

**A control and signalling device for protective
switching apparatus**

The present invention relates to a control and signalling device intended for protective switching applications, particularly relay-switches provided with a protective assembly capable of detecting faults (overloads or overcurrents) on each current path associated with a power pole, such device being actuated by a manual control member which may be in a 'ON' position corresponding to closed contacts, a 'OFF' position corresponding to open contacts and a 'TRIP' position corresponding to the position after detection of a fault.

On motor cut-out switches or relay switches the control and signalling elements are described as interlocks.

A motor cut-out switch or manual starter permits control of the poles either manually, or via a thermal and magnetic triggering assembly which provides a protective function. When an electrical fault is detected on one of the line phases, the thermal or magnetic device of the corresponding phase triggers the opening of contacts by means of a shared interlock. The latter may further be manually actuated by a manual control.

A relay switch combines both a contactor and a circuit breaker. It comprises a magnetic and/or thermal trigger unit and an electromagnet which controls the

poles to ensure the contactor function. The motor cut-out switch or manual starter mentioned earlier includes similar means to activate its contacts but lacks an electromagnet.

5 An interlock relay switch permits control of the 'ON', 'OFF', 'TRIP' and reset functions and it also make the position of the contacts visible through the manual position of the control button of this interlock.

10 Numerous interlock devices exist but they are often complicated, costly, bulky, and of complex and delicate operation.

15 The aim of the present invention is to provide a control and signalling device that is simple, reliable, quiet and inexpensive. It generates little friction and does not require large physical effort to be operated by the operator. It provides smooth operation whatever the size or power of the equipment. It may be mounted directly on the equipment itself or be distant from it.
20 Moreover, it can be used on equipment of different sizes.

25 The device according to this invention is characterised in that it comprises a moveable control knob which can be tripped by the action of a triggering spring loaded cam and which can, from the 'run' position in which it is held by an automatic interlock, after triggering and freeing by the interlock, activate the manual control knob which in turn activates the coil switch.

One particular feature is that the spring loaded cam and the manual control knob are both operated by a tilting spring.

5 The invention will now be described in more detail, referring to embodiments given by way of example and illustrated by the appended drawings in which:

10 - Figure 1 is a diagram of the relay switch fitted with the control and signalling device according to the invention;

- Figure 2 is a section along line II-II on Figure 1;

- Figure 3 is a sectional view along line III-III of the device;

15 - Figure 4 is an axial section along line IV-IV on Figure 2;

- Figures 5 and 6 show the device according to the invention in the "OFF" position (with the control knob removed and the control knob in place, respectively);

20 - Figures 7 and 8 show the device in the "ON" position;

- Figures 9 and 10 show the device in the "TRIP" position;

25 - Figures 11, 12 and 13 show a variant of the device in the position of "OFF", "ON" and "TRIP" respectively;

- Figure 14 shows a device mounted distant from the equipment it controls.

30 The control and signalling device according to the invention, indicated 5, is intended to be fitted to

protection apparatus such as that shown in Figure 1. This apparatus is of a relay switch type and comprises several pole contacts capable of cutting the current on current paths which terminate in connection terminals for connection of electrical wires. Only a single pole of the double break type is shown in Figure 1 in order to simplify the drawing.

Each pole comprises a bridge of mobile contacts 1 which co-operate with fixed contacts to establish or interrupt the passage of current between the connection terminals. The fixed contacts are connected to the connection terminals to which the external wires are jointed by means of wires 2.

A contact-bearer assembly 3 which carries the contact bridges 1 slides in the housing 7, perpendicular to the plane of the fixed contacts.

An electromagnet 6 lodged in the housing comprises a fixed magnetic circuit, a mobile magnetic circuit linked mechanically to the contact-bearer assembly 3 and a coil whose terminals are linked to a power supply source, the power supply of the coil being controlled by a coil switch 81. The mobile circuit of the electromagnet is biased by a return spring 61 which, when the coil is no longer excited, moves it as well as the contact-bearer 3 to the open position (contacts open).

A protection assembly 4 is incorporated in the apparatus in such a way as to detect any overload or overcurrents in each current path associated with a pole. When this electrical protection assembly 4

detects an overcurrent or an overload on a current path, it controls the opening of the poles via the device 5. This protection assembly 4 is of the magnetic and/or thermal type, or of the electronic type.

5 The device 5 which is shown in detail in Figures 2 to 10, comprises, apart from the manual selector member 51, a mobile spring loaded cam 52.

10 The manual selector member 51 moves between three main positions: "run" or "ON" (contacts closed), "stop" or "OFF" (contacts open), "tripped" or "TRIP" (contacts open upon default).

15 The device comprises switches (or contacts) 81 and 82. Switch 81 is the contact coil. In the embodiment shown in Figures 2 to 10, switch 82 is a signalling contact. As an indication, micro-switches may be employed for switches 81 and 82.

20 The cam 52 is spring loaded, on one hand from the tilting spring 53 pivoting on the manual selector member 51, and on the other hand, from the trigger spring 54 which presses against the keeper plate 71.

 One end of the tilting spring 53 is coupled at 531 to the spring loaded cam 52, while the other end is coupled at 532 to the manual selector member 51.

25 One end of the trigger spring 54 is coupled at 541 on the spring loaded cam 52, while the other extremity is coupled at 542 on keeper plate 71.

30 The spring loaded cam 52 acts in co-operation with an automatic interlock 55 which can hold it in a locked position ("ON" position in Figures 7 and 8 or "OFF" position in Figures 5 and 6) or free it (when the

interlock is activated by the protection assembly 4) in such a way that it then assumes the "TRIP" position shown in Figures 9 and 10. This interlock 55 is therefore capable of immobilising the spring loaded cam 52, by its lever 523, in the locked position (Figures 5 to 8) which corresponds to either the "ON" position or the "OFF" position, these positions "ON" or "OFF" being indicated by the control member 51.

By way of example, the automatic interlock 5 can be of an electromagnetic type and it is then made up of a permanent magnet associated to an unlocking coil. The spring loaded cam 52 is provided with a magnetic material section 521 (adjacent to 523) and which is able to be attracted by the permanent magnet of the interlock 5. During unlocking, the magnetic field of the permanent magnet is cancelled out by the electromagnetic field produced by the unlocking coil.

Alternatively, the automatic interlock 5 could be composed of a latch that is unlocked electrically.

In the embodiment shown in Figures 2 to 10, the control member 51 is a knob rotatably mounted about an axis 511, on plate 71, so as to pivot between the three main positions: "run" or "ON" (contacts closed), "stop" or "OFF" (contacts open), "tripped" or "TRIP" (contacts open upon default).

The spring loaded cam 52 is pivotally mounted about an axis 56 on plate 71. The pivot axis 56 of the cam 52 is parallel to the axis of 511 and in proximity to it. Alternatively, the pivot axis 56 of the cam may coincide with pivot axis 511 of knob 51.

The spring loaded cam 52 actuates switch 82 by means of finger 522.

5 In the "OFF" position (Figure 5), the knob 51, by means of its cam lobe 513, acts upon the coil switch 81 and opens it. In the "ON" position, the knob and its cam lobe 513 no longer actuate switch 81 which is thus in a closed position (Figure 7).

10 When cam 52 is in its locked position ("ON" or "OFF" position) (Figures 5 and 7), it acts upon the signalling switch 82. As soon as the spring loaded cam 52 moves towards the "tripped" position, i.e. in case of a fault being detected by the protection assembly 4, it no longer acts upon signalling switch 82.

15 The control member 51 incorporates a stop 512 which can abut with cam 52 in such a way so as to cause it to rotate as soon as an operator turns the control member 51.

20 It is possible forcibly actuate upon the power contacts by means of an additional mechanism. This mechanism comprises a pivoting lever 91 which is actuated by the knob 51 and which acts upon the contact bridge 3. Lever 91 can pivot about an axis 92. The end 93 of the lever is guided in a slot 514 of the knob 51, whereby, depending upon the position of the knob, the lever moves or not the contact bridge 3 (position A or B).

The operation of the device shown in Figures 2 to 10 will now be explained by referring to the drawings.

30 In the "OFF" position shown in Figures 5 and 6, the spring loaded cam 52 is locked in the locked

position by the automatic interlock 55. The triggering spring 54 is compressed. The coil switch 81 is open.

In order to proceed from "OFF" (Figures 5 and 6) to "ON" (Figures 7 and 8), the operator turns the selector knob 51 from "Stop" (or "OFF") to "Run" (or "ON"). The spring loaded cam 52 is held from rotation by interlock 55. During the turning of the selector knob 51, the axis of spring 53 tilts from one side to the other of the line of thrust 532 - 56. At the end of its travel, the knob 51 triggers the closing of coil switch 81 (cam lobe 513 clears from the switch pusher). Electromagnet 6 is then supplied with current and the contact-bearer 3 moves so as to close the poles.

In order to proceed from "run" to "stop", the above operations are reversed.

In the case of a fault (overload or short circuit), a triggering instruction is provided by the protection assembly 4 and sent, via an electrical link, to the electromagnetic interlock 55. This frees the spring loaded cam 52 which, by means of the thrust of spring 54, begins to turn (direction *f*) towards the "tripped" position illustrated in Figures 9 and 10. The tilting spring 53 is compressed in this initial phase. At a certain moment, the axis of spring 53 crosses the line of thrust 532 - 56. Spring 53 through its tilting action pivots the knob 51 in relation to the spring loaded cam 52 and in the opposite direction of the rotation direction *f* of this cam 52. The knob 51 moves from the "Run" position to the "Trip" position as shown in Figures 9 and 10. During its rotation, the knob 51

opens switch 81 (via cam lobe 513) which cuts the current to the coil. Simultaneously, finger 522 of cam 52 opens switch 81. Because of this, the electromagnet 6 opens and the poles open.

5 It should be noted that rotation of cam 52 actuates the signalling switch 82.

 The turning of the knob 51 relative to the spring loaded cam 52 is finally halted by stop 512. Spring 53 finally actuates on cam 52 in the same direction as
10 spring 54.

 To move from the "Trip" position (Figures 9 and 10) to the "Stop" position (Figures 5 and 6), the operator turns the knob 51 in the opposite direction of f . This, by means of stop 512, moves cam 52 which then
15 returns to its locked position as shown in Figures 5 and 6. At the end of its travel, the automatic interlock 55 locks the spring loaded cam 52 in its locked position, the knob 51 being on the "Stop" position.

20 To move from the "Trip" position to the "Run" position, the operator carries out the previously described operation and further turns the knob 51 to the "Run" position.

 If the operator holds the knob 51 on the "Run" position during a short-circuit, the cam 52 via its
25 lobe 522 will trigger and open switch 81 (see Figure 9).

 The device shown in Figures 11 to 14 differ from the one Figures 2 to 10 in that the movements of cam 52
30 and the control member 51 are linear whereas the

movements of those same components in the device in Figures 2 to 10 are rotative. Operation is nevertheless similar to the operation of the rotative device.

5 In Figure 15, an assembly in which device 5 is away from the apparatus 7 housing the electromagnet, the switches and the protection assembly. The device could, for example, be mounted on the door of an electrical cabinet with the apparatus itself being mounted at the back of the cabinet.

10 Obviously, without departing from the scope of the invention, variants and improvements to details can be made as well as providing the use of equivalent means.

As a variant, a second switch can be associated with the first coil switch, both switches being
15 connected in series on the coil supply. This second switch is actuated after triggering by finger 522 of cam 52.

As a variant, the device can be provided with an extension spring instead of a compression spring 53.

CLAIMS

1. A control and signalling device intended for a protective switching apparatus, particularly for relays fitted with protective assemblies (4) capable of detecting faults in each current path associated with a power pole (1) and in a switch (81) serving to control the coil supply, this device being actuated by means of a manual control member (51) adapted to take a "run" position corresponding to closed contacts, a "stop" position corresponding to open contacts, and a "trip" position corresponding to the position after detection of a fault, characterised in that it comprises a mobile spring loaded cam 52 biased by a triggering spring (54) and is capable, from the "run" position, in which it is locked by an automatic interlock (55), of activating, after triggering and unlocking of the interlock (55), the manual control member (51) which then actuates the coil switch (81).

2. A device according to claim 1, characterised by the fact that the cam (52) and the manual control member (51) are biased by a tilting spring (53).

3. A device according to any of the preceding claims, characterised by the fact that one end of the tilting spring (53) is coupled to the triggering cam (52), while the other end of this spring is coupled at (532) to the knob (51).

4. A device according to any of the preceding claims, characterised by the fact that one end of the triggering spring (54) is coupled to the spring loaded cam (52), while the second end is coupled to the plate (9) of the device.

5. A device according to any of the preceding claims, characterised by the fact that it comprises a



second switch serving either for signalling or as coil contacts.

6. A device according to any of the preceding claims, characterised by the fact that the automatic
5 interlock (52) is of the electromagnetic type and made up of a permanent magnet in association with an unlocking coil.

7. A device according to any of the preceding claims, characterised by the fact that the control
10 member (51) is a knob rotatably mounted about an axis (511) on the plate (9), so that it pivots between the "run", "stop" and "trip" positions.

8. A device according to any of the preceding claims, characterised by the fact that the spring
15 loaded cam (52) pivots about an axis (56) on the mounting plate (9).

9. A device according to any of the preceding claims, characterised by the fact that the knob (51) is provided with a cam lobe (513) capable of actuating the
20 coil switch (81).

10. A device according to any of the preceding claims, characterised by the fact that the spring loaded cam (52) is fitted with one finger (522) serving to actuate the coil switch (81) and a second (523)
25 serving to actuate the signalling switch (82).

11. A device according to any of the preceding claims, characterised by the fact that the knob (51) is fitted with a stop (512) capable of turning the spring loaded cam (52).

12. A device according to any of the preceding claims, characterised by the fact that it can be
30 distant from the apparatus (7) housing the electromagnet, the switches and the protection assembly.