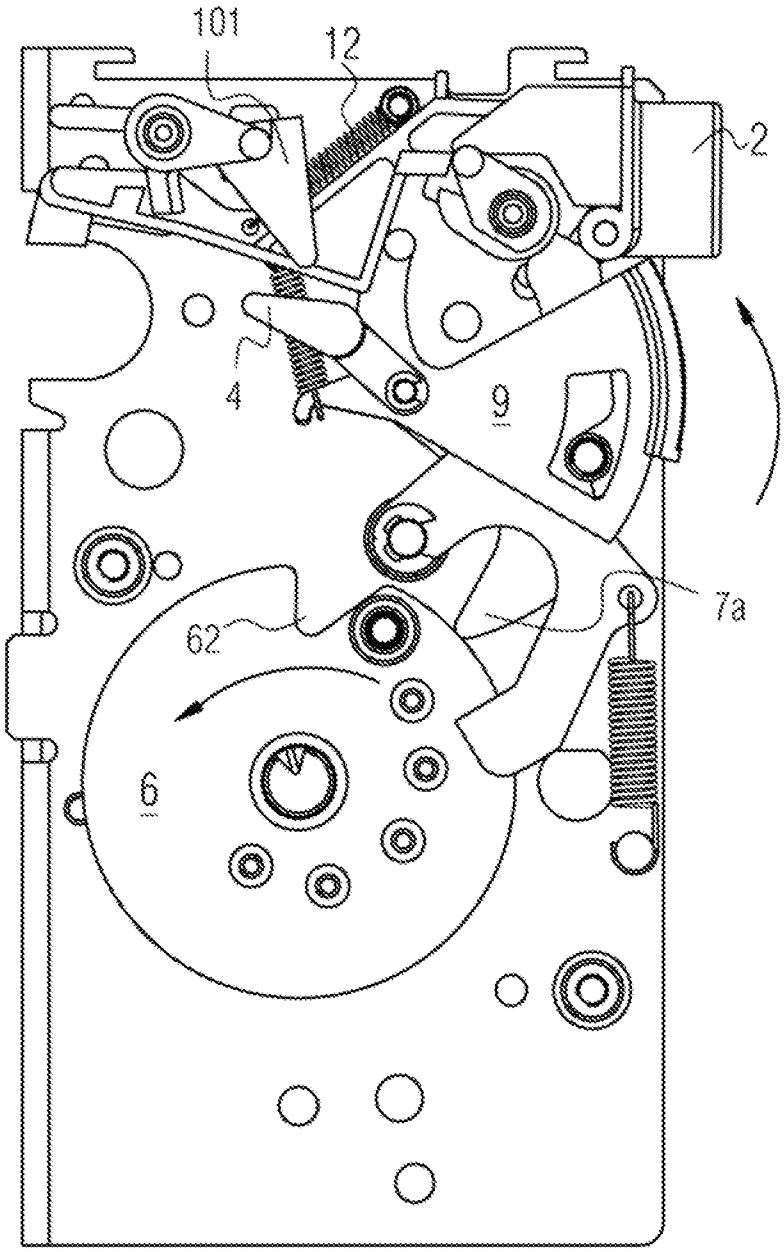

FIG. 6b

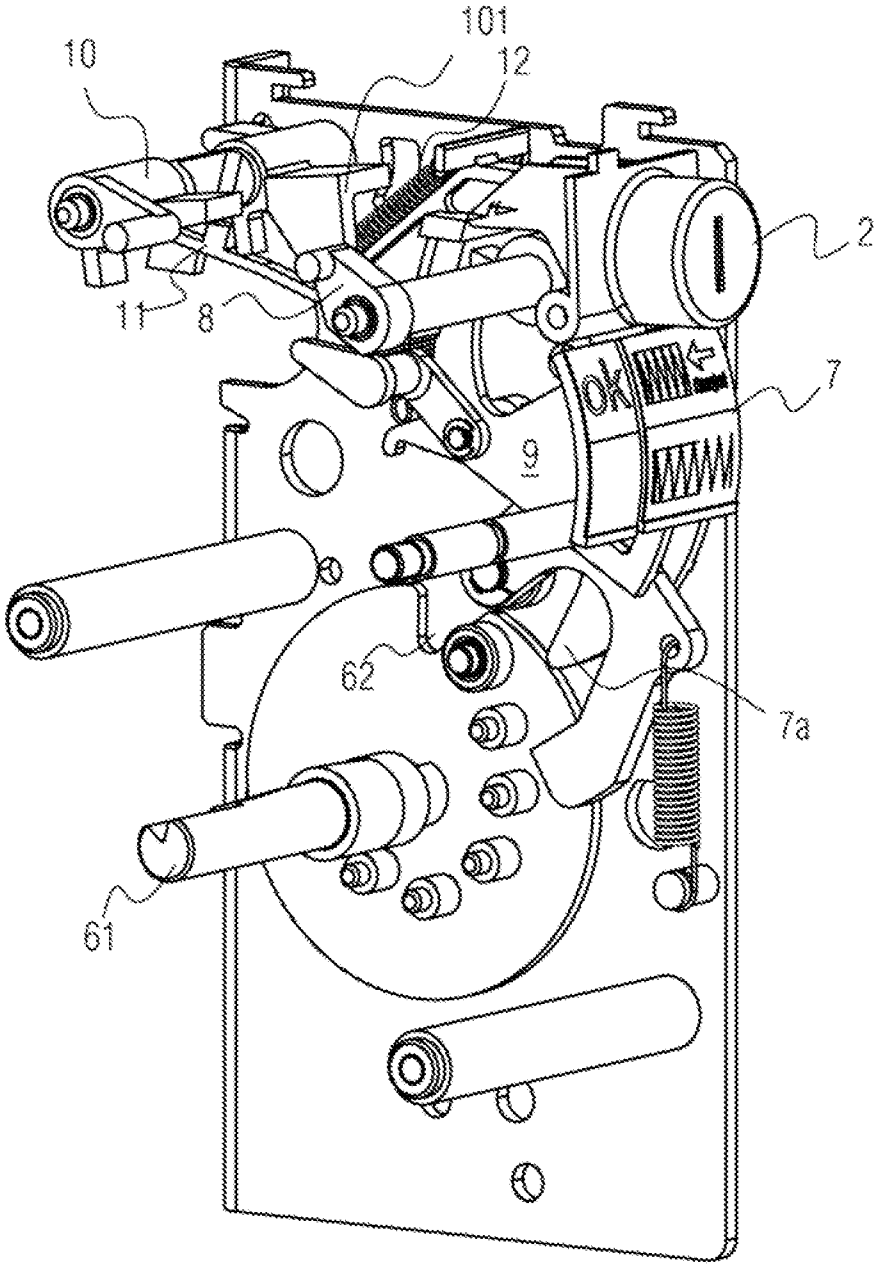

FIG. 6c

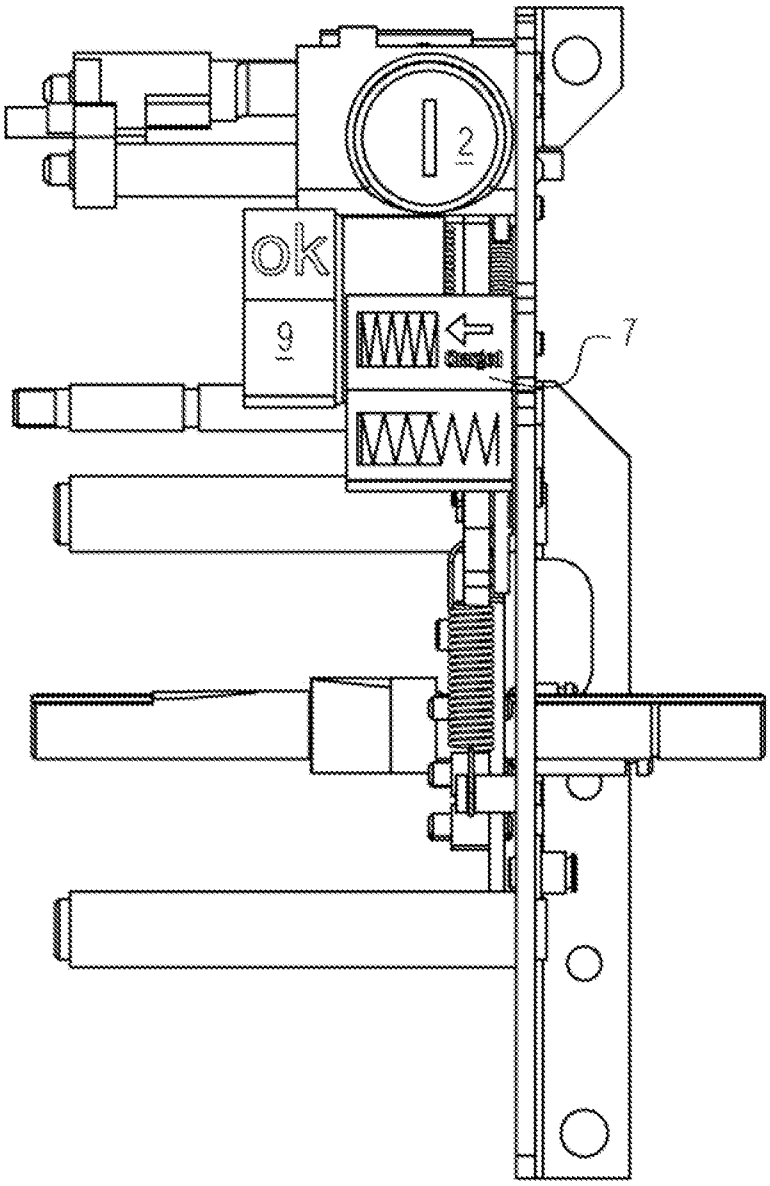

FIG. 7a

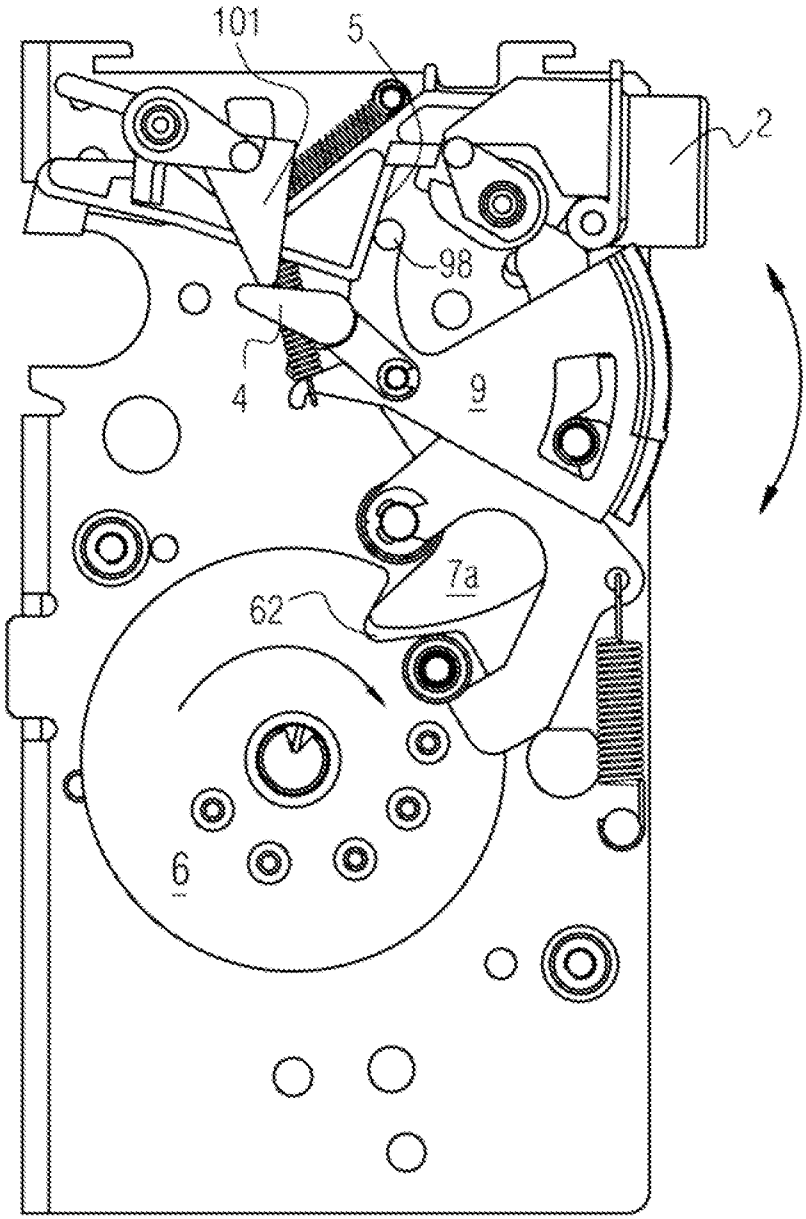

FIG. 7b

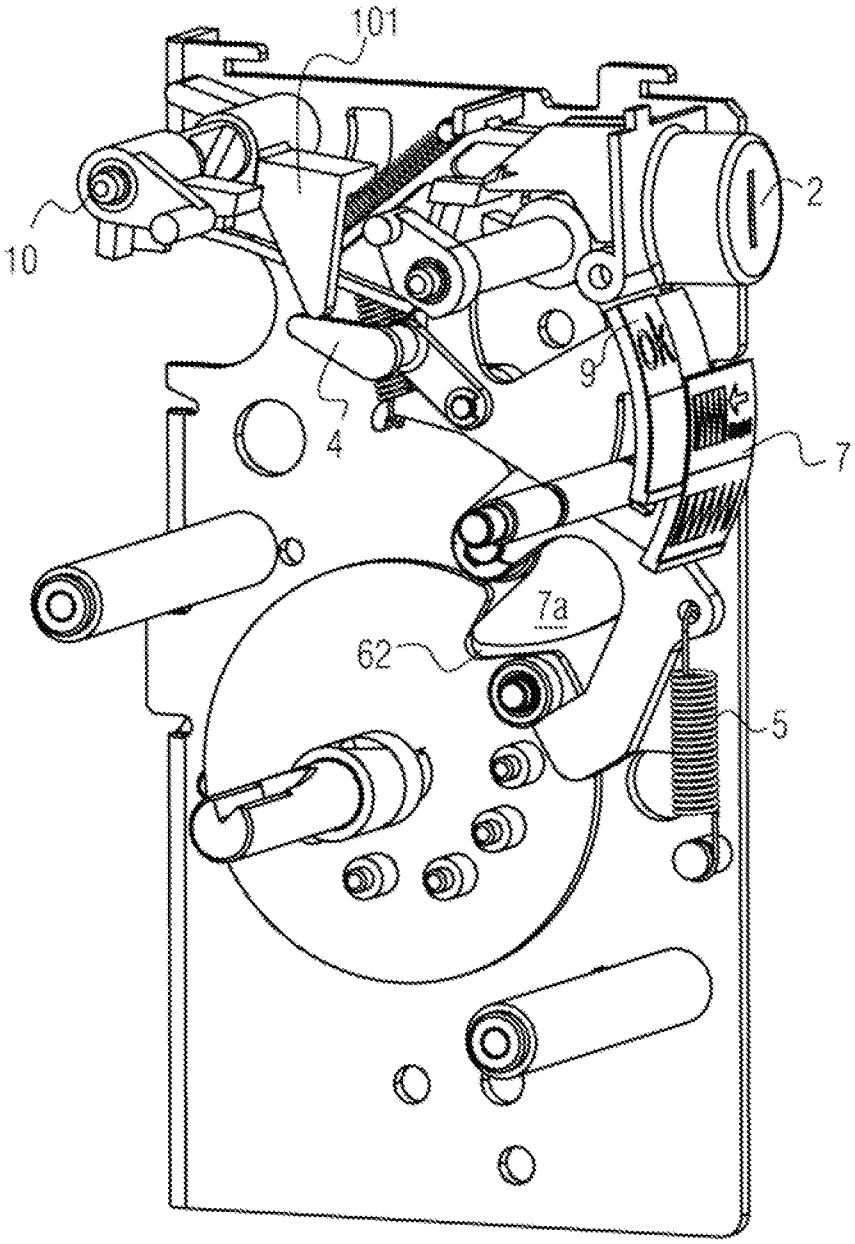

FIG. 7c

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2009/070414

A. CLASSIFICATION OF SUBJECT MATTER

H01H 71/04 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H01H

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

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

CNPAT, CNKI, WPI, EPODOC, PAJ: breaker, switch, close, indicator, shaft, axle, axial, axis, axes, half, semi

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN2550895Y(CHANGSHOU SWITCH FACTORY) 14 May 2003(14.05.2003) the whole document	1-5
A	EP1130615B1(SIEMENS AG) 22 Jun. 2005(22.06.2005) the whole document	1-5
A	CN2884507Y(SHANGHAI ELECTRICAL APPLIANCES) 28 Mar. 2007(28.03.2007) the whole document	1-5
A	EP1111644A1(HAGER ELECTRO SA) 27 Jun. 2001(27.06.2001) the whole document	1-5

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

* Special categories of cited documents:

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"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
29 Apr. 2009(29.04.2009)	**21 May 2009 (21.05.2009)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer NI, Guangyong Telephone No. (86-10)62411730

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2009/070414

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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		DE10010727A1	06.09.2001
		DE10010727C2	07.03.2002
		DE50106564G	28.07.2005
CN2884507Y	28.03.2007	NONE	
EP1111644A1	27.06.2001	EP1111644B1	24.03.2004
		DE69915845E	29.04.2004
		DE69915845T2	24.03.2005
		AT262732T	15.04.2004