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The present invention concerns an electromagnetically operated switch comprising two identical switch devices disposed side by side and each having a sliding contact-holder mobile in translation and provided with a contactor finger. The two switch devices are coupled together by a mechanical interlocking device adapted to prevent simultaneous movement of the two sliding contact-holders, said mechanical interlocking device being covered by a lid.

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It is standard practice to dispose side by side two contactor modules or like devices and to couple the mobile parts of the contactor modules together mechanically to constitute a composite device called a switch. This type of composite device is in very widespread use for controlling a motor to run in one direction of rotation or the other by cross-connecting two phases. To prevent the two contactors being closed simultaneously, which would short-circuit the two phases concerned, there is provision for interlocking the contactors with respect to each other: immediately one begins to close the other cannot be closed. Auxiliary contacts in series with the solenoid coils of the contactor modules are usually provided to prohibit

simultaneous excitation of the coils of the two solenoids, i.e. electrical interlocking.

5 It is also standard practice to add an interlocking module to provide mechanical interlocking between the mobile parts of the contactor modules so that one of the contactor modules is disabled immediately the other begins to close.

10 These mechanical interlocking modules use two moving parts coupled to the moving parts of the contactor modules.

15 Mechanically interlocked contactors of this kind are described in the patents FR-A-2 521 772, DE-A-39 09 061 and DE-A-30 11 779.

20 In these prior art contactors the mechanical interlocking module is disposed on top of the contactor modules and increases the height of the assembly.

25 If add-on modules are incorporated they must be fixed to the interlocking module and to demount them force has to be applied directly to the interlocking module with the risk of detaching it from the contactor modules to which it is fixed. The height of the contactor depends on whether the interlocking module is fitted or not.

30 It is not possible to achieve direct control of the add-on modules from the contactor modules. The add-on modules are operated by intermediate transmission members which complicate the structure.

35 Patent DE-A-21 14 509 comprises two switch devices which are connected to each other by a mechanical interlocking device mounted on top of the devices. Mounting of the

switch devices , as well as of the interlocking device takes place by means of a lid. The drawback is that, for removing the interlocking device, it is necessary to separate the two switch devices by taking off the lid, and that the addition of said device results in a greater hight of the apparatus.

The present invention proposes to provide a switch comprising two elementary switch devices in which the mechanical interlocking device or module is recessed into the elementary switch devices. The result of this is that the overall dimension or height of the switch fitted with the interlocking module is not increased. The invention makes it possible to avoid direct engagement of the add-on modules with the interlocking module and to enable direct operation of the add-on modules. The add-on modules are fixed to the lid of the switch, whether the mechanical interlocking module is incorporated into the switch or not. Demounting of the add-on modules does not apply any direct force to the interlocking module. The height of the switch does not depend on whether the interlocking module is fitted or not. The interlocking module can be added or removed without it being necessary to demount the elementary switch devices.

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According to the invention, the device is characterized in that each switch device has a central recess in the front surface of the case between the compartments into which engage the terminals, and in which is embedded the mechanical interlocking device, so that this latter may be fitted or removed without demounting the switch devices.

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According to one preferential feature of the invention the interlocking device comprises two coupling links

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coupled to the contactor fingers and pivoted to a cam swing arm cooperating with a fixed abutment pin.

5 According to another preferential feature the lid includes apertures enabling relative movement of the contactor fingers to enable the contactor fingers to be coupled to add-on modules.

10 According to another preferential feature the interlocking device comprises a support plate guiding movement in translation of the coupling links.

15 According to one preferential feature the ends of the contactor fingers pass through the apertures in the lid covering the interlocking device and the front surface of the switch devices and through drive apertures in the coupling links.

20 According to one preferential feature the interlocking device is disposed under the lid which comprises guide means for the coupling links.

25 The invention will now be described in more detail by way of example only and with reference to the embodiments shown in the appended drawings in which:

30 Figure 1 is an exploded perspective view of a first embodiment of the mechanically interlocked switch in accordance with the invention.

Figure 2 is an exploded perspective view of a second embodiment of the mechanically interlocked switch in accordance with the invention.

An electromagnetically operated switch as shown in the drawings comprises a first switch device 1 and an identical second switch device 2 disposed side by side. These switch devices are contactor modules or power relays.

In the embodiments shown in the drawings and described hereinafter the devices 1 and 2 are contactor modules.

Each contactor module 1 or 2 comprises a moulded insulative casing 11 or 21 containing a plurality of poles. The casing 11 or 21 has compartments 12, 13 or 22, 23 in which are accommodated connecting terminals connected to contacts.

The contactor modules 1 and 2 have respective front surfaces 16 and 26 and respective rear surfaces 17 and 27. Each of the rear surfaces incorporates snap-fastener means 18 so that the contactor module can be clipped onto a rail.

In a manner that is known in itself, a chamber in each of the casings accommodates a sliding contact-holder carrying mobile bridges provided with mobile contacts. The sliding contact-holder is guided in a housing of the casing so as to move in a direction perpendicular to the surface of the contacts between an open position and a closed position parallel to the rear surface 17 or 27 of the contactor module. In a manner that is known in itself the contact-holder incorporates springs for urging the mobile contacts against the fixed contacts. The sliding contact-holder can be moved in its chamber in the above defined guidance direction by a solenoid.

Each of the casings 11 or 21 has a central recess 15 or 25 set back relative to the respective front surface 16 or 26 between the compartments. Each recess 15 or 25 has a substantially rectangular cross-section and is delimited by parallel lateral surfaces perpendicular to the front surface 16 or 26 and by a bottom 19 or 29. Each recess extends parallel to the direction of movement in translation of the respective sliding contact-holder. Each sliding contact-holder has towards the front end a contactor finger 14 or 24 which projects from the respective back 19 or 29 of the respective recess 15 or 25. The contactor finger 14 or 24 can move in translation along the longitudinal axis of the central recess. Each central recess 15 or 25 is open on at least one lateral surface of the contactor casing. Projections 191 or 291 upstanding from the back 19 or 29 are provided in the recesses. The wall forming one or other of the recesses 15 or 25 is in one piece, i.e. there is no longitudinal seam. Each recess 15 or 25 extends across the full width of the switch.

The mechanical interlocking device 4 comprises a first coupling link 41, a second coupling link 42 and a cam swing arm 43 cooperating with a fixed abutment pin 45.

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The coupling link 41 has at one end a drive aperture 411 into which the end of the contactor finger 14 is inserted to provide a positive coupling between the link and the lever. At its other end the link 41 has a journal 412 inserted into a pivot housing 432 of the cam swing arm 43 to provide a pivot. Similarly, the coupling link 42 has at one end a drive aperture 421 into which the end of the contactor finger 24 is inserted to provide a positive coupling between the link and the lever. At its other end the link 42 has a journal 422 inserted in a pivot

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housing 43 of the cam swing arm 43 to provide a pivot between said link and said swing arm. The journals 412 and 422 are perpendicular to the front surface of the contactor modules.

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The cam swing arm 43 has a heart-shape cam formed by two ramp surfaces 433 and 434 and cooperates with a pin 45 fastened to the support plate 44.

10 The interlocking device 4 is recessed into the recesses 15 and 25 with the links 41 and 42 fitted over the fingers 14 and 24. A lid 3 covers the front surfaces of the contactor modules.

15 The casings 11 and 21 do not comprise any part or permanently fitted separate component for retaining the interlocking device in a direction perpendicular to the front surfaces of the switch devices.

20 The interlocking module 4 is retained in a direction perpendicular to the front surfaces (i.e. the mounting or demounting direction) by the lid 3. The projections 191 and 291 on the casing immobilise the module 4 in the direction parallel to the longitudinal axis of the
25 recesses.

The interlocking device comprises a support plate 44 on which the links 41 and 42 and the centrally disposed swing arm 43 are mounted. The plate has rectilinear
30 slideways 441 which guide movement in translation of the coupling link 41 and rectilinear slideways 442 which guide movement in translation of the coupling link 42. The plate has two apertures 443 and 444 through which the ends of the operating levers 14 and 24 pass. The
35 apertures 443 and 444 respectively face the apertures 411

and 421 in the coupling links. Holes 445 and 446 are provided in the support plate 44 to accommodate the projections 191 and 291.

5 The lid 3 has two apertures 31 and 32 through which the ends of the respective contactor fingers 14 and 24 pass. These two apertures face the apertures in the plate 44 and the apertures in the coupling links. The apertures 443, 444 in the support plate 44 and the apertures 31 and 10 32 in the lid 3 allow movement in translation of the fingers 14 and 24. The interlocking device 4 is accommodated under the lid 3 and the contactor fingers 14 and 24 respectively pass through the aligned apertures 411, 443 and 31 and 421, 444 and 32.

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In the figure 1 embodiment the mechanical interlocking device 4 is independent of the lid 3 which is adapted to cover the front surfaces of the contactor modules 1 and 2. The support 44 could be associated with a cardboard support to be used for fitting the mechanical 20 interlocking device.

In the figure 2 embodiment the mechanical interlocking device 4 is mounted underneath and integrated with the 25 lid 3. The slideways 441 and 442 and the pin 45 are fastened to the lid 3.

In a first variant, the slideways 441 and the pin 45 could be moulded in one piece with the lid 3. The 30 abutment pin 45 is then part of the lid 3.

In a second variant, the device comprises a support plate 44 fixed underneath it by snap-fastener lugs which engage in holes in the lid.

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The lid 3 has holes 33 along its sides to provide access to the connecting terminals. Known fixing means are provided on the lid for fixing the lid. These fixing means comprise clips 34.

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Add-on contactor modules 5 and 6 may be fixed to the top of the lid 3 and operated directly by the operating levers 14 and 24.

10 The operation of the mechanical interlocking device will now be described with specific reference to figures 6, 7, 8 and 9.

15 Figure 8 shows the interlocking device in the rest position. The positions of the coupling links 41 and 42 in this figure are those when the contactor fingers 14 and 24, which are not operated, are in their rest position A. The axis of symmetry of the cam 433-434 is aligned with the longitudinal axis 46 of the device.

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When the contactor module 2 is operated (figure 7) the contactor finger 24 moves from the rest position A to the operative position B shown in dashed outline in figure 6. The movement of the coupling link 42 turns the cam swing arm 43. The ramp surface 433 is positioned facing the fixed abutment pin 45. The coupling link 41 is then unable to move in translation (in the direction of movement of the finger 14 from position A to position B) because the ramp surface 433 of the cam is in contact with the pin 45. This prevents movement of the finger 14. The contactor module 1 is therefore disabled.

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Similarly, when the contactor module 1 is operated (figure 9) the contactor finger 14 moves from the rest position A to the operative position B shown in dashed

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outline in figure 6. The movement of the coupling link 41 turns the cam swing arm 43. The ramp surface 434 is positioned facing the fixed abutment pin 45. The coupling link 42 is then unable to move in translation (in the direction of movement of the finger 24 from position A to position B) because the ramp surface 434 is in contact with the pin 45. This prevents movement of the finger 24. The contactor module 2 is therefore disabled.

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The interlocking device 4 can be inserted into the contactor modules 1 and 2 or extracted therefrom without demounting them.



CLAIMS

1. Mechanically interlocked electromagnetically operated switch comprising two identical switch devices (1, 2) disposed side by side and each having a casing (11 or 21) and a sliding contact-holder mobile in translation and provided with a projecting contactor finger (14 or 24), in which switch said two switch devices (1, 2) are coupled to each other by a mechanical interlocking device (4) adapted to prevent simultaneous displacement of the two sliding contact-holders, said mechanical interlocking device (4) being covered by a lid (3),

characterized in that each switch device (1, 2) has a central recess (15 or 25) in the front surface (16 or 26) of the casing (11 or 21) between the compartments (12, 13 or 22, 23) into which the terminals engage and into which the mechanical interlocking device (4) is recessed so that it can be inserted or extracted without demounting the switch devices (1, 2).

2. Switch according to claim 1,

characterized in that each recess (15 or 25) has a substantially rectangular cross-section and is delimited by parallel lateral surfaces perpendicular to the front surface of the casing.

3. Switch according to any one of the preceding claims,

characterized in that the interlocking device (4) comprises two coupling links (41, 42) coupled to the contactor fingers (14 and 24) and pivoted to a cam swing arm (43) cooperating with a fixed abutment pin (45).

4. Switch according to any one of the preceding claims,



characterized in that the lid (3) has apertures (31, 32) enabling relative movement of the contactor fingers (14, 24) to enable the contactor fingers (14, 24) to be coupled to add-on modules (5, 6).

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5. Switch according to any one of the preceding claims,

characterized in that the interlocking device (4) comprises a support plate (44) guiding movement in translation of the coupling links (41, 42).

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6. Switch according to claim 4,

characterized in that the ends of the contactor fingers (14, 24) pass through apertures (31, 32) in the lid (3) covering the interlocking device and the front surface of the switch devices (1, 2) and through drive apertures (411, 421) of the coupling links (41, 42).

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7. Switch according to any one of the preceding claims,

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characterized in that the interlocking device (4) is mounted underneath the lid (3) which carries it.

8. Switch according to any one of the preceding claims,

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characterized in that the abutment pin (45) and the coupling link guide slideways (441, 442) are fastened to the support plate (44).

9. Switch according to any one of the preceding claims, characterized in that the abutment pin (45) and the coupling link guide slideways (441, 442) are fastened to the lid (3).

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10. Switch according to any one of the preceding claims,

characterized in that the support plate (44) is integrated under the lid (3).

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11. Switch according to any one of the preceding claims,

characterized in that the cam swing arm (43) incorporates a heart-shape cam (433, 434).

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12. Switch according to any one of the preceding claims,

characterized in that the apertures (31, 32) in the cover enabling relative movement of the contactor fingers face apertures (411, 421) whereby the links (41, 42) are driven by the contactor fingers (14, 24).

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13. Switch according to any one of the preceding claims,

characterized in that the lid (3) incorporates holes (33) for access to connecting terminals.

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