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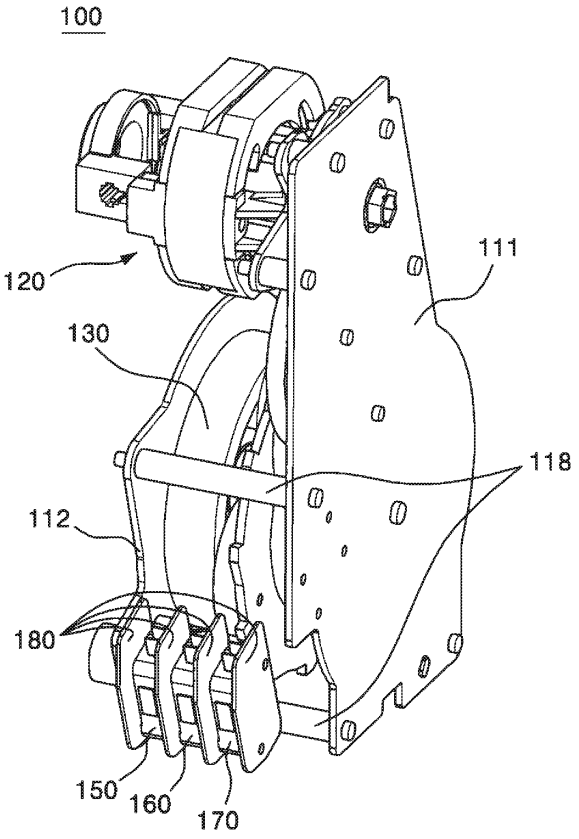
(54) **Spring charging device of air circuit breaker**

(57) Disclosed is a spring charging device (100) of air circuit breaker mounted with at least one or more micro switches and a switch lever (140) for turning on/off the micro switches capable of compressing the spring (11) and notifying completion of the compression of the spring when the charging is completed, thereby enhancing the efficiency in operation of the air circuit breaker by a user (an operator).

FIG. 3



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Description

TECHNICAL FIELD

[0001] The following description relates generally to a spring charging device of air circuit breaker, and more particularly to a spring charging device of air circuit breaker mounted with at least one or more micro switches and a switch lever for turning on/off the micro switch capable of compressing a connection spring of an air circuit breaker and notifying completion of the compression of the connection spring when the charging is completed.

BACKGROUND ART

[0002] Generally, an ACB (air circuit breaker) includes a stationary contactor and a movable contactor movable to a connected position for closing a conducted circuit by contacting the stationary contactor and to an interruption (trip) position for opening the conducted circuit by being separated from the stationary contactor, and allow the stationary contactor and the movable contactor to be contacted at all times for flowing the current, but when an abnormal over-current (a large current caused by i.e., short circuit and ground fault) generated at an electric circuit such as a power transmission/distribution line and private power transforming facilities occurs, the movable contactor is swiftly separated from the stationary contactor to interrupt the current from flowing to thereby protect load units such as a motor and a transformer and an electric line against an abnormal current. The ACB also exposes the stationary and movable contactors to pull in the compressed air and to distinguish the arc generated during the occurrence of abnormal current.

[0003] As noted above, the ACB is utilized for connecting a high-voltage current to or interrupting the current from a power station or distributing station, and is mounted, if necessary, with an actuator for swiftly interrupting or separating a contact point between the stationary contactor and the movable contactor. The driving method of the actuator is largely classified into a manual manipulation method, a solenoid manipulation method and an electric spring manipulation method.

[0004] In the ACB of the electric spring manipulation method, an interruption spring is elastically connected to one side of a cam axle mounted with a charging cam connected to a link connected to a movable contactor, and a manual charging device rotating the cam axle using a manual lever or an electric charging device using a motor is connected to the cam axle. The cam axle is rotated while a rotation moment-added main energy is maximally accumulated in the interruption spring using the charging device. If necessary, a lock is released to rotate the cam axle using the accumulated energy of the interruption spring and sequentially-meshed link separates the movable contactor from the stationary contactor to interrupt the current.

[0005] FIG. 1 is a perspective view illustrating configuration of a typical ACB and FIGS. 2a, 2b and 2c are schematic views sequentially illustrating an operational state of an actuator mechanism.

[0006] Referring to FIGS. 1, 2a, 2b and 2c, the typical ACB includes a connection spring (hereinafter referred to as spring. 11) selectively separating or connecting a contact point between a stationary contactor (3) and a movable contactor (5) for opening and closing a conducted circuit, an actuator mechanism (1) including a linkage (15), an interruption spring (21) and a cam axle (30), a driving motor (50. hereinafter referred to as motor) rotating the cam axle (30), and a charging device (40) including a decelerating gear assembly (60) and an output gear (70).

[0007] Now, referring to FIGS. 2a, 2b and 2c, the actuator mechanism (10) of the typical ACB will be described. FIG.2a illustrates an initial state of the actuator mechanism (1) where the contact point between the stationary contactor (3) and the movable contactor (5) are opened.

[0008] Thereafter, the cam axle (30) is rotated by the driving motor (50) or a charging handle (not shown), and a driver lever (16) is rotated by rotation of a charging cam (12) meshed with the cam axle to compress the spring (11) to be in a state illustrated in FIG.2b, i.e., in the state of charging completed. The changing cam (12) accumulated by the spring (11) maintains an equilibrium of force due to an ON lever (14) contacting a connection latch (13). An ON coupling (17) contacting a connection solenoid (not shown) is in a position capable of rotating the ON lever (14).

[0009] Then, when a user presses a connection button, or rotates the ON lever (14) by allowing the connection solenoid to move the ON coupling (17) downward, the connection latch (13) releases the charging cam (12)to allow the accumulated force of the spring (11) to be transmitted to the linkage (15) via a driver lever (16). An open/close axis (10) is rotated clockwise to allow contact points of the stationary contactor (3) and the movable contactor (5) to be contacted therebetween via an open/close lever (20) rotating in conjunction with the open/close axis (10) and to elongate the interruption spring (21), the state of which is illustrated in FIG.2c. The state of the contact points between the stationary contactor (3) and the movable contactor (5) being contacted, i.e., the equilibrium of force of the air breaker being cormected, is maintained by an open lever (23) via the linkage (15) and an open latch (22).

[0010] Thereafter, when a user presses an interruption button (now shown) by detecting an occurrence of overcurrent caused by failure at an electric line, or the open lever (23) is rotated by operation of the interruption solenoid (now shown), the open latch (22) is rotated to release the linkage (15) toggled by the connection operation and to rotate the open/close axis (10) according to force elongated by the interruption spring (21), such that the contact point of the stationary contactor (3) and the movable contactor (5) is separated to form a state of the

current being blocked illustrated in FIG.2a,

[0011] Meanwhile, the motor (50) for rotating the cam axle (30) is controlled by a motor-controlling micro switch (not shown) provided at the charging device. The motor-controlling micro switch causes the motor (50) to be applied with a driving current for charging (compression) of the spring (11), allowing the rotational force of the motor (50) to be transmitted to the cam axle (30). When the charging is completed as illustrated in FIG.2b, the driving current applied to the motor (50) is interrupted.

[0012] In the operation of the air circuit breaker, there occurs a need of notifying a user (an operator) that the charging has been completed. However, there is no separate means provided at the afore-mentioned charging device (40) of a typical air circuit breaker for letting a user (an operator) notified of the completion of the charging illustrated in FIG.2b. The motor-controning micro switch is basically structured to apply a driving current to the motor (50), such that, although the motor-controlling micro switch may be additionally configured with a separate distributing circuit to allow the user to be notified of the completion of charging, it is not advisable to install a separate distributing circuit configuration on the motor-controlling micro switch due to complication of the distributing circuit and possible erroneous operation of the motor (50).

TECHNICAL SOLUTION

[0013] This disclosure is provided to solve the afore-mentioned disadvantages and an object of this disclosure is to provide a spring charging device of air circuit breaker, wherein the spring charging device is mounted with at least one or more micro switches and a switch lever for turning on/off the micro switch capable of compressing a connection spring of the air circuit breaker and notifying completion of the compression of the connection spring when the charging is completed, thereby enhancing the efficiency in operation of the air circuit breaker by a user (an operator).

[0014] In one general aspect, a spring charging device of air circuit breaker comprises: first and second plates connected via a plurality of shafts each in a predetermined discrete distance; a driving motor mounted at the first plate; an output gear formed at an circumferential surface thereof with a predetermined groove and mounted at the second plate for connecting to a cam axle for charging a connection spring; a decelerating gear assembly connecting the driving motor to the output gear for transmitting a rotational force of the driving motor to the output gear; a driving motor-controlling micro switch mounted at one side of the second plate; a first micro switch mounted at an upper surface of the driving motor-controlling micro switch; display means for being electrically connected with the first micro switch; and a switch lever formed with a gear contactor provided at one end thereof with a projection contacting a circumferential surface of the output gear, a hinge unit bent from the other end of the gear contactor and provided at a distal end thereof with a hinge through hole, and a switch compressor vertically extended relative to the gear contactor and the hinge unit, whereby the switch lever is rotatably mounted on the second plate via a hinge axle inserted into the hinge through hole.

[0015] Implementations of this aspect may include one or more of the following features.

[0016] The switch compressor may increase thickness thereof as being distanced from the gear contactor to lower a bottom surface selectively contacting the micro switches.

[0017] The switch compressor may be provided with a first projection for complementing the compressed pressure relative to the first micro switch.

[0018] The switch lever may further comprise a first rib for preventing the switch compressor from being bent by being horizontally and extensively formed from the switch compressor to be connected to the hinge unit.

[0019] The switch lever may be further formed with a second rib for preventing the switch compressor from being bent by being vertically and extensively formed from the switch compressor to be connected to the gear contactor.

[0020] The first micro switch may be further formed at an upper surface thereof with a second micro switch connected to a separate display means, where the switch compressor may be formed with a second projection for complementing the compressed pressure relative to the second micro switch.

[0021] An insulation plate may be interposed between the second plate and the driving motor-controning micro switch.

[0022] An insulation plate may be interposed between the first micro switch and the driving motor-controlling micro switch.

[0023] An insulation plate may be interposed between the first micro switch and the second micro switch.

ADVANTAGEOUS EFFECTS

[0024] The advantageous effect of the spring charging device of air circuit breaker is such that the spring charging device is mounted with at least one or more micro switches and a switch lever for turning on/off the micro switch capable of compressing a connection spring of the air circuit breaker and notifying completion of the compression of the spring when the charging is completed, thereby enhancing the efficiency in operation of the air circuit breaker by a user (an operator).

DESCRIPTION OF DRAWINGS

[0025]

FIG.1 is a perspective view of a typical air circuit breaker.

FIGS. 2a, 2b and 2c are schematic views sequen-

tially illustrating construction and an operational state of an actuator mechanism of FIG.1.

FIG.3 is a perspective view of a connection spring charging device of an air circuit breaker according to an exemplary implementation.

FIG.4 is a partial perspective view of arranged relationship of an output gear, a switch lever and a driving motor-controlling micro switch illustrated in FIG.3.

FIG.5a and FIG. 5b are a perspective view of a switch lever illustrated in FIG.4.

FIG. 5c is a lateral view of a switch lever illustrated in FIG.5a.

FIGS.6a and 6b are operational constitutional views sequentially illustrating an operational state of a connection spring charging device of an air circuit breaker according to an exemplary implementation.

MODE FOR INVENTION

[0026] Exemplary implementations of a spring charging device of air circuit breaker according to the present novel concept will be described in detail with reference to the accompanying drawings,

[0027] FIG.3 is a perspective view of a connection spring charging device of an air circuit breaker according to an exemplary implementation, and FIG.4 is a partial perspective view of arranged relationship of an output gear, a switch lever and a driving motor-controlling micro switch illustrated in FIG.3,

[0028] Referring to FIGS.3 and 4, a spring charging device (100) of air circuit breaker includes first and second plates (111, 112) connected via a plurality of shafts each in a predetermined discrete distance.

[0029] The first plate (111) is mounted with a driving motor (120. hereinafter referred to as motor) for providing a rotational force for rotating a cam axle (30) for compressing a connection spring (11. hereinafter referred to as spring, see FIGS. 2a, 2b and 2c).

[0030] The second plate (112) formed with a groove (132) formed at a circumferential surface (131) and a projecting piece (133) protrudisgly formed at one side of the circumferential surface (131) is mounted with an output gear (130) for connecting with the cam axle (30). Unexplained reference numeral 135 defines a cam axle insertion groove for inserting the cam axle (30).

[0031] Between the first and second plates (111, 112) is there interposed a decelerating gear assembly (190. see FIG.6a) for connecting the motor (120) to the output gear (130) to transmit a rotational force of the motor (120) to the output gear (130).

[0032] The second plate (112) is mounted at one side thereof with a motor controlling micro switch (150) controlling the operation of the motor (120) by applying or blocking a driving current to the motor (120) in response to the operation of a switch lever (140. described later). An insulation plate (180) for insulating the motor controlling micro switch (150) is interposed between the motor controlling micro switch (150) and the second plate (112).

[0033] The motor controlling micro switch (150) is mounted thereon with a first micro switch (160) turned on/off by operation of the switch lever (140) for notifying a user of completion of charging by applying a driving current to display means (not shown) such as a buzzer or a lamp when the spring (11) is compressed to complete the charging. An insulation plate (180) is interposed between the first micro switch (160) and the motor controlling micro switch (150) for insulation of the first micro switch (160).

[0034] The first micro switch (160) may be additionally mounted thereon with a second micro switch (170). The second micro switch (170) is turned on/off in response to operation of the switch lever (140) as the first micro switch (160).

[0035] Under a system where a plurality of users (operators) operates the air circuit breaker for its effective operation, when the spring (11) is compressed to complete the charging as illustrated in FIG.2b, the second micro switch may be connected to another display means (not shown) such as a buzzer or a lamp provided separately from the display means (not shown) such as a buzzer or a lamp connected to the first micro switch (160) to notifying the completion of charging to a second user (operator), or may be connected to another operator provided inside the system of the air circuit breaker, for example, to a connection solenoid for connecting the circuit breaker when the charging is completed as illustrated in FIG.2b.

[0036] At this point, an insulator (180) may be interposed between the first micro switch (160) and the second micro switch (170) for insulating the second micro switch (170).

[0037] Now, the switch lever (140) will be described in detail with reference to the accompanying drawings.

[0038] FIG.5a and FIG. 5b are a perspective view of a switch lever illustrated in FIG.4, and FIG. 5c is a lateral view of a switch lever illustrated in FIG.5a.

[0039] Referring to FIGS. 4, 5a, 5b and 5c, the switch lever (140) is formed with a gear contactor (141) provided at one end thereof with a projection (141a) contacting a circumferential surface (131) of the output gear (130), a hinge unit (143) bent from the other end of the gear contactor (141) and provided at a distal end thereof with a hinge through hole (143a), and a switch compressor (145) vertically extended relative to the gear contactor (141) and the hinge unit (143), whereby the switch lever (140) is rotatably mounted on the second plate (112) via a hinge axle (13) provided at one side of the second plate (112).

[0040] The switch compressor (145) may press each button (not shown) of the motor controlling micro switch (150) and the first micro switch (160), while the projection (141a) provided at the gear contractor (141) of the switch lever (140) contacts the circumferential surface (131) of the output gear (130). Under a certain circumstance, the switch compressor (145) may press buttons (not shown) of the second micro switch (170), such that the compress-

ing pressure pressing each button of the micro switches (150, 160, 170) may be weakened as being distanced from the gear contactor (141). In order to reinforce the weakening compressing pressure, the switch compressor (145) increases in thickness thereof as being distanced from the gear contactor (141), as illustrated in FIG.5c, to lower a bottom surface contacting each button of the micro switches (150, 160, 170).

[0041] The switch compressor (145) may be further formed with a second projection (145b) depressing the second micro switch (170) and the first projection (145a) depressing the first micro switch (160) while the projection (141a) provided at the gear contactor (141) of the switch lever (140) abuts the circumferential surface (131) of the output gear (130).

[0042] Meanwhile, as illustrated in the above, the switch compressor (145) presses the motor controlling micro switch (150) and each button of the first micro switch (160), and in some cases, presses buttons of the second micro switch (170), such that the switch compressor (145) tends to get bent in use as being distanced from the gear contactor (141). In order to prevent the switch compressor (145) from being bent in use, the switch lever (140) is formed with a first rib (146) horizontally and extensively formed from the switch compressor (145) to be connected to the hinge unit (143), and a second rib (147) vertically and extensively formed from the switch compressor (145) to be connected to the gear contactor (141).

[0043] Now, the operational state of the spring charging device of air circuit breaker according to operation of the aforementioned micro switches (150, 160, 170) will be described in detail with reference to FIGS.6a and 6b.

[0044] FIGS.6a and 6b are operational constitutional views sequentially illustrating an operational state of a spring charging device of an air circuit breaker according to an exemplary implementation.

[0045] FIG.6a describes a state in which the motor (120) is driven to rotate the output gear (130) clockwise, thereby rotating the cam axle (30) to charge the spring (11. see FIG.2a). In other words, FIG.6a illustrates a state where the projection (141a) provided at the gear contactor (141) of the switch lever (140) is brought into contact with the circumferential surface (131) of the output gear (130), and a left distal end of the switch compressor (145) compresses the button of the motor controlling micro switch (150) to prompt the motor controlling micro switch (150) to apply a current to the motor (120), thereby rotating the output gear (130) to rotate clockwise, as illustrated in FIG.5a.

[0046] An internal circuit of the motor controlling micro switch (150) maintains a state of open contact point under a normal situation, but changes the state to a closed contact point to apply a driving current to the motor (120) by allowing the button to be pressed by the left distal end of the switch compressor (145).

[0047] Meanwhile, an internal circuit of the first and second micro switches (160, 170) disposed on the same axis as that of the motor controlling micro switch (150) maintains a closed contact point under a normal situation, but changes the state to that of open contact point to interrupt the current applied to the solenoid that connects the display means such as a buzzer or a lamp by being changed to the open contact point when each button is pressed by the switch compressor (145) or by the first and second projections (145a, 145b) provided at the switch compressor (145).

[0048] Successively, when the motor (120) keeps driving to rotate the output gear (130) clockwise and when the projection (141a) provided at the gear contactor (141) of the switch lever (140) is in a position of being inserted into the groove (132) formed at the circumferential surface (131) of the output gear (130), as illustrated in FIG. 6b, the switch compressor (145) is pushed by the restoring force of the buttons of the micro switches (150, 160, 170) to cause the projection (141a) provided at the gear contactor (141) of the switch lever (140) to be inserted into the groove (132) of the circumferential surface (131) of the output gear (130). This state is the charging completed state of the spring as illustrated in FIG.2b.

[0049] Under this circumstance, the buttons of the motor controlling micro switch (150) are released to allow the internal circuit to be changed to the state of open contact point, whereby the driving current applied to the motor (120) is interrupted to stop the driving of the motor (120). As a result, the supplied rotational force is removed to stop the output gear (130) and the cam axle (30) ceases to rotate. At this time, the projection piece (133) formed at the circumferential surface (131) of the output gear (130) is hitched by a stopper (114) provided at the second plate (112), whereby the possibility of the output gear (130) being rotated by a barely operated rotational force is interrupted.

[0050] Meanwhile, each button of the first and second micro switches (160, 170) disposed on the same axis as that of the motor controlling micro switch (150) is released of being compressed, and the internal circuit of the first and second micro switches (160, 170) is changed to a state of closed contact point to cause the display means such as a buzzer or a lamp to be applied with a current, whereby a user (an operator) is notified of the charging completion, or to cause the solenoid to be applied with a current, thereby connecting the circuit breaker as illustrated in FIG.2c.

INDUSTRIAL APPLICABILITY

[0051] As noted in the foregoing, the spring charging device of air circuit breaker is mounted with at least one or more micro switches (160, 170) and a switch lever (140) for turning on/off the micro switches (160, 170) capable of compressing the spring and notifying completion of the compression of the spring when the charging is completed, thereby enhancing the efficiency in operation of the air circuit breaker by a user (an operator).

[0052] While the present disclosure has been particularly shown and described with reference to exemplary

implementations thereof, the general inventive concept is not limited to the above-described implementations. It will be understood by those of ordinary skill in the art that various changes and variations in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims,

Claims

1. A spring charging device (100) of air circuit breaker **characterized by**: first and second plates (111, 112) connected via a plurality of shafts (118) each in a predetermined discrete distance; a driving motor (120) mounted at the first plate (111); an output gear (130) formed at an circumferential surface thereof with a predetermined groove and mounted at the second plate (112) for connecting to a cam axle (30) for charging a connection spring (11); a decelerating gear assembly (190) connecting the driving motor (120) to the output gear (130) for transmitting a rotational force of the driving motor (120) to the output gear (130); a driving motor-controlling micro switch (150) mounted at one side of the second plate (112); a first micro switch (160) mounted at an upper surface of the driving motor-controlling micro switch (150); display means for being electrically connected with the first micro switch (160); and a switch lever (140) formed with a gear contactor (141) provided at one end thereof with a projection (141a) contacting a circumferential surface of the output gear (130), a hinge unit (143) bent from the other end of the gear contactor (141) and provided at a distal end thereof with a hinge through hole, and a switch compressor (145) vertically extended relative to the gear contactor (141) and the hinge unit (143), whereby the switch lever (140) is rotatably mounted on the second plate (112) via a hinge axle (113) inserted into the hinge through hole (143a).

2. The spring charging device (100) as claimed in claim 1, **characterized in that** the switch compressor (145) increases thickness thereof as being distanced from the gear contactor (141) to lower a bottom surface selectively contacting the micro switches.

3. The spring charging device (100) as claimed in claim 1, **characterized in that** the switch compressor (145) is formed with a first projection (145a) for complementing the compressed pressure relative to the first micro switch (160).

4. The spring charging device (100) as claimed in claim 1, **characterized in that** the switch lever (140) further includes a first rib (146) for preventing the switch compressor (145) from being bent by being horizontally and extensively formed from the switch compressor (145) to be connected to the hinge unit (143).

5. The spring charging device (100) as claimed in claim 1, **characterized in that** the switch lever (140) is further formed with a second rib (147) for preventing the switch compressor (145) from being bent by being vertically and extensively formed from the switch compressor (145) to be connected to the gear contactor (141).

6. The spring charging device (100) as claimed in claim 1, further **characterized by** a second micro switch (170) and a separate display means electrically connected to the second micro switch (170) mounted on the first micro switch.

7. The spring charging device (100) as claimed in claim 6, **characterized in that** the switch compressor (145) is formed with a second projection (145b) for complementing the compressed pressure relative to the second micro switch (170).

8. The spring charging device (100) as claimed in claim 1, **characterized in that** an insulation plate (180) is interposed between the second plate (112) and the driving motor-controlling micro switch (150).

9. The spring charging device (100) as claimed in claim 1, **characterized in that** an insulation plate (180) is interposed between the first micro switch (160) and the driving motor-controlling micro switch (150).

10. The spring charging device (100) as claimed in claim 6, **characterized in that** an insulation plate (180) is interposed between the first micro switch (160) and the second micro switch (170).

FIG. 1

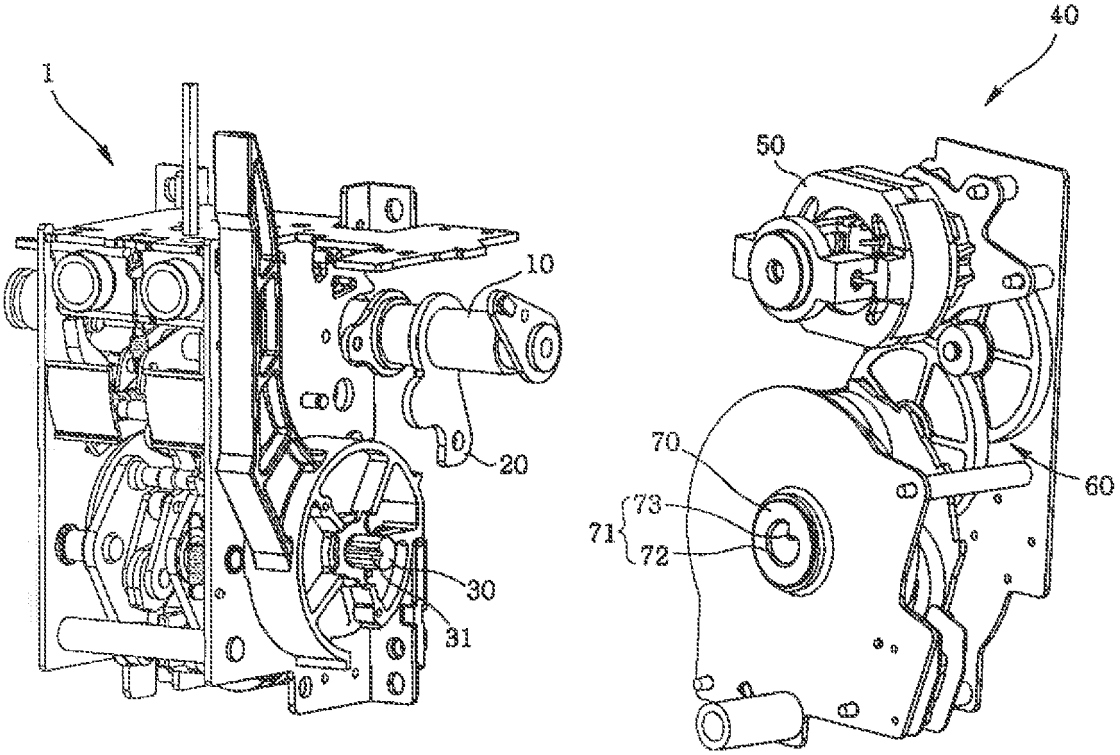
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FIG. 2a

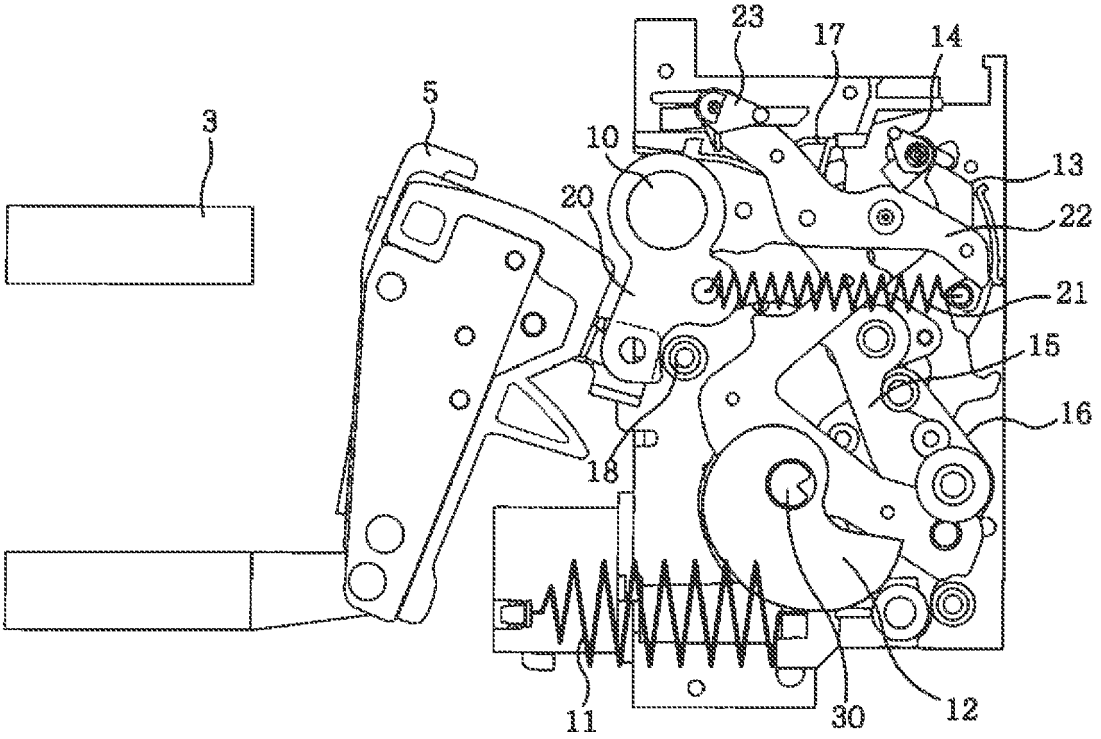
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FIG. 2b

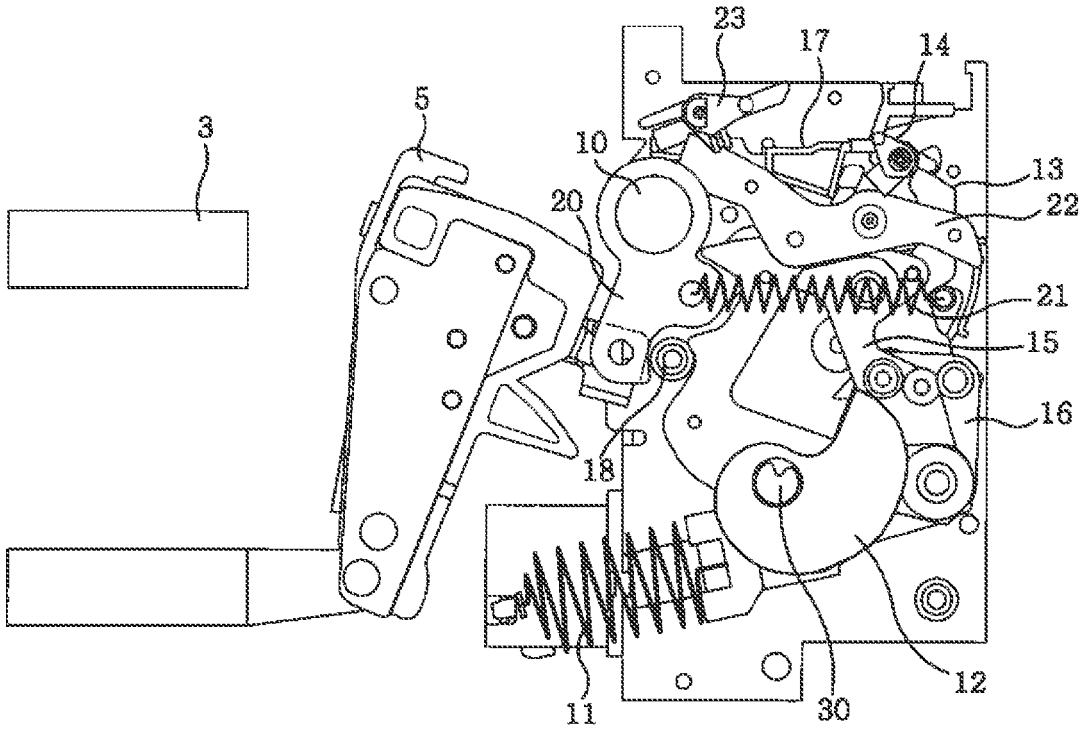
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FIG. 2c

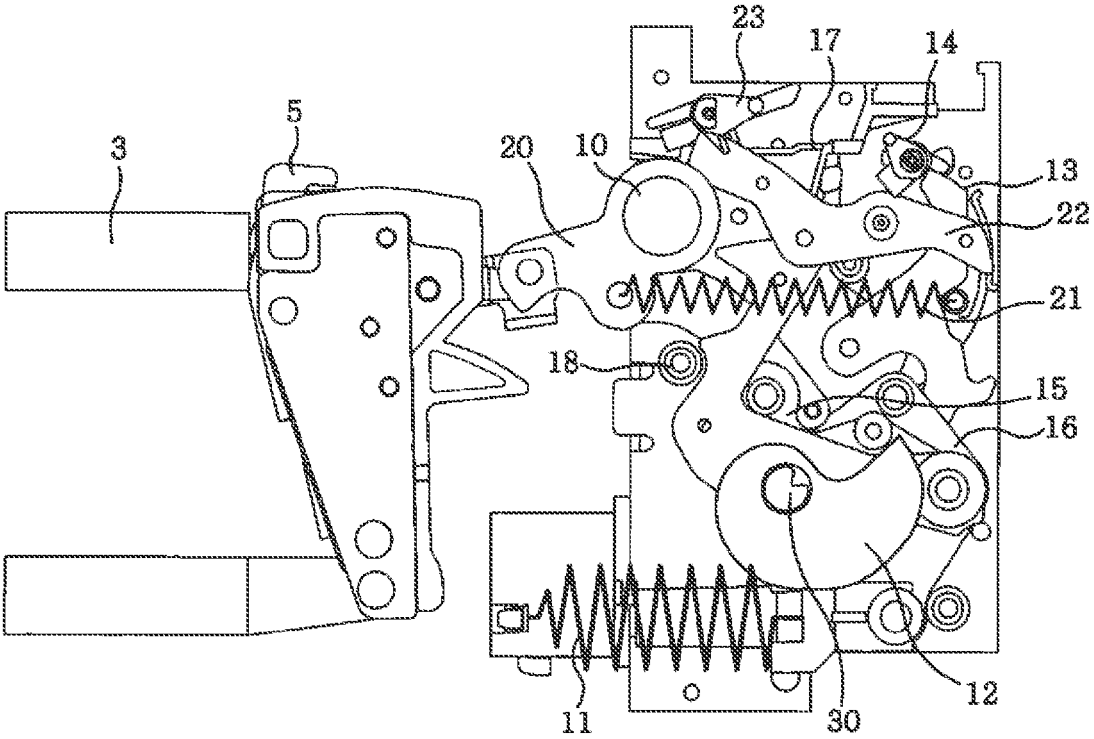
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FIG. 3

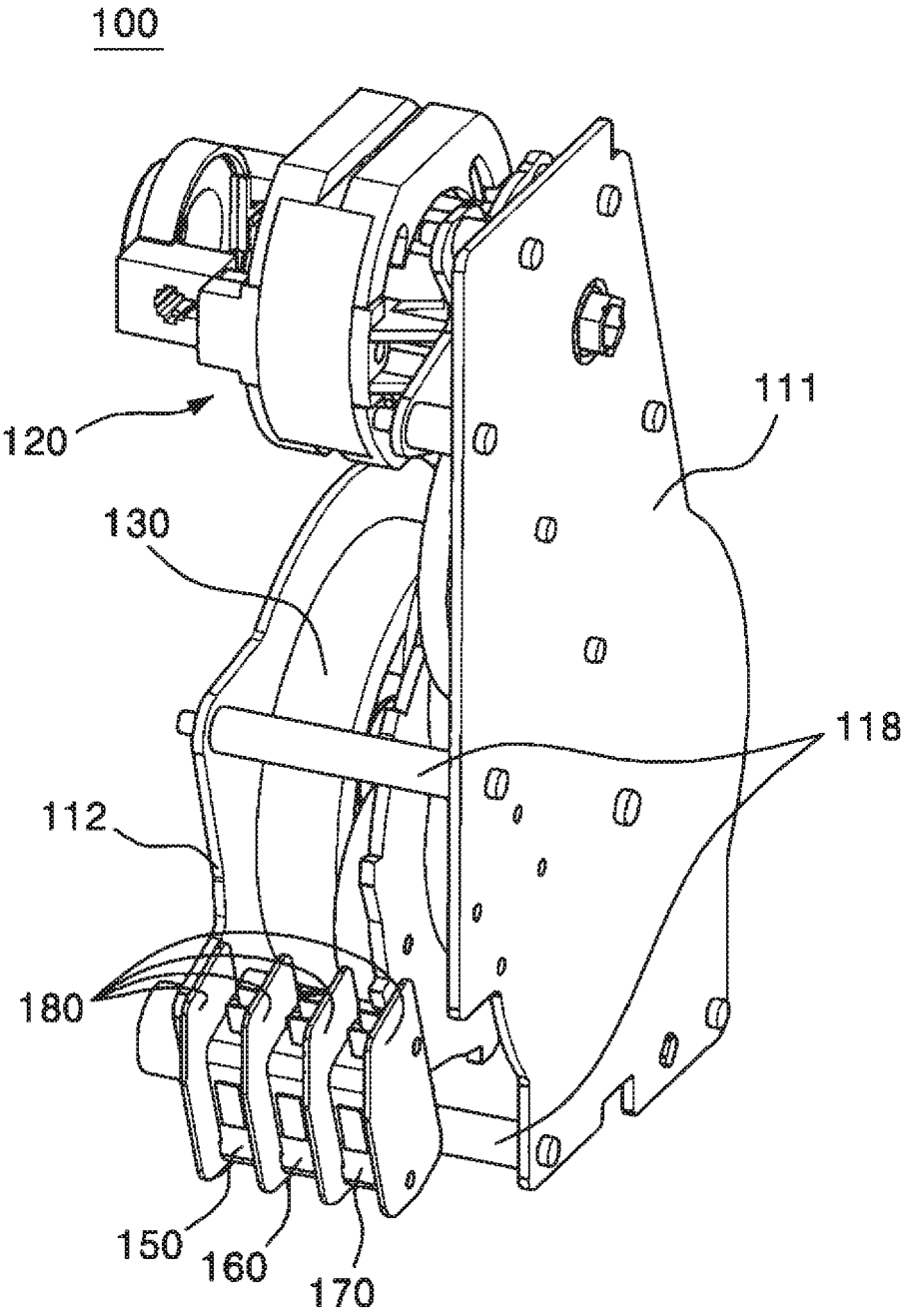

FIG. 4

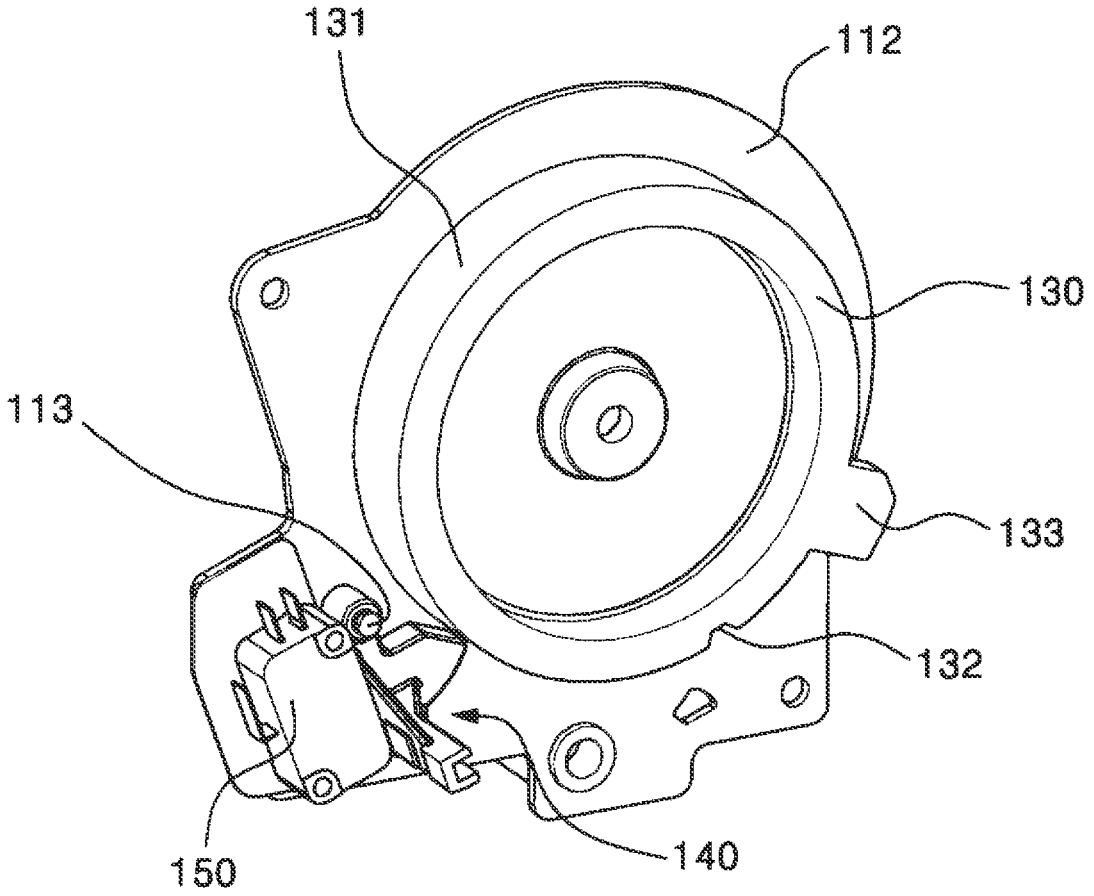

FIG. 5a

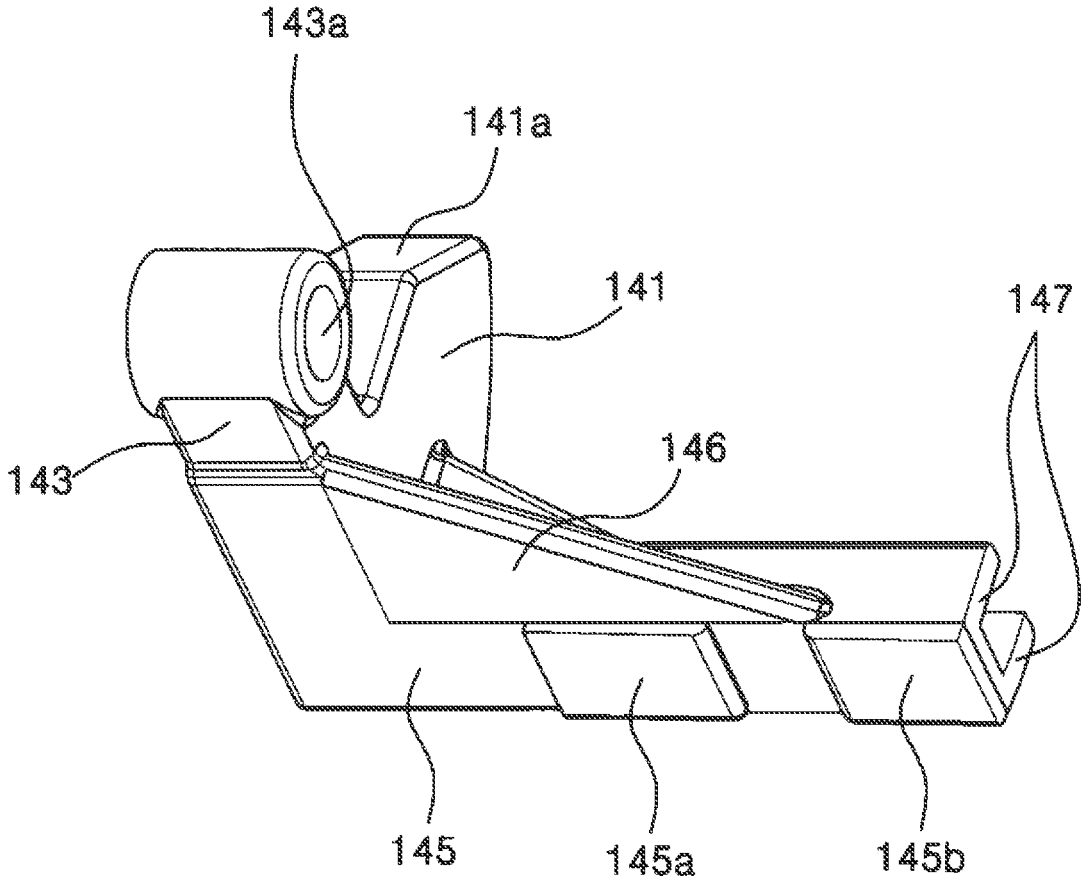

FIG. 5b

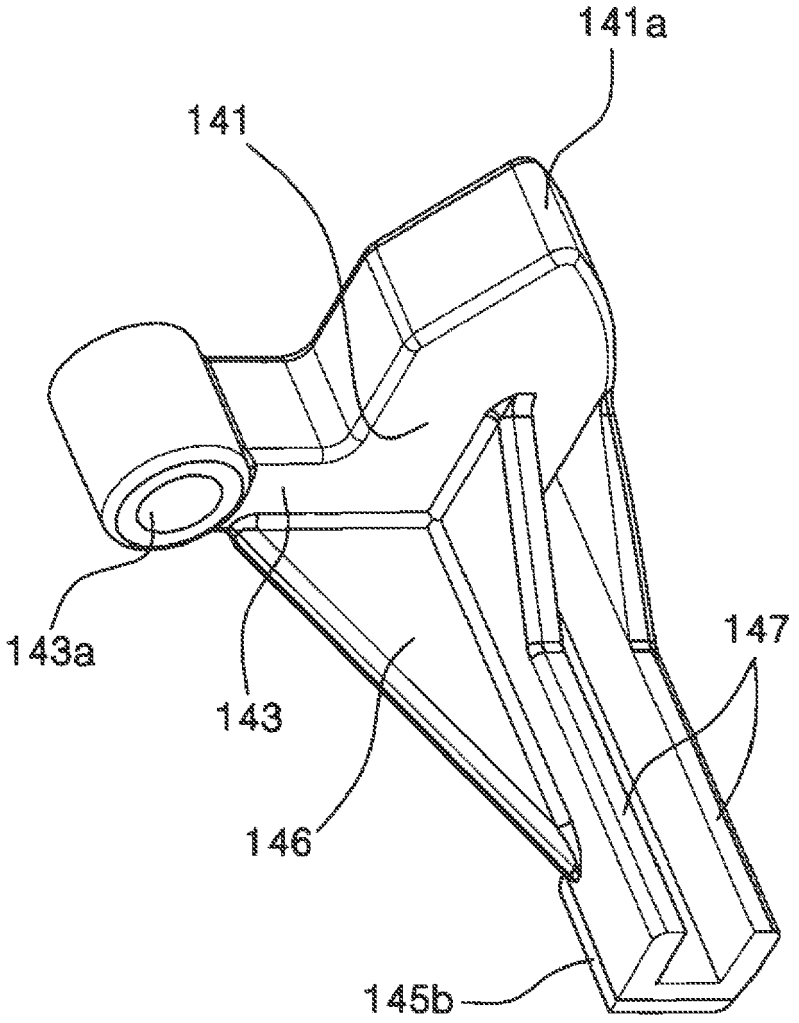

FIG. 5c

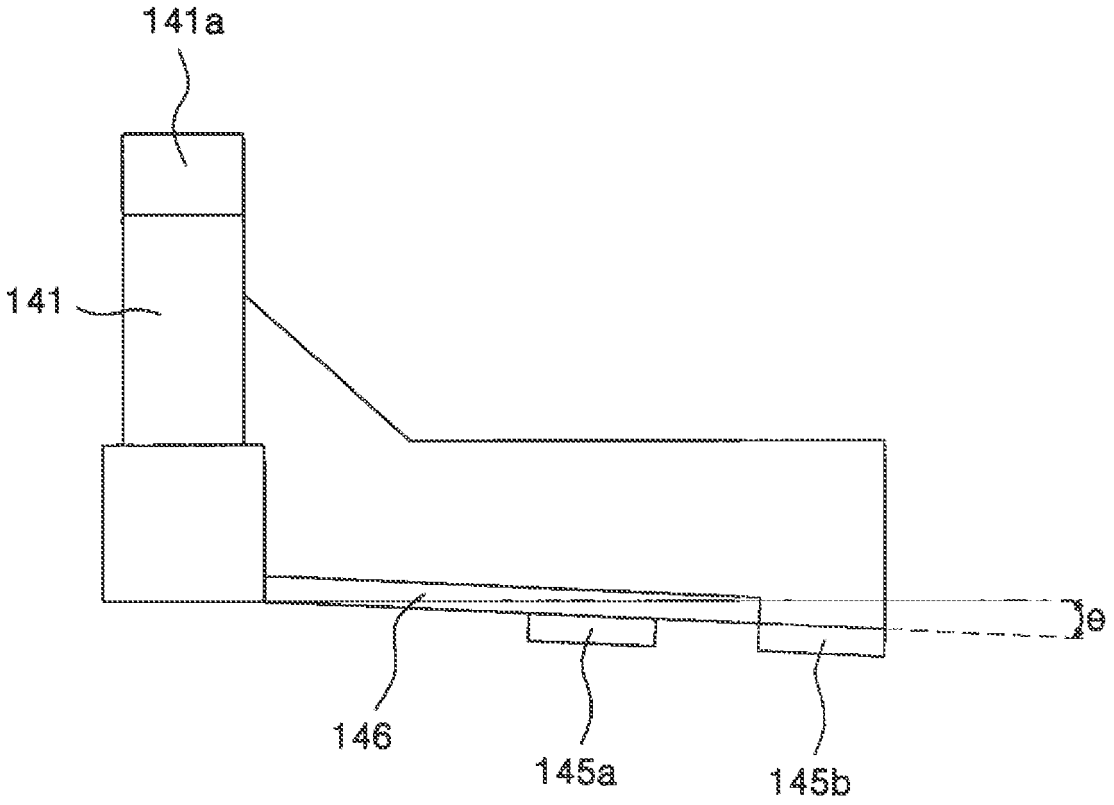

FIG. 6a

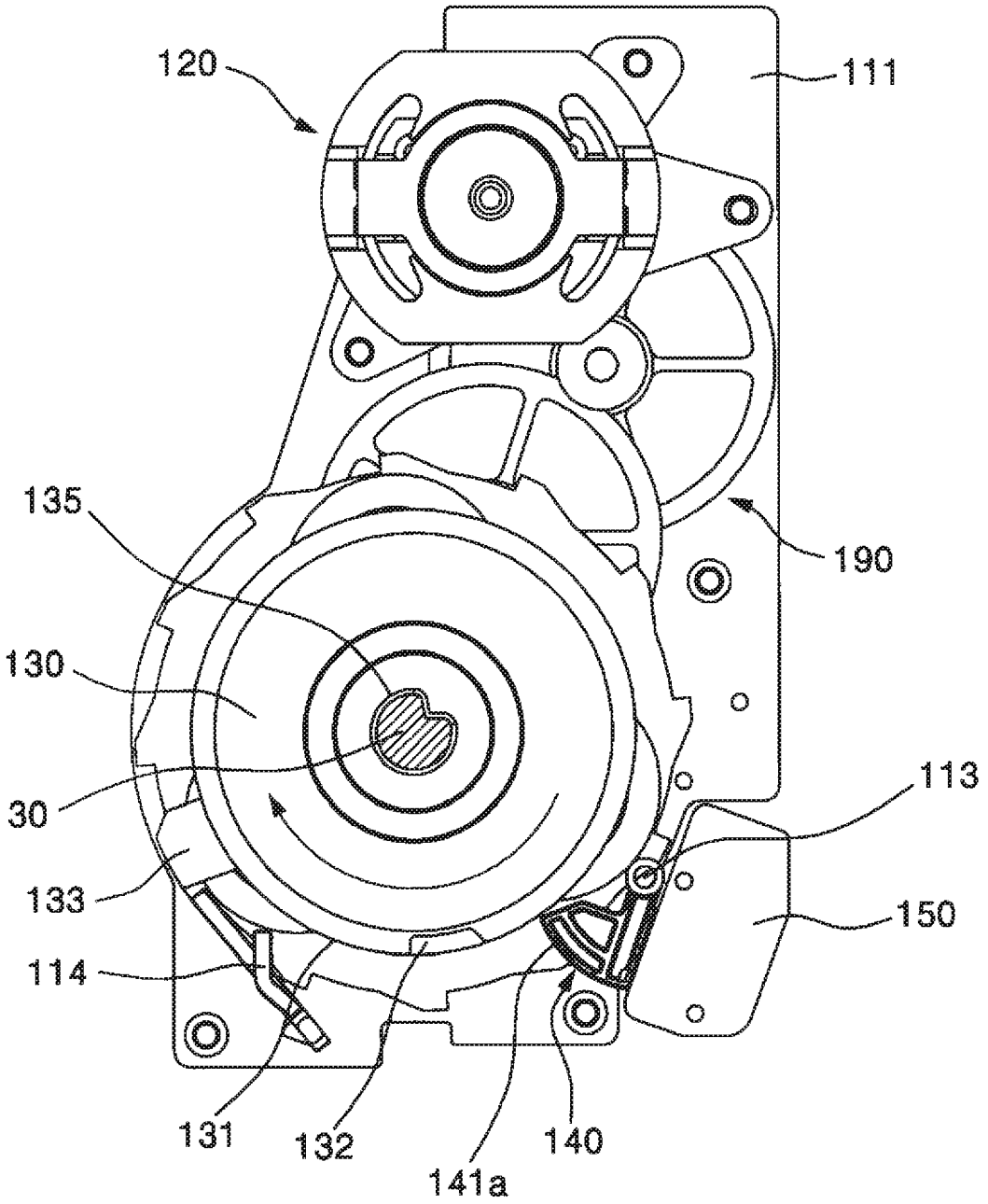

FIG. 6b