

A MECHANICALLY CONTROLLED SWITCH WITH AUTOMATIC OPENING

Description

The invention relates to a mechanically controlled switch with automatic opening for a protective limiting apparatus comprising :

- a case,
- 5 - a breaking chamber having fins for fractioning the arcs,
- a power switch placed in this chamber and having at least one fixed contact and a mobile contact which is actuated by a pushbutton and which is subjected to the
10 action of a fixed pressure spring tending to apply it against the fixed contact,
- a coil which is placed in series in a circuit where is situated the switch and which is adapted to attract a magnetizable striker when the circuit has passing there-
15 through a short circuit current,
- a control device having a mobile part which cooperates by pushing with the pushbutton to move the mobile contact,
- input and output terminals for connecting the
20 switch,
- this striker cooperating with this pushbutton so as to move this latter when it is attracted and independently of the mobile part, and to bring it into a position where a locking device holds the switch in an open safety position.
- 25 Such switches are particularly used in protection apparatus where the power contacts serve at the same time

for establishing and for the frequent breaking of the power supply circuits which are usually controlled by contactors.

In a known apparatus, whose construction complies with the one defined above, no measures are taken for changing the fixed or mobile contacts ; such measures, which respond however to one of the constant worries of users, meet in this particular case difficulties due especially to the relative complexity of the device ; it is then desirable to make this operation as simple as possible by giving the user means which allow him to carry out such operations rapidly and without the possibility of incorrect assembly.

It is desirable, moreover, to make it possible to change the contacts without it being necessary to separate the terminals of the protection apparatus from the network and from the load and to make available to users a range of contacts whose dimensions as well as those of the coil correspond with different current intensities and with different levels of limitation.

In accordance with the invention, this result is attained because the switch, the breaking chamber, the coil and the striker, as well as the locking device are placed in a removable insulating cartridge which is placed in a housing in the apparatus and which has externally, on the one hand, two connecting terminals cooperating with the terminals of the protection device connected to the network or to a user apparatus and between which are placed in series the coil and the switch, and, on the other hand, in a region opposite the breaking chamber : one end of

the pushbutton adapted to cooperate with the mobile part of the control device, and one end of the locking device adapted to communicate a movement when the switch is held in the open safety position, guiding and holding means being 5 placed on this cartridge to ensure such cooperation and communication of this movement.

The invention, as well as other complementary arrangements, will appear more clearly from the following detailed description.

10 In the accompanying drawings :

Figures 1a and 1b show schematically two mechanically respectively electromagnetically, controlled protection apparatus in which this objet of invention is put in practice ;

Figure 2 shows in elevational view, in section through 15 a median plane PP', a cartridge in accordance with that of the invention, a double breaking switch being in the "closed" position ;

Figure 3 illustrates a view from the left-hand side of the cartridge in a section through a breaking plane QQ', the 20 switch being closed ;

Figure 4 shows an elevational view of the cartridge, with local section, the switch being in the open safety position ;

Figure 5 shows a side view of the cartridge with a 25 local section through the plane QQ' when the switch is in the open safety position ;

Figure 6 illustrates an external elevational view of

the cartridge in accordance with the invention ;

Figure 7 shows the apparatus of figure 2 in the open controlled state of the switch ; and

Figure 8 illustrates a cartridge in accordance with 5 the invention using a single break switch.

The limiting switch which will be described below may be used in a protection apparatus such as shown schematically at 1 in figure 1a ; this apparatus comprises principally in a case 2 an automatic switch 3 whose emergency 10 opening, should a faulty current, more especially a short circuit, appear, is operated by means of a coil 4 placed in series with this switch between an input terminal 5 connected to network R and an output terminal 6 connected to a load C, and a manual control device 7 whose operation produces rapid 15 opening or closing of the switch through a mobile control part 8 acting on a pushbutton 9 of the switch, whereas a fault signalling member 10 associated with the switch acts on the manual control device 7 to give it, when a fault appears, a particular state which interrupts the action of 20 the control device and confirms the automatic opening. This limiter switch may also be used in a contactor apparatus having additional current limiting (possibly circuit breaking) functions shown schematically at 11 in figure 1b ; like the preceding one, this latter apparatus comprises in a case 25 12, a switch 13 and a coil 14 placed in series between the terminals 15, 16 similar to those of switch 3, but in which the repeated closing and opening control is effected by

means of an electromagnet 17 whose mobile control part 18 cooperates with the pushbutton 19 of the switch 13, whereas the fault signalling member 20 acts directly or indirectly on a control contact 21 placed in series with the coil 22 of the electromagnet so as to confirm, should the case arise, the automatic safety opening by de-energization of this electromagnet.

Additional terminals 25, 26 here serve for applying a control signal to the electromagnet.

10 In one or other of the possible applications, the switch 3, 13 which is contained in a removable insulating cartridge 23 separable from case 1, 11 may be a single break or a double break switch and it is clear that the number of cartridges used in an apparatus corresponds to that of the 15 number of phases of the network.

The insulating cartridge 23, as well as its contents, are better shown in figure 2 where it can be seen that it has the general shape of an L having a first leg 27 and a second leg 28 which are substantially perpendicular.

20 The first leg 27 contains a first volume 29 in which are disposed the switch 3 respectively 13 and a breaking chamber 30 which is associated therewith and which comprises, in a way known per se, fins 31, 32 for fractionating the arcs.

25 This switch comprises in the example shown, two fixed contacts 33, 34 which are carried by bent conductors 35 respectively 36, one of which extends as far as a first

connection terminal 37 external to the cartridge ; a mobile bridge contact 38 is carried by a mobile contact holder 39 which may move along an axis ZZ' by means of guide surfaces 40 of the cartridge. The mobile contact as well as the contact holder are subjected to the action of a fixed compression spring 41 which tends to close the switch by bearing on an internal end 42 of the contact holder and on a wall 43 of the cartridge.

Because of the bent shape of conductors 35, 36 repulsion forces develop on the mobile contact bridge 38 which moves parallel thereto.

A second end 44 of the contact holder 39, opposite the first end, is placed externally of the first volume and has a first bearing surface 45 directed towards spring 41 and an elongated opening 46 having a second bearing surface 47 also directed towards the spring.

The second leg 28 contains a second volume 48 in which are disposed, on the one hand, a magnetizable yoke 49, a coil 50 which is associated therewith and a magnetizable striker 51 of the plunger core type and, on the other hand, a transmission lever 52 and a locking lever 53.

The ends of coil 50 are connected, on the one hand, to the bent conductor 36, for example by means of a flexible conductor 54 and, on the other hand, to a second external connection terminal 55. The striker, which assumes a rest position shown in figure 2 (for example by means of a spring not shown), may move along an axis VV' which is also that of

coil 50 and which is substantially parallel to the axis ZZ' .

The transmission lever 52 which moves in a median plane PP' of the cartridge through a pivot or pin 56 whose axis is perpendicular to this plane, has a free end 57 which penetrates into the elongated opening 46 of the contact holder 39 so as to be able to cooperate with the second bearing surface 47, and a central portion 58 placed opposite one end 59 of the striker ; a return spring 60 is associated with this transmission lever for resiliently maintaining it against fixed stop 61 in a rest position R which is that shown in figure 2.

The locking lever 53 rocks about a pivot 62 whose axis YY' is parallel to the median plane PP' or passes there-through ; this axis YY' is substantially perpendicular to the axis VV' of the coil. A return spring 63, placed for example about pivot 62, communicates to this locking lever 53 an anticlockwise torque K, shown in particular in figure 3, which causes it to apply a first end 64 against lateral face 65 of the transmission lever and which gives to a second end 66 of the locking lever 53, outside the second volume, a particular position I.

It will be noted that the transmission lever 52 is placed between the first volume 29 and the coil 50 and that the outer end 44 of the contact holder forming a pushbutton, moves in the vicinity of the second leg 28 of the cartridge in a region 75 opposite the breaking chamber 30, whereas the outer end 66 of the locking lever 53 moves at the end of this

second leg 28 in a region 76 also opposite the breaking chamber.

The cartridge 23 is preferably formed by associating together two insulating half cases 67 and 68 (see figure 3) 5 which are applied to each other along a joint plane merging with the median plane PP' and are held in contact, either by resilient hooks integrally moulded with the half cases, or by means of external metal clips or else by means of rivets.

When the switch is to be opened and placed in position 10 O (see figure 7), the contact holder 39 receives on its first bearing surface 45 a thrust in direction F which is conveyed thereto by a part 8, 18 of the mechanical 7 or electromagnetic 17 control device ; because there exists a clearance j between the end 57 of the transmission lever 52 15 and the elongated opening 46, this movement has not effect on the transmission lever ; the switch closes again under the effect of spring 41 when the action on the contact holder 39 ceases. When the switch is in the closed position and a very high current flows in the coil, striker 51 is 20 attracted by the coil and the yoke and pushes back the transmission lever 52, against the action of its return spring 60, so that its end 57 exerts on the second bearing surface 47 an action for the emergency opening of the contacts of the switch.

25 As soon as the transmission lever reaches or exceeds the working position T, shown in figures 4 and 5, in which this current will have been sufficiently limited, the

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internal end 64 of the locking lever passes above an edge 69 of the transmission lever 52 so as to hold it in this position T where the switch is now in the open safety condition S.

During this operation, the locking lever 53 assumes an active position A, shown in figure 5, under the effect of its return spring 63.

The movement of the outer end 66 of this locking lever is used either for confirming the opening of the switch 3, 13 by means of a mechanical action supplied by the device 7, 8 of figure 1a, or for opening, directly or not, the switch 20 of the control electromagnet 17, 18, these operations being carried out by means of a transmission part such as 90 (figure 8).

In both cases, a particular indication may be delivered for informing the maintenance staff that the automatic opening is due to the appearance of a short circuit current.

As can be seen more especially in figure 4, measures may be adopted for the cooperation between the mobile parts placed in the second volume 48 to take place under good conditions. Thus, the stop 61 of the transmission lever 52 and the pivot 62 of the locking lever 53 are both carried by the yoke 49 in which a cylindrical socket 70 serves for guiding the striker 51.

The cartridge 33 is further guided in the case of the apparatus which receives it by means of grooves 71, 72 parallel to axis ZZ', which are formed in the opposite external faces 73, 74 parallel to the contact holder plane (see figures 6 and 3).

It can be seen in particular from figures 3 and 5 that

the cartridge 23 occupies a small width d which allows several of them to be placed side by side in parallel compartments 1', 11' of an apparatus 1 or 11 designed for using them, without for all that resulting in large dimensions.

The contact holder 39 which is shown in the preceding figures and forming a pushbutton may also be replaced by another pushbutton 77 for acting on a mobile single break contact 78, shown in figure 8, which is returned by spring 10 81 and which cooperates with a single fixed contact 79 of switch 3.

In this same figure, it can be seen that the cartridge 23 is maintained in a compartment 1', respectively 11', of the apparatus through the cooperation, on the one hand, of 15 surfaces such as 84, 85 with walls 86, 87 of the case 1, 11 and, on the other hand, of surfaces such as 88 with a lid 89 closing the compartment. In this situation, the external terminals 37, 55 of the cartridge cooperate with the internal terminals 82, 83 of case 1 going towards the connection 20 terminals 5, 6 respectively 15, 16 of the apparatus which receives it, whereas the end 66 of the locking lever transmits its possible movement to a transmission part 90 whose purpose is to trigger the mechanical device 7 or the control switch 21 of the electromagnetic device 17.

25 Resetting of the locking 53 and transmission 52 members is obtained by communicating to the end 66, through manual or automatic control means not described, a movement in direction G, see figure 5.



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CLAIMS

1. A mechanically controlled switch (13, 3) with automatic opening for a protective limiting apparatus comprising :
 - a case (2),
 - a breaking chamber (30) having fins (31, 32) fractionating the arcs,
 - a power switch placed in this chamber and having at least one fixed contact (33, 34) and one mobile contact (38) which is actuated by a pushbutton (39) and which is subject to the action of a fixed compression spring (41) tending to apply it against the fixed contact (33, 34),
 - a coil (50) which is placed in series in a circuit containing the switch (13, 3) and which is adapted to attract a magnetizable striker (51) when the circuit has a short circuit current passing therethrough,
 - a control device having a mobile part (8, 18) which cooperates by pushing with the pushbutton (39) to move the mobile contact (38),
 - input and output terminals for connecting the switch (13,3) this striker (51) cooperating with this pushbutton (39) so as to move this latter when the striker is attracted, and independently of a mobile part (8, 18), and to bring the pushbutton into a position where a locking device (53) holds the switch (13,3) in an open safety position, characterized in that the switch (13,3), the breaking chamber (30), the coil (50) and the striker (51), as well as the locking device (53) are placed in a removable insulating cartridge (23) which is placed in a housing (1',11') of the



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apparatus (1, 11) and which has externally, on the one hand, two connecting terminals (37, 55) which cooperate with terminals (82, 83) of the protection device not directly connected to the network or to a user apparatus, and between 5 which are placed in series the coil and the switch and which has, on the other hand, in a region (75) opposite the breaking chamber : one end (44) of the pushbutton (39) respectively (77) adapted to cooperate with the mobile part (18, 8) of the control device (7, 17) and one end (66) of the 10 locking device (53) adapted to communicate a movement for triggering the control device when this switch is held in the open safety position (S) ;

- guide (71, 72) and holding (84, 85, 88) means being placed on this cartridge for giving to this latter a 15 position ensuring this cooperation and the communication of this movement.

2. The switch according to claim 1, characterized in that the insulating cartridge (23) is formed by a flat case (21) having two distinct adjacent volumes so as to assume 20 the general shape of an L, in each of the legs (28, 27) of which is located a first volume (29) and respectively a second volume (48), the first volume receiving the switch (3, 13) and the breaking chamber (30) whereas the second volume receives the coil (50), the striker (51) and the 25 locking device (53).

3. The switch according to claim 2, characterized in that the outer end (44) of a contact holder (39) or push button (77) moves parallel to the leg (28) of the cartridge



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(23) containing the second volume (48) in a region (75) proximate the two legs (27, 28).

4. The switch according to one of claims 1, 2 or 3, characterized in that the locking device comprises a transmission
5 lever (52) with resilient return (60) which rocks in a median plane (PP') of the cartridge about a first pivot (56) and one end of which (57) cooperates with an outer end (44) of the contact holder or pushbutton (39, 77), and a resilient
locking lever (53, 63) which rocks about a second pivot (62)
10 whose axis (YY') is parallel to said plane (PP'), this transmission lever being disposed between the first volume (29) and the coil (50) so as to receive the action of the striker (51) between the first pivot (56) and the end (57).

5. The switch according to claim 4, characterized in
15 that the locking lever (53) is placed in the vicinity of the outer end (44) of the contact holder or pushbutton (39, 77) and has a second end (66) which is opposite the first end (64) and which is placed outwardly in a region (76) of the second leg (28) opposite the breaking chamber (30) so as to
20 communicate a movement to the mechanical (7) or electromagnetic (17) control device.

6. The switch according to claim 5, characterized in that the first end (64) of the locking lever (62) is resiliently applied against a lateral surface (65) of the trans-
25 mission lever (52) when this latter is in rest position R, and passes above an edge (69) of the transmission when this latter takes up a working position (T.)