



MOVABLE CONTACT MECHANISM FOR CIRCUIT BREAKER

TECHNICAL FIELD

- 5 The present invention relates to the field of low-voltage electrics, more particularly, to a movable contact mechanism of a current-limiting circuit breaker.

BACKGROUND

In the field of low-voltage circuit breaker, it is always a problem to improve the
10 ability of disconnection during short. For a partial modification of a conventional circuit breaker, the ability of disconnection can be improved by increasing the separation of the circuit breaker, namely, increasing the arc length to increase the arc resistance so as to improve the ability of current limitation. However, the circuit breaker should be manufactured smaller and smaller. Thus, it is a problem how to
15 improve the ability of disconnection of the circuit breaker without increasing its size.

Currently, some products have a structure of a single arm and dual contacts. This structure can increase the arc length in a certain extent so as to improve the ability of current limitation without increasing the size of the device. However, the
20 wearings for the two contacts are not consistent with each during its use. Thus, the final pressure is not uniform, which may result in the increase of the contact resistance. Thus, the performance of the circuit breaker will be weak.

Some other products have a structure of dual arms and dual contacts. There are a joint device connected between the two arms, which may make the final pressure
25 uniform, so as to solve the problem of unstable contact resistance. However, this structure is complicated and uneasily for installation and maintenance.

SUMMARY OF INVENTION

To this end, the present invention is to provide a movable contact mechanism of a
30 current-limiting circuit breaker with a dual-contact having the advantages of simple



structure, easy installation, and uniform final pressure so as to solve the problem of unstable contact. Thus, the ability of disconnection of the circuit breaker can be improved without increasing the size of the breaker.

A movable contact mechanism of a circuit breaker according to the present
5 invention, comprises: a rotating shaft for driving supporting rods; a plurality of supporting rods each having a vertical hole provided in its upper portion and a transverse hole provided in its lower portion and each rotatably connecting with the rotating shaft via a shaft passing through its transverse hole; a plurality of Y-shaped contact levers each provided with contacts and an axial lever inserted into the
10 vertical hole of a corresponding supporting rod to rotatably connect to the supporting rod, wherein the number of the Y-shaped contact levers is equal to that of the supporting rods; and a plurality of elastic elements each having one terminal connected to the axial lever of a corresponding Y-shaped contact lever or a corresponding supporting rod and another terminal connected to the rotating shaft
15 that the rotating shaft drives the movement of the supporting rods via the elastic elements.

The elastic elements are parallel double-torsion springs each includes an upper torsion arm mounted onto the axial shaft of the Y-shaped contact lever or the supporting rod and a lower torsion arm connected onto the rotating shaft.

20 The supporting rod may, at its middle portion, has a traverse groove, which is communicating with the vertical hole at the upper portion. The axial lever of each Y-shaped contact lever may be provided with an annular trough at a location corresponding to the groove of the supporting rod in line with the insertion of the axial lever into the vertical hole of the supporting rod. The upper torsion arm of the
25 torsion spring may be embedded in the groove of the supporting rod and is fastened within the annular trough of the axial lever.

The supporting rod may, at its middle portion, has a traverse pin hole communicating with the vertical hole of the upper portion. The supporting rod may have a transverse groove at its middle portion. The axial lever of each Y-shaped
30 contact lever may be provided with an annular trough at a location corresponding to

the pin hole of the supporting rod in line with the insertion of the axial lever into the vertical hole of the supporting rod. The Y-shaped contact lever may rotatably connect to the corresponding supporting rod through a pin inserted into the pin hole of the supporting rod and the annular trough of the axial lever. The upper torsion
 5 arm of the torsion spring may be fastened within the groove of the supporting rod.

The axial lever of the Y-shaped contact lever has an axial flange that the underside of axial flange and the top surface of the supporting rod sandwiches a leaf spring in between.

The lower portion of the supporting rod may be connected, through a pin, to a lever
 10 used to flip the supporting rod to break the contacts.

The bottom of the supporting rod carries a projection that the projection contacts the edge of the lever upon rotating the lever to a predetermined angle.

The U-shaped arm of the Y-shaped contact lever is fabricated with an axial hole at its middle portion that the axial lever rigidly connects the U-shaped arm through the
 15 axial hole.

The axial lever is connected to the U-shaped arm by riveting, threading or welding.

Compared with the prior art, the present invention has a simple structure, can be installed easily, can automatically uniform the final pressure of the double-breakpoint contact, and can solve the problem that the conductivity of the double-
 20 breakpoint contact is less and less.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is an axonometric view according to Example 1 of the present invention;

Fig. 2 is a sectional view of the structure according to Example 1 of the present
 25 invention;

Fig. 3 is an axonometric view of a supporting rod according to Example 1 of the present invention;

Fig. 4 is an axonometric view of a Y-shaped contact lever according to the present invention;

30 Fig. 5 is an axonometric view of a spring according to the present invention;

Fig. 6 is an axonometric view of a U-shaped arm of the Y-shaped contact lever according to the present invention;

Fig. 7 is an axonometric view of an axial lever of the Y-shaped contact lever according to the present invention;

5 Fig. 8 is an axonometric view of a supporting rod with additional features according to the present invention;

Fig. 9 is an axonometric view of an example of the supporting rod with additional features according to the present invention;

Fig. 10 is a sectional view of an example of the supporting rod with additional
10 features according to the present invention;

Fig. 11 is a sectional view of the structure according to Example 2 of the present invention; and

Fig. 12 is an axonometric view of a supporting rod according to Example 2 of the present invention.

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DESCRIPTION OF EMBODIMENTS

A conventional current-limiting circuit breaker having an insulating plastic housing includes: at least one fixed contact part and at least one movable contact part for each electrode, which can be connected/disconnected with each other at the circuit
20 breaker's on/off status; and a mechanism providing energy for movement of the movable contact part, determining connection/disconnection between the movable contact part and its corresponding fixed contact part, and having a rotating shaft for the connection between each electrode and the movable contact part.

The movable contact mechanism of the circuit breaker according to the present
25 invention comprises a rotating shaft for driving supporting rods; a plurality of supporting rods each having a vertical hole provided in its upper portion and a transverse hole provided in its lower portion and rotatably connecting with the rotating shaft via a shaft passing through its transverse hole; a plurality of Y-shaped contact levers each composed of U-shaped arms and a axial lever wherein the
30 number of the Y-shaped contact levers is equal to that of the supporting rods, each

arm is provided with a contact, and each axial lever is inserted into the vertical hole of a supporting rod to connect rotatably to the supporting rod; a plurality of torsion springs each having one terminal connected to the axial lever of a Y-shaped contact lever or a supporting rod and another terminal connected to the rotating shaft driving the supporting rods to rotate via the torsion springs.

Hereinafter, the present invention will be described in detail with reference to the accompanying drawings.

Example 1

10 As shown in Fig. 1, the movable contact part of the current-limiting circuit breaker according to the present invention includes three supporting rods 1, a shaft 2, a rotating shaft 3, three Y-shaped contact lever 4 and three springs 5.

As shown in Fig. 3, a vertical hole 12 is provided in the upper portion of the supporting rod 1 and a transverse hole 11 is provided in the low portion of the supporting rod 1. The vertical hole 12 and the transverse hole 11 are substantially perpendicular to each other. As shown in Fig. 2, the supporting rod 1 is connected to the rotating shaft 3 via the shaft 2 passing through the transverse hole 11 so that the supporting rod 1 can rotate relative to the rotating shaft 3 with the shaft 2 as the rotating axis.

20 As shown in Fig. 4, the Y-shaped contact lever 4 is composed of U-shaped arms 42 and an axial lever 43. Each of two U-shaped arms 42 is provided with a contact 41 contacting a fixed contact part of the circuit breaker. As shown in Fig. 6, a cylindrical hole 421 of the U-shaped contact arm 42 and the axial lever 43 is riveted to form a rigid integration. Alternatively, they can be rigidly connected to each other by threading or welding connection. The axial lever 43 of the Y-shaped contact lever 4 is inserted into the vertical hole 12 of the supporting rod 1 so as to rotatably connected to the supporting rod 1. The Y-shaped contact lever 4 can rotate about the central axis of the vertical hole 12 so as to facilitate the uniformity of the contact pressure from the Y-shaped contact lever 4 to the fixed contact part.

As shown in Fig. 3, a groove 15 is transversely provided in the middle portion of the supporting rod 1 and is communicated with the vertical hole 12 in the upper portion of the supporting rod. As shown in Fig. 7, an annular trough 431 is provided on the axial lever 43 of the Y-shaped contact lever. The location of the annular trough 431 in line with the insertion of the axial lever 43 into the vertical hole 12 of the supporting rod corresponds to the groove 15 of the supporting rod. As shown in Fig. 5, the structure of the spring 5 is in the form of two parallel torsions and the spring 5 includes an upper torsion arm 511 and two low torsion arms 512.

During the assembly, the axial lever 43 of the Y-shaped contact lever 4 is inserted into the vertical hole 12 of the supporting rod 1. The upper torsion arm 511 of the spring 5 is embedded in the groove 15 of the supporting rod and fastened within the annular trough 431 of the axial lever 43. Then, the two low torsion arms 512 of the spring 5 are fastened on a boss 31 of the rotating shaft 3 (as shown in Fig. 2). In this connection, the spring 5 is in an energy-stored compressed status and applies a pressure to the axial lever 43 of the Y-shaped contact lever 4, so that the axial lever 43 will not get out of the hole 12 of the supporting rod 1 due to vibration or the like, the Y-shaped contact lever 4 has a resistance against its rotation about the axial lever 43, and the supporting rod 1 is elastically pressed to the rotating shaft 3.

The supporting rod 1 is connected to the rotating shaft 3 via the spring 5, shaft 43 and shaft 2. The rotating shaft 3 is driven by a driving mechanism of the circuit breaker to drive the supporting rods 1 to rotate via the torsion springs 5. Then, the Y-shaped contact levers 4 connected with the supporting rods 1 are driven to rotate. Therefore, the connection and disconnection between the movable contact part and the fixed contact part can be achieved. In the status of connection, a stable contact pressure from the Y-shaped contact lever 4 to the fixed contact part is provided by using the spring 5. Where the heights of contacts of fixed contact parts are slightly different from each other during manufacture, assembly or use, the contact pressure of the two contacts 41 of a Y-shaped contact lever can be automatically uniformed with the rotation of the Y-shaped contact lever. This may efficiently solve the problem that the conductivity of the double-breakpoint contact is less and less.

During disconnection and in the status of disconnection, the Y-shaped contact lever 4 may not rotate undesiredly to change the contact spacing due to the existing of the spring 5, so as to ensure the reliability of breaking.

According to the present invention, the circuit breaker is current-limited by using the double-breakpoint form in series. The process of current-limiting is as follows. When the circuit breaker is disconnected or the mechanism is released, the contacts 41 of the Y-shaped contact lever 4 are separate from the fixed contact part and two electrical arcs are generated between one contact 41 and the fixed contact part, respectively. The two arcs are individual and insulating from each other. Thus, the arc length of such a device is increased two times to the arc length of a conventional single breakpoint device, and the arc resistance is also increased two times. This will efficiently limit the fault current in the circuit and efficiently increase the ability of current-limiting of the circuit breaker.

In addition, as shown in Figs. 8-10, a pin hole 13 and a boss 14 can be provided in the lower portion of the supporting rod 1. The pin hole 13 is parallel to the transverse hole 11. A pin shaft passes through both of the pin hole 13 of the supporting rod 1 and a corresponding hole of a lever 6 so that the lever 6 can rotate relative to the supporting rod 1 about the pin hole 13. The lever is used to throw the breaking contact of the supporting rod 1. The bottom of the supporting rod 1 carries a projection that the projection contacts the edge of the lever 6 upon rotating the lever 6 to a predetermined angle. In the status of connection of the circuit breaker, a force perpendicular to a surface 61 of the lever 6 is applied to a terminal of the lever 6 to rotate a corresponding supporting rod 1 about the rotating shaft 3 so as to drive the corresponding Y-shaped contact lever 4 in rotation. Then, the separation of the movable contact part from the fixed contact part can be achieved. This structure can be used with an electromagnetic actuator in a return circuit controlled by a selective breaker so as to achieve the actuation with a short extensive protection.

Example 2

- As shown in Fig. 12, Example 2 is different from Example 1 in that a transverse pin hole 14 in the middle portion of the supporting rod 1, which is communicated with the transverse hole 12 in the upper portion of the supporting rod. And, the groove 15 is not communicated with the transverse hole 12. The upper torsion arm 511 of the spring 5 is fastened within the groove 15 of the supporting rod 1. The axial lever 43 of the Y-shaped contact lever 4 is inserted into the transverse hole 12 of the supporting rod 1. The annular trough 431 of the axial lever 43 is aligned with the pin hole 14 of the supporting rod 1. The axial lever 43 is prevented from being released from the pin hole 14 of the supporting rod 1 through a pin-shaft connection.
- 10 Alternatively, the supporting rod 1 can be provided with no groove 15 and the spring 5 is pressed onto the supporting rod 1, directly, which can achieve a same function. The axial lever 43 of the Y-shaped contact lever has an axial flange 432 that the underside of axial flange 432 and the top surface 16 of the supporting rod 1 sandwiches a leaf spring 7 in between. One end of the leaf spring 7 contacts the top
- 15 surface 16 of the supporting rod 1 and another end of the leaf spring 7 contacts the axilla of the axial flange 432 of the axial lever 43 so that the axial lever 43 and the supporting rod 1 suffer contact pressures, respectively. Then, there is a suitable resistance force to the axial lever 43 during its rotation relative to the supporting rod 1.
- 20 The above description should not be considered as limitations to the scope of the present invention. It can be understood that various modifications, additions and substitutions may be made thereto without departing from the scope and spirit of the present invention. Therefore, the scope of the present invention should be construed on the basis of the appended claims.

CLAIMS

1. A movable contact mechanism of a circuit breaker, comprising:
 - 5 a rotating shaft for driving supporting rods;
 - a plurality of supporting rods each having a vertical hole provided in its upper portion and a transverse hole provided in its lower portion and each rotatably connecting with the rotating shaft via a shaft passing through its transverse hole;
 - a plurality of Y-shaped contact levers each provided with contacts and an axial lever
 - 10 inserted into the vertical hole of a corresponding supporting rod to rotatably connect to the supporting rod, wherein the number of the Y-shaped contact levers is equal to that of the supporting rods; and
 - a plurality of elastic elements each having one terminal connected to the axial lever of a corresponding Y-shaped contact lever or a corresponding supporting rod and
 - 15 another terminal connected to the rotating shaft that the rotating shaft drives the movement of the supporting rods via the elastic elements.
2. A movable contact mechanism of a circuit breaker according to claim 1,
 - wherein the elastic elements are parallel double-torsion springs each
 - 20 includes an upper torsion arm mounted onto the axial shaft of the Y-shaped contact lever or the supporting rod and a lower torsion arm connected onto the rotating shaft.
3. A movable contact mechanism of a circuit breaker according to claim 2,
 - 25 wherein the supporting rod, at its middle portion, has a traverse groove which is communicating with the vertical hole at the upper portion,
 - the axial lever of each Y-shaped contact lever is provided with a annular trough at a location corresponding to the groove of a corresponding supporting rod in line with the insertion of the axial lever into the vertical hole of the supporting rod, and

the upper torsion arm of ~~each~~ the torsion spring is mounted into the groove of the supporting rod and is fastened within the annular trough of the axial lever.

4. A movable contact mechanism of a circuit breaker according to claim 2,
5 wherein the supporting rod, at its middle portion, has a traverse pin hole communicating with the vertical hole of the upper portion, the supporting rod has a traverse groove ~~in~~ at its middle portion, the axial lever of each Y-shaped contact lever is provided with an annular trough at a location corresponding to the pin hole of the supporting rod in line with the
10 insertion of the axial lever into the vertical hole of the supporting rod, the Y-shaped contact lever rotatably connects to the corresponding supporting rod through a pin inserted into the pin hole of the supporting rod and the annular trough of the axial lever, and the upper torsion arm of the torsion spring is fastened within the groove of the
15 supporting rod.

5. A movable contact mechanism of a circuit breaker according to claim 4, wherein the axial lever of the Y-shaped contact lever has an axial flange that the underside of axial flange and the top surface of the supporting rod sandwiches a leaf spring in between.
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6. A movable contact mechanism of a circuit breaker according to claim 1, wherein the lower portion of the supporting rod connects, through a pin, to a lever used to flip the supporting rod to break the contacts.
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7. A movable contact mechanism of a circuit breaker according to claim 6, wherein the bottom of the supporting rod carries a projection that the projection contacts the edge of the lever upon rotating the lever to a predetermined angle.
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8. A movable contact mechanism of a circuit breaker according to claim 1, wherein the U-shaped arm of the Y-shaped contact lever is fabricated with an axial hole at its middle portion that the axial lever rigidly connects the U-shaped arm through the axial hole.

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9. A movable contact mechanism of a circuit breaker according to claim 8, wherein the axial lever connects to the U-shaped arm by riveting, threading or welding.