

OPERATING MECHANISM OF AN AUXILIARY TRIP UNIT FOR A MODULAR
CIRCUIT BREAKER

The invention relates to an auxiliary trip unit with a moulded insulating case capable of being adjoined and coupled laterally to a multipole circuit breaker unit comprising at least one pair of separable contacts, and a switching mechanism associated with a thermal and magnetic main trip device, the case of the auxiliary unit housing an operating mechanism, which comprises :

- a trip lever controlled by a trip relay having an operating coil and a tripping cap,
- a mechanical transmission link of the tripping order sent by the cap of the relay to the switching mechanism of the circuit breaker unit, so as to trip the latter by cooperation of the coil of said relay,
- a latch arranged between a handle and a plate, which is pivotally mounted on a first fixed spindle between a loaded position and an unloaded position,
- an energy storage spring urging the plate to the unloaded position when breaking of the latch occurs brought about by the trip lever,
- and an intermediate automatic resetting lever of the relay due to the action of the plate moving to the unloaded position, said lever being articulated on a second fixed spindle of the case.

A device of this kind is known from the German Patent 3,114,717, which is applied to an undervoltage release for a modular circuit breaker. Resetting of the relay is accomplished by the plate acting on the resetting lever pivotally mounted on the same spindle as the trip lever. Coupling of the mechanical

tripping link with the circuit breaker unit is achieved by means of a bearing fixed on the lower arm of the trip lever. The plate of the auxiliary unit also brings about tripping of the switching mechanism of the circuit breaker unit, but this tripping is operated with a certain delay after the latch has been unlocked.

The object of the invention consists in reducing the tripping time of the mechanism of a circuit breaker unit associated with a relay of an auxiliary unit.

The auxiliary trip unit is characterized by the fact that the plate bears a pin of the mechanical tripping link, and a third articulation spindle of the trip lever, which comprises a first arm cooperating with the latch, and a second arm separated from the tripping cap of the relay by the resetting lever mounted with free rotation on the second spindle.

The function of the relay consists only in unlocking the latch, which then releases the plate. The mechanical energy available following expansion of the energy storage spring serves the purpose of both transmitting the tripping force of the circuit breaker unit, and of resetting the relay.

After the relay has been reset, the mechanical energy is again stored in the storage spring of the plate when the handle is actuated to the make position, and the latch maintains the spring in the loaded position.

The resetting lever is equipped with a damper spring on which a protrusion of the plate acts first when it moves to the unloaded position, the spring being arranged to modulate the resetting force exerted on the relay cap. The damper spring is advantageously shaped as a pin premounted on the resetting lever before the latter is fitted in the second spindle of the case.

A polarization spring is associated with the resetting lever to urge it against the trip lever when the plate is in the loaded position. A preset distance then separates the tripping cap from the resetting lever when the relay is set.

Other advantages and features will become more clearly apparent from the following description of an illustrative 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 operating mechanism of an auxiliary trip unit, represented in the make position of the circuit breaker;
- Figures 2 and 3 are identical views to figure 1, respectively in the course of tripping, and in the tripped position of the circuit breaker.

Referring to figures 1 to 3, an auxiliary trip unit 10 with a moulded insulating case 12, can be adjoined and coupled laterally to a multipole circuit breaker unit (not shown) of conjugate shape.

Each pole of the circuit breaker unit is equipped with a switching mechanism, for example of the type described in the French Patent application N° 2,616,583. The switching mechanism is associated with a pivoting manual operating handle, and with a thermal and magnetic main trip device designed to monitor the current intensity flowing through the pole. A pair of separable contacts operates in conjunction with the switching mechanism to bring about interruption or closing of the electrical circuit arranged between two connection terminals of the pole.

The auxiliary trip unit 10 houses an operating mechanism 14

controlled by a resetting handle 16, and a trip coil relay 18. The mechanism 14 transmits the tripping order from the relay 18 to the circuit breaker unit, via a mechanical trip link 19. This link is formed by a pin 20 passing through an opening 22 of the case 12 to operate in conjunction with the trip bar (not shown) of the circuit breaker unit switching mechanism.

The auxiliary unit 10 can be arranged either as a differential trip device, or as an undervoltage trip device MN, or as a shunt trip device MX. The operating mechanism 14 is standard, whereas the relay 18 is adapted to each type of trip device.

In the case of a differential trip device, the relay 18 is electrically connected to a differential detector with a summing transformer of the currents flowing in the active input conductors of the circuit breaker unit. When an insulation fault occurs, the differential detector causes excitation of the coil of the relay 18 which brings about tripping of the operating mechanism 14, and cascading tripping of the circuit breaker unit by means of the mechanical link 19.

In the case of an undervoltage release MN, the relay 18 acts when the voltage of the power supply system to be monitored disappears or reaches a value lower than a preset pick-up level. This results in automatic tripping of the circuit breaker unit on undervoltage.

In the case of a shunt release MX, excitation of the relay 18 takes place from outside by means of a remote control circuit controlled by a push-button or a controller. This results in forced remote tripping of the circuit breaker unit.

The operating mechanism 14 of the auxiliary trip unit 10 comprises a plate 24 pivotally mounted on a first fixed spindle 26 between a loaded position (figure 1) and an unloaded position

(figure 3). The plate 24 supports the pin 20 of the mechanical trip link 19, and a third spindle 28 on which a trip lever 30 is fitted whose first upper arm cooperates in the locked position with a latching lever 31 to form a latch 32. The latching lever 31 is mounted with limited pivoting on a spindle 34 of the plate 24, and is coupled to the handle 16 by a transmission rod 36. The resetting handle 16 is swivel-mounted on a fixed spindle 36, a toggle whose articulation point 40 is eccentric in relation to the spindle 38 of the handle 16.

The trip lever 30 is biased to the locked position by an elastic tongue 42 acting as a return spring. An intermediate resetting lever 44 of the relay 18 is arranged between the relay 18 and the plate 24, one of the ends of the lever 44 being mounted with free rotation on a second spindle 46. The opposite end 48 cooperates to the left with the actuating cap 50 of the relay 18, and to the right with the second lower arm of the trip lever 30. Between the two ends of the resetting lever 44 there is located a boss 52 on which a pin-shaped spring 54 is mounted. One of the strands 53 of the pin 54 is moved by a protrusion 56 of the plate 24 when tripping of the mechanism 14 occurs, whereas the other strand 58 bears permanently against a protrusion of the end 48.

The energy storage spring 60 of the operating mechanism 14 is formed by a torsion spring mounted coaxially on the spindle 26 of the plate 24. The spring 60 bears on a protuberance 62 of the insulating case 12, and urges the plate 24 counterclockwise to the unloaded position (figure 3), after breaking of the latch occurs brought about by the cap 50 of the trip relay 18. A stop 64 stops the movement of the plate 24 when the handle 16 reaches the open position of the circuit breaker (see figure 3).

The top edge of the plate 24 is provided with an indicator flag 66 capable of being positioned facing a display orifice 68

arranged in the front face of the case 12 to indicate tripping of the circuit breaker by the action of the mechanism 14 of the auxiliary unit 10. The indicator flag 66 advantageously comprises a coloured zone clearly visible through the orifice 68.

Operation of the operating mechanism 14 of the auxiliary trip unit 10 is as follows :

CIRCUIT BREAKER IN THE MAKE POSITION

In the loaded position of the auxiliary unit 10, represented in figure 1, the handle 16 is in the stable right-hand position, and a small clearance separates the cap 50 from the end 48 of the resetting lever 44. The energy storage spring 60 is stretched, and locking of the latch 32 by the trip lever 30 maintains the kinematic link between the plate 24 and the handle 16.

CIRCUIT BREAKER IN THE COURSE OF TRIPPING

In the case of excitation of the relay 18, the tripping cap 50 is driven in the direction of the arrow F (see figure 2), and strikes the resetting lever 44 which pivots counterclockwise around the spindle 46. The movement of the resetting lever 44 drives the trip lever 30 from the locked position to the unlocked position so as to break the latch 32, and to break the kinematic link between the handle 16 and the plate 24. Subjected to the release action of the storage spring 60, the plate 24 then pivots counterclockwise around its spindle 26 to the position represented in figure 3, fulfilling two distinct functions, i.e. a first tripping function of the juxtaposed circuit breaker unit, and a second resetting function of the relay 18.

The first tripping function is performed by the pin 20 of the plate 24 moving the mechanical link 19 from the lowered position (figure 2) to the raised position (figure 3) along the curved opening 22 of the case 12. This results in tripping of the circuit breaker unit switching mechanism, and in automatic opening of the contacts of the different poles.

The second resetting function of the relay 18 is performed by the protrusion 56 coming into engagement with the strand 53 of the spring 54 driving the intermediate resetting lever 44 clockwise so as to push the tripping cap 50 inwards (see figure 3). The relay 18 is reset when the plate 24 comes into contact with the stop 64, and the handle 16 is in the stable left-hand position corresponding to the open position of the circuit breaker unit. In this position in figure 3, the latch 32 is automatically relocked to re-establish the kinematic link between the handle 16 and the plate 24. The damper spring 54 enables any overtravel of the operating mechanism 14 to be taken up elastically, and limits the resetting force on the cap 50 of the relay 18. The storage spring 60 remains unloaded so long as the plate 24 is bearing against the stop 64.

FINAL RESETTING OF THE AUXILIARY UNIT.

Final resetting of the auxiliary unit 10 is performed by a clockwise rotation of the handle 16 from the left-hand position (figure 3), to the right-hand position (figure 1). This movement of the handle 16 moves the plate 24 from the unloaded position to the loaded position, in the course of which movement the storage spring 60 is automatically stretched, and the pin 20 of the tripping link 19 is urged to the lowered inactive position enabling the circuit breaker to make.

Rotation of the handle 16 for final resetting of the auxiliary unit 10 can be performed manually or automatically. In the

former case, the handle 16 is independent from the switching mechanism of the adjoined circuit breaker unit. In the latter case, the handle 16 is connected to the switching mechanism by a mechanical resetting link.

It can be noted that the resetting lever 44 is provided with a polarization spring 70 which urges said lever 44 against the lower second arm of the trip lever 30 when the plate 24 is in the loaded position. When the relay 18 is loaded, a constant minimum distance separates the cap 50 from the end 48 of the resetting lever 44 (see figure 1).

This arrangement enables the circuit breaker response time to be reduced when the tripping order is sent to the switching mechanism.

CLAIMS

1. An auxiliary trip unit (10) with a moulded insulating case (12) capable of being adjoined and coupled laterally to a multipole circuit breaker unit comprising at least one pair of separable contacts, and a switching mechanism associated with a thermal and magnetic main trip device, the case (12) of the auxiliary unit (10) housing an operating mechanism (14), which comprises :

- a trip lever (30) controlled by a trip relay (18) having an operating coil and a tripping cap (50);

- a mechanical transmission link (19) of the tripping order sent by the cap (50) of the relay (18) to the switching mechanism of the circuit breaker unit so as to trip the latter by cooperation of the coil of said relay (18);

- a latch (32) arranged between a handle (16) and a plate (24) which is pivotally mounted on a first fixed spindle (26) between a loaded position and an unloaded position;

- an energy storage spring (60) urging the plate (24) to the unloaded position when breaking of the latch (32) occurs brought about by the trip lever (30);

- and an intermediate automatic resetting lever (44) of the relay (18) due to the action of the plate (24) moving to the unloaded position, said lever (44) being articulated on a second fixed spindle (46) of the case (12).

characterized by the fact that :

the plate (24) bears a pin (20) of the mechanical tripping link (19), and a third articulation spindle (28) of the trip lever (30), which comprises a first arm cooperating with the latch (32), and a second arm separated from the tripping cap (50) of the relay (18) by the resetting lever (44) mounted with free



rotation on the second spindle (46).

2. The auxiliary trip unit according to claim 1, characterized by the fact that the resetting lever (44) is equipped with a damper spring (54) on which a protrusion (56) of the plate (24) acts first when it moves to the unloaded position, the spring (54) being arranged to modulate the resetting force exerted on the cap (50) of the relay (18).

3. The auxiliary trip unit according to claim 2, characterized by the fact that the damper spring (54) is shaped as a pin premounted on the resetting lever (44) before the latter is fitted in the second spindle (46) of the case (12).

4. The auxiliary trip unit according to one of the claims 1 to 3, characterized by the fact that the plate (24) is provided with an indicator flag (66) facing a display orifice (68) arranged in the front face of the case (12) to indicate tripping of the auxiliary unit (10) when the plate (24) is in the stable unloaded position.

5. The auxiliary trip unit according to one of the claims 1 to 4, characterized by the fact that the resetting lever (44) is associated with a polarization spring (70) urging said lever against the second arm of the trip lever (30) when the plate (24) is in the loaded position, and that the tripping cap (50) is separated from the resetting lever (44) by a preset distance in the loaded position of the relay 18.

6. The auxiliary trip unit according to one of the claims 1 to 5, characterized by the fact that the latch (32) comprises a latching lever (31) mounted with limited pivoting on a fourth spindle (34) of the plate (24), and mechanically coupled to the handle (16) by a transmission rod (36).

7. The auxiliary trip unit according to one of the claims 1 to 6, characterized by the fact that the operating coil of the polarized relay (18) is connected to a differential current



detector.

8. The auxiliary trip unit according to one of the claims 1 to 6, characterized by the fact that the operating coil of the trip relay (18) is controlled by an external remote-control circuit so as to form a shunt trip device MX.

9. The auxiliary trip unit according to one of the claims 1 to 6, characterized by the fact that the trip relay (18) acts on the operating mechanism (14) according to the value of a voltage to be monitored so as to form an undervoltage trip device MN.

