

BREAKING DEVICE FOR A MULTIPOLE CIRCUIT BREAKER WITH DOUBLE ROTARY CONTACT

The invention relates to a breaking device for a low voltage multipole circuit breaker with moulded case, comprising a rotary switching bar guided in rotation around a transverse fixed axis by means of bearings arranged in the case, said axis being perpendicular to the longitudinal direction of each pole, which comprises :

- a pair of stationary contacts connected to the connection terminals;
- a double-break rotary contact extending in a housing of the bar according to the longitudinal direction of the pole, and having opposing contact parts cooperating with the stationary contacts in the closed position;
- a pair of springs arranged inside the bar, and bearing on the rotary contact to provide a predetermined contact pressure of the contact parts on the stationary contacts, one of the ends of each spring cooperating with a part for securing the bar.

The use of a double-break rotary contact in a circuit breaker enables two arcs to be connected in series favouring a high breaking capacity. In a hyperstatic system with full guiding of the movable contact in rotation, the problem of uniform distribution of the contact pressure on the two stationary contacts arises. A solution to this problem is proposed in the document EP-A-O-174,904, in which the centre part of the rotary contact comprises an oblong hole slotted onto a fixed support rod to form a guiding system having a degree of freedom in translation. The fixed support rod is cylindrical in shape and is mounted coaxially in the bar, so that the rotary contact can move slightly in the direction perpendicular to the longitudinal

axis of the pole to provide a balanced contact pressure at the level of the two breaking gaps. The diameter of the rod corresponds appreciably to the width of the oblong hole, and any movement of the rotary contact in the longitudinal direction is rendered impossible. The longitudinal positioning of the rotary contact is determined with precision by the support rod, which imposes stringent manufacturing tolerances.

A double-break rotary switch similar to the one described in the preamble of claim 1 is for example known from the document DE-A-2,845,950. In this switch, the springs exert a contact pressure effect, and any recentering to the equilibrium position in the longitudinal direction is impossible. Depending on the wear of the contacts in the course of the life-time of the switch, there remains a risk of incorrect positioning of the movable contact with respect to the stationary contacts, which is detrimental to correct operation of the device.

The object of the invention consists in simplifying the assembly of a double-break rotary contact on the switching bar of a moulded insulating case circuit breaker.

The breaking device according to the invention is characterized in that the pair of springs is located in the housing of the rotary contact, the other of the ends of each spring being fixed to a latching part of the rotary contact, that the two latching parts of the pair of springs are diametrically opposite with respect to a dummy rotation axis of the rotary contact, that the two securing parts of said pair of springs are diametrically opposite with respect to the transverse fixed axis of the bar, and that the arrangement of the springs ensures floating mounting of the dummy rotation axis of the rotary contact with respect to the transverse fixed axis of the bar, and simultaneously enables a contact pressure torque of uniform distribution, and flexible positioning with two degrees of

freedom in translation of the rotary contact, the latter being urged to an equilibrium position in the longitudinal direction of the pole by the self-centering effect of the springs.

Floating assembly of the rotary contact by means of the two symmetrical springs ensures self-centering of the rotary contact on the dummy axis of rotation. The latter may be the same as the transverse fixed axis of the bar, or on the other hand move in a plane perpendicular to the latter.

The springs cooperating with the rotary contact may be torsion, tension or compression springs.

Other advantages and features will become more clearly apparent from the following description of several illustrative embodiments of the invention, given as non-restrictive examples only and represented in the accompanying drawings, in which :

- Figure 1 is a schematic vertical sectional view of a breaking device according to the invention, the circuit breaker contacts being represented in the closed position;
- Figure 2 is a horizontal sectional view of figure 1;
- Figures 3 and 4 show similar views to those of figures 1 and 2, of an alternative embodiment;
- Figures 5 and 6 represent similar views to those of figures 1 and 2, of another alternative embodiment.

Referring to figures 1 and 2, a breaking pole 10 of a low voltage circuit breaker is housed in a compartment of the case 12 made of moulded insulating material. The pole 10 comprises a double-break rotary contact 14 capable of pivoting around a dummy rotation axis 16 between a closed position (figure 1) and

an open position (not shown). The dummy rotation axis 16 is located in the centre zone of the pole 10, and the rotary contact 14 is formed by a pair of lever arms 18, 20 extending between the dummy rotation axis 16 and two opposing contact parts 22, 24 cooperating respectively with stationary contacts 26, 28.

Electrical connection of the pole is accomplished by means of two connection terminals 30, 32 passing through two opposite faces of the case 12. The terminals 30, 32 are aligned in the longitudinal direction 34 of the pole, and their internal ends bear the stationary contacts 26, 28. An arc extinguishing chamber 36, 38 comprising a stack of metal plates is associated with each pair of contacts 26, 22; 28, 24 located on either side of the dummy rotation axis 16.

In the closed position of the circuit breaker, the rated current flows through the main circuit of the pole being input via one of the terminals, for example 30, and then flowing through the stationary contact 26, the rotary contact 14, and the stationary contact 28, and being output from the pole via the other terminal 32. Clockwise rotation of the movable contact 14 causes simultaneous separation of the two pairs of contacts 26, 22; 28, 24 and formation of two arcs connected in series. The rotary contact 14 is driven in rotation by means of a switching bar 40 made of insulating material extending in the transverse direction of the dummy rotation axis 16 of the contact 14. The bar 40 is guided in rotation around a transverse fixed axis by means of bearings arranged in the case 12.

The bar 40 occupies the central compartment 39 of the case 12, separated from the arc extinguishing chambers 36, 38 by subdividing walls 37. Orifices 35 are arranged in the walls 37 for the movable contact 14 to pass through.

An operating mechanism (not shown) is mechanically coupled to the bar 40 to transmit the opening and closing movements to the different poles.

The rotary contact 14 of the pole 10 is positioned in a housing 41 of the bar 40 and extends perpendicularly to the transverse fixed axis and parallel to the longitudinal direction 34.

The functions of holding and guiding of the rotary contact 14 inside the housing 41 are performed by a pair of torsion springs 42, 44 disposed coaxially along the dummy rotation axis 16 on each side of the contact 14. The first torsion spring 42 comprises a curved end 46 hooked in a notch 47 of the lever arm 18, and the other end 48 is urged by the elasticity of the spring 42 up against an internal protrusion 50 of the bar 40. The hooking notch 47 of the spring 42 is located on the opposite side from the contact part 22.

The second spring 44 is similarly secured in a notch 52 of the lever arm 20, and on an internal protrusion 54 of the bar 40. The two protrusions 50, 54 of the bar 40 are diametrically opposite with respect to the transverse fixed axis of the bar 40.

The presence of the two torsion springs 42, 44 urges the rotary contact counterclockwise to ensure a uniform distribution of the contact pressure of the contact parts 22, 24 on the corresponding stationary contacts 26, 28, and at the same time allows the movable contact 14 to be positioned flexibly along the longitudinal direction 34 of the pole. Inside the housing 41, the dummy rotation axis 16 of the movable contact 14 is mounted floating with respect to the transverse fixed axis of the bar 40. This results in the double-break movable contact 14 tending towards an equilibrium position in the longitudinal direction according to the manufacturing tolerances of the case

12 and of the bar 40.

According to the alternative embodiment in figures 3 and 4, positioning of the rotary contact 14 in the housing 41 of the bar 40 is accomplished by means of two tension springs 60, 62 disposed in the mid-plane whose trace is the longitudinal direction 34 of the pole. The first tension spring 60 is inserted between a catch 64 fixed onto a boss of the lever arm 18, and an anchoring lug 66 securedly united to the bar 40. The second tension spring 62 is similarly mounted between a catch 68 of the lever arm 20 and a lug 70 of the bar 40. The two catches 64 and 68 of the double-break rotary contact 14 are diametrically opposite with respect to the dummy rotation axis 16. The two lugs 66 and 70 of the bar 40 are diametrically opposite with respect to the transverse fixed axis of the bar 40. The two tension springs 60, 62 extend parallel to one another in an oblique direction with respect to the horizontal direction 34 (figure 3). Arranging the springs 60, 62 in such a way enables both a contact pressure torque and an equilibrium position of the rotary contact 14 in the longitudinal direction 34 to be generated.

In figures 5 and 6, the rotary contact 14 is associated with two compression springs 72, 74 enabling the contact pressure on the stationary contacts 26, 28 and the longitudinal equilibrium position to be achieved.

In the three alternative embodiments in figures 1 to 6, it can be seen that the rotary contact 14 can be separated from the stationary contacts 26, 28 by electrodynamic repulsion effect, while the bar 40 remains immobile until tripping of the operating mechanism occurs. This repulsion effect is obtained by a suitable, notably looped, shape of the support terminals 30, 32 of the two stationary contacts 26, 28.

CLAIMS

1. A breaking device for a low voltage multipole circuit breaker with moulded case (12), comprising a rotary switching bar (40) guided in rotation around a transverse fixed axis by means of bearings arranged in the case (12), said axis being perpendicular to the longitudinal direction (34) of each pole, which comprises :

- a pair of stationary contacts (26, 28) connected to the connection terminals (30, 32);

- a double-break rotary contact (14) extending in a housing (41) of the bar (40) according to the longitudinal direction (34) of the pole, and having opposing contact parts (22, 24) cooperating with the stationary contacts (26, 28) in the closed position;

- a pair of springs (42, 44; 60, 62; 72, 74) arranged inside the bar (40) and bearing on the rotary contact to provide a pre-determined contact pressure of the contact parts (22, 24) on the stationary contacts (26, 28), one of the ends of each spring (42, 44; 60, 62; 72, 74) cooperating with a securing part (50, 54; 66, 70) of the bar (40);

characterized in that the pair of springs (42, 44; 60, 62; 72, 74) is located in the housing (41) of the rotary contact (14), the other of the ends of each spring (42, 44; 60, 62; 72, 74) being fixed to a latching part (47, 52; 64, 68) of the rotary contact (14), that the two latching parts (47, 52; 64, 68) of the pair of springs (42, 44; 60, 62; 72, 74) are diametrically opposite with respect to a dummy rotation axis (16) of the rotary contact (14), that the two securing parts (50, 54; 66, 70) of said pair of springs are diametrically opposite with respect to the transverse fixed axis of the bar (40), and that the arrangement of the springs (42, 44; 60, 62; 72, 74) ensures



floating mounting of the dummy rotation axis (16) of the rotary contact (14) with respect to the transverse fixed axis of the bar (40), and simultaneously enables a contact pressure torque of uniform distribution and flexible positioning with two degrees of freedom in translation of the rotary contact (14), the latter being urged to an equilibrium position in the longitudinal direction (34) of the pole by the self-centering effect of the springs (42, 44; 60, 62; 72, 74).

2. The breaking device according to claim 1, characterized in that the rotary contact (14) comprises two opposite lever arms (18, 20), that the two positioning springs of the rotary contact (14) are torsion springs (42, 44) arranged coaxially along the dummy rotation axis (16) and on each side of the rotary contact (14), that each of said latching parts is formed by a notch (47, 52) located on the corresponding lever arm (18, 20) and on the opposite side from the contact part (22, 24), and that each of said securing parts is formed by an internal protrusion (50, 54) of the bar (40).

3. The breaking device according to claim 1, characterized in that the rotary contact (14) comprises two opposite lever arms (18, 20) and that the two positioning springs of the rotary contact (14) are tension springs (60, 62) extending parallel to one another in an oblique direction to the longitudinal direction.

4. The breaking device according to claim 3, characterized in that each of said securing parts is formed by a catch (64, 68) situated on the corresponding lever arm (18, 20), and that each of said securing parts is formed by a lug (66, 70) of the bar (40).

5. The breaking device according to one of the claims 1 to 4, characterized in that two arc extinguishing chambers (36, 38)



are disposed on each side of the bar (40) along the longitudinal direction (34), with interposed subdividing walls (37) having orifices (35) for the rotary contact (14) to pass through.

6. The breaking device according to one of the claims 1 to 5, characterized in that the terminals (30, 32) supporting the stationary contacts (26, 28) are loop-shaped to generate an electrodynamic repulsion effect at the beginning of separation of the circuit breaker contacts.

