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(71) Applicant: **BTICINO S.P.A.**
20154 Milano (IT)

(72) Inventors:
- **Zilio, Luca**
  I-21024, Biandronno (Varese) (IT)
- **Cirolini, Andrea**
  I-21010, Ferno (Varese) (IT)

(74) Representative: **Carangelo, Pierluigi et al**
Jacobacci & Partners S.p.A.
Via delle Quattro Fontane 15
00184 Roma (IT)

(54) Electrical resetting apparatus adapted to be associated to a protection device for automatic resetting thereof

(57) Electrical resetting apparatus (10) adapted to be associated to a protection device (20) provided with a control lever (22) adapted to be actuated to electrically connect/disconnect an electric load circuit to/from a power supply network, the electrical resetting apparatus (10) comprising:
- a resetting device (13,30,31,32), adapted to be connected to the power supply network, comprising a rotating resetting arm (13) adapted to mechanically cooperate with the control lever (22);
- a control circuit (50) adapted to be connected to the electric load circuit to detect an operating state thereof in order to control said resetting device (13,30,31,32);
- sectioning elements (c1,c2,c3) adapted to be actuated to acquire a first or a second operating state, for respectively connecting/disconnecting the control circuit (50) to/from the load circuit;
- a control handle (11,12) rotatable around a rotation axis (R-R), adapted to be actuated to manually rotate the resetting arm (13).

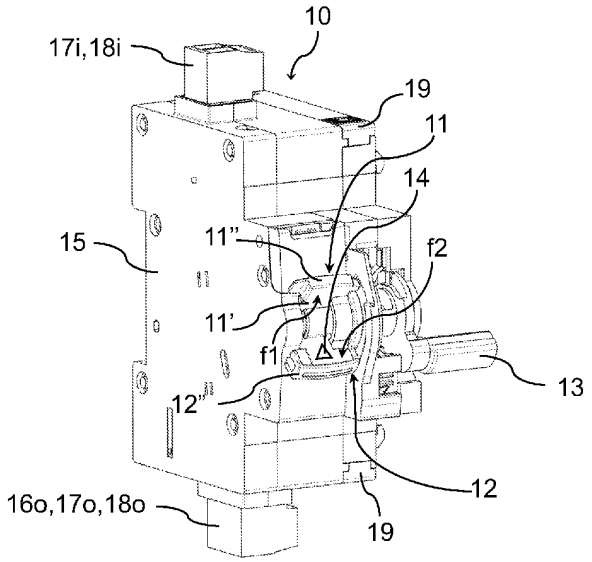

FIG 3

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Description

[0001] The present description refers to an electrical resetting apparatus adapted to be associated to a protection device for automatic resetting thereof.

[0002] In particular the present description refers to an electrical resetting apparatus of the type defined in the preamble of claim 1. An electrical apparatus of such type is known for example from the European patent application published under reference EP 1744428.

[0003] As known, protection devices (such as, for example, automatic circuit breakers, differential circuit breakers, or differential automatic circuit breakers) installed in a system can be subject to failures in case of untimely interventions. For example, in the specific case of differential circuit breakers, a frequent phenomenon is represented by tripping, i.e. the untimely opening of the circuit breaker due to dispersion currents which are generated towards the earth due to transient overvoltage on the power supply line (direct or indirect lightning discharge on the line) or due to temporary failure of the insulator.

[0004] If the installation area is not guarded, an untimely tripping of the protection device is not followed by a manual closure and thus there may be major failures, such as: failure of the anti-burglary systems or security systems in general, pumping systems, refrigeration devices.

[0005] These problems were addressed and solved by resetting electrical apparatuses to be associated to the protection devices which are capable of resetting and thus, automatically closing, i.e. without the manual intervention of the operator, such devices after a preset period of the tripping. As mentioned above, an electrical resetting apparatus of the prior art is described in the patent application published under reference EP1744428.

[0006] An object of the present description is to propose an improved electrical resetting apparatus with respect to the resetting apparatus of the prior art and which, in particular, is provided with an even more intuitive user interface and which guarantees even higher performance in terms of safety.

[0007] Such object is provided according to the invention through an electrical resetting apparatus as generally described in the attached claim 1. Preferred embodiments of said apparatus are described in the dependent claims.

[0008] Further characteristics and advantages of an apparatus according to the present description shall be apparent from the detailed description that follows, provided purely by way of non-limiting example, with reference to the attached drawings, wherein:

- figure 1 is a perspective view of an assembled electrical group comprising an electrical resetting apparatus and an associated protection device, in which the electrical apparatus is shown in a first operating configuration;
- figure 2 is a perspective view and with some parts removed of the electrical resetting apparatus of figure 1, in which the electrical apparatus is shown in a second operating configuration;
- figure 3 is a perspective view and with some parts removed of the electrical resetting apparatus of figure 1, in which the electrical apparatus is shown in a third operating configuration;
- figure 4a is a perspective view of the electrical apparatus of figure 1, in which the electrical resetting apparatus is shown in a fourth operating configuration;
- figure 4b is a perspective view of the electrical resetting apparatus of figure 1, in which the electrical apparatus is shown in the same operating configuration of figure 1;
- figure 5 shows a perspective view of three mutually assembled components of the electrical resetting apparatus of figure 1;
- figure 6a shows a perspective view of two components of the electrical resetting apparatus of figure 1, in which such components are shown separate from each other;
- figure 6b shows a perspective view of a further component of the electrical resetting apparatus of figure 1;
- figure 6c shows a perspective view of the further component of figure 6b together with one of the components of figure 6a;
- figure 6d shows a perspective view of a further component of the electrical resetting apparatus of figure 1;
- figure 7 is a plane view in which some inner parts of the electrical apparatus of figure 1 are represented, and in which the electrical apparatus is in the same operating configuration of figure 1;
- figure 8 is a plane view in which the inner parts of the electrical apparatus of figure 1 represented in figure 7 are represented, in which the electrical apparatus is in the operating configuration of figure 2;
- figure 8a is a view entirely similar to figure 8 in which one of the components of the electrical apparatus (i.e. the component represented in figure 6b) is shown in a different operating configuration;
- figure 9 represents a simplified functional block diagram of the electrical apparatus of figure 1;
- figure 10 is a plane view in which some inner parts of the electrical apparatus of figure 1 are represented, and in which the electrical apparatus is in the same operating configuration of figure 1;
- figure 11 is a plane view in which some inner parts of the electrical apparatus of figure 1 are represented, and in which the electrical apparatus is in the same operating configuration of figure 2;
- figure 12 is a plane view in which some inner parts of the electrical apparatus of figure 1 are represented, and in which the electrical apparatus is in the same operating configuration of figure 3;

- figure 13 is a plane view in which some inner parts of the electrical apparatus of figure 1 are represented, and in which the electrical apparatus is in a configuration of transition between the operating configuration of figure 3 and the operating configuration of figure 1;
- figure 14 is a perspective view of the electrical resetting apparatus of figure 1, in which the apparatus is shown in the operating configuration of figure 1;
- figure 15 is a perspective view of the protection device of figure 1; and
- figure 16 is a perspective view of the electrical resetting apparatus of figure 1, in which the apparatus is shown with some parts removed and in the operating configuration of figure 4.

[0009] With reference to figure 1, an electrical group 1, in assembled configuration, is shown, comprising an electrical protection device 20 operatively associated to an electrical resetting apparatus 10. From now henceforth in the present description the electrical resetting apparatus 10 shall be indicated, without entailing any restriction whatsoever, by the term "reset module 10".

[0010] The electrical protection device 20 is provided with input terminals 27i, 28i (for example, a phase terminal or a neutral terminal) for connection to a power supply network and with output terminals, not visible in the figures, for connection to an electric load circuit (such as, for example, a household electrical system). In a per se known manner, the electrical protection device 20 is such to acquire a closed operating state, in which the load circuit is connected to the power supply network, and an open operating step (figures 1 and 15), in which the load circuit is disconnected from the power supply network. In a per se known manner, the protection device 20 comprises a rotatable control lever 22 adapted to be moved to switch the operating state of the protection device 20, between two operating positions respectively corresponding to the open operating state (in the example when the lever 22 is directed downwards - figure 15) and to the closed operating state (in the example, when the lever 22 is directed upwards).

[0011] In the particular represented example, the electrical protection device 20 is a modular protection device such as for example a "miniature circuit breaker". The electrical protection device 20 can be, for example, one of the following conventional circuit breakers: automatic circuit breaker, differential circuit breaker, differential automatic circuit breaker. For the sake of simplicity, from now henceforth the electrical protection device 20 shall be indicated, without entailing any restriction whatsoever, by the term "circuit breaker module 20".

[0012] The circuit breaker module 20 comprises a container body 25 made of insulating material which houses electromechanical components (not shown in that known) therein. Furthermore, with reference to figure 15 the circuit breaker module 20 has at least on the lateral wall 81 adapted in use to face a lateral wall 101 of the reset module 10 a slotted aperture 82 in which an interface pin 92 projecting from the lateral wall 101 of the reset module 10 through a slotted aperture 102 can be inserted from outside. Such interface pin 92 is adapted to be mechanically coupled with an engaging and disengaging mechanism (not shown in that conventional) housed in the container body 25.

[0013] With reference to the attached figures, the reset module 10 comprises a container body 15, made of insulating material, for example including a central part 15' and two lateral shells 15", 15"' fixed to the central part 15', so as to define two inner subcompartments, one of which is indicated with V1, between the central part 15' and the lateral shell 15", and the other indicated with V2, between the central part 15' and the lateral shell 15"'. It should be observed that the reset module 10 is a module separated from the circuit breaker module 20, in that the container body 15 of the reset module 10 is independent from container body 25 of the circuit breaker module 20.

[0014] According to an embodiment, the container body 15 of the reset module 10 is provided with reversible fixing elements 19 which allow coupling and/or decoupling to/from the container body 25 of the circuit breaker module 20. According to an embodiment the abovementioned fixing elements 19 are provided according to the disclosure of the European patent application published under reference EP 2180495.

[0015] The reset module 10 comprises a first plurality of terminals 17i, 18i adapted to be connected to the power supply network, for example through the input terminals 27i, 28i of the circuit breaker module 20. Furthermore, the reset module 10 comprises a second plurality of terminals 16o,17o,18o, one of which 16o is adapted to be connected to an earth reference of the load circuit and the remaining two 17o, 18o are adapted to be connected, for example, through the output terminals of the circuit breaker module 20, to the load circuit.

[0016] The reset module 10 comprises:

- a resetting device 11, 13, 30, 31, 32 comprising a resetting arm 13 adapted to mechanically cooperate with the control lever 22 of the circuit breaker module 20; and
- a control circuit 50 adapted to be connected (in the example through the terminals 17o, 18o) to the electric load circuit to detect an operating state thereof in order to control the resetting device 11, 13, 30, 31, 32.

[0017] The resetting arm 13 is adapted to be operatively coupled to the control lever 22 of the associable circuit breaker module 20 so as to be integral thereto in rotation. For example, the resetting arm 13 is provided with a coupling channel 47 (figure 14) adapted to at least partly receive the control lever 22.

[0018] Furthermore the reset module 10 comprises a slidable protective cover 24, for example of the type analogous to the one described in the previously mentioned

patent application EP 1744428, slidably coupled to the container body 15 so as to be manually translated between two operating positions, respectively sectioning (figure 4a) and resetting (figure 4b) positions. Advantageously the slidable protective cover 24 projects laterally with respect to the container body 15 from the side of the associable circuit breaker module 20, so as to prevent a manual actuation by direct contact with the resetting arm 13 and/or with the control lever 22.

[0019] According to an embodiment, the reset module 10 comprises an electric motor 30, for example of the reversible synchronous type, operatively connected to the resetting arm 13 through mechanical coupling components 31, 32, such as for example a plurality of toothed wheels 31 and a thrust gear 32.

[0020] As observable in figures 6 and 7, the electric motor 30 comprises a drive shaft 30' rotatable around a rotation axis M-M.

[0021] According to a non-limiting embodiment, the electric motor 30 is a 12 V motor and the mechanical coupling components 31,32 allow connecting the resetting arm 13 to the electric motor 30 so as to guarantee a desired reduction ratio.

[0022] Preferably the mechanical coupling components 31, 32 are such that the resetting arm 13 can acquire an operating coupling configuration (for example, represented in figure 7), in which a rotation of the resetting arm 13 is constrained to a movement of the electric motor 30, and an idle configuration (for example in the configuration of figure 8a), in which the resetting arm 13 can rotate freely without being braked or blocked by the motor 30 (for example to allow the resetting arm 13 to follow - with a suitable speed - a tripping of the associated circuit breaker module 20 and move to the configuration of figure 3). In order to attain what has been indicated above, it can for example be provided for that the resetting arm 13 be operatively coupled to the motor 30 through a thrust gear 32 rotatably coupled with clearance to the resetting arm 13 and rotatably rigidly coupled to the motor 30, for example through one or more toothed wheels 31. More in particular, in the represented example the thrust gear 32 is provided with a toothed outer part 132, with a central part 38 pivoted around the same rotation axis R-R of the resetting arm 12. Between the central part 38 and the toothed part 132 there is provided a hollow part so that the central part 38 can be received in a recess 45 arranged at the base of the resetting arm 13. The hollow part of the gear 6b has two abutment walls 232', 232" which, according to the relative direction between the thrust gear 32 and the resetting arm 13, are such to interfere in abutment or without abutment with an axial locking element 145 of the resetting arm 13. For example in figure 6c, there is a situation of interference with abutment hence the resetting arm 13 cannot rotate freely in the direction of the arrow IV without driving the thrust gear 32 to rotate it in the same direction. In this configuration, the abovementioned rotation of the resetting arm 13 is hindered (or at least slowed down) by the mechanical coupling components 31, 32 and by the motor 30. It is thus evincible how, starting from the configuration of figure 6c, by rotating the gear 32 by a limited angle (for example corresponding to the travel of the resetting arm 13) in the direction of the arrow IV, there no longer occurs an abutment interference between the wall 232" and the axial locking element 45, hence the resetting arm 13 is free to rotate by the abovementioned limited angle in the direction of the arrow IV. Thus, with reference to figures 7, 8, 8a:

- in the configuration of figure 7 the abutment wall 232" of the thrust gear 32 interferes in abutment with the axial locking element 45, thus rotating the gear 32 clockwise through the motor 30 allows moving the resetting arm 13 in the configuration of figure 8;
- in the configuration of figure 8 the abutment wall 232" still interferes in abutment with the axial locking element 145, hence the resetting arm 13 may not freely rotate anticlockwise for example to follow the lowering movement of the control lever 22 of the circuit breaker module 2o due to tripping;
- starting from the configuration of figure 8 it is possible to rotate anticlockwise - through the motor 30 - the thrust gear 32 by an amount corresponding to the angular travel of the resetting arm 13 so as to obtain the configuration of figure 8a in which the resetting arm 13 is free to follow - without any hindrance - a tripping of the associated circuit breaker module 20.

[0023] With reference to figure 9, the control circuit 50 comprises a check electronic block 51 adapted to be connected to the load circuit and such to detect a failure condition or a normality condition of the load circuit, by activating - in the second case - a control circuit 53 adapted to control the electric motor 30.

[0024] According to an embodiment, the control circuit 50 comprises a printed circuit board housed in the container 15 and power supplied by voltage regulator 35 adapted to provide in output a direct current, for example equivalent to 12 Volts, starting from an alternating current supplied by the power supply network.

[0025] The check block 51, preferably integrated in the printed circuit board, can for example be provided through technologies known in the industry. The check block 51 is connected to the load circuit and it is capable of performing electrical parameter measurements of the load circuit. Furthermore, the check block 51 is capable of detecting whether the reset module 20 is in the open state.

[0026] The check block 51, upon detecting that the circuit breaker module 20 is in the open state, is such to start one or more measurements regarding the load to evaluate whether it is in an actual failure condition or whether the cause of the opening of the circuit breaker module 20 is only temporary (for example, due to an untimely tripping of the circuit breaker module 20). Regarding the type of measurements that can be carried out by

the check block 51 reference shall be made to the description subject of the aforementioned European patent application EP 1744428.

[0027] According to an embodiment, the reset module 10 comprises a detection / driving lever 34', 34" rotatably hinged to the container body 15 and adapted to be coupled to the reset module 20 through an interface pin 92 which, due to the provision of a slotted aperture 102, traverses the lateral wall 101 of the container body 15 to be interfaced with the mechanism for disengaging the circuit breaker module 20. With reference to figure 6d, in the represented particular example, such lever 34', 34" comprises two parts 34', 34" respectively housed in the compartment V1 and in the compartment V2, which are integral in rotation with respect to each other for example being hinged at the same end portion to the container body 15 through a respective pin 73, 73' and being made integral with respect to each other by the same interface pin 92 which for example traverses two engagement apertures 72' and 72" respectively provided for in the part 34' and in the part 34".

[0028] The detection/driving lever 34',34", besides enabling the check block 51 to detect a condition of occurred tripping of the circuit breaker module 20, also enables, as better outlined hereinafter, the reset module 10 to impart a tripping to the circuit breaker module 20. In order to perform the detection function, the detection/driving lever 34', 34" can for example be provided with a seat 36 for housing the mobile part, such as for example a small permanent magnet, with a Hall effect sensor. It should also be observed that advantageously providing the mobile part with a Hall effect sensor coupled to the detection/driving lever 34', 34" allows the check block 51 to distinguish whether the opening of the circuit breaker module 20 occurred following a manual intervention or following an automatic tripping of the circuit breaker module 20.

[0029] Furthermore, the control circuit 50 comprises a circuit 52 for controlling a sectioning actuator 40. Such sectioning actuator 40 is for example a solenoid linear electromagnetic transducer 40 which can be directly supplied, through a power switch 41 controlled by the control circuit 52, by the alternating voltage of the power supply network.

[0030] Furthermore the reset module 10 comprises sectioning elements c1, c2, c3 adapted to be actuated for connecting / disconnecting the control circuit 50 to/ from the load circuit. According to an embodiment, each of the abovementioned sectioning elements c1, c2, c3 include fixed electrical contacts 60 and movable electrical contacts 62 provided for connecting or disconnecting the control circuit 50 to/from the load circuit with respect to each other. According to an advantageous and non-limiting embodiment, the abovementioned sectioning elements c1, c2, c3 also comprise electrical contacts c1 adapted to interrupt a power supply line L_m provided between the control circuit 50 and the resetting electric motor 30.

[0031] The reset module 10 also comprises a control handle 11, 12 rotatable around a rotation axis (axis R-R in figure 5) and adapted to be actuated to manually rotate the resetting arm 13. As evincible from the joint observation of figures 5 and 7, in the represented particular example the rotation axis R-R of the control handle 11,12 is perpendicular to the rotation axis M-M of the electric motor 30.

[0032] The control handle 11, 12 comprises a first 11 and a second 12 handle portion adapted to rotate with respect to each other around the rotation axis R-R and articulated to each other like calipers.

[0033] The first handle portion 11 is operatively coupled with sectioning elements c1, c2, c3 and it is rotatable around the rotation axis R-R between two distinct angular positions each corresponding to a respective open/ closed state of the sectioning elements c1, c2, c3. In the example represented in the figure, when the first handle portion 11 is directed upwards (figures 2,3,11,12), the sectioning elements c1, c2, c3 are in the closed state, hence the control circuit 50 is connected to the load circuit and the power supply line L_m of the electric motor 30 is not interrupted. On the contrary, when the first handle portion 11 is directed downwards (figures 1, 4, 10) the sectioning elements c1, c2, c3 are in the open state, hence the control circuit 50 is disconnected from the load circuit and the power supply line L_m of the motor is interrupted. According to a preferred embodiment, a torsion spring 21 is operatively interposed between the first handle portion 11 and the body 15 for containing the reset module 10 and it is adapted, in absence of external restraints, to move the first handle portion 11 in the angular position corresponding to the open state of the sectioning elements c1, c2, c3 (figure 10).

[0034] As clearly observable in figures 5 and 6a, the second handle portion 12 is integral in rotation with the resetting arm 13, to rotate around the rotation axis R-R. For example, the second handle portion 12 and the resetting arm 13 are provided in two distinct pieces, for example made of insulating plastic, which are operatively coupled to each other by fitting a grooved appendage 33 of one of said pieces (in the example of the piece 13) into a counter-shaped retention seat provided in the other of said pieces (in the example in the piece 12, but not visible in the figures).

[0035] As observable in figures 1-4, the control handle 11, 12 is such to be adapted to acquire a first operating configuration (figures 1, 2 and 4a), or aligning configuration, in which the handle portions 11, 12 are substantially aligned with respect to each other and one in abutment against the other and a second operating configuration, or opened out configuration, in which such handle portions 11, 12 are angularly spaced apart (figure 3).

[0036] According to an embodiment, the first 11 and the second 12 handle portion respectively comprise a first f1 and a second f2 face which are parallel to and facing each other in the alignment operating configuration of the handle 11, 12. According to an advantageous

embodiment, the control handle 11, 12 bears a graphical/written indication 14 that is visible only when the control handle 11, 12 is in the opened out operating configuration (figure 3) and that is indicative of a situation of possible danger (for example, of an imminent resetting of the circuit breaker module 20). For example, such graphic indication is a writing or a drawing provided or applied on at least one of the abovementioned first f1 or second f2 face, or between said faces f1, f2, or generally on any point of the first 11 and/or of the second 12 handle portion which is only visible when the control handle 11, 12 is in the opened out operating configuration.

[0037] According to an embodiment, the handle portions 11, 12 respectively comprise:

- a first 11' and a second arm 12';
- a first 11" and a second 12" end portion distal from the rotation axis R-R connected respectively to the first 11' and to the second 12' arm, the distal end portions 11", 12" being shaped so as to form, in the alignment operating configuration (figures 1, 2 4), a single ergonomic end for gripping the control handle 11,12. Preferably, such gripping end is shaped as a bar directed parallel to the rotation axis R-R.

[0038] According to a further embodiment, the second handle portion 12 comprises a rotary base body 42 having a substantially cylindrical shape hinged around the rotation axis R-R, and the first handle portion 11 comprises a rotary base body 41 within which the rotatable body 42 of the second handle portion 12 is at least partly fitted. In the particular represented example, the arm 11', 12' of each handle portion 11, 12 projects radially from the respective rotary base body 41, 42.

[0039] According to an embodiment, the first handle portion comprises a driving element 91, such as for example a projecting appendage 91 (visible in figure 5) adapted to cooperate with the slidable protective cover 24 so that when the latter is moved manually from the resetting position to the sectioning position, the first handle portion 11, starting from the angular position (figures 2,3) corresponding to the closed state of the sectioning elements c1, c2, c3 moves, possibly also driving the second handle portion 12, to the angular position (figure 4a) corresponding to the state for sectioning, or opening, the sectioning elements c1, c2, c3.

[0040] With reference to figures 5 and 16, according to an embodiment, the slidable protective cover 24 comprises a safety locking element 23 (such as for example a projecting appendage 23) adapted to cooperate with a conjugated safety locking element 43 of the resetting arm 13 (such as for example a retention seat 43), adapted to prevent a rotation of the resetting arm 13 when the slidable protective cover 24 is in the sectioning position (figure 4a and 16).

[0041] With reference to figures 10-13, the reset module 10 comprises a coupling linkage between the first portion handle 11 and the sectioning elements c1, c2, c3. Preferably such coupling linkage is a linkage for overcoming the dead centre adapted to guarantee two stable positions of the first handle portion 11.

[0042] With reference to the particular described example, the sectioning elements c1, c2, c3 comprise pairs of fixed contacts 60 and movable contacts 62 adapted to establish/interrupt electrical connections between an associated pair of fixed contacts 60. The fixed contacts 60 are for example pins while the movable contacts 62 are elastic blades, each of which is adapted to establish an electrical connection between an associated pair of pins 60.

[0043] The coupling linkage comprises a thruster 65 to which the fixed contacts 62 are permanently fixed. The thruster 40 is slidably housed in the retention body 15 and it is adapted to slide between two operating positions, respectively connection (figures 11 and 12) and sectioning (figure 10) positions. In a preferred embodiment, the coupling linkage comprises a spring 56, for example helical and compression spring, adapted to thrust the thruster 65 in the operating sectioning position, so that the sectioning elements c1, c2, c3 can be defined of the normally open contact type.

[0044] According to an embodiment, the thruster 65 is such to cooperate with the detection/driving lever 34', 34", for example through a contact appendage 67 provided for in the thruster 65, so that when passing from the operating connection position to the operating sectioning position, the thruster 65 causes the rotation of the detection/driving lever 34', 34" to a point, through the interface pin 92, of determining a tripping of the circuit breaker module 20.

[0045] In the exemplified case, the coupling linkage also comprises a transmission lever 67, in the example of the crank type, having an end portion connected to the thruster 65, in particular hinged to the latter, and an opposite end portion connected by means of a crosspiece 68, for example made of metal, to the base body 41 of the first handle 11. The crosspiece 68 has a first end portion rotatably hinged to the base body 41 of the first handle 11, for example inserted in an opposite retention seat 41' (figure 5) provided in the base body 41, and an opposite second end portion adapted to cooperate with the transmission lever 67. In particular, the second end portion is adapted to acquire an engagement condition, in which the latter is rotatably hinged to the transmission lever 67, and a disengagement condition, in which the latter is free to slide with respect to the transmission lever 67, for example translating in a slotted aperture 69 provided for in the latter.

[0046] The transmission lever 67 is rotatable around a rotation axis parallel to the rotation axis R-R, being for example rotatably hinged to the container body 15.

[0047] The coupling linkage also comprises an intervention lever 70 and a disengagement lever 71, the intervention lever 70 being operatively interposed between the sectioning actuator 40 and disengagement lever 71. The disengagement lever 71 is rotatably coupled to the

transmission lever 67 and the intervention lever 70 is rotatably coupled to the container body 15. As clearly observable in the figures, the intervention lever 70 is such to cooperate with the disengagement lever 71 so as to influence the operating condition (engagement/ disengagement) of the second end 68" of the crosspiece 68. In particular, in the exemplified case, the sectioning actuator 40 comprises a piston 49 which can be moved linearly between an advanced position (figure 13) and a receded position (figures 10-12). Such movement may occur automatically following a control imparted by the control circuit 50, and in this case it may for example come from the check block (should the latter for example detect a permanent failure situation in the load circuit), or it may derive from a remote control sent by a remote operator.

[0048] When passing from the receded position to the advanced position (figure 13) the piston 49 is such to determine a rotation of the intervention lever 70 which in turn is such to determine a rotation of the disengagement lever 71 after which the second end 68" of the crosspiece 68 is free to slide in the slotted guide 69. This determines, due to the thrust of the spring 66, a translation of the thruster 65 - and thus a sectioning of the contacts 60, 62 - and a simultaneous rotation of the transmission lever 67, due to the spring 66. Still simultaneously, the first handle portion 11 under the effect of the torsion spring 21 (figure 10) rotates downwards possibly also driving the second handle portion 12 and the reset module 10 returns to the configuration of figure 1. In the translation of the thruster 65, the contact appendage 67 provided in the thruster 65 is such to determine a rotation of the detection/driving lever 34 which in turn is such to determine, through the interface pin 92, a tripping of the circuit breaker module 20 through the disengagement and engagement mechanism comprised therein.

[0049] With reference to the attached figures, following is a brief illustration of the operation of the electrical group of figure 1, for example should the latter be connected to an electric load circuit constituted by an electrical power supply, for example of a residential building, and should the protection device 20 be a circuit breaker 20 of the type referred to by the name "miniature circuit breaker".

[0050] In a first operating configuration, for example the initial one, the electrical group 1 is in the operating configuration of figure 1 in which the circuit breaker module 20 is open and the reset module 10 is in a sectioning state (figure 10). In such state the control circuit 50 is disconnected from the load circuit and the check block 51, though power supplied, cannot verify the state of the load circuit and thus it cannot impart to the motor 30 a control for resetting the circuit breaker module 20. Furthermore, also the sectioning (sectioning elements c1) of the power supply line L_M of the electric motor 30 is provided in the described example as a further safety measure.

[0051] Starting from the operating configuration of figure 1, an operator desiring to supply the load circuit with power may manually move the reset module 10 to the operating configuration of figure 2 (and thus of figure 11), hence implying a manual reset of the circuit breaker module 20. Starting from this operating configuration, for example following a tripping of the circuit breaker module 20, the resetting device 20 acquires the operating configuration of figure 3 (and thus of figure 12). In this operating configuration, the check block 51 can carry out measurements on the load. It should be observed that it can be provided for that in this configuration an danger indicator 14, warning of the fact that the load is supplied with power but it is not sectioned and thus it could be close to resetting, be visible by a user. In this configuration, the user is aware of a possible nearing resetting and thus could avoid performing maintenance operations on the load circuit.

[0052] Starting from the configuration of figure 3, should the check block 51 not detect (possibly even after a given number of attempts) a failure situation, the control circuit 40 may control the electric motor 30 so as to return the electrical group 1 to the operating configuration of figure 2. On the contrary, should the check block 51 detect a situation of permanent failure, the control circuit 50 may control the sectioning actuator 40 so as to return the electrical group 1 to the configuration of figure 1.

[0053] Starting from any of the operating configurations described above, a manual actuation of the slidable protective cover 24 which determines a translation thereof downwards is such to move the reset module 10 to the operating configuration represented in figures 4a and 16. It is also possible to provide- in the reset module 10 - a safety system for locking the cover 24 in this position, for example by sealing or by means of a padlock, so as to avoid untimely reset by third parties.

[0054] According to the description above, it is thus possible to understand how a resetting apparatus of the previously described type allows attaining the preset objectives. Actually, it should be observed that due to the control handle 11, 12 the resetting apparatus is capable of simultaneously offering a simple, intuitive and safe use.

[0055] Without prejudice to the principle of the invention, the embodiments and construction details may widely vary with respect to what has been described and illustrated purely by way of non-limiting example, without departing from the scope of the invention as defined in the attached claims.

Claims

1. Electrical resetting apparatus (10) adapted to be associated with a protection device (20) provided with a control lever (22) adapted to be actuated to electrically connect/disconnect an electric load circuit to/ from a power supply network, the electrical resetting apparatus (10) comprising:

- a resetting device (13, 30, 31, 32), adapted to be connected to the power supply network, comprising a rotating resetting arm (13) adapted to mechanically cooperate with the control lever (22);
- a control circuit (50) adapted to be connected to the electric load circuit for detecting an operating state thereof in order to control said resetting device (13, 30, 31, 32);
- sectioning elements (c1, c2, c3) adapted to be actuated to take up a first or a second operating state, for respectively connecting/disconnecting the control circuit (50) to/from the load circuit;
- a control handle (11,12) rotatable around a rotation axis (R-R), adapted to be actuated to manually rotate the resetting arm (13);

characterised in that
the control handle (11,12) comprises a first (11) and a second (12) handle portion adapted to rotate with respect to one another around said axis (R-R) and articulated like calipers, the first portion (11) being operatively coupled with sectioning elements (c1, c2, c3) and adapted to rotate between two distinct angular positions each corresponding to a respective operating state of the sectioning elements (c1, c2, c3).

2. Electrical resetting apparatus (10) according to claim 1, wherein the second handle portion (12) is such to rotate as a unit with the control arm (13).

3. Electrical resetting apparatus (10) according to claim 1, wherein the control handle (11,12) is such to be adapted to acquire an alignment operating configuration wherein the first and the second handle portion (11,12) are substantially aligned and facing one another and an opened out operating configuration wherein such handle portions (11,12) are angularly spaced apart.

4. Electrical resetting apparatus (10) according to claim 3, wherein the control handle (11, 12) bears a graphical/written indication (14) that is visible exclusively when the control handle (11, 12) is in the opened out operating configuration and that is indicative of a situation of possible danger.

5. Electrical resetting apparatus (10) according to claims 3 or 4, wherein the handle portions respectively comprise a first (11") and a second (12") end portion distal from said rotation axis (R-R), such distal end portions (1", 12") being shaped so as to form a single ergonomic end for gripping the control handle (11,12), in the alignment operating configuration.

6. Electrical resetting apparatus (10) according to any one of the previous claims, wherein the second handle portion (12) comprises a rotary base body (42) hinged to rotate around said rotation axis (R-R), and wherein the first handle portion (11) is rotatably hinged around said rotary base body (42).

7. Electrical resetting apparatus (10) according to any one of the previous claims, further comprising a linkage for coupling said first handle portion (11) to said sectioning elements (c1, c2, c3), said linkage being of the dead-centre overcoming type.

8. Electrical resetting apparatus (10) according to claim 7, wherein said coupling linkage comprises a thruster suitable for translating between two operating positions to influence the operating state of said sectioning elements.

9. Electrical apparatus according to claims 7 or 8, also comprising a spring (56) suitable for thrusting the thruster (65) in an operating position wherein said sectioning elements (c1, c2, c3) acquire said second operating state.

10. Electrical group (10,20) comprising an electrical protection device (20) adapted to connect/disconnect a load circuit to/from a power supply network,
characterised in that it comprises an electrical resetting apparatus (10) according to any one of the previous claims.

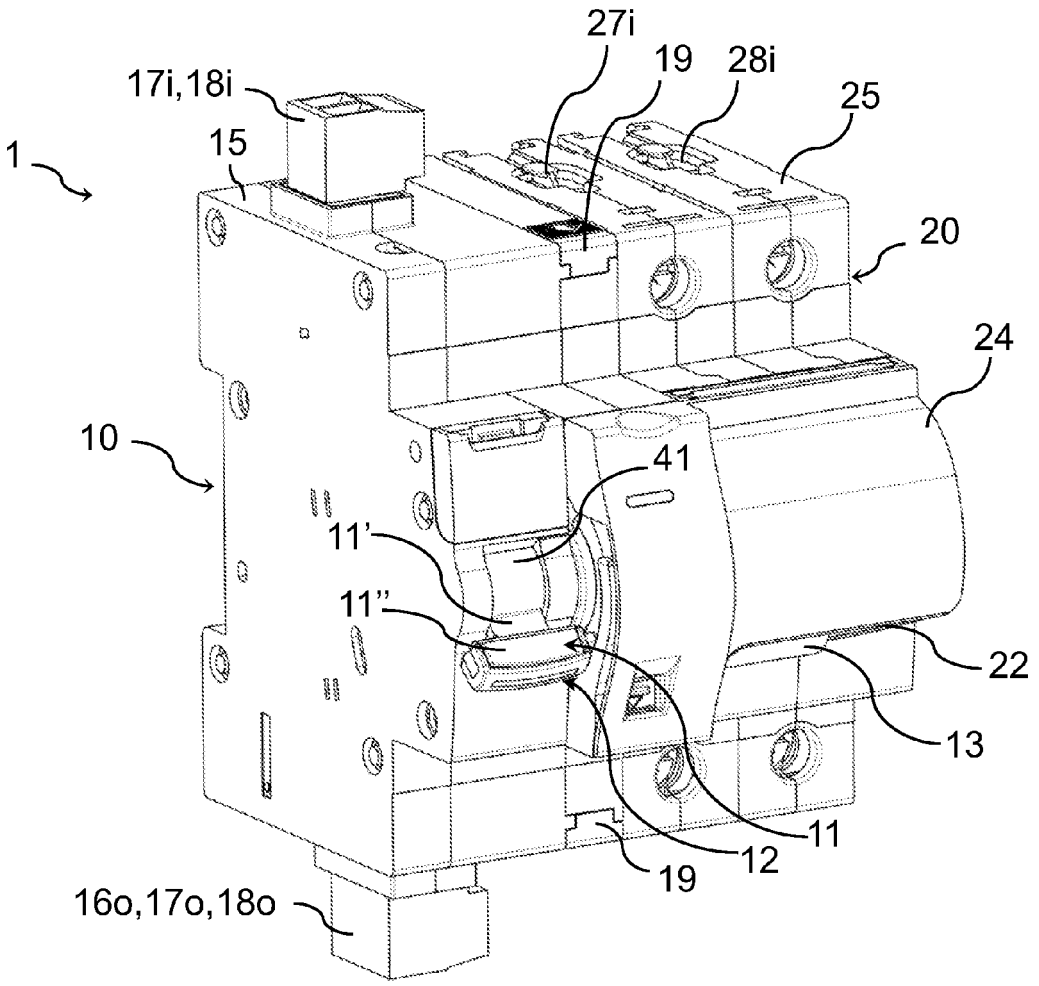
27i
19
28i
25
17i,18i
15
1
20
24
10
41
11'
11''
22
13
11
12
19
16o,17o,18o

FIG 1

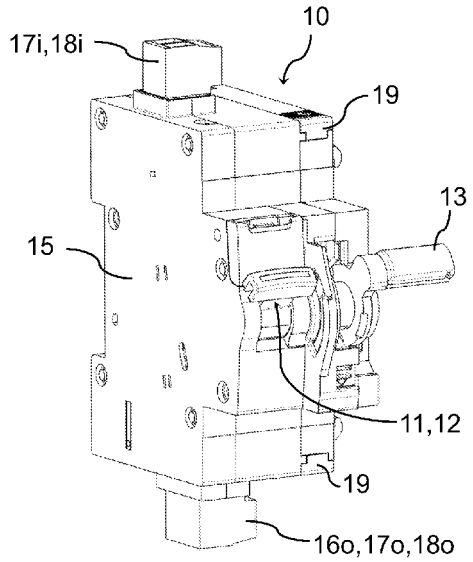
10
17i,18i
19
13
15
11,12
19
16o,17o,18o

FIG 2

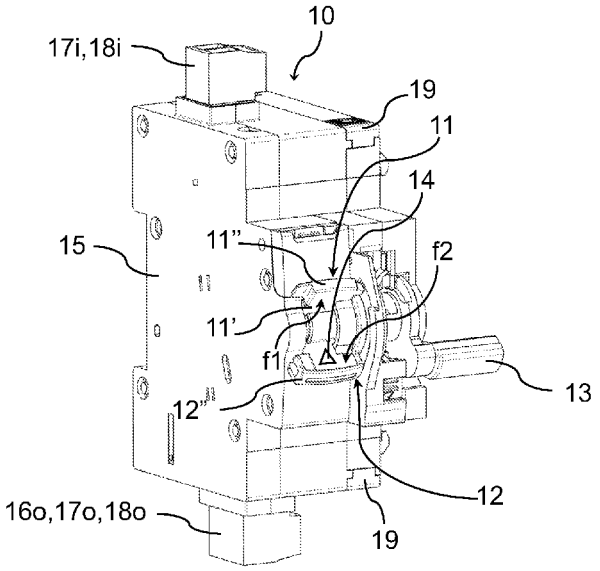
10
17i,18i
19
11
14
15
11"
f2
11'
f1
13
12"
12
16o,17o,18o
19

FIG 3

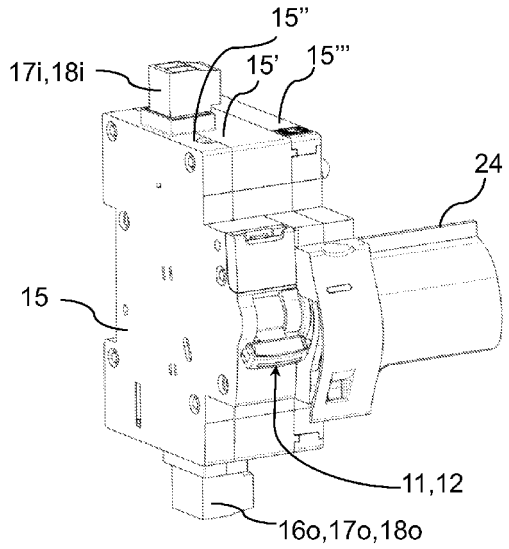
15”
17i,18i
15’
15’’’
24
15
11,12
16o,17o,18o

FIG 4a

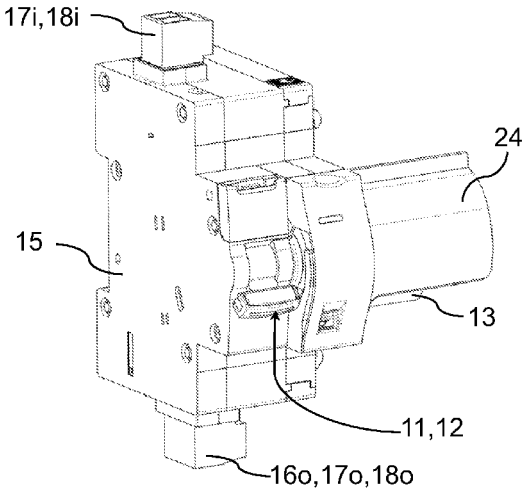
17i,18i
24
15
13
11,12
16o,17o,18o

FIG 4b

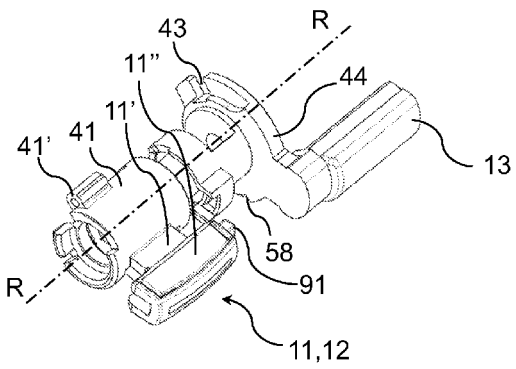

FIG 5

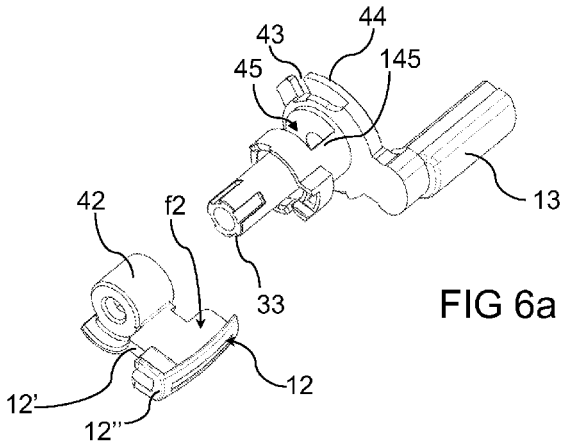

FIG 6a

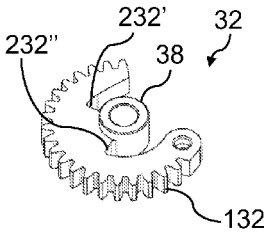

FIG 6b

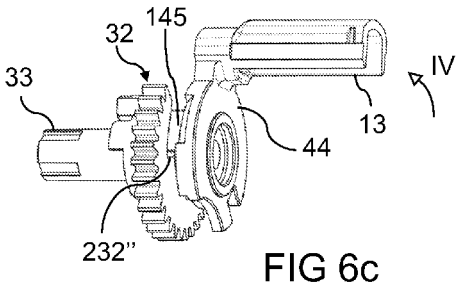

FIG 6c

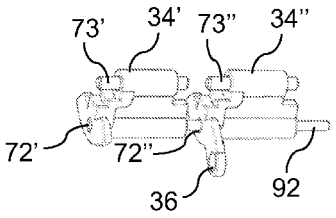

FIG 6d

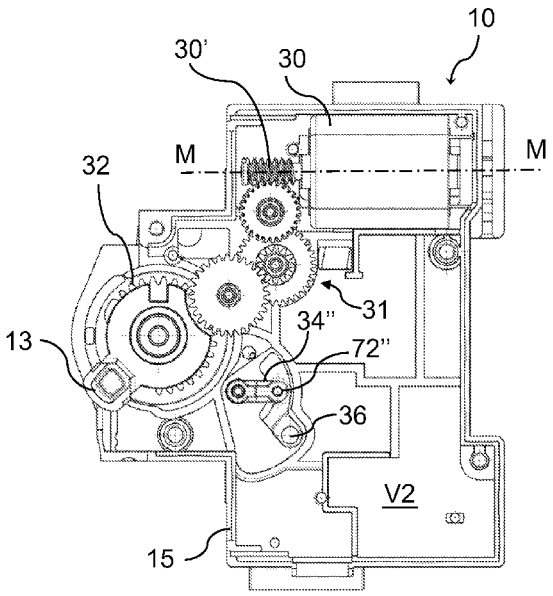

FIG 7

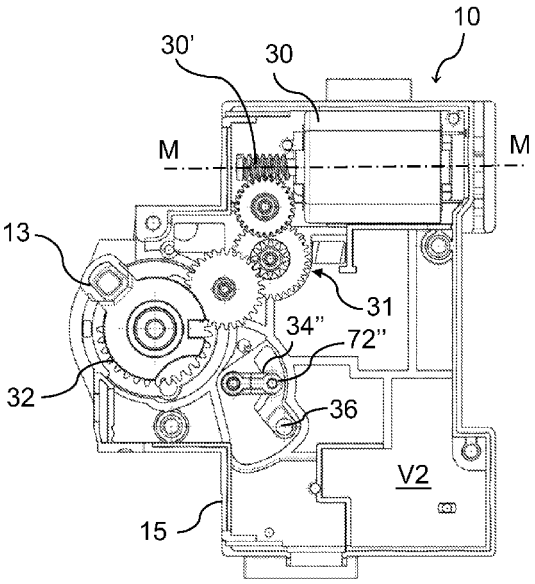

FIG 8

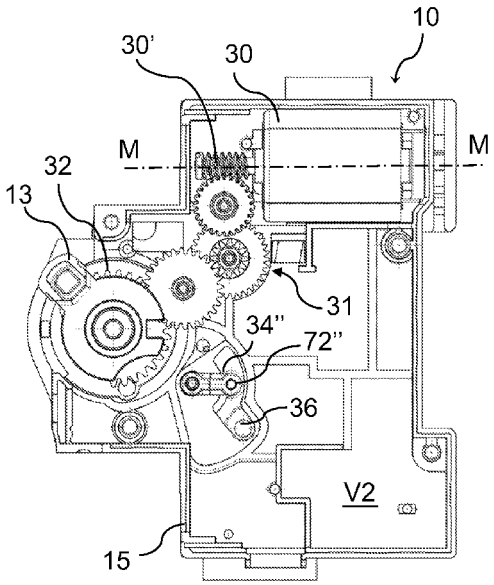
10
30'
30
M
M
32
13
31
34''
72''
36
V2
15

FIG 8a

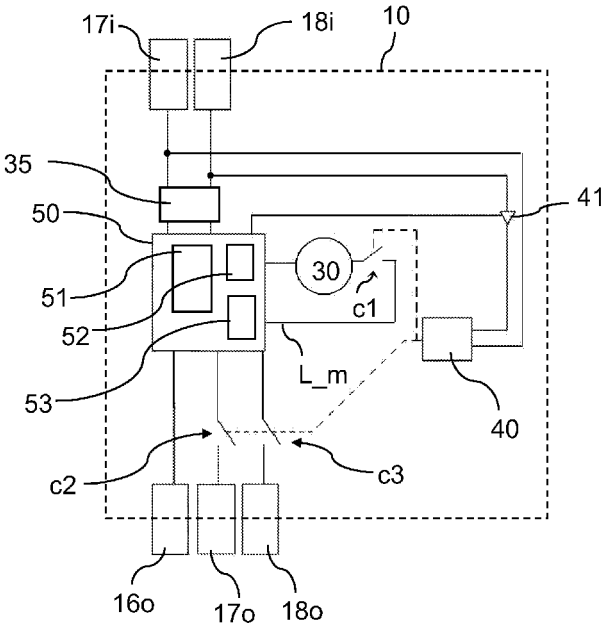
17i
18i
10
35
41
50
30
51
c1
52
L_m
53
40
c2
c3
16o
17o
18o

FIG 9

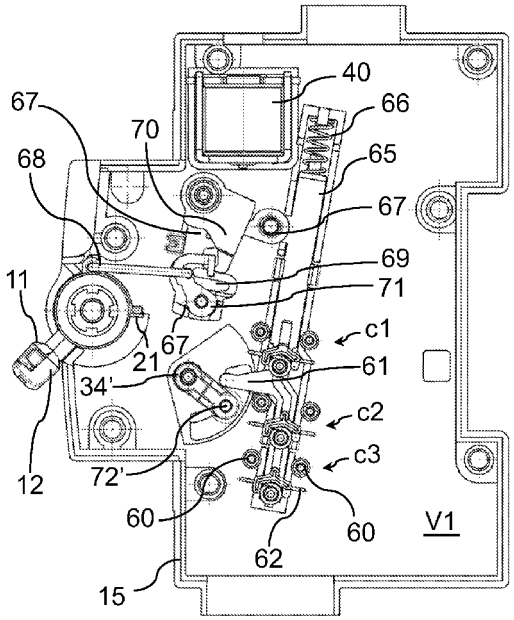
67
70
68
40
66
65
67
69
71
11
67
21
c1
61
34'
c2
c3
12
72'
60
60
62
V1
15

FIG 10

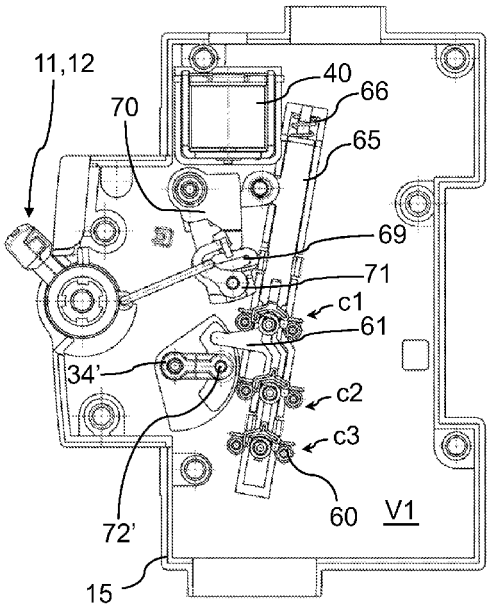
11,12
70
40
66
65
69
71
c1
61
34'
c2
c3
60
V1
72'
15

FIG 11

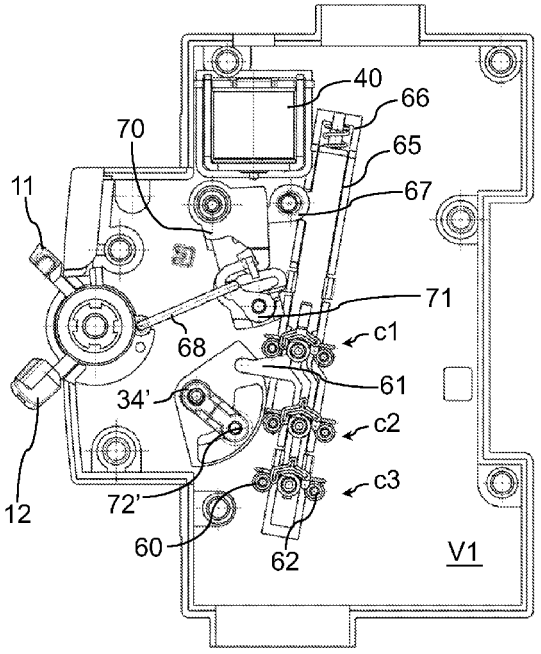
40
66
70
65
11
67
71
68
c1
61
34'
c2
c3
72'
12
60
62
V1

FIG 12

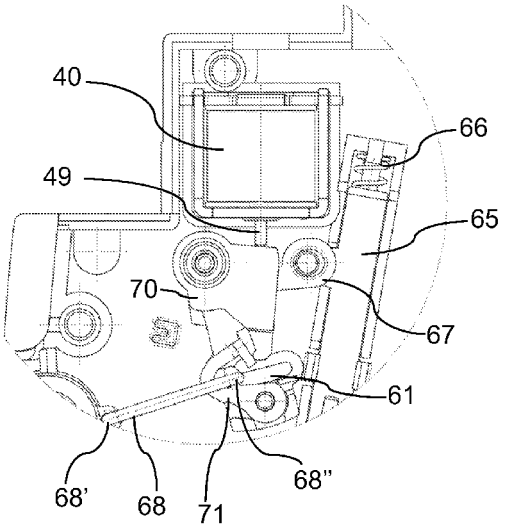
40
66
49
65
70
67
61
68'
68
71
68"

FIG 13

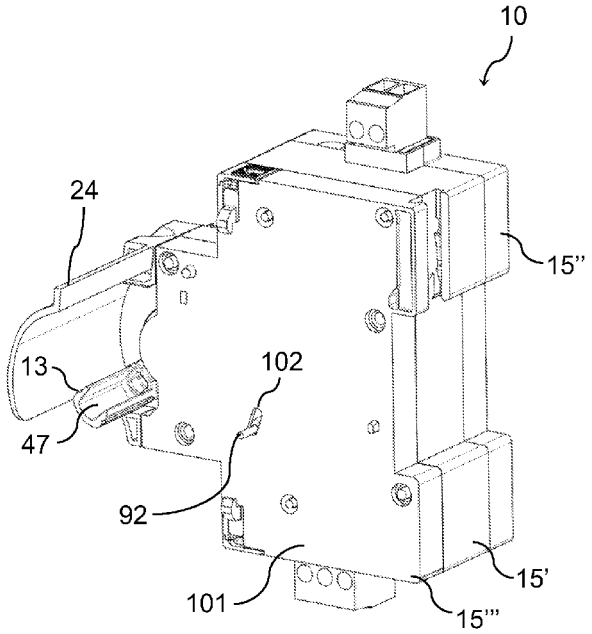

FIG 14

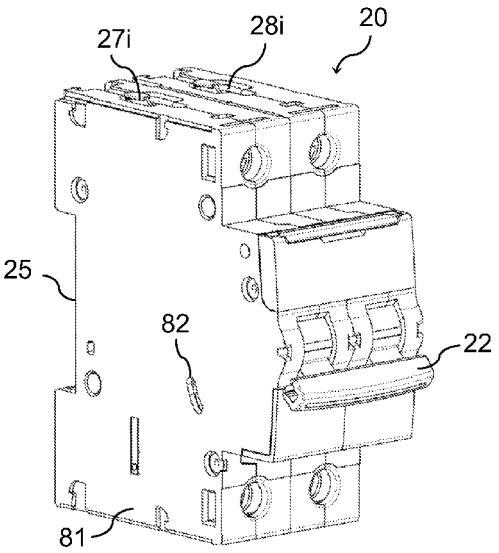

FIG 15

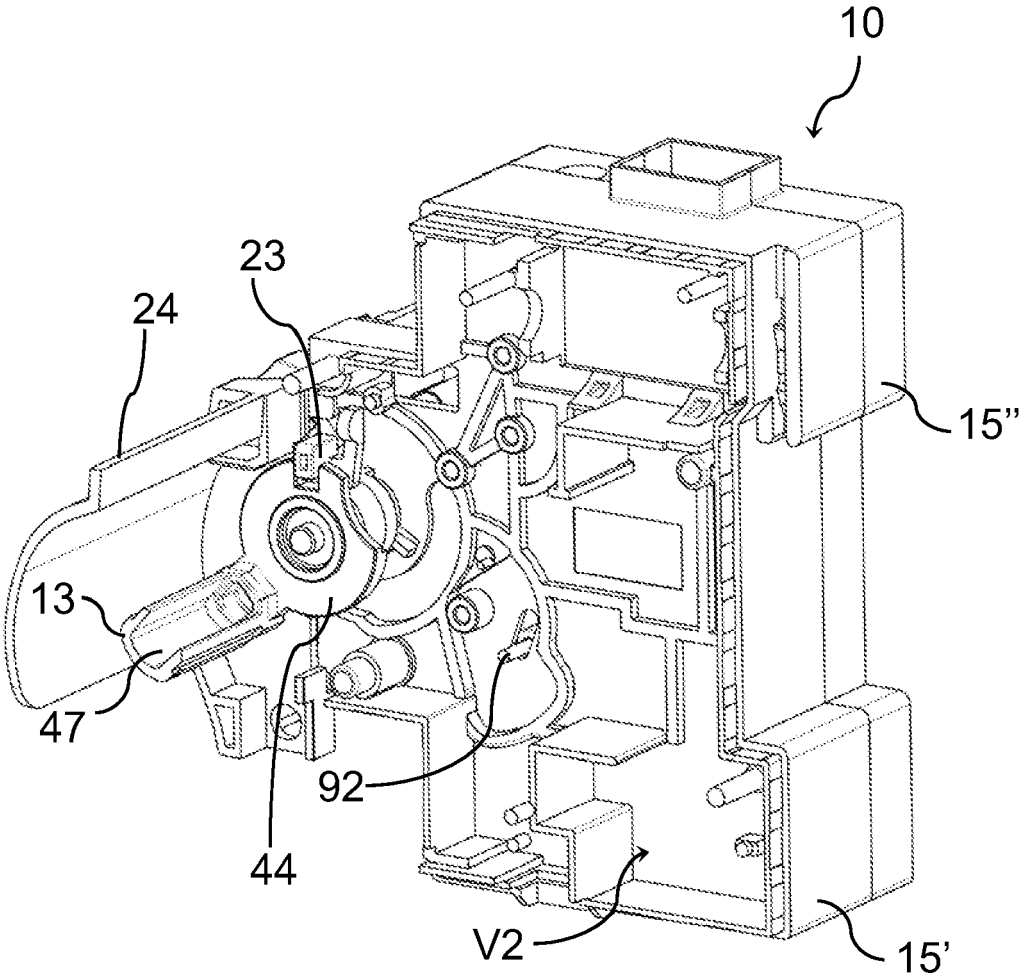

FIG 16

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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 9956

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 July 2011	Ruppert, Christopher

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