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(54) **Electrical connection auxiliary module for circuit breakers.**

(57) Electrical connection auxiliary module for circuit breakers removably associable to a circuit breaker for allowing an easy wiring of auxiliary devices associated to the circuit breaker.

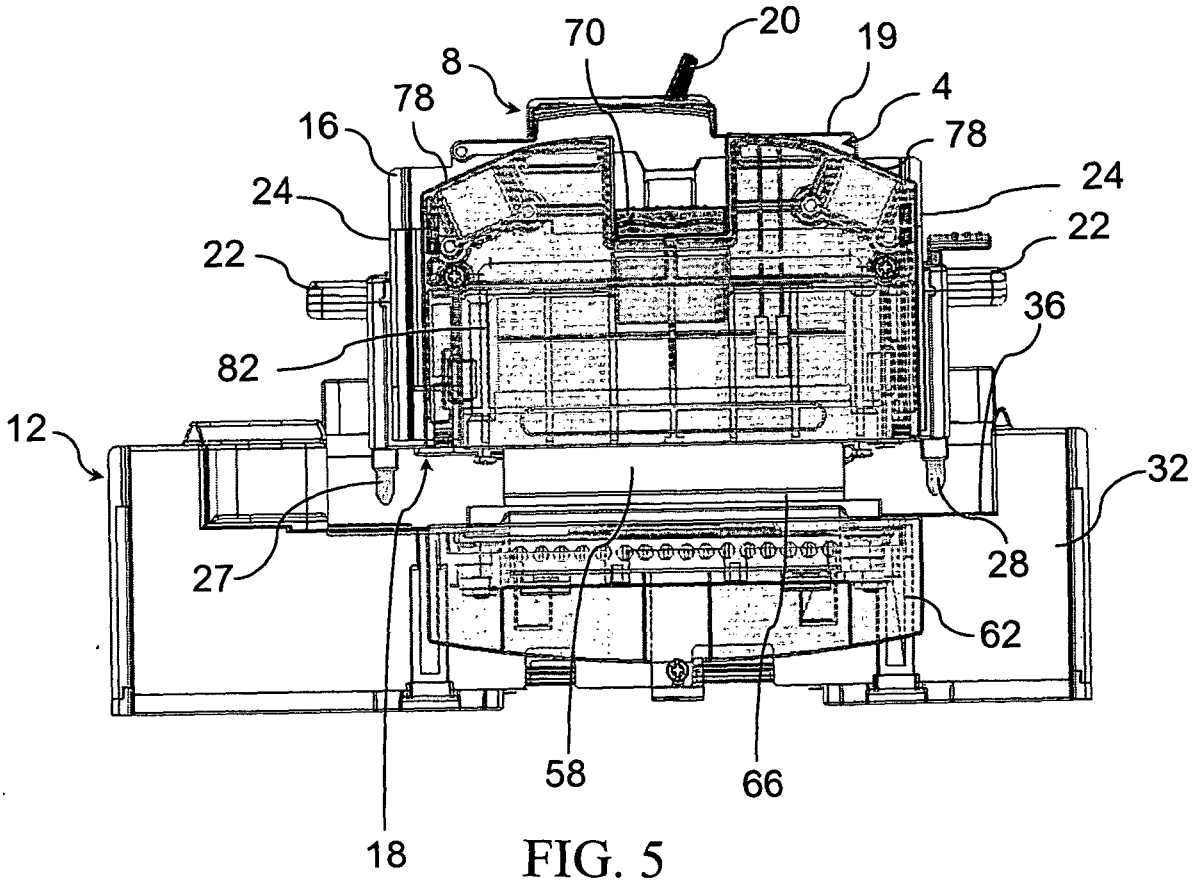

FIG. 5

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Description

[0001] The present invention relates to an auxiliary connection module for circuit breakers, and in particular moulded case electrical circuit breakers, a base for circuit breakers, a circuit breaker and a circuit breaker group.

[0002] To mechanically fix a moulded case circuit breaker in the inner space of an electrical panel and ensure the electrical connection of such circuit breaker to an electrical installation, it is known to use a support and electrical connection base. Such base is typically mechanically fixed to the electrical panel, for example to a vertical plate or to uprights/crosspieces seated in the inner space of the electrical panel, and moreover it is electrically connected inside the electrical panel to an electrical installation the circuit breaker is to be connected to and in particular, to an electrical circuit upstream of the circuit breaker, or line circuit, and an electrical circuit downstream of the circuit breaker, or loading circuit.

[0003] The base includes electrical connection terminals, for example in the form of terminals, suitable for cooperating with respective connection terminals of the circuit breaker for connecting the circuit breaker to the line circuit and to the loading circuit. The connection terminals of the circuit breaker are for example made in the form of bars intended for being coupled into corresponding complementary terminals provided in the base.

[0004] The use of a support and electrical connection base inside an electrical panel allows making the removal of the circuit breaker from the electrical panel and optionally a subsequent re-installation especially easy and quick. The removal of a circuit breaker becomes necessary for example if the circuit breaker installed in the panel must be replaced with a new one or when, as required by the safety regulations, the temporary removal of the circuit breaker and its separation therefrom are required for carrying out maintenance operations on the electrical system controlled by the circuit breaker.

[0005] As known, in order to install a moulded case circuit breaker in an electrical panel it is necessary not only to ensure the electrical connection to the line and loading circuits of the power terminals of the circuit breaker but also make the wiring and the connection of the so-called auxiliary devices associated to the circuit breaker. By auxiliary devices it is meant those ancillary devices capable of providing auxiliary functions to the circuit breaker, such as functions of various types such as for example signalling, motor, etc. not directly related to the main function of the circuit breaker, that is, that of electrically connecting/disconnecting the line circuit from the loading circuit.

[0006] Two techniques are currently known for making the connection of the auxiliary devices of the circuit breaker in the electrical panel.

[0007] The first technique envisages making the connections of the auxiliary devices using conductor bundles with an end portion connected to the auxiliary devices and an opposite end portion provided with an electrical connector intended for being coupled to a complementary connector provided in the electrical panel. The bundle of conductors is left sufficiently loose so as not to make the removal/insertion operations between circuit breaker and base very complicated. This technique exhibits the advantage of a relative simplicity of wiring of the auxiliary devices, however it exhibits the disadvantage of having to provide for a sufficiently loose cable bundle in the electrical panel. A further disadvantage of this solution is given by the fact that the operation of removal of the circuit breaker from the panel implies two subsequent operations: the circuit breaker must first be disconnected from the base and then the connector dedicated to the auxiliary devices must be disconnected.

[0008] According to a further known technique, the arrangement of an auxiliary connector is provided behind the circuit breaker and integral therewith; a complementary connector is provided on the base. The electrical wires of the auxiliary devices are made to pass from the front of the circuit breaker, winding them quite strictly around the side walls of the same to reach the back connector. This solution that exhibits the advantage of concurrently ensuring a disconnection of the circuit breaker from the base and the disconnection of the auxiliary devices, nevertheless implies a considerable wiring difficulty.

[0009] The object of the present invention is to solve the disadvantages mentioned with reference to the prior art.

[0010] Such disadvantages and restrictions are solved by an electrical connection module for circuit breakers in accordance with claim 1.

[0011] Other embodiments of the device according to the invention are described in the subsequent claims.

[0012] Further features and the advantages of the present invention will appear more clearly from the following description of preferred non-limiting embodiments thereof, wherein:

[0013] - figure 1 shows an axonometric view of a circuit breaker provided with an auxiliary connection module according to the present invention, in a configuration of insertion of the circuit breaker into the relevant base;

[0014] - figure 2 shows an axonometric view of the circuit breaker of figure 1, in a configuration of extraction from the relevant base;

[0015] - figure 3 shows an axonometric view of the circuit breaker of figure 1, in a configuration of removal from the relevant base;

[0016] - figure 4 shows a side view of the circuit breaker of figure 1, from the side of arrow IV of figure 3, wherein the auxiliary connection module is in a second operating configuration;

[0017] - figure 5 shows a side view of the circuit breaker of figure 1, from the side of arrow V of figure 2, wherein the auxiliary connection module is in a second operating configuration;

[0018] - figures 6-8 show schematic partly cutaway side views of the circuit breaker of figure 1, respectively

in a first configuration of circuit breaker enabled, and in a second and third configuration wherein the circuit breaker is cut off, that is, extracted but connected to the base.

[0019] In the different figures, like or similar elements shall be indicated by the same reference numerals.

[0020] With reference to the above figures, reference numeral 4 globally denotes an electrical connection auxiliary module for circuit breakers 8, preferably moulded case circuit breakers, suitable for making electrical connections between auxiliary devices of the circuit breaker and a support and electrical connection base 12.

[0021] Base 12 can be used for mechanically fixing the moulded case circuit breaker 8 into the housing of an electrical panel and for securing the electrical connections of circuit breaker 8 to an electrical circuit upstream of base 12, or line circuit, and to an electrical circuit downstream of base 12, or loading circuit.

[0022] A moulded case circuit breaker 8, as opposed to a so-called "open-type" circuit breaker, exhibits a box shaped body 16 made of insulating material, which has a carrying function for the internal circuits and mechanisms of the circuit breaker. At present, moulded case circuit breakers are generally used in the fields of industrial automation and of the high-tech service industry for cutting off currents for example even having a value up to 1500 A.

[0023] The moulded case circuit breaker 8 for example is a magneto-thermal switch. More in detail, in the particular example described circuit breaker 8 is a quadripole magneto-thermal moulded case circuit breaker.

[0024] The box-shaped body 16 of circuit breaker 8 comprises a back face 18, directly opposite the associable base 12 and a front face 19, opposite the back face 18 and carrying a control lever 20.

[0025] In the example described, circuit breaker 8 is provided with gripping handles 22, better seen in figures 4 and 5, connectable to two opposite horizontal faces 24 of the box shaped body 16 of circuit breaker 8 and suitable for making the connecting/disconnecting operations between circuit breaker 8 and base 12 easy and comfortable.

[0026] The box shaped body 16 of circuit breaker 8 comprises a pair of side faces 25 substantially perpendicular to the back, front and horizontal faces 18, 19, 24.

[0027] As can be seen for example in figures 3-5, circuit breaker 8 comprises two opposite arrays of electrical connection terminals 27, 28, or power terminals, for the electrical connection of circuit breaker 8 to the relevant electrical panel, and in particular to the line circuit and to the loading circuit by the associable base 12. The electrical connection between circuit breaker 8 and base 12 takes place following the complete insertion of circuit breaker 8 into the relevant base 12 (figures 1 and 6). In the latter for example there are provided two arrays of terminals (not visible in the figures), or power terminals of the base, electrically connected/connectable respectively to the line circuit and to the loading circuit, and suitable for receiving coupling-wise the power terminal arrays 27, 28 of circuit breaker 8 when the latter is inserted in base 12. As is well known to an expert of the field, the main function of circuit breaker 8 is to selectively enable/cut off the electrical connection between the line circuit and the loading one. Other functions not directly relating to such function are called auxiliary functions (signalling, remote control, etc.).

[0028] According to a possible embodiment of the present invention, circuit breaker 8 comprises coupling means (not shown) suitable for selectively coupling circuit breaker 8 to the relevant base 12 in an insertion position and in an extraction position of circuit breaker 8. In the extraction position, circuit breaker 8 is mechanically constrained to base 12 but the power terminals of the circuit breaker are electrically disconnected from the complementary power terminals of the base.

[0029] Base 12, better seen in figure 3, exhibits a base body 32 of electrically insulating material with essentially parallelepiped shape, having a front face 36 intended for being juxtaposed to the back face 18 of the box shaped body 16 of the moulded case circuit breaker 8.

[0030] Base 12 is further provided with means, not shown in the figures, suitable for allowing the mechanical fixing thereof in the inner space of an electrical panel.

[0031] In the insertion position, circuit breaker 8 is inserted in base 12, mechanically connected thereto and with its power terminals 27, 28 electrically connected to the complementary power terminals of the base.

[0032] In the extraction position, or cut off position, circuit breaker 8 is mechanically constrained to base 12, at a predetermined distance therefrom, but in such position the electrical power terminals 27, 28 of the circuit breaker are electrically insulated from the complementary power terminals of the base.

[0033] The auxiliary connection device 4 is preferably associated to a side face 25 of the box shaped body 16 of circuit breaker 8, so that in an assembled configuration of the circuit breaker group, the auxiliary module 4 is arranged at the side relative to the box shaped body of circuit breaker 8. The fixing between connection module 4 and circuit breaker 8 is preferably obtained at first by joint-wise coupling means and then optionally made integral by screw fixing means.

[0034] Advantageously, the auxiliary module 4 comprises a box shaped element 50, removably associable to the box shaped body 16 of circuit breaker 8 and in particular to a side face 25 thereof.

[0035] The box shaped element 50 defines an inner space 54 that encloses a terminal board 58 of first electrical connection terminals suitable for being electrically connected, for example by conductor wires, to auxiliary devices of the circuit breaker (not shown, and in any case to be understood as external to module 4). Such auxiliary devices, in se known to a man skilled in the art, may for example be applied external to the circuit breaker, for example on the front face thereof 19, or contained into special spaces arranged frontally into the box shaped

body 16 of circuit breaker 1 and accessible by a door 6 turnably hinged to such body 16 on the side of the front face 19 of the circuit breaker. Terminal board 58 for example comprises a connector having a body of insulating material provided on a side facing base 12 with an array of conductive pins and provided on an opposite side and inside the box shaped element 50 with wiring terminals each electrically connected to a respective conductive pin or making up an end portion, towards the inner space, of said conductive pin.

[0036] According to a particularly preferred embodiment, module 4 comprises a further box-shaped element 62, removably associable to base 12 of circuit breaker 8, comprising a base 66 of second auxiliary electrical connection terminals conjugate relative to the terminals of terminal board 58 and suitable for being connected thereto by coupling the base on terminal board 58. The connection terminals of base 66 are for example connected by wires that are external to the base, not shown in the figures, to power/control/signalling devices provided in the electrical panel. According to an alternative embodiment, base 66 is built in and directly wired to the base without the use of a second box shaped element 66 distinct from base 12.

[0037] Advantageously, terminal board 58 is slidingly arranged into the box shaped element 50 so as to selectively shift from a coupling position, wherein terminal board 58 mechanically and electrically connects onto the corresponding base 66 to a disconnected position wherein terminal board 58 is mechanically and electrically disconnected from base 66.

[0038] Preferably, the box shaped element 50 comprises an actuating button 70, mechanically connected to terminal board 58, for example by a stiff bracket having a first end portion connected to button 70 and an opposite end portion connected to terminal board 58, so as to allow the pressure-wise connection of terminal board 58 onto the corresponding base 66. Preferably, the actuating button 70 is arranged on a front face 74 of the box shaped element 50 adjacent the front face 19 of the associable circuit breaker 8.

[0039] Advantageously, the shifting stroke of button 70 and thus of the relevant terminal board 58 relative to the first box shaped element 50 is at least equal to a cut off stroke S of circuit breaker 8, so as to allow the electrical connection of terminal board 58 to base 66, when circuit breaker 8 is in the extraction position, that is, constrained to base 12 but arranged at a predetermined distance therefrom.

[0040] According to a possible embodiment, module 4 may comprise locking means actuable for preventing the relative sliding between the box shaped element 50 and terminal board 58. For example, such means comprise a stopping element (not shown), for example a block, suitable for being removably inserted in a recess defined between the first box shaped element 50 and the actuating button 70, so as to make button 70 integral with the first box shaped element 50. In other words, the stopping element block any axial shifting movement of button 70 and therefore of terminal board 58 relative to the box shaped body 16 of circuit breaker 8.

[0041] Preferably, the first box shaped element 50 comprises at least one front opening 78 for allowing the connection of an auxiliary device to terminal board 58. Opening 78 is preferably arranged on the front face 74 of the first element 50 so as to be directly and easily accessible from the outside of circuit breaker 8. Opening 78 may optionally seat a connector connected by wires to the terminal board to make the wiring of the auxiliary circuits especially quick.

[0042] In a first particularly preferred embodiment, the first box shaped element 50 preferably comprises a pair of openings 78 arranged at opposite sides relative to the control lever 20 of the associable circuit breaker 8. The provision of two openings advantageously allows applying device 4 on any of the two side walls 25 of the circuit breaker.

[0043] According to an embodiment, the box shaped element 50 comprises an access door 82 to the inner space 54 thereof for allowing the wiring of the auxiliary devices to terminal board 58. Preferably, the access door 82 is arranged on a side face or wall of the box shaped element 50 so as to be accessible also when the box shaped element is applied to the circuit breaker 8.

[0044] Advantageously, the box shaped element 50 is arranged at a side face 25 of the box shaped body 16 of the circuit breaker and the other box shaped element 62 is arranged on a corresponding side wall 86 of the base so as to be axially aligned with the box shaped element 50. The term axial direction means a direction parallel to direction of insertion of circuit breaker 8 on the relevant base 12.

[0045] In an assembled configuration of module 4 on circuit breaker 8 and on base 12, the box shaped element 50 is associated to body 16 of circuit breaker 8 and is directly facing and connectable on the other box shaped element 62 fixed to base 12 of circuit breaker 8.

[0046] An example of operation of an electrical connection auxiliary module 4 and of a relative circuit breaker according to the present invention shall now be described.

[0047] In a configuration of insertion of circuit breaker 8 into the relevant base, shown in figures 1 and 6, circuit breaker 8 is seated in base 12 and is electrically connected to the electrical panel by the power connection terminals 27, 28. The auxiliary devices of the circuit breaker, which have been wired to the terminal board by wires or connections passing inside the box shaped element 50 are electrically connected to base 66 because the terminal board 58 is connected to base 66. In such configuration for example, a block is inserted into recess 82 below the actuating button 78 and thus the terminal board 58 cannot shift relative to the box shaped element 50.

[0048] If there is the need to cut off circuit breaker 8, the same is removed, after releasing the relevant fixing

means between circuit breaker and base, so as to disconnect the power terminals 27, 28 of the latter from the corresponding power terminals provided in the base.

[0049] After the extraction of circuit breaker 8, due to the presence of the block in recess 82, the terminal board 58 is mechanically and electrically disconnected from base 66 of base 12 (figure 7) substantially concurrently to the cut off between the power terminals of the circuit breaker and those conjugated provided in the base.

[0050] In such cut off configuration, it is possible to electrically connect the auxiliary devices of the circuit breaker removing the block and pressing button 70; in this way terminal board 58 advances relative to the box shaped element 50 integral with circuit breaker 8 and directly connects on base 66 connected to base 12 (figure 8).

[0051] After running the cut off test, it is possible to insert circuit breaker 8 again into the relevant seat of base 12; in this way, circuit breaker 8 shifts towards base 12 relative to terminal board 58 that remains connected to base 66 and the auxiliary devices maintain the electrical connection with base 12.

[0052] As can be appreciated from the description, the auxiliary module, the base and the circuit breaker according to the invention allow overcoming the disadvantages of the prior art.

[0053] Both the wiring of the auxiliary devices, and the operations of insertion/removal between circuit breaker and base in fact are especially quick and convenient. Moreover, it should be noted that in general it is not necessary to provide for loose cables inside the electrical panel. Only if a shifting terminal board 58 is provided for the connection of the auxiliary devices to the terminal board it is necessary to set up slightly longer cables, but only by a reduced quantity necessary to allow terminal board 58 to carry out its stroke, generally very limited (1-2 cm). Moreover, the excess cable portions can be advantageously seated into the space of the box shaped element 50.

[0054] Moreover, it should be noted that in the embodiment wherein terminal board 58 is sliding, the auxiliary connection module and the circuit breaker of the present invention allow running tests of auxiliary functions of the circuit breaker with cut off system without using extension cables of various types. The overall dimensions are thus reduced, the manual operation of removal of the circuit breaker is prevented and the risks of accidental contact with electrical live parts are limited.

[0055] Moreover it should be noted that the auxiliary connection module may be provided as an accessory associable to an existing moulded case circuit breaker.

[0056] A man skilled in the art may make several changes and adjustments to the electrical connection auxiliary module and to the circuit breakers described above in order to meet specific and incidental needs, all falling within the scope of protection defined in the following claims.

Claims

1. Electrical connection auxiliary module (4) for circuit breakers (8), suitable for making electrical connections between auxiliary devices associable to the circuit breaker (8) and a base (12) for inserting the circuit breaker (8), the circuit breaker (8) comprising electrical connection terminals (27, 28) for being connected to a line circuit and a loading circuit, the base (12) comprising electrical terminals (37, 38) complementary to the electrical terminals (27,28) of the circuit breaker and suitable for cooperating therewith for electrically connecting the circuit breaker (8) to the electrical line and loading circuit,
characterised in that
the module further comprises a first box shaped element (50), removably associable to a box shaped body (16) of the circuit breaker (8) and defining a space (54) which encloses a terminal board (58) of first auxiliary electrical connection terminals connectable to electrical connection terminals of auxiliary devices of the circuit breaker (8), the terminal board being facing the base for allowing the coupling into the terminal board of a base (66) of second connection terminals provided in the base for wiring said auxiliary devices into an electrical panel.

2. Module (4) according to claim 1, wherein the base (66) is built in the base (12).

3. Module (4) according to claim 1, further comprising a second box shaped element (62), removably associable to the base (12) of the circuit breaker (8) and comprising such base (66).

4. Module (4) according to any one of the previous claims, wherein the terminal board (58) is slidingly arranged into the first box shaped element (50) so as to selectively shift from a coupling position, wherein the terminal board (58) mechanically and electrically connects to the corresponding base (66) to a disconnected position wherein the terminal board (58) is mechanically and electrically disconnected from the base (66).

5. Module (4) according to claim 4, wherein the first box shaped element (50) comprises an actuating button (70), mechanically connected to the terminal board (58), so as to allow the pressure-wise connection of the terminal board (58) onto the corresponding base (66).

6. Module (4) according to claim 4, wherein the shifting stroke of the button (70) and of the relevant terminal board (58) relative to the first box shaped element (50) is at least equal to a cut off stroke of the circuit breaker (8), so as to allow the electrical connection of the terminal board (58) to the base (66), when the

circuit breaker is in the extraction position.

7. Module according to claim 4, 5 or 6, comprising locking means actuable for preventing a relative sliding between the terminal board and the first box shaped element.

8. Module (4) according to claim 7, wherein said locking means comprise a stopping element, suitable for being removably inserted between the first box shaped element (50) and the actuating button (70), so as to make the button (70) integral with the first box shaped element (50).

9. Module (4) according to any one of claims 5 to 8, wherein the actuating button (70) is arranged on a front face (74) of the first box shaped element (50), adjacent a front face (19) of the associable circuit breaker.

10. Module (4) according to any one of the previous claims, wherein the first box shaped element (50) comprises at least one opening (78) for allowing the electrical connection of an auxiliary device to the terminal board by connection elements crossing said opening (78) and said space (54) for reaching said terminal board.

11. Module (4) according to claim 10, wherein said opening (78) is arranged on a front face (74) so as to be directly accessible from the outside of the circuit breaker.

12. Module (4) for circuit breaker according to claim 10 or 11, wherein the first box shaped element (50) comprises a pair of openings (78) arranged at opposite sides relative to a control lever (20) of the associable circuit breaker (8).

13. Module (4) according to any one of the previous claims, wherein the first box shaped element (50) comprises an access door (82) to said space (54) for allowing the wiring of said terminal board inside said space (54).

14. Module (4) according to claim 10, wherein the access door (82) is arranged on a side face (25) of the first box shaped element (50) so as to be accessible on the side relative to the circuit breaker (8).

15. Support and electrical connection base (12) suitable for receiving an electrical circuit breaker (8) provided with an auxiliary module according to claim 2, the base (12) comprising a base body having an insertion seat for the electrical circuit breaker and having said base built in said base body.

16. Support and electrical connection base (12) suitable for receiving an electrical circuit breaker (8) provided with an auxiliary module according to claim 3, or according to any one of claims 4 to 14 as depending on claim 3, the base being removably associated to said second box shaped element (62).

17. Circuit breaker (8) comprising an auxiliary module (4) according to any one of claims 1 to 14, the module (4) being arranged at a side face (25) of the circuit breaker (8), so that the first box shaped element (50) is associated to the body of the circuit breaker and the terminal board (58) is directly facing said base provided into the corresponding base (12) of the circuit breaker (8).

18. Circuit breaker (8) according to claim 17, wherein said circuit breaker (8) comprises coupling means suitable for selectively connecting the circuit breaker (8) to the relevant base (12) in an insertion position and in a position of extraction of the circuit breaker (8), in said extraction position the circuit breaker (8) being mechanically constrained to the base and said electrical terminals of the circuit breaker being electrically disconnected from said connection terminals of the base.

19. Circuit breaker group comprising a circuit breaker (8) according to claims 17 or 18 and a base (12) according to claims 15 or 16.

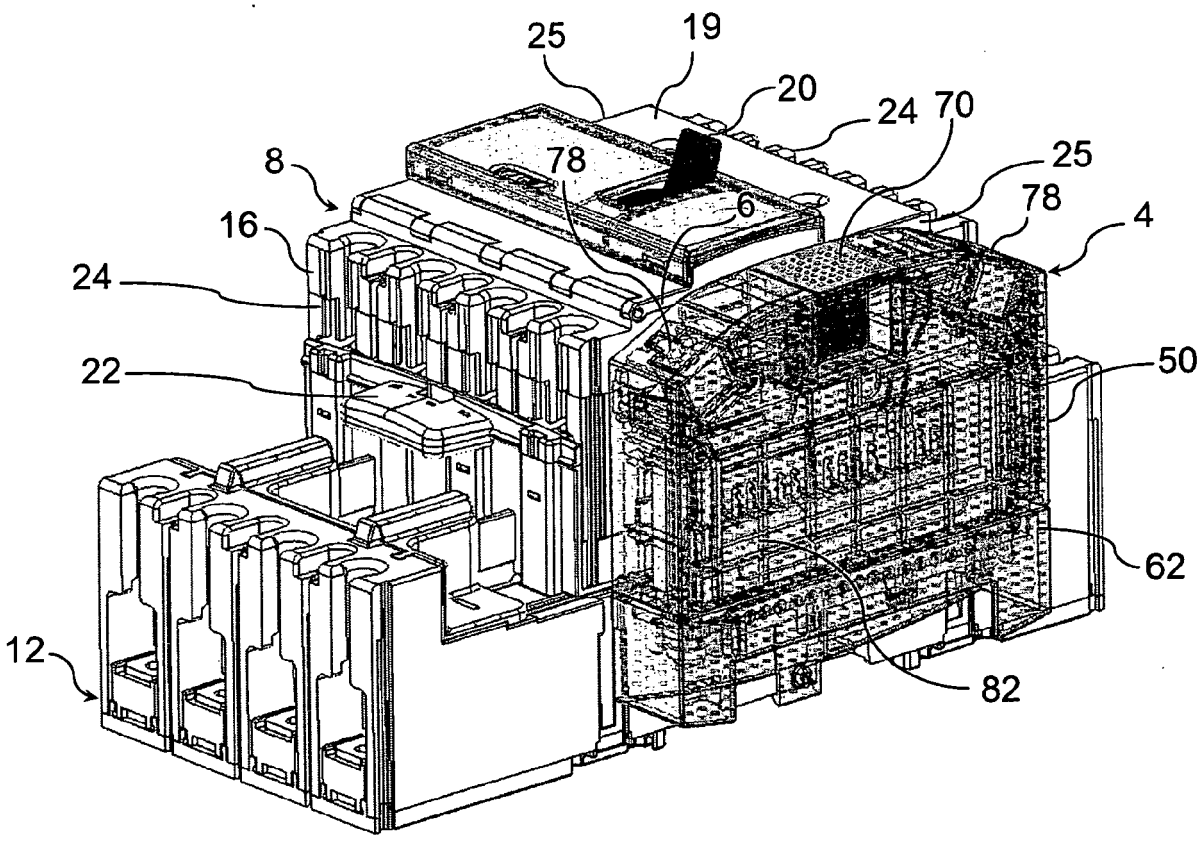

FIG. 1

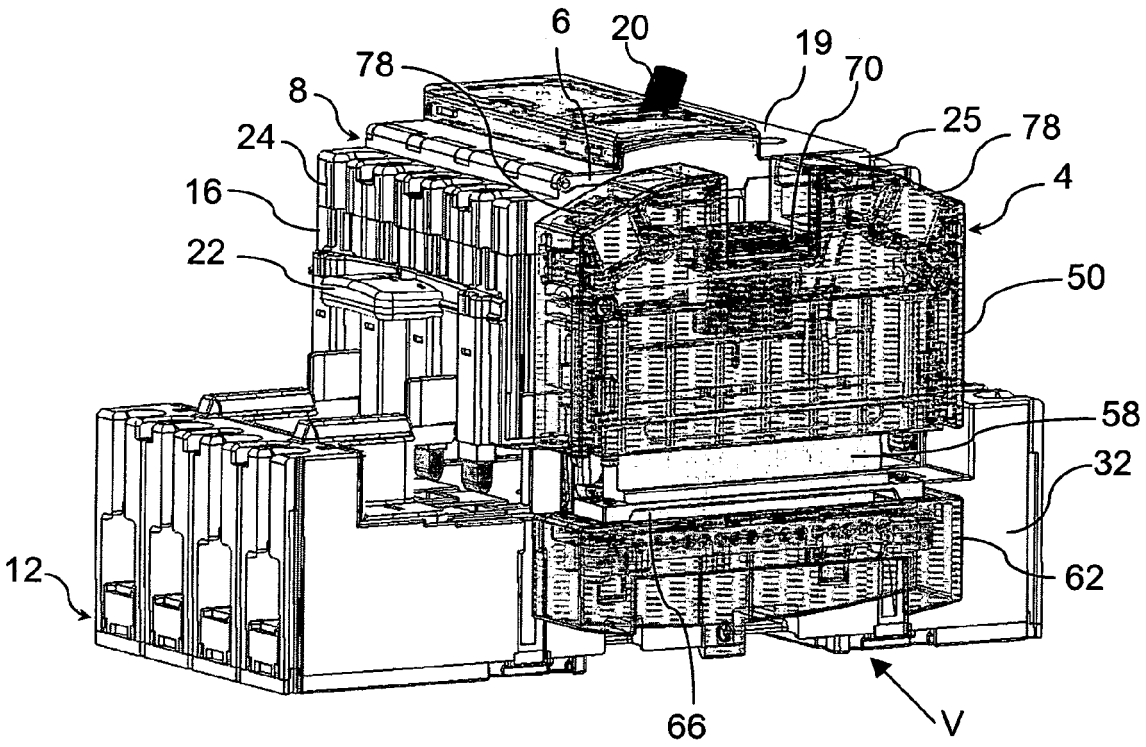
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FIG. 2

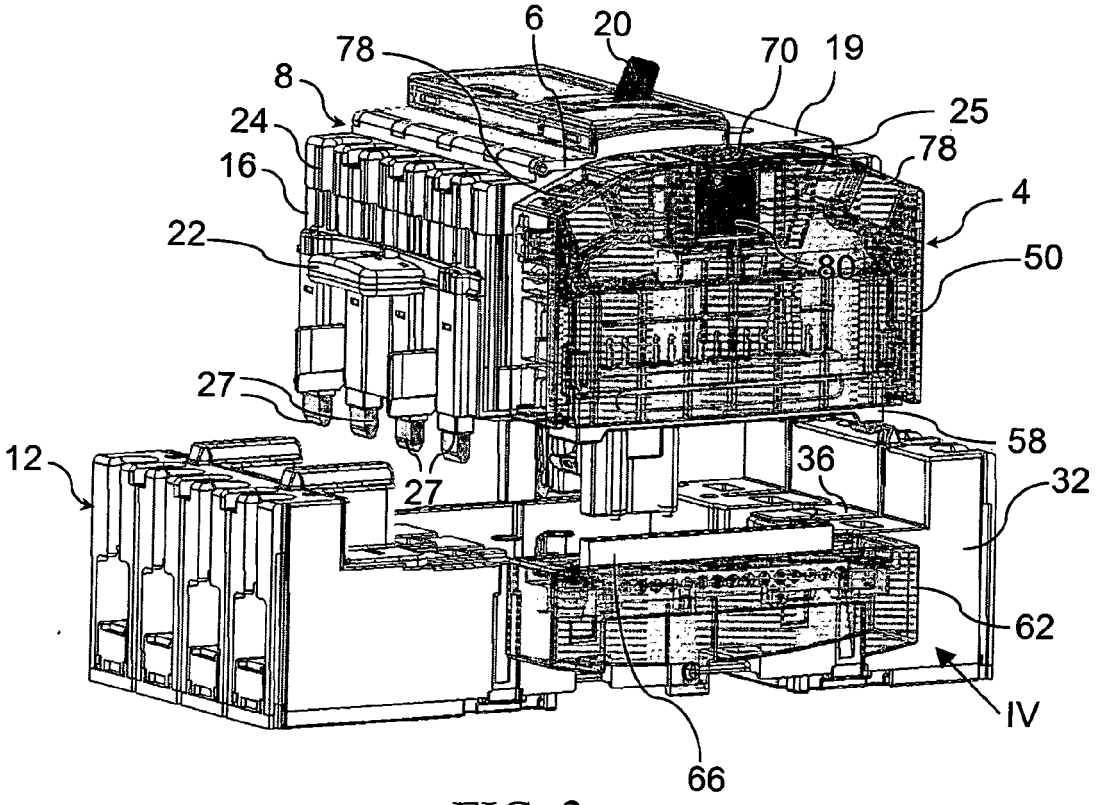
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FIG. 3

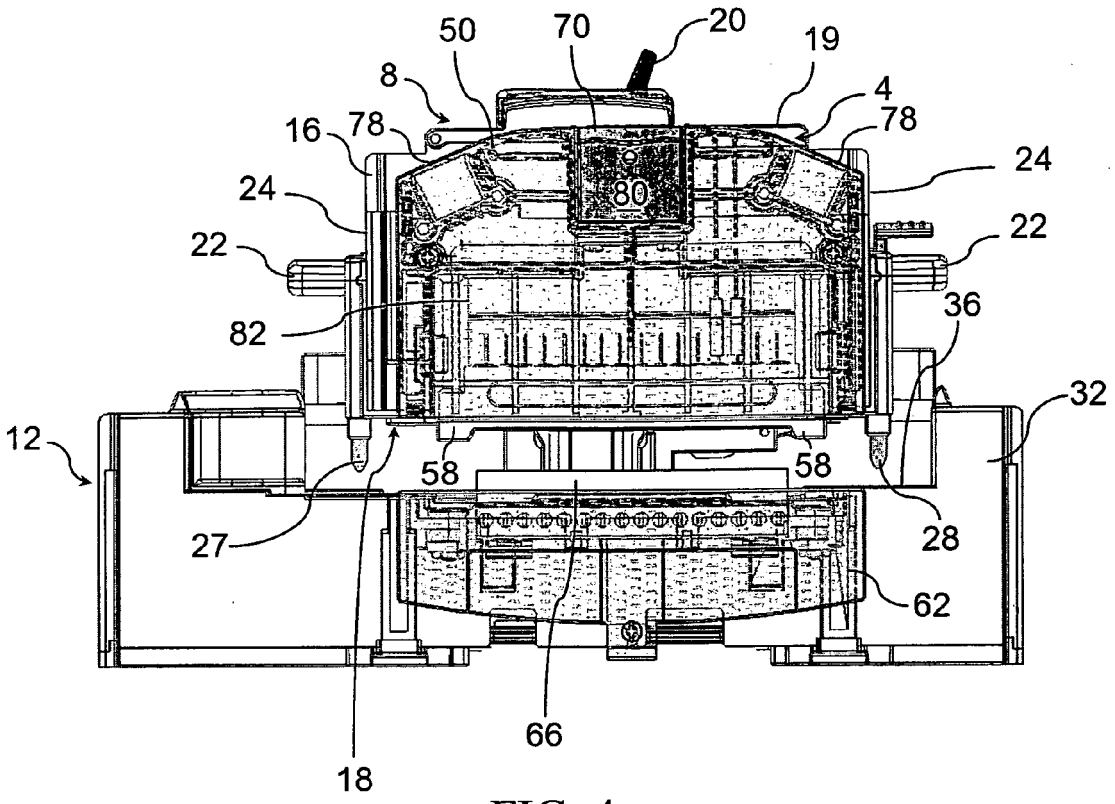
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FIG. 4

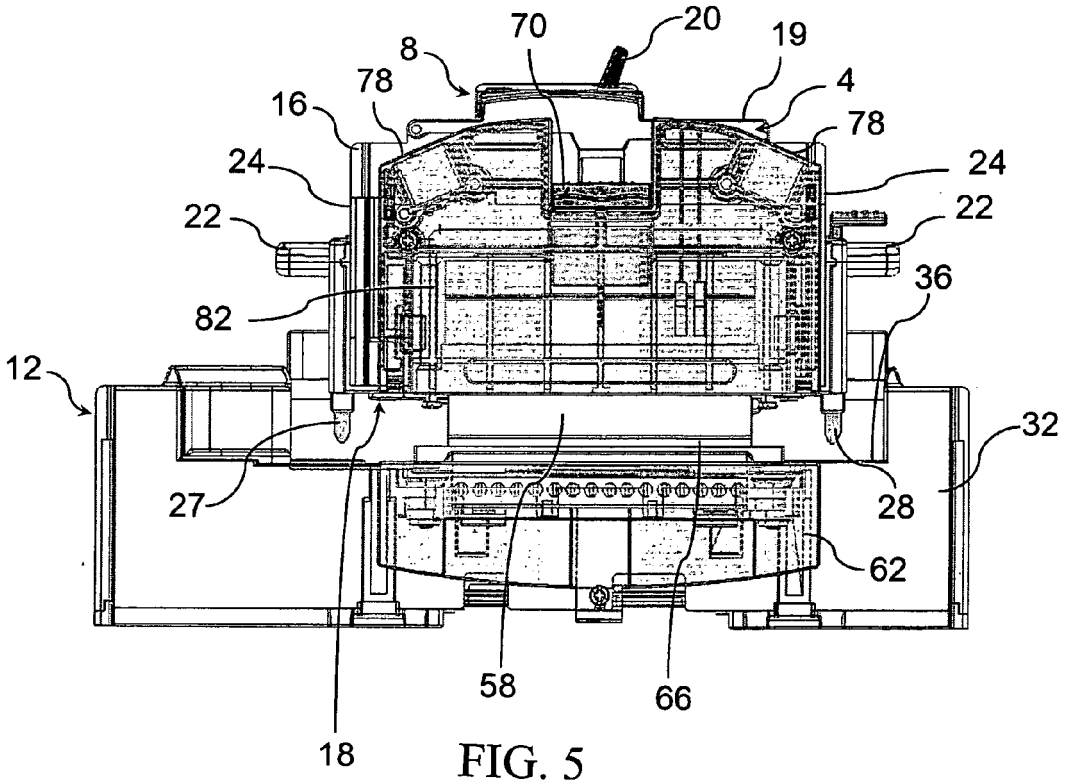
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FIG. 5

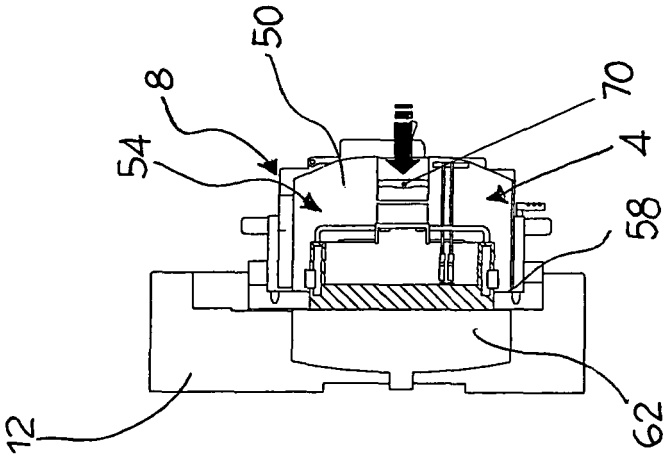

FIG. 8

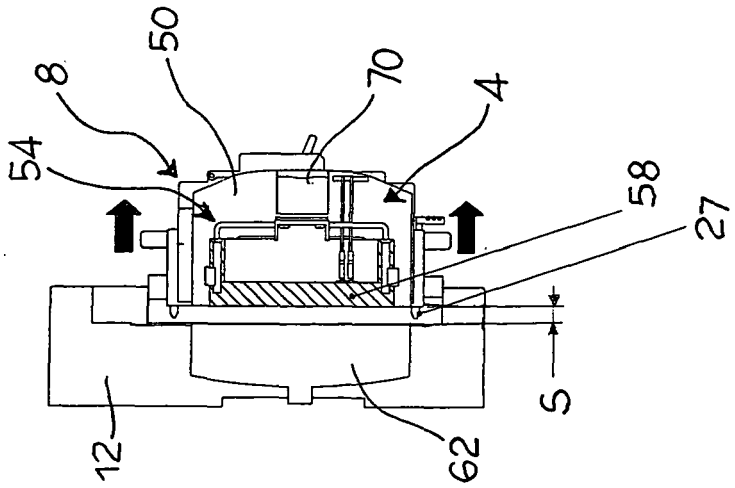

FIG. 7

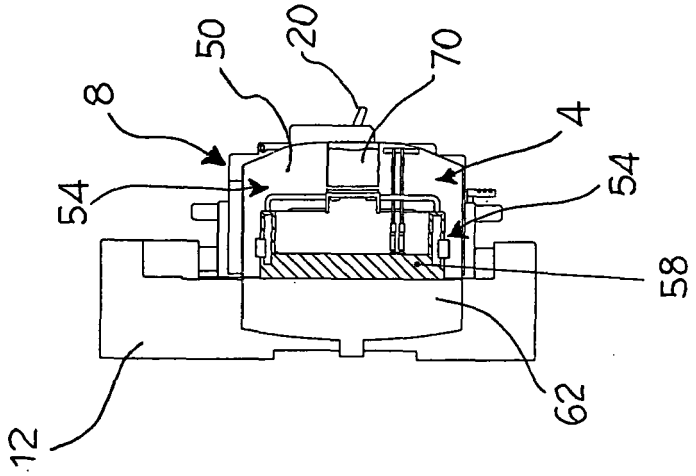

FIG. 6

European Patent Office

DECLARATION

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number EP 07 42 5477

The Search Division considers that the present application, does not comply with the provisions of the EPC to such an extent that it is not possible to carry out a meaningful search into the state of the art on the basis of all claims

Reason:

The subject matter of claim 1 is unclear. In lines 1 to 5, said claim explains that the the "auxiliary module" 4 serves the purpose of making electrical connections between "auxiliary devices" and the base for inserting the circuit breaker. These "auxiliary devices" are however not shown in the figures, and the description does not provide any information to understand where they are, what they do and how they interact with the circuit breaker.
Moreover, it seems from the figures and from paragraph 55 of the description that the auxiliary module 4 actually serves as a connection means between the circuit breaker and the base. This is also claimed at lines 16 and 17 of claim 1. It is therefore unclear what the auxiliary module actually connects.
The claims also suffer from an extensive use of the term "suitable for", which makes most of their subject matter merely optional and renders the scope of protection sought obscure (see the Guidelines, C-III 4.8).

The applicant's attention is drawn to the fact that a search may be carried out during examination following a declaration of no search under Rule 45 EPC, should the problems which led to the declaration being issued be overcome (see EPC Guideline C-VI, 8.5).

CLASSIFICATION OF THE APPLICATION (IPC)

INV.
H01H71/02

Place of search	Date	Examiner
Munich	21 November 2007	Simonini, Stefano

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EPO FORM 1504 (P04C37)