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ELECTRICAL CIRCUIT BREAKER WITH ELECTROMAGNETIC ACTUATOR FOR HIGH RATINGS

The invention relates to an electrical circuit breaker with a moulded insulating case comprising a first compartment housing the operating mechanism, and a second compartment containing an electromagnetic actuator, and separable contacts associated to an extinguishing chamber, said actuator having a magnetic circuit, and comprising :

- a core on which an excitation coil is mounted,
- a first air-gap in which the movable contact arm extends to occupy a rest position in the closed state of the contacts, and an active contact separation position when the current intensity exceeds a preset threshold,
- a pivoting blade cooperating with polar faces of the magnetic circuit to form a second air-gap located opposite the first air-gap,
- and a striker associated to the blade to act on the contact arm in the opening direction after magnetic attraction of the blade against the polar faces.

Using an electromagnetic actuator in a circuit breaker to bring about high-speed separation of the contacts enables very high breaking capacities to be obtained. Extinction of the arc in the extinguishing chamber does however generate ionized gases liable to produce external manifestation phenomena. These phenomena are particularly undesirable on the front face side, due to the ionized gases escaping through the orifice allowing movement of the handle.

The object of the invention is to achieve an electrical circuit breaker for high performances, insensitive to any external manifestation phenomena.

The circuit breaker according to the invention is characterized in that the striker is formed by an elongated

part located between the magnetic circuit and the first compartment, and cooperating with the support means of the contact arm to blank off the passage between the first and second compartments after the blade has been attracted, and to free said passage after the blade has been returned to the separated position.

According to a preferred embodiment of the invention, the spindle connecting the striker on the blade is arranged in an intermediate zone between an articulation spindle of the blade and the second air-gap. The striker forms a shield which is fitted to the internal part of the case. The passage between these two compartments is advantageously situated above the first air-gap opposite the stationary contact.

According to one feature of the invention, the support means of the contact arm comprise drive stops cooperating with the mechanism, and a bearing face cooperating with the free end of the striker to bound said passage.

Other advantages and features will become more clearly apparent from the following description of an embodiment of the invention, given as a non-restrictive example only and represented in the accompanying drawings, in which :

Figure 1 is a schematic elevational view of the circuit breaker equipped with the actuator according to the invention.

Figure 2 represents a perspective view of the actuator of figure 1.

Figure 3 is a sectional view along the mid-plane of the actuator of figure 2, the blade and striker being in the inactive position.

Figure 4 shows a plane view of figure 3.

Figure 5 is an identical view to figure 3, in the active position of the blade and striker.

Figure 6 is a plane view of figure 5.

With reference to figure 1, a circuit breaker 1 comprises a case 2 housing a stationary contact 3, a movable contact 4 mounted at the end of a movable contact arm 5, an extinguishing chamber 6 and various electrical connection parts (not represented) enabling the stationary and movable contact to be connected to terminals (not represented). The circuit breaker in addition comprises an electromagnetic actuator AE causing tripping of the circuit breaker and high-speed separation of the stationary and movable contacts 3, 4 in the event of a fault occurring.

The electromagnetic actuator AE comprises a yoke 7 made of magnetic material, a pivoting blade 8, and a striker 9.

In figure 2, the H-shaped yoke or magnetic circuit 7 comprises a cylindrical core 10 surrounded by a coil 34, and two sides 11, 12 arranged parallel to one another and extending perpendicularly to the axis of the core 10. The side 11 presents a first end 13 directed towards the blade 8 and an opposite second end 14. The other side 12 comprises a third end (not represented) directed towards the blade 8 and an opposite fourth end 16. The first end 13 and the third end form coplanar polar faces cooperating with the flat face 18 of the blade 8. The second and fourth ends 14, 16 form flat faces arranged facing one another to bound a first air-gap 17.

When the electromagnetic actuator AE is at rest, the blade 8 is located at a certain distance from the face 18 of the yoke 7 forming a second air-gap 19. The pivoting blade 8 is mounted on an articulation spindle 21 and the movable contact arm 5 is also pivotally mounted by means of another articulation

spindle 22. The stationary contact 3 is at the base of the air-gap 17, and at least a part of the movable contact arm 5 extends through the air-gap 17. The striker 9 is presented in the form of an appreciably rectangular elongated part one of whose ends is articulated on a connecting spindle 23 arranged on the blade 8, and whose other free end 24 is located near to the movable contact arm 5 on the opposite side from the stationary contact 3.

The width of the striker corresponds appreciably to the width of the case.

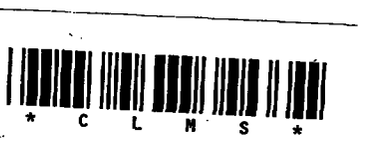
With reference to figures 3 to 6, the contact arm 5 is supported by support means 26 arranged opposite the movable contact 4 and having drive stops cooperating with the mechanism (not represented) to perform closing and separation of the contacts 3, 4. The support means 26 in addition comprise a bearing face 36 cooperating with the free end 24 of the striker 9.

The connecting spindle 23 of the striker 9 on the blade 8 is located in an intermediate zone between the articulation spindle 21 and the second air-gap 19. The free end 24 of the striker 9 is separated from the bearing face 36 by a passage 28 in the form of a slot whose thickness is variable according to the magnetization state of the electromagnetic actuator AE.

In the closed position of the contacts 3, 4 (figures 3 and 4), the magnetic flux in the second air-gap 19 following the rated current flowing in the coil of the actuator AE is insufficient to attract the blade 8 against the polar surfaces 13 of the yoke 7. The blade 8 is held in the separated position due to the action of its return spring, and the striker 9 also remains immobile in the inactive position. The slot 28 between the striker 9 and the support means 26 of the arm 5 is maximum

and allows the contact zone to communicate with the upper compartment 30 housing the mechanism 31.

In the presence of a short-circuit current, the increase of the magnetic flux in the yoke 7 generates large electromagnetic forces in the first air-gap 17, urging the contact arm 5 to the open position (figures 5 and 6). The pivoting blade 8 is simultaneously attracted against the polar surfaces 13 of the second air-gap 19, and moves the striker 9 in translation in the same direction. The end 28 coming into engagement against the support means 26 accelerates the pivoting of the contact arm 5 to the open position, and at the same time blanks off the slot 28. The ionized gases generated by the arc when separation of the contacts 3, 4 takes place cannot escape to the upper compartment 30 and remain confined in the lower compartment 32 housing the extinguishing chamber 6. The striker 9, in addition to its function of accelerating the contact arm 5, thus plays a role of separating shield between the two compartments, and the slot 28 remains blanked off in the attracted position of the blade 8, i.e. so long as the current in the coil exceeds a preset value. Blanking off the slot 28 in the course of the arc extinguishing phase prevents any flowback of gas to the upper compartment 30 and in particular to the orifice for passage of the handle, so as to prevent the occurrence of any external manifestation phenomena on the front face of the case 2.



CLAIMS

1. An electrical circuit breaker with a moulded insulating case (2) comprising a first compartment (30) housing the operating mechanism (31), and a second compartment (32) containing an electromagnetic actuator (AE), and separable contacts (3, 4) associated to an extinguishing chamber (6), said actuator having a magnetic circuit (7), and comprising :
- a core (10) on which an excitation coil (34) is mounted,
- a first air-gap (17) in which the movable contact arm (5) extends to occupy a rest position in the closed state of the contacts (3, 4), and an active contact separation position when the current intensity exceeds a preset threshold,
- a pivoting blade (8) cooperating with polar faces (13) of the magnetic circuit (7) to form a second air-gap (19) located opposite the first air-gap (17),
- and a striker (9) associated to the blade (8) to act on the contact arm (5) in the opening direction after magnetic attraction of the blade (8) against the polar faces,
characterized in that the striker (9) is formed by an elongated part located between the magnetic circuit (7) and the first compartment (30), and cooperating with the support means (26) of the contact arm (5) to blank off the passage (28) between the first and second compartments (30, 32) after the blade (8) has been attracted, and to free said passage after the blade (8) has been returned to the separated position.

2. The circuit breaker according to claim 1, characterized in that the spindle (23) connecting the striker (9) on the blade (8) is arranged in an intermediate zone between the articulation spindle (21) of the blade and the second air-gap (19).

3. The circuit breaker according to claim 2, characterized in that the striker (9) forms a shield which is fitted to the

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internal part of the case (2), and that the passage (28) is situated above the first air-gap (17) opposite the stationary contact (3).

4. The circuit breaker according to one of the claims 1 to 3, characterized in that the support means (26) of the contact arm (5) comprise drive stops cooperating with the mechanism (31), and a bearing face (36) cooperating with the free end (24) of the striker to bound said passage (28).