(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 576 151 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.06.2025 Bulletin 2025/26

(21) Application number: **24222035.8**

(22) Date of filing: **20.12.2024**

(51) International Patent Classification (IPC):
H01H 71/02 *(2006.01)* ***H01H 71/08*** *(2006.01)*
H01H 9/02 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H01H 71/0214; H01H 71/08; H01H 9/0264; H01H 71/0221

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(30) Priority: **22.12.2023 BR 102023027379**

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(54) CIRCUIT BREAKER COMPRISING FIXED TERMINALS

(57) The present invention relates to a circuit breaker (100) comprising a molded base (200) comprising: at least one housing (220) of a thermomagnetic set (600) comprising at least one terminal housing (201), a plurality of tab housings (202), a plurality of housings of a first rear tab (203) and a plurality of housings of a second rear tab (204). The present invention also relates to a circuit breaker (100) comprising a molded base (200) comprising: at least one arc extinguishing chamber (230) housing comprising at least one terminal housing (244), at least one pair of tab housings (245), at least one housing of a first rear tab (247) and at least one housing of a second rear tab (246).

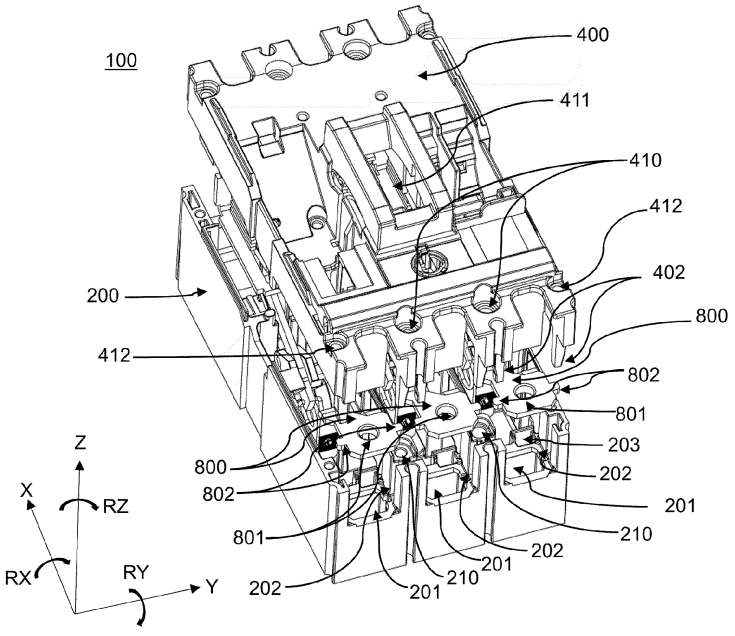

Fig. 4

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Description

Technical Field

[0001] The present invention pertains to the field of breakage switches with arc extinguishing or arc prevention means. The present invention also pertains to the field of circuit breaker terminals.

Introduction

[0002] The present invention relates to a circuit breaker, more specifically to a circuit breaker having, by convention, a front side (related to a thermomagnetic set) and a rear side (opposite to the first and normally related to a gas extinguishing and outlet chamber) comprising at least one fixed terminal comprising upper and rear tabs, a molded cover comprising fixing rods and a molded base comprising housings, in which this set of elements simultaneously prevents both rotation and translation of the terminal, giving it sufficient mechanical and positional resistance to withstand the screwing torque and the pull-out force of conductors (wires or bars or the like) connected to it.

Background of the Invention

[0003] As is common knowledge for a person skilled in the art, molded case circuit breakers can have their working based on thermal, magnetic, thermomagnetic or even electronic principles, through the movement of electrical contacts, and can be used, above all, to protect electrical circuits subject to short-circuits and/or electrical overloads generated by electrical current levels that exceed a nominal limit previously established by connection of input and output terminals, connected to the electrical supply circuit to be protected.

[0004] Thus, it can be seen that circuit breakers fundamentally work similarly to electrical switches, i.e., they work to change the electrical conduction state of an electrical circuit between the "on" and "off" states. In addition to actuating automatically, conventional circuit breakers also comprise an operating handle that can be operated by a user. In this type of molded case construction, it is typical for the current carrying capacity to support relatively high values, for example, between 30A to 1600A or more.

[0005] This type of electrical device requires a manual installation step by a user to enable the use of circuit breakers in their electrical circuit. Therefore, a solution that can optimize and facilitate the assembly of these circuit breakers would be able to optimize both the time and costs involved in installing circuit breakers, in addition to preventing accidents and damages involved in this type of operation by users.

Prior art

[0006] Solutions known in the prior art for circuit breakers of the type discussed here can be verified in prior art documents such as the European document EP 2863410, entitled *"Trip device for circuit breaker"*, which presents a trip device for a circuit breaker that includes a first terminal connected to a power supply side, a second terminal connected to a load side and a bimetal having one side connected to the first terminal and the other side connected with said second terminal, so that a current can flow through it, wherein said bimetal comes into surface contact with at least one of said first terminal and the second terminal, with an arc-resistant element interposed between them.

[0007] Despite presenting a circuit breaker comprising a trip device with two terminals and a bimetal between them, EP 2863410 did not present any type of surface tab for clamping these terminals, or even an internal configuration on its cover that presses these terminals in such a way as to simultaneously prevent both their rotation and their translation without the use of screws or pressing or other fixing elements. Therefore, this configuration makes the terminal more difficult to stabilize, in addition to increasing resistance to torque and reducing the maximum pullout force of the set, for example, when fixing wires or bars to the terminals and when they are already connected and subject to various forces.

[0008] Other solutions such as document US 6448876, entitled *"Load terminal with conductive tang for use in a circuit breaker"*, refer, for example, to a load conductor for use with a circuit breaker that includes a load terminal, and a conductive tang engaged to each other. The load terminal is manufactured of a first material having a first electrical conductivity and the tang is manufactured of a second material having a second electrical conductivity. The first electrical conductivity of the first material is such that the load terminal remains at a high temperature during the circuit breaker operation to prevent interference with the function of a bimetallic strap assembled on the load terminal. The tang extends through a bend formed at the load terminal to prevent the bend from heating up during circuit breaker operation.

[0009] Similar to other known solutions, document US 6448876, despite presenting a circuit breaker terminal with arms that slide through an opening in the inner wall of the circuit breaker base, does not present a molded cover with a lower rod that presses these arms, or even a system that incorporates a bimetal in the terminals. Therefore, this configuration does not guarantee the stability of the terminal, in addition to reducing the maximum pullout force of the set, when the conductive wires are connected. Furthermore, this configuration is not capable of preventing unwanted rotation and translation of its internal terminals without the use of screws or pressing, or other clamping elements.

[0010] Thus, the state of the art does not provide robust, simple, and low-cost solutions for a linking term-

inal clamping system that is capable of being firmly fixed to a circuit breaker without the use of screws or pressing and prevents both rotation and involuntary translation of this terminal without the use of screws or other clamping elements.

[0011] There is therefore space for a circuit breaker that:

a) prevent involuntary rotation of its internal terminal in a simple manner, with low implementation costs and low material consumption;
b) do not use screws, reinforcement washers, rivets, and equivalent clamping elements dedicated or exclusive to clamping said terminal inside the molded base; and
c) allow rotational and translational jamming of the terminal through at least one pair of upper tabs and rear tabs of said terminal.

Objects of the invention

[0012] One of the objectives of the invention is to provide a circuit breaker, according to the characteristics of claim 1 of the attached set of claims.

[0013] Another objective of the invention is to provide a circuit breaker according to the characteristics of claim 2 of the attached set of claims.

[0014] Another objective of the invention is to achieve high resistance to the pullout of terminals from their seats when connected to wires.

[0015] Another objective of the present invention is to promote stability in the fixing of wires to the fixed terminals of circuit breakers.

[0016] Another objective of the present invention is to reduce the deformation of the walls adjacent to the fixed terminals during a pullout test, based on the IEC 60947-1 Standard.

[0017] Additional characteristics and details thereof are presented in the dependent claims.

Brief description of the drawings

[0018] For a better understanding and visualization of the object, the present invention will now be described with reference to the accompanying drawings, representing the obtained technical effect through an example embodiment without limiting the scope of the present invention, wherein it schematically presents:

Figura 1: perspective view of a circuit breaker comprising a stabilization system of at least one terminal, according to the present invention;
Figura 2: perspective view of said circuit breaker of Figure 1 shown open and without its molded cover, according to the present invention;
Figura 3: cross-sectional side view of said circuit breaker of Figure 1, according to the present invention;
Figura 4: exploded view of the upper perspective assembly of said circuit breaker in Figure 1, highlighting its terminal stabilization system, according to the present invention;
Figura 5: upper perspective view of said circuit breaker in Figure 1, highlighting its terminal stabilization system in the final position, according to the present invention;
Figura 6: enlarged perspective view of said circuit breaker in Figure 1, highlighting a final assembly position of said conductor terminal, according to the present invention;
Figura 7: upper perspective view of a fixed terminal according to the present invention;
Figura 8: lower perspective view of said fixed terminal of Figure 7, according to the present invention;
Figura 9: rear perspective view of an assembled thermomagnetic set including a fixed terminal according to the present
Figura 10: invention; front perspective view of said terminal set, including a fixed terminal, according to the present invention;
Figura 11: upper perspective view of a molded base, according to the present invention;
Figura 12: rear exploded perspective view of the circuit breaker of Figure 1 shown open;
Figura 13: presents a rear perspective view of the circuit breaker in Figure 1 shown closed, without the cover;
Figura 14: upper front perspective view of said fixed terminal, showing a central hole, according to the present invention;
Figura 15: lower front perspective view of said fixed terminal, showing a central hole, according to the present invention;
Figura 16: partial upper front perspective view of the molded base, according to the present invention; and
Figura 17: partial upper view of the rear side of the molded base, according to the present invention.

Detailed description of the drawings

[0019] Figure 1 shows, from an upper front perspective, a view of a circuit breaker (100), comprising a molded base (200), an operating mechanism (300), at least one fixed terminal (800), a molded cover (400), casing fixing means (403), and a cap (500).

[0020] Figure 2 presents a front perspective view of the circuit breaker (100) of Figure 1 shown open, without its molded cover (400) or said cap (500), showing inside it at least one housing (220) of a thermomagnetic set (600) including at least one fixed terminal (800), at least one arc

extinguishing chamber (230), an operating mechanism (300), a transverse trip bar (635), a handle (388), movable contacts (631), and conductor fasteners (601), said housing (220) of thermomagnetic set (600) being preferentially three, equally spaced from each other, where said handle (388) of said circuit breaker (100) is capable of a translational movement relative to the molded cover (400), so as to change the electrical conduction state of an electrical circuit between the "ON" and "OFF" states, or present another operating state, such as "tripped", for example.

[0021] Figure 3 shows a longitudinal cross-sectional side view of the circuit breaker (100) in Figure 1, showing part of the main internal components of said circuit breaker (100). More precisely, Figure 3 shows the molded base (200), the molded cover (400), the cap (500), a magnetic actuator(221), a thermomagnetic set (600) including a core of ferromagnetic material (602), at least one conductor fixer (601), a fixed contact (630) comprising an electrical connection terminal (632), a contact system (634) comprising at least one movable contact (631), movable contact arm (636) and a spring (633), a transverse trip bar (635), and electric arc extinguishing plates (650). Figure 3 shows said circuit breaker presented in its "OFF" state, i.e., with the said fixed and movable contacts (630, 631) spaced apart from each other. Furthermore, said Figure 3 shows said thermomagnetic set (600) and its ferromagnetic core (602) assembled inside said circuit breaker (100) and connected with its respective conductor fixer (601).

[0022] Figure 4 presents a front exploded perspective view of the circuit breaker (100) of Figure 1 shown open, said molded base (200) comprising holes (210), said molded cover (400) and a plurality of holes (410, 411, 412), highlighting a stabilization system of at least one fixed terminal (800) formed between said molded base (200) and said molded cover (400), comprising in said molded base (200) at least one terminal housing (201), a tab housing (202), said molded cover (400) comprising at least a pair of lower rods (402) and a fixed terminal (800) (shown in detail in Figures 7 and 8), comprising a central hole (801), and at least one upper tab (802). The X, Y, Z (linear) degrees of freedom axes are also presented, in addition to the rotation axes (RX, RY, RZ).

[0023] Figure 5 shows a front perspective view of said circuit breaker (100) of Figure 1 shown closed, without the cap (500), showing the molded cover (400) assembled on the molded base (200). Figure 5 also shows the holes (410, 412) of said molded cover (400), fixed terminals (800) and their respective central holes (801) positioned on the surface of said terminal housing (201) (seen in Figure 4) of said molded base (200) and pressed on its lateral parts by a pair of lower rods (402) and on the rear part by the wall (401) of said molded cover (400).

[0024] Figure 6 presents an enlarged partial perspective view of said circuit breaker (100) of said Figure 1 closed, showing said molded cover (400) assembled on said molded base (200) and a conductor fixer (601) clamped to the fixed terminal (800). In Figure 6 it is also possible to observe that said molded base (200) additionally comprises locking chamfers (205), which can fit into the opposing surface (806) of said fixed terminal (800), in addition to retaining side walls (206).

[0025] Figure 7 presents an upper front perspective view of said fixed terminal (800), showing the central hole (801), the upper tabs (802) of a surface (808), in addition to a first rear tab (803), a second rear tab (804) and a lower hole (805) comprised in said second rear tab (804). Preferentially one face (807) of said second rear tab (804) is preferentially directed positioned perpendicular to said upper face (808) of said fixed terminal (800). It can be observed that said second rear tab (804) additionally comprises a rough region around said lower hole (805).

[0026] Figure 8 presents a lower front perspective view of the fixed terminal (800) of Figure 7, showing the central hole (801), the upper tabs (802), said first tab (803) comprising a width (L1), said second rear tab (804) comprising a width (L2) and the lower hole (805) spaced from the lower part of said second rear tab (804) by a distance (d3), said first tab (803) and said second rear tab (804) being spaced from each other by a distance (d2). A first setback distance (d1) is also presented, wherein its smaller faces (sides) are also preferentially parallel and spaced, having a second distance (d2) between them.

[0027] Figure 9 shows a front perspective view of said assembled thermomagnetic set (600), comprising a bimetal element (700) comprising a thermal adjustable actuator (721), heating resistance (710), two clamping means (740) preferentially rivets, connecting means, particularly a braided support (750), a tab support (730) comprising holes (731) and receiving the tabs (222) (seen in Figure 10) and a magnetic core (732), preferentially fixed in a deformation region (733) and a magnetic actuator (221) of an armature (223), in addition to said fixed terminal (800) comprising a central hole (801), the upper tabs (802) of the surface (808), the first tab (803), and the second rear tab (804).

[0028] Figure 10 shows a rear perspective view of the assembled thermomagnetic set (600), which comprises the bimetal element (700) comprising a thermal adjustable actuator (721), two support ends (701), braided support (750), heating resistor (710), a magnetic core (732), a tab support (730) of said magnetic core (732), said tab support (730) comprising holes (731) in each of its tabs for receiving bearing tabs (222) of an driver (221) of armature (223), at least two clamping means (740) and the fixed terminal (800) comprising the second visible rear tab (804) and said central hole (801), in addition to upper tabs (802) of the surface (808).

[0029] Figure 11 presents a partial upper front perspective view of the molded base (200), showing at least two holes (210), at least two holes (212), spaces provided as terminal housings (201), the tab housings (202), at least two tab housings (203) of the first tab (803) and at least two housings of the second rear tab (204).

[0030] Figure 12 presents a rear exploded perspective

view of the circuit breaker (100) of Figure 1 open, showing said molded base (200) comprising holes (210), said molded cover (400) and a plurality of holes (410, 411, 412), highlighting a stabilization system of at least one fixed terminal (632) formed between said molded base (200) and said molded cover (400), comprising in said molded base (200) at least one terminal housing (244), a tab housing (245), said molded cover (400) comprising at least one pair of lower rods (422), and a fixed terminal (632) (shown in detail in Figure 14 and 15), comprising a central hole (637) and at least one pair of upper tabs (638).

[0031] Figure 13 shows a rear perspective view of said circuit breaker (100) of Figure 1 shown closed, without the cap (500), showing the molded cover (400) assembled on the molded base (200). Figure 13 also shows the holes (410, 412) of said molded cover (400), at least one fixed terminal (632) comprising central holes (637) for screwing of said conductor fixer (601) (also seen in Figure 3), said at least one fixed terminal (632) positioned on the surface of said housing (244) (seen in Figure 12) of said molded base (200), and pressed on its tabs (638) (also seen in Figure 13 and 14) by a pair of lower rods (422) and at the rear part by the wall (423) comprising at least one gas outlet hole (424) preferentially of said molded cover (400) or alternatively by another closing element, such as for example of an extinguishing chamber casing (not shown).

[0032] Figure 14 presents an upper front perspective view of said fixed terminal (632), showing the central hole (637), the upper tabs (638) of an upper surface (639), in addition to a first rear tab (640) and a second rear tab (641) (best seen in Figure 15). Preferentially one face (642) of said first rear tab (640) and one said face (643) of said second rear tab (641) are preferentially constructed with an orientation perpendicular to said upper face (639) of said fixed terminal (632). Figure 14 also shows that said fixed terminal (632) has a second conductive end portion (644) connected to a support folded portion (645) for the fixed contact (630) of said fixed terminal (632).

[0033] Figure 15 shows a lower front perspective view of said fixed terminal (632), showing the central hole (637) comprising a conformation (646), the upper tabs (638), in addition to a first rear tab (640) and a second rear tab (641), predominantly parallel and spaced apart from each other, which are connected to the upper surface (639) through a wall (647), predominantly positioned perpendicular to said upper surface (639). Figure 15 also shows the second conductive end portion (644) connected to a support folded portion (645) for the fixed contact (630) seen in Figure 14. Said first rear tab (640) and a second rear tab (641) comprise a length C3 and a width L3.

[0034] Figure 16 presents a partial upper front perspective view of the molded base (200), showing a hole (210), at least two holes (212), spaces provided as terminal housings (244), the tab housings (245), at least one housing (246) of the first rear tab (640) and at least one housing (247) of the second rear tab (641) (best seen in Figure 17).

[0035] Figure 17 shows a partial upper view of the rear side of the molded base (200), showing a hole (210), at least two holes (212), a fixed terminal (632), the tab housings (245) that receive the upper tabs (638) fitted, at least one housing (246) of the first rear tab (640) and at least one housing (247) of the second rear tab (641), which are spaced apart from each other, preferentially parallel.

Detailed description of the invention

[0036] A molded case circuit breaker (100) in a low voltage, in accordance with the invention comprises a molded base (200), at least one operating mechanism (300), a molded cover (400), a plurality of fixed terminals (800, 632) and optionally at least one cap (500) disposed over said molded cover (400).

[0037] The molded base (200) comprises, in a preferred embodiment, a plurality of holes (210), a plurality of holes (212), a plurality of housings (220) of thermomagnetic set (600), at least one arc extinguishing chamber (230), a plurality of terminal housings (201), a plurality of tab housings (202), a plurality of tab housings (203) for accommodating a first tab (803) and a plurality of tab housings (204) for accommodating a second rear tab (804) of said fixed terminal (800), located in the front portion of the circuit breaker (100). The molded base (200) further comprises, in an optional embodiment, spaces provided as terminal housings (244), tab housings (245), at least one housing (246) of the first rear tab (640) and at least one housing (247) of the second rear tab (641), located in the rear portion of the circuit breaker (100).

[0038] The through holes (412) are suitable for receiving one or more types of casing fixing means (403), such as screws, rivets, among others, which pass through both said molded cover (400) and the holes (212) of said molded base (200) for fixing of said circuit breaker (100), for example, to a panel or DIN rail. The holes (410) are through holes that receive one or more types of clamping means, such as screws (403), rivets, among others, that pass through the molded cover (400) and are fixed in the holes (210) of the molded base (200), so as to keep both elements joined together, when the circuit breaker (100) is closed.

[0039] The housings (220) of thermomagnetic set (600) are chambers disposed within the molded base (200) in a current interruption path pole region seen in the "XY" Plane (Figure 3) of the circuit breaker (100), preferentially having 3 poles, each receiving a thermomagnetic set (600) preferentially comprising a trip magnetic actuator (221) and a trip thermal adjustable actuator (721).

[0040] The magnetic drivers (221) of a mobile core or the thermal trip adjustable actuators (721) have the function of regulating the actuating course of the thermomag-

netic set (600) positioned on the front side of the circuit breaker (100), to actuate the transversal trip bar (635) in the operating mechanism (300) and disengage said circuit breaker (100).

[0041] The arc extinguishing chambers (230) are chambers arranged inside the rear side of the molded base (200), in an inlet region and separate from the region of the housings (220) of the thermomagnetic set (600). Said arc extinguishing chambers (230) receive a fixed contact (630) and a movable contact (631) from a contact system (634).

[0042] The terminal housing (201) is a housing positioned on the front side of the circuit breaker (100), with a shape and dimensions corresponding to the fixed terminal (800), so as to allow said terminal housing (201) to receive and house said fixed terminal (800). Likewise, the terminal housing (244) is a housing positioned on the rear side of the circuit breaker (100), with a shape and dimensions corresponding to the fixed terminal (632), so as to allow said terminal housing (244) to receive and house said fixed terminal (632).

[0043] The tab housings (202, 245) are vertical cavits open at their upper end and arranged in the terminal housings (201, 244) of the molded base (200), having a depth corresponding to at least the thickness of the upper tab (802, 638) of the surface (808, 639), wherein said tab housings (202, 245) serve as rails that allow the fixed terminals (800, 632) to move vertically therethrough, while preventing unwanted rotation of the fixed terminal (800, 632) when applying the screwing torque of a said conductor fixer (601) to said fixed terminal (800, 632) for conductors (wires or bars, not shown) of an electrical circuit that will receive the circuit breaker (100). Furthermore, the tab housings (202, 245) are preferentially arranged in pairs and on opposite faces of each of the terminal housings (201, 244).

[0044] The housings of the first tab (203, 246) are vertical cavities open at their upper part located inside the molded base (200), which receive and house a first rear tab (803, 640) of the fixed terminal (800, 632). Preferentially, there is at least one first tab housing (203, 246) for each fixed terminal (800, 632).

[0045] Each housing of the first tab (203, 246) must correspond in dimensions, shape, quantity, and positioning with each of the first rear tabs (803, 640) of the fixed terminal (800, 632).

[0046] The housings of the second rear tab (204, 247) are vertical cavities open at their upper part located inside the molded base (200), which receive and house a second rear tab (804, 641) of the fixed terminal (800, 632). Preferentially, there is at least one second rear tab housing (204, 247) for each fixed terminal (800, 632).

[0047] Each housing of the second rear tab (204, 247) must correspond in dimensions, shape, quantity, and positioning with each of the second tabs (804, 641) of the fixed terminal (800, 632).

[0048] The operating mechanism (300) is a unipolar, bipolar, tripolar, tetrapolar electrical trigger mechanism, among others, comprising known and usual elements of the prior art, such as: a plurality of side plates arranged on opposite sides. A handle mechanism (388) located in the upper region and responsible for the internal manual movement of the components of said operating mechanism (300); having a plurality of positioning engagements; at least one contact spring; at least one positioning shaft; at least one positioning hole; at least one return spring; at least one return shaft; and at least one return hole that accommodates said return shaft and said return spring, known to the person skilled in the art. Furthermore, said operating mechanism (300) additionally comprises at least one spring (633), a contact system (634) and at least one handle (388), which interact with each other to operate the opening and closing movement operations of the fixed and movable contacts (630, 631).

[0049] The handle (388) is a switch capable of manually switching the handle mechanism of the circuit breaker (100) freely between the closed, open or turned on position upon an external driving force performed by a user after a trip due to a fault. Preferentially, if there is only one handle (388), this is commonly centered in relation to the molded cover (400) and/or in relation to the cap (500) of the circuit breaker (100). If there are two or more handles (388), they are preferentially arranged side by side in a central position in relation to the molded cover (400) and/or in relation to the cap (500) of the circuit breaker (100) and can also be connected to each other.

[0050] The molded cover (400) has dimensions corresponding to the molded base (200), so as to be able to generate a corresponding fit to each other, sealing and protecting the interior of the circuit breaker (100), wherein said molded cover (400) comprises at least one through hole (410) that receives one or more types of fixing means (403), at least one through hole (411) for the handle (388), at least one through hole (412), and at least one pair of lower rods (402).

[0051] The lower rods (402) are vertical protrusions of the molded cover (400) that preferentially protrude perpendicularly from a lower surface of said molded cover (400) for insertion into the tab housings (242). Furthermore, when positioning said molded cover (400) on the molded base (200), each of the lower rods (402) slides housed in the corresponding tab housing (202, 245), being able to slide preferentially free throughout the entire path of said corresponding lower rods (402), at the same time as in their final position, they reinforce the assembly by providing a rotational jamming of said molded cover (400) in relation to said molded base (200) and at the same time to the fixed terminal (800, 638), blocking the upper tabs (802, 638).

[0052] Preferentially, the lower rods (402) have a polygonal shape and a length equal to the height of the tab housings (202, 245) minus the thickness of said fixed terminals (800, 632), so that each of said lower rods (402) remains within its corresponding tab housing (202, 245), contacting and holding pressed its said corresponding upper tab (802, 638). It should be noted that each lower

rods (402) corresponds in quantity, shape, dimensions and positioning to its corresponding tab housing (202, 245).

[0053] Optionally, it is possible for the circuit breaker (100) not to comprise the cap (500), so that the closing of the circuit breaker (100) results solely from the clamping of the molded cover (400) to the molded base (200).

[0054] The circuit breaker (100) further comprises at least one thermomagnetic set (600), at least one fixed contact (630), at least one movable contact (631), at least one electrical connection terminal (632), at least one spring (633), at least one contact system (634), at least one transverse trip bar (635), at least one conductor fixer (601) and a plurality of electric arc extinguishing plates (650).

[0055] Each thermomagnetic set (600) comprises at least one bimetal element (700), a heating resistor (710), at least one tab support (730), a fixed terminal (800), a thermal adjustable actuator (721), a magnetic actuator (221) and clamping means (740).

[0056] Said movable contacts (631) are moved via the contact system (634) to close or open said movable contact (631) relative to the fixed contacts (630). Furthermore, in a preferred embodiment, the arc extinguishing chambers (230) comprise electric arc extinguishing plates (650), which together aim to prevent damage to equipment caused by the electric arc that forms when the electrical circuit is abruptly interrupted during a fault event, particularly when the currents are high, as occurs in a short circuit, and the operating mechanism (300) of the circuit breaker (100) is actuated through the thermomagnetic set (600) that acts on the transverse trip bar (635) in communication with said operating mechanism (300) to open said movable contacts (630, 631), turning off said circuit breaker (100) and protecting the electrical circuit connected thereto.

[0057] The contacts (630, 631) are internal switching elements that aim to ***(i)*** allow the passage of electrical energy when they are in contact with each other; or ***(ii)*** interrupt the passage of electrical energy when they are not in contact with each other.

[0058] In both cases, each fixed contact (630) remains fixed with the terminal (632) and receives a movable or permanent conductor fixer (601), which fixes one of the conductors of an electrical circuit to the circuit breaker (100).

[0059] Furthermore, when a fault occurs, notably an overload or a short circuit, the contacts (630, 631) are designed to open from the thermal interaction of the bimetal (700) which, through an excessive electric current for the system, bends due to a differential in thermal expansion between two different materials, and pushes said bimetal element (700) through the thermal adjustable actuator (721) or even through a magnetic actuator (221), in a shift resulting from a large instantaneous electric current circulating through a magnetic core (732), also connected to a heating resistance (710) and to said bimetal (700), which attracts an armature (223) connected to said magnetic actuator (221), pushing a transverse trip bar (635), which acts on the operating mechanism (300) and disengages the circuit breaker (100), as a consequence, separating said contacts (630, 631) and interrupting the electric circuit.

[0060] The circuit breaker (100) protects an electrical circuit, by at least one electric current interruption path, comprised of a front side, through a fixed terminal (800) receiving a conductor fixer (601), said fixed terminal (800) comprised in a thermomagnetic set (600) which can be electrically connected preferentially to a cable (not shown) or other optional connecting means, a contact system (634) comprising at least one movable contact (631) and a spring (633), a fixed contact (630) comprised in an electrical connection terminal (632) connecting the opposite side behind said circuit breaker (100), the power supply and/or load being made from either connection side, said circuit breaker (100) being positioned between them to protect said electrical circuit.

[0061] The spring (633) is located internally in the contact system (634) and has the function of keeping the operating mechanism (300) in a "closed" or armed position, defined by driving the handle (388), until a fault trip occurs, from the thermomagnetic set (600) and said spring (633) is released. Otherwise, from an "open" or disarmed position, said spring (633) will be tensioned when said handle (388) is shifted to the "on" position engaging the operating mechanism (not shown) again to the "closed" or armed position of the circuit breaker (100), prepared to protect the electrical circuit in a new fault event.

[0062] The conductor fixer (601) is preferentially a movable fixing means such as a screw, arranged at the ends of the circuit breaker (100), which aims to individually fix conductors of the electrical network to said circuit breaker (100).

[0063] The electric arc extinguishing plates (650) are known from the prior art, being arranged individually stacked and spaced apart from each other, in each of the arc extinguishing chambers (230). More precisely, each of the electric arc extinguishing chambers (230) is individually located around each of said contacts (630, 631), so as to attract and prevent the propagation of electric sparks formed during the transition of the circuit breaker (100) from an "open position" to a "closed position", or vice versa.

[0064] The bimetal element (700) preferentially comprises a plurality of support ends (701) and a thermal adjustable actuator (721). Furthermore, the bimetal element (700) allows the passage of an electric current that comes through the fixed terminal (800) and passes through the bimetal (700), subsequently being conducted preferentially by a cable (not shown) or another conductor to the mobile contact arm (636) of the contact system (634) of the circuit breaker (100).

[0065] The ends of the bimetal (701) are preferentially arranged in pairs and in a bifurcated configuration, comprising at least one clamping through hole (not shown) at

their ends, to receive the clamping means (740).

[0066] The heating resistance (710) preferentially comprises a bifurcated shape and holes at the ends (not shown) for its fixing to the bimetal (700) and actuates at least one corresponding magnetic actuator (221) through the armature (223) which is sensitized by a current induced by a circulating current both in said bimetal (700) and in the heating resistance (710) connected to each other, of the thermomagnetic set (600), to actuate the operating mechanism (300) of the circuit breaker (100).

[0067] Preferentially, one of the through holes (not shown) for clamping the ends (701) of said bimetal (700) and the heating resistance (710) is used to clamp them to the fixed terminal (800), while the other is used to clamp a cable support (750) (not shown) or other conductive means, which can be welded to it.

[0068] The bimetal (700) is known in the state of the art and comprises two or more metal sheets with distinct properties between them, wherein the bimetal (700), upon application of a temperature and/or of an excessive electric current to the system, bends due to its thermal expansion and pushes the bimetal element (700) through the thermal adjustable actuator (721), pushing the transverse trip bar (635) and disengaging the circuit breaker (100), interrupting an electric circuit, as a consequence.

[0069] The central hole (801, 637) may protrude beyond the lower base of the fixed terminal (800), incorporating a lower conformation (809, 646) to receive the conductor fixer (601), facilitating the fitting thereof. Preferentially, the central hole (801) is a threaded hole.

[0070] The upper tabs (802, 638) are tabs located preferentially on the surface (808), in the central region of the fixed terminal (800, 632), having a preferentially rounded shape at the edges and a thickness equal to the thickness of the fixed terminal (800, 632). Additionally, the upper tabs (802) have a shape and dimensions corresponding to the tab housings (202), so as to allow the tab housings (202) to receive and allow the free passage of the upper tabs (802) therethrough.

[0071] Furthermore, whereas remaining within the tab housings (202), the upper tabs (802) of the fixed terminal (800) are pressed by the lower rods (402) and optionally by the wall (401) of the molded cover (400). Thus, the upper tabs (802) remain housed within the tab housings (202) while being pressed downwards by the lower rods (402) and by the wall (401), touching said fixed terminal (800) and ensuring that it is prevented from rotating due to the upper tabs (802) and prevented from translating vertically due to the lower rods (402) and by the wall (401), whereas the molded base (200) and the molded cover (400) remained positioned and pressed against each other. It should be noted that said molded cover (400) comprises a wall (401, 423) that touches the surface (808) of said fixed terminal (800).

[0072] Preferentially the first tab (803, 640) comprises a first length (c1, c3) and a first width (L1, L3) and is the shortest tab of the fixed terminal (800), which protrudes subsequently to an edge of the surface (808, 639) of the fixed terminal (800, 632) and in a direction preferentially perpendicular to the lower region of said fixed terminal (800), wherein the first tab (803, 640) preferentially has a polygonal shape.

[0073] Furthermore, the first tab (803) is housed in the tab housing (203) of the molded base (200), serving as a guide for the fixed terminal (800) when fitting it into the molded base (200), in addition to helping to prevent the fixed terminal (800) from rotating when applying the screwing torque of said conductor fixer (601) in contact with said fixed terminal (800).

[0074] Preferentially the second rear tab (804) comprises a second length (c2) and a second width (L2) and is the longest wing of the fixed terminal (800), which, like the first tab (803), protrudes subsequently to an edge of the surface (808) of the fixed terminal (800) and in a direction preferentially perpendicular to the surface (808) of the fixed terminal (800), wherein the second rear tab (804) preferentially has a polygonal shape and roughness around the lower hole (805), which assist in fixing the clamping means (740) for the bimetal (700) and the heating resistance (710), on both sides of its thickness.

[0075] Furthermore, the end of the second rear tab (804) is housed in the housing of the second rear tab (204) of the molded base (200), serving as a guide for the fixed terminal (800) when fitting it into the molded base (200), in addition to preventing the fixed terminal (800) from rotating when applying the screwing torque of said conductor fixer (601) to the fixed terminal (800), in addition to making it difficult to pull it out, since both the first and second rear tabs (803, 804) are constructed in a direction preferentially perpendicular to the surface (808) of the fixed terminal (800), in the event of a pull on the conductors (not shown) in the direction of the current path out of said circuit breaker (100), the tab housings (203, 204) of said molded base (200) serving as a perpendicular barrier to the pulling out of said tabs (803, 804) inserted inside it.

[0076] Preferentially, the second length (c2) of the second rear tab (804) is between 2 and 5 times, preferentially at least 3 times greater than the first length (c1) of the first tab (803).

[0077] Preferentially both the first and second rear tabs (803, 804) are parallel to each other and are arranged perpendicularly to the surface (808) of the fixed terminal (800), their larger faces being preferentially parallel to each other and forming between them a first setback distance (d1) that corresponds to a value between 0.2 and 1 time, preferentially between 0.5 and 0.9 times the first length (c1), wherein their smaller faces are also preferentially parallel and spaced having between each other a second distance (d2) that corresponds to a value between 0.1 and 2, preferentially 1 time the first width (L1) or the second width (L2), considering that the widths (L1, L2) are equal to each other. The purpose of the setback distance (d1) is to open space for the positioning of a support (730) of tabs (222) of said armature (223) in the

deformation region (733). Preferentially, the faces of the tabs (640,641) are parallel, spaced and form a distance (d3) between each other that corresponds to a value between 0.5 and 0.9 times the total width of the fixed terminal (632).

[0078] The lower through hole (805) comprised in the second rear tab (804) is located at a distance (d3) preferentially between 0.25 and 0.5 times the second length (c2) of the second rear tab (804) and receives one of the clamping means (740).

[0079] The clamping means (740) are arranged at both support ends (701) of the bimetal element (700), at both ends of the heating resistance (710) and at the second rear tab (804) of the fixed terminal (800) and are intended to keep the bimetal element (700) and heating resistance (710) attached to said fixed terminal (800).

[0080] It should be noted that the fixed terminal (800) comprises components such as the upper tab (802), the first tab (803) and the second rear tab (804) which, together with the lower rods (402) of the molded cover (400), the tab housing (202), at least one housing of the first tab (203) and at least one housing of the second rear tab (204) of the molded base (200), simultaneously prevent both rotation and translation of the fixed terminal (800) when applying the screwing torque of said conductor fixer (601) to the fixed terminal (800) to clamp the conductors of the electrical circuit that the circuit breaker (100) will receive. Also, after being fixed, this stabilization system provides increased resistance to the accidental pulling out of the wires attached to the terminals (800) of said circuit breaker (100).

[0081] More specifically, to prevent the fixed terminal (800) from rotating or translating during the application of the screwing torque of said conductor fixer (601), one or more of an upper tab(802) must be housed in its respective tab housing (202) and pressed by the lower rods (402) of the molded cover (400); the first tab (803) must be housed in the housing of the first tab (203); and the second rear tab (804) must be housed in the housing of the second rear tab (204) of said circuit breaker (100).

[0082] In an alternative embodiment, on the rear side of said circuit breaker (100), where gas outlet holes (424) of an arc extinguishing chamber (230) are observed, the present invention embodies a stabilization system of at least one fixed terminal (632), formed between said molded base (200) and said molded cover (400), comprising in said molded base (200) at least one terminal housing (244), a tab housing (245), said molded cover (400) comprising at least one pair of lower rods (422). Said fixed terminal (632) comprises upper tabs (638) of an upper surface (639), a central hole (637), and at least one pair of upper tabs (638), in addition to a first rear tab (640) and a second rear tab (641); and a second conductive end portion (644) connected to a support folded portion (645) for the fixed contact (630). A face (642) of said first rear tab (640) and a face (643) of said second rear tab (641) are preferentially constructed perpendicular to said upper face (639) of said fixed terminal (632) and are inserted adjacent to the arc extinguishing chamber (230).

[0083] The result obtained is the blocking on all the "X", "Y", "Z" (linear) axes, in addition to the "RX", "RY", "RZ" rotation axes. The benefits of blocking up to 6 axes of degrees of freedom are obtained:

- on the "X" axis through the barrier created in the assembly through the upper tabs (802) of a surface (808) of said fixed terminal (800, 632) which are fitted into tab housings (202) of said molded base (200);
- on the "Y" axis through the barrier created in the assembly by seating at least one said fixed terminal (800, 632) in the terminal housing (201) of said base (200) and retaining side walls (206) in relation to an edge of the surface (808) of said fixed terminal (800, 632);
- on the "Z" axis through the barrier created in the assembly by seating said fixed terminal (800, 632) on the base of at least one terminal housing (201) of said molded base (200) and the lower rods (402) of the molded cover (400) which presses or touches a surface (808) of said fixed terminal (800, 632), assisted by casing clamping means (403) which pass through both said molded cover (400) and the holes (212) of said molded base (200) for clamping said circuit breaker (100);
- on the "RX" axis through the barrier created in the assembly through the upper tabs (802) of a surface (808) of said fixed terminal (800, 632) which are fitted into tab housings (202) of said molded base (200) and positioned by at least one pair of lower rods (402) of said molded cover (400), assisted by casing clamping means (403), which pass through both said molded cover (400) and holes (212) of said molded base (200) for a clamping of said circuit breaker (100);
- on the "RY" axis through the barrier created in the assembly by seating at least one said fixed terminal (800, 632) in the terminal housing (201) of said molded base (200), through the upper tabs (802, 638) of a surface (808) of said fixed terminal (800, 632) and of the first and second rear tabs (803, 804, 640, 641) of said fixed terminal (800, 632) that are arranged perpendicularly to the surface (808, 639) of said fixed terminal (800, 632) and fitted into housings of the first tab (203, 246) and housings of the second rear tab (204, 247), respectively;
- on the "RZ" axis through the barrier created in the assembly by seating said fixed terminal (800, 632) on the base of at least one terminal housing (201, 245) of said molded base (200) and of the first and second rear tabs (803, 804, 640, 641) of said fixed terminal (800, 632) which are arranged perpendicularly to the surface (808) of said terminal (800, 632) and fitted into housings of the first tab (203, 246) and housing of the second rear tab (204, 247), respectively, both said tabs (803, 804, 640, 641) and said

housings (201, 245) of said fixed terminal (800, 632) of the circuit breaker (100) being spaced apart from each other, preferentially parallel to each other.

[0084] It should be noted that the quantity of the elements: arc extinguishing chamber (230); terminal housing (201); said movable contacts (631); electrical connection terminal (632); spring (633); contact system (634); said conductor fixer (601); and the thermomagnetic set (600) directly depends on the quantity of current paths or poles present in the circuit breaker (100).

[0085] Obviously, the number of poles of the circuit breaker (100) may vary depending on the model chosen. Preferentially, the circuit breaker (100) can be single-phase, biphasic, tripolar or tetrapolar. In the exemplary case of the figures, a three-phase circuit breaker model (100) is represented. However, this representation is only intended to illustrate a possible exemplary configuration, not limiting the circuit breaker (100) to being just a three-phase circuit breaker.

[0086] As an additional detail, it should be mentioned that the terms "closed position" and "open position" serve to describe the electrical circuit of the circuit breaker (100), where the "closed position" denotes a closed circuit, which allows the passage of electrical energy through the contact of said contacts (630, 631) and the "open position" denotes an open circuit, which does not allow the passage of electrical energy through said contacts (630, 631), since they are far from each other in this position.

Final remarks

[0087] The present invention describes a circuit breaker (100) comprising at least the molded base (200), the operating mechanism (300), the molded cover (400) and the cap (500), in which the upper tabs (802, 638), the first rear tab (803, 640) and the second rear tab (804, 641) are housed respectively in the tab housings (202, 245), in the housing of the first rear tab (204, 247) and in the housing of the second rear tab (203, 246), in which said upper tabs (802) are pressed by the lower rods (402) of said molded cover (400) and optionally by a wall (401), so as to prevent involuntary rotation of the fixed terminals (800, 632) at the time of application of the screwing torque of said conductor fixer (601) on said fixed terminal (800, 632) to fix the conductors of the electrical system that will receive the circuit breaker (100), or even protects against an involuntary tearing off of the fixed terminal (800, 632) due to a pull of conductors (not shown) of the electrical circuit that said circuit breaker (100) is arranged to protect. This protection is demonstrated on all possible starting axis "X", "Y", "Z", "RX", RY" and "RZ".

[0088] It is evident that the relationships between the dimensions described for the present invention may vary according to the sizing of the molded base (200), the operating mechanism (300), the molded cover (400), the fixed terminals (800, 632), the thermomagnetic set (600), the arc extinguishing chamber (230) and the internal components of the circuit breaker (100). However, said dimensions and their relationships are reproducible, in addition to being highly efficient and effective, significantly increasing the mechanical resistance of the assembly of the fixed terminals (800, 632) between the molded base (200) and the molded cover (400) of said circuit breaker (100).

Conclusion

[0089] As can be inferred from the description above, the object, according to the present invention, exceeds the solutions provided for by the prior art, being an object, perfectly susceptible to industrial application, which presents novelty and non-obviousness.

Claims

1. Circuit breaker (100) comprising a molded base (200), a molded cover (400), a thermomagnetic set (600) comprising at least one fixed terminal (800), electrically connected to at least one contact system (634) comprising at least one movable contact (631), an electrical connection terminal (632) comprising a fixed contact (630) and an operating mechanism (300) for closing or opening said movable contact (631) relative to the fixed contact (630),

characterized in that said molded base (200) comprises:

- at least one thermomagnetic set (600) housing (220) comprising at least one terminal housing (201), a plurality of tab housings (202), a plurality of housings of a first rear tab (203) and a plurality of housings of a second rear tab (204);

said molded cover (400) comprising a plurality of lower rods (402); and
said fixed terminal (800) comprising:

- at least one pair of upper tabs (802), a first rear tab (803), a second rear tab (804);

wherein, when said molded cover (400) is assembled on said molded base (200), for each fixed terminal (800):

the pair of upper tabs (802) are housed within at least one pair of tab housings (202) and are pressed downwards by the lower rods (402);
at least one said first rear tab (803) being housed in said housing of said first rear tab (203) of said molded base (200); and

at least one said second rear tab (804) being housed in said second rear tab housing (204) of said molded base (200).

2. Circuit breaker (100), comprising a molded base (200), a molded cover (400), a thermomagnetic set (600) comprising at least one fixed terminal (800) electrically linked to at least one contact system (634) comprising at least one movable contact (631), an electrical connection terminal (632) comprising a fixed contact (630) and an operating mechanism (300) for closing or opening said movable contact (631) relative to the fixed contact (630),

characterized in that said molded base (200) comprises:

- at least one arc extinguishing chamber (230) housing comprising at least one terminal housing (244), at least one pair of tab housings (245), at least one housing of a first rear wing (247) and at least one housing of a second rear wing (246);

said molded cover (400) comprising at least one pair of lower rods (402); and
said fixed terminal (632) comprising:

- at least one pair of upper tabs (638), a first rear tab (640) , a second rear tab (641);

wherein, when said molded cover (400) is assembled on said molded base (200), for each fixed terminal (632):

said pair of upper tabs (632) are housed within tab housings (245) and are pressed downwards by at least one said pair of lower rods (402);
said first rear tab (640) being housed in said housing of said first rear wing (247) of said molded base (200); and
said second rear tab (641) being housed in said housing of said second rear wing (246) of said molded base (200).

3. Circuit breaker (100) according to claim 1 or 2, **characterized in that** said molded cover (400) comprises a wall (401, 423) that touches the surface (808) of said fixed terminal (800).

4. Circuit breaker (100) according to claim 1 or 2, **characterized in that** it comprises at least one cap (500) arranged on the molded cover (400).

5. Circuit breaker (100) according to claim 1 or 2, **characterized in that** it comprises a threaded central hole (801, 637) that protrudes beyond the lower base of the fixed terminal (800), incorporating a lower conformation (809, 646).

6. Circuit breaker (100) according to claim 1, **characterized in that** the upper tab (802, 638) is a tab located in the central region of the fixed terminal (800, 632) and has a thickness equal to the thickness of said fixed terminal (800, 632).

7. Circuit breaker (100) according to claim 1 or 2, **characterized in that** the first tab (803, 640) protrudes beyond an edge of the fixed terminal (800, 632) in a direction preferentially perpendicular to the surface (808, 639) of said fixed terminal (800, 632), wherein said first tab (803, 640) comprises a first length (c1, c3) and a first width (L1, L3).

8. Circuit breaker (100) according to claim 1, **characterized in that** the faces of the tabs (803, 804) are parallel and form, between each other, a first setback distance (d1) that corresponds to a value between 0.2 and 1 time, preferentially between 0.5 and 0.9 times, the first length (c1).

9. Circuit breaker (100) according to claim 1, **characterized in that** the smaller faces of the tabs (803, 804) are also parallel and spaced apart from each other.

10. Circuit breaker (100) according to claim 8, **characterized in that** the faces of the tabs (803, 804) have, between each other, a second distance (d2) corresponding to a value between 0.1 and 2 times the first width (L1) and a value between 0.1 and 2 times a second width (L2).

11. Circuit breaker (100) according to claim 1, **characterized in that** the second rear tab (804) protrudes beyond an edge of the fixed terminal (800) and in a direction preferentially perpendicular to the surface (808) of the fixed terminal (800), wherein the second rear tab (804) comprises roughness around a lower hole (805), a second length (c2), and a second width (L2).

12. Circuit breaker (100) according to claim 11, **characterized in that** the second length (c2) of the second rear tab (804) is between 2 and 5 times greater than the first length (c1) of the first tab (803).

13. Circuit breaker (100), according to claim 1, **characterized in that** the lower hole (805) is a through hole located at a distance (d3) between 0.25 and 0.5 times the second length (c2) of the second rear tab (804) and receives at least one clamping mean (740).

14. Circuit breaker (100) according to claim 2, **charac-**

terized in that the faces of the tabs (640,641) are parallel, spaced and form a distance (d3) between each other that corresponds to a value between 0.5 and 0.9 times the total width of the fixed terminal (632).

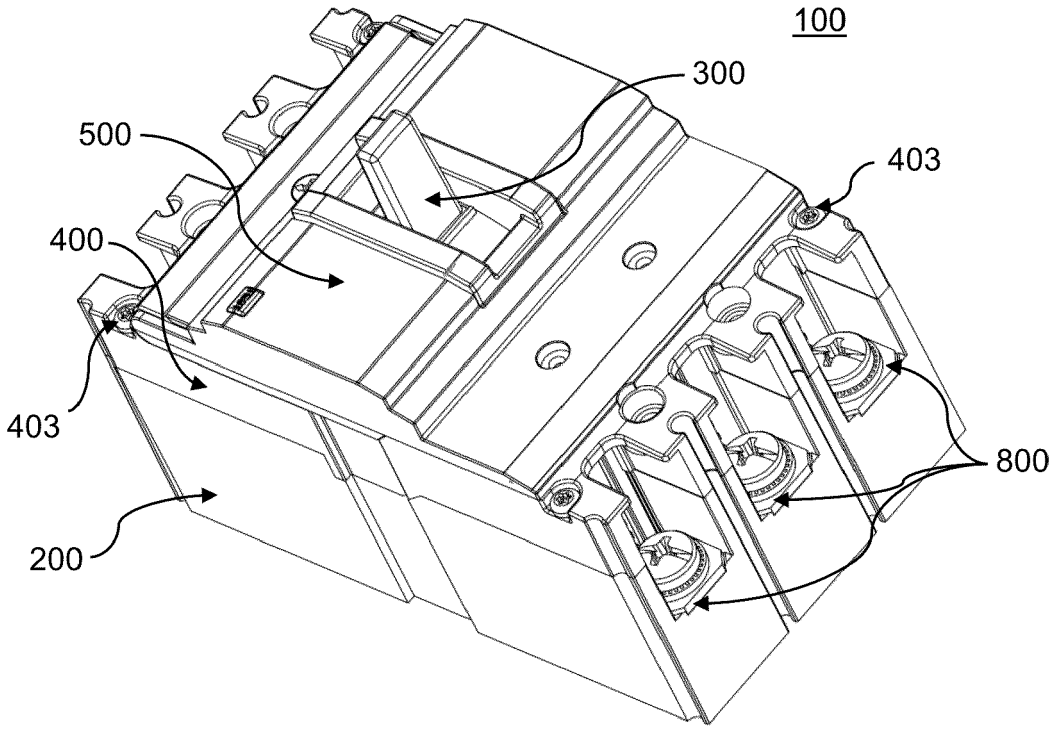
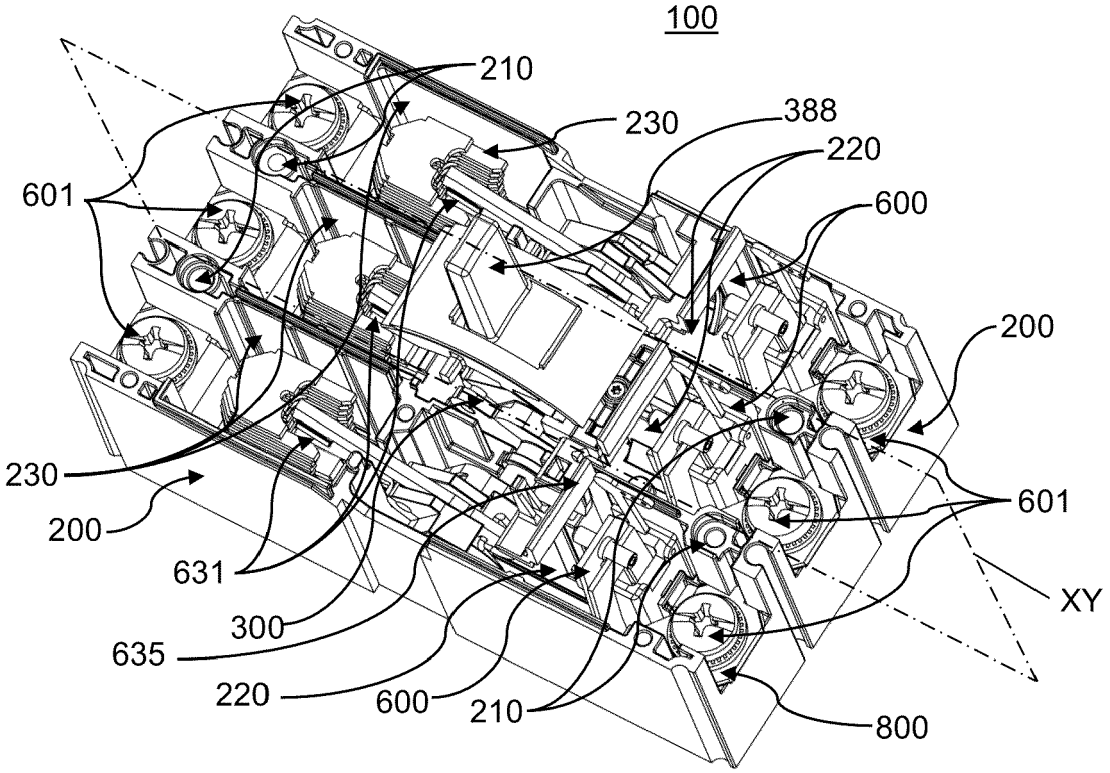

100
300
500
403
400
403
800
200

Fig. 1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210
230
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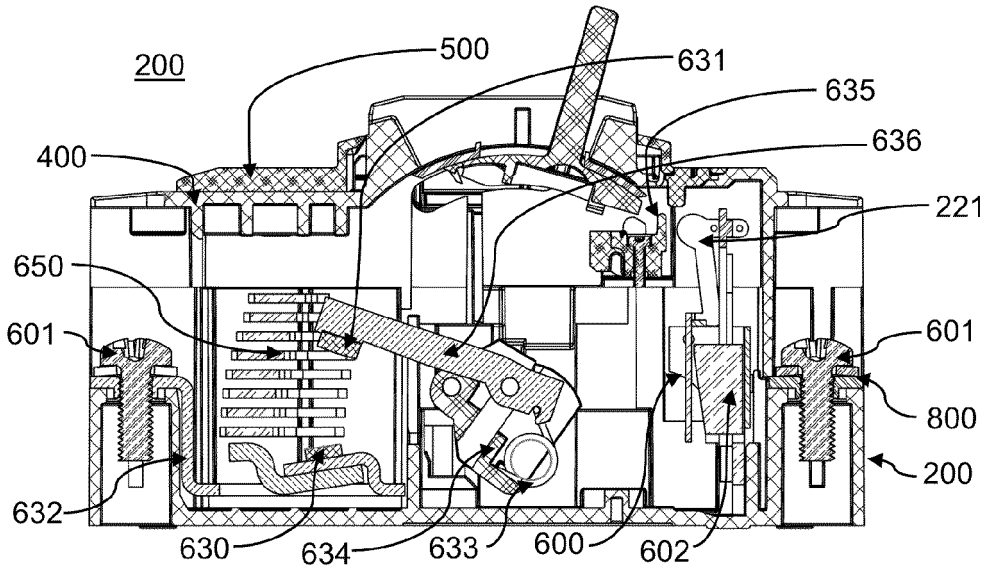
220
601
600
200
230
601
200
631
XY
300
635
220
600
210
800

Fig. 2



"XY" section

Fig. 3

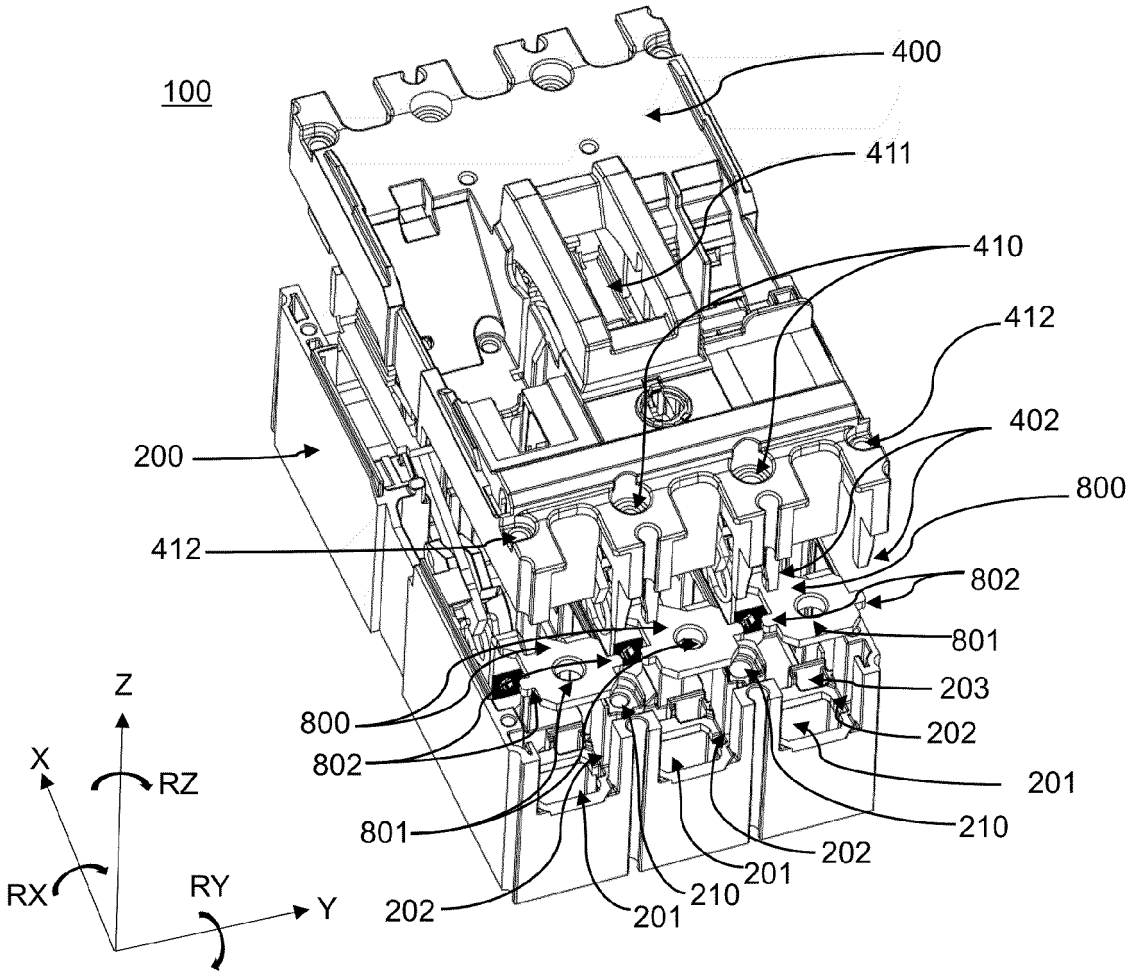
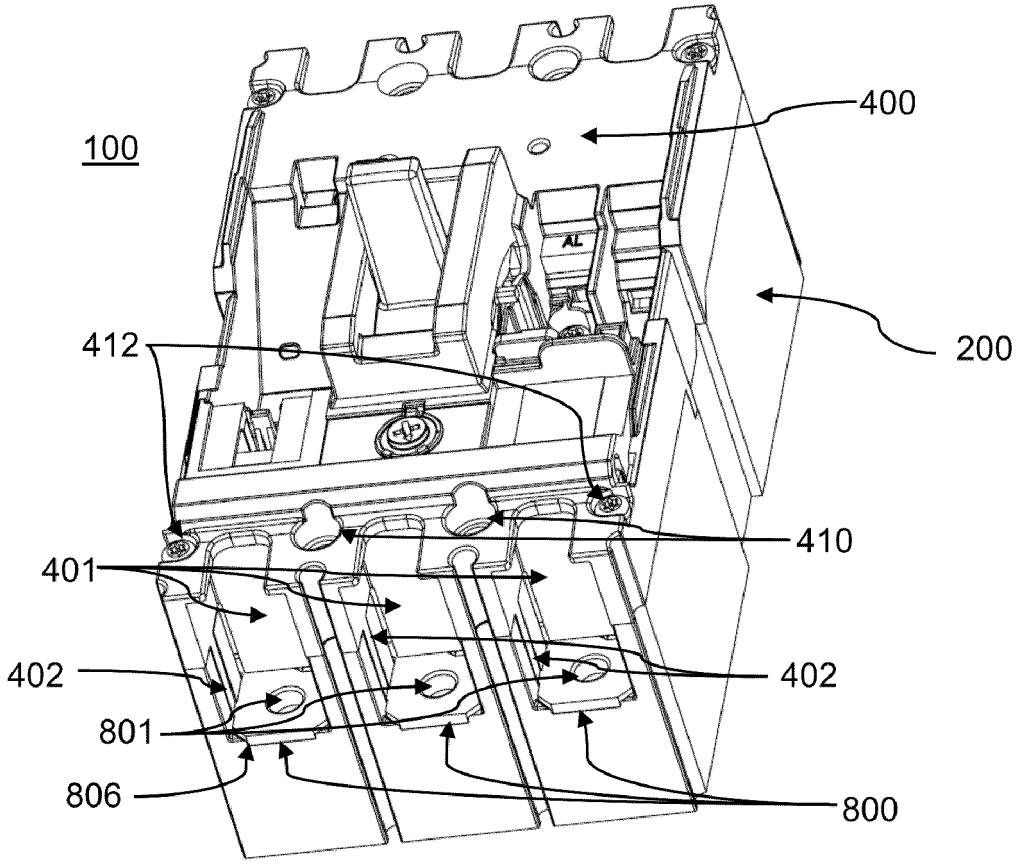


Fig. 4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401
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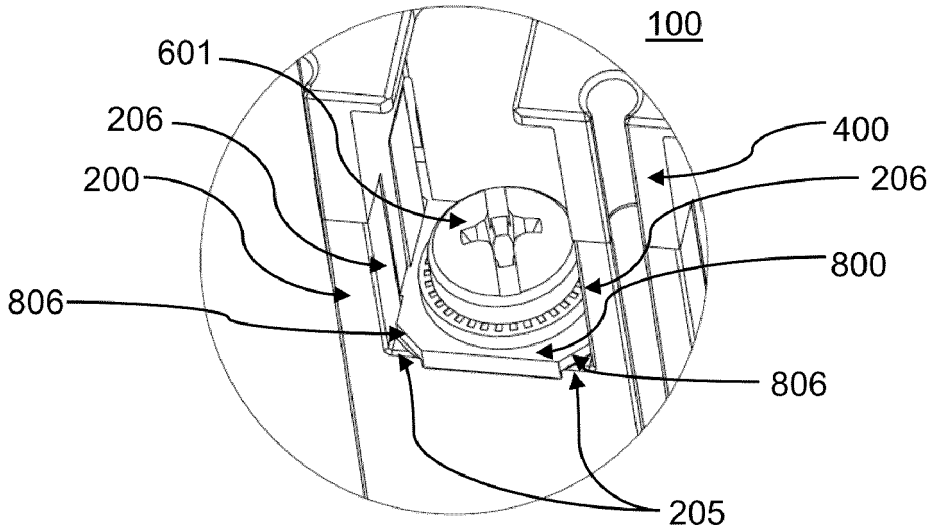
402
801
806
800

Fig. 5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800
806
205

Fig. 6

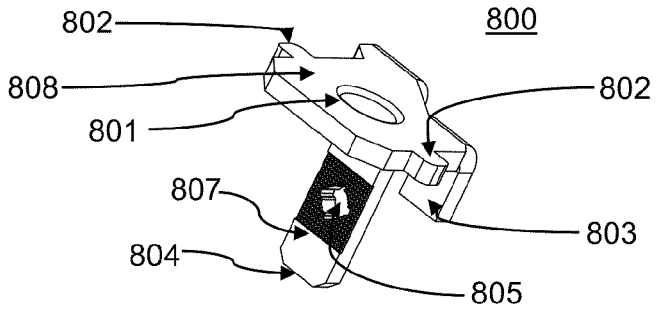


Fig.7

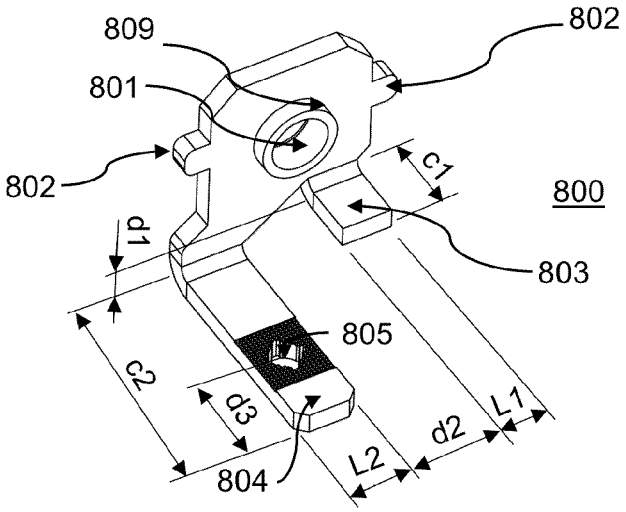


Fig. 8

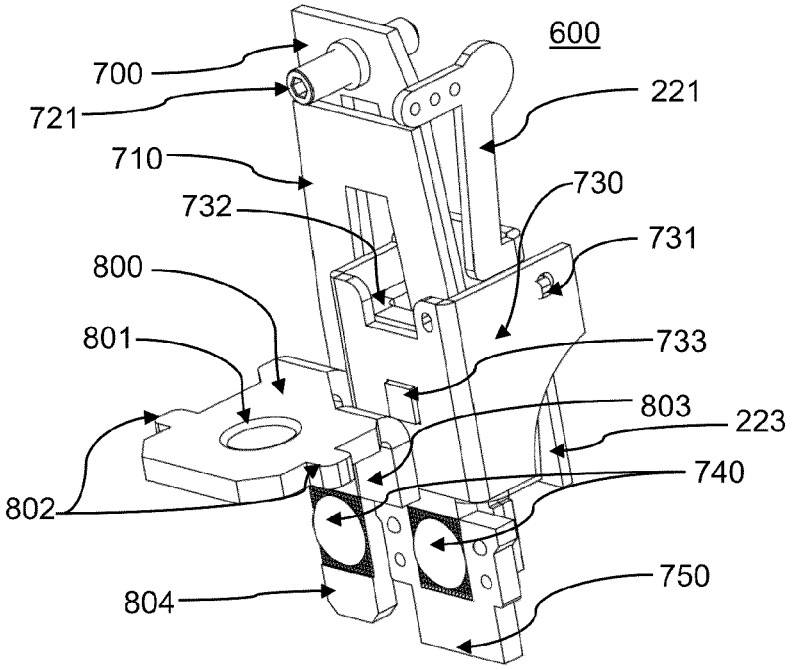
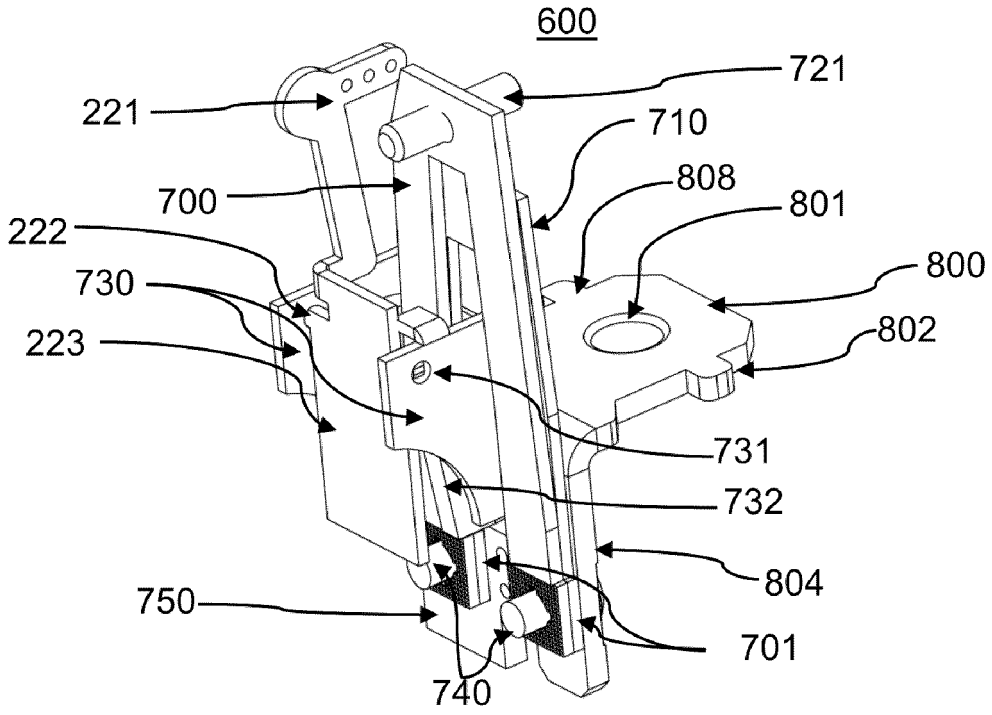


Fig. 9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721
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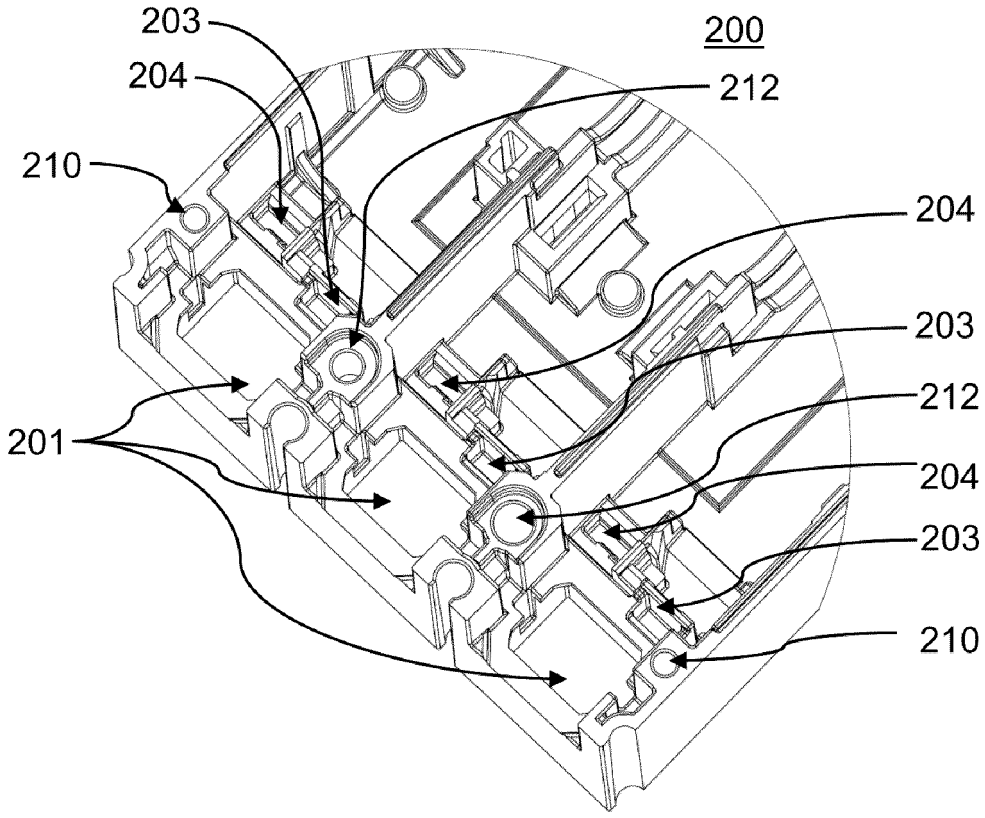
710
808
700
801
222
800
730
802
223
731
732
804
750
701
740

Fig. 10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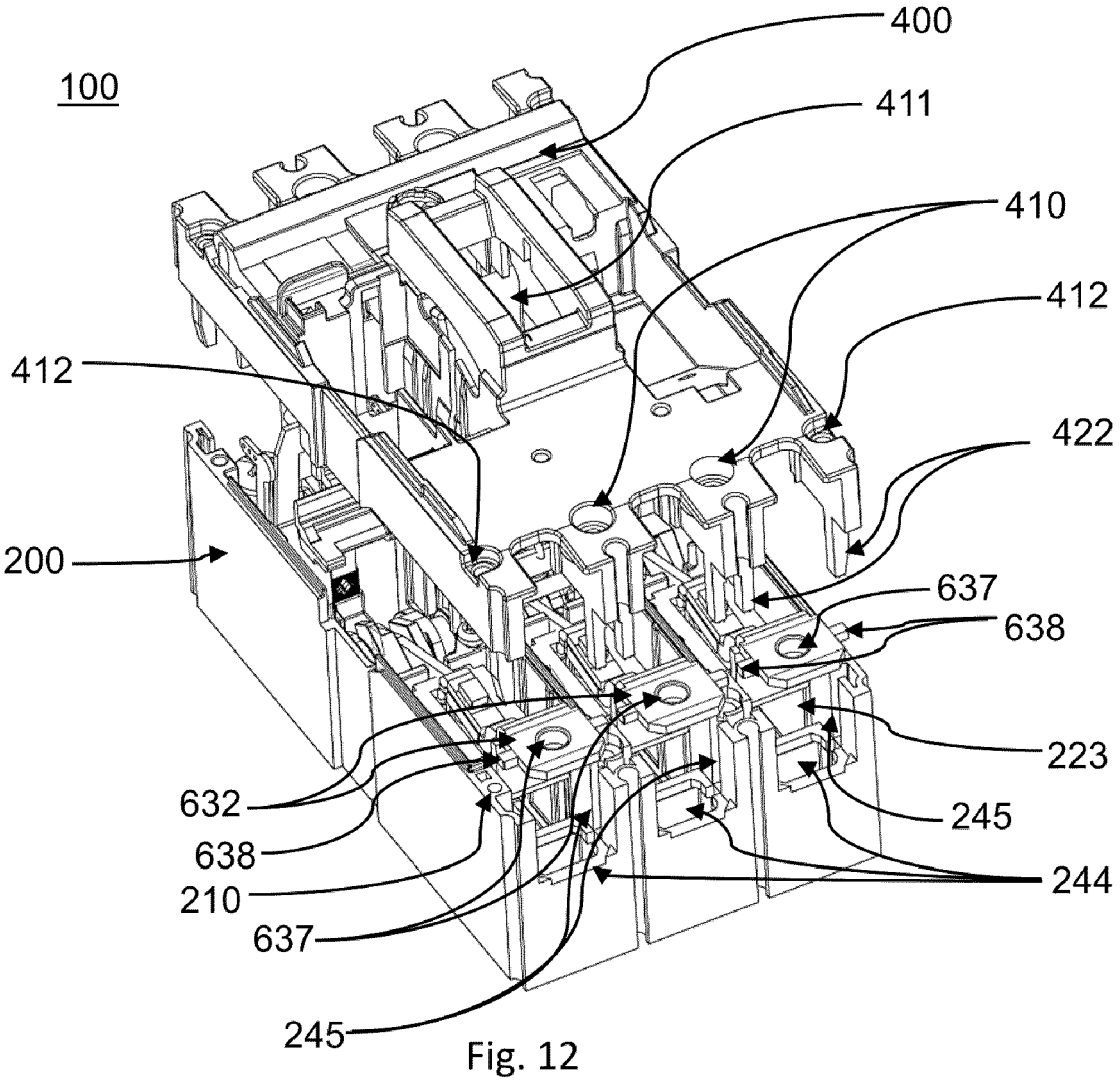
210

Fig. 11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412
422
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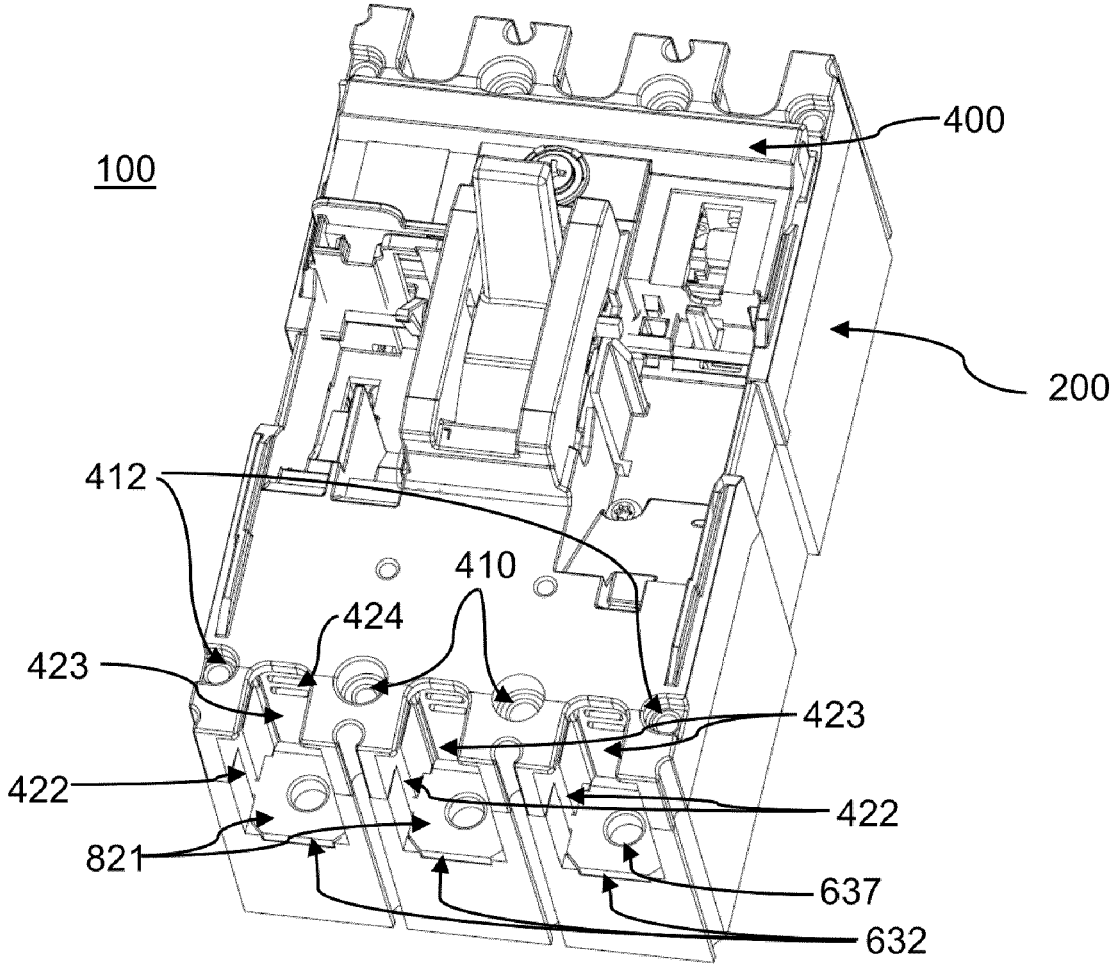
638
223
632
245
638
244
210
637
245

Fig. 12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632

Fig. 13

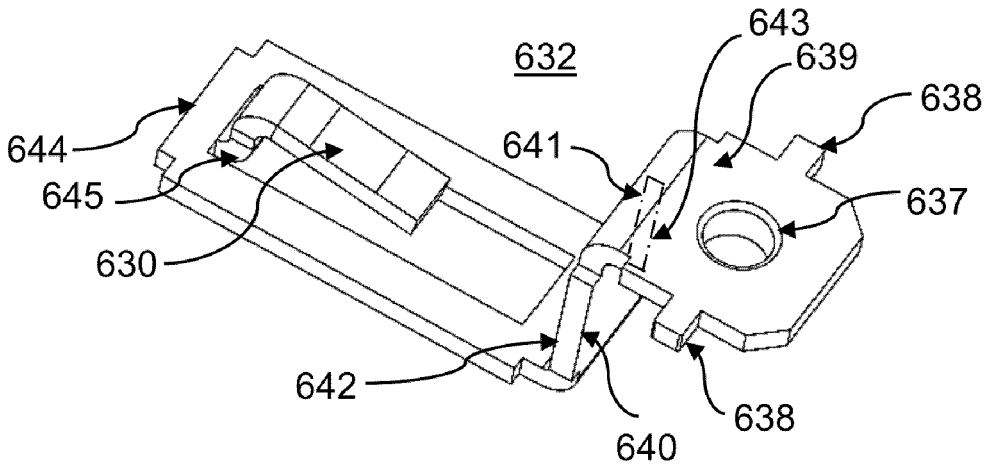
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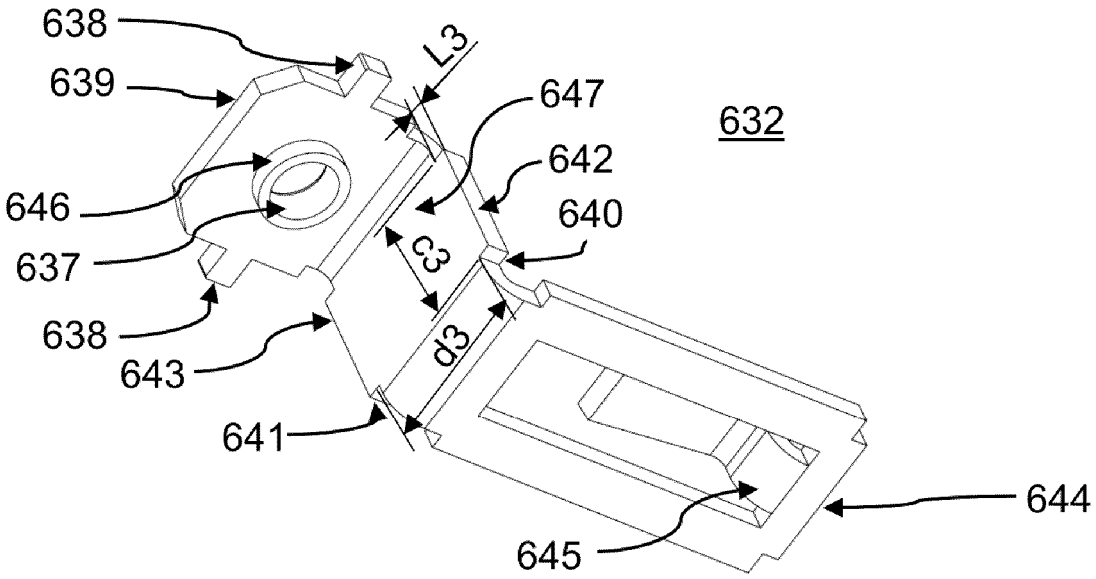
Fig. 14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d3
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Fig. 15

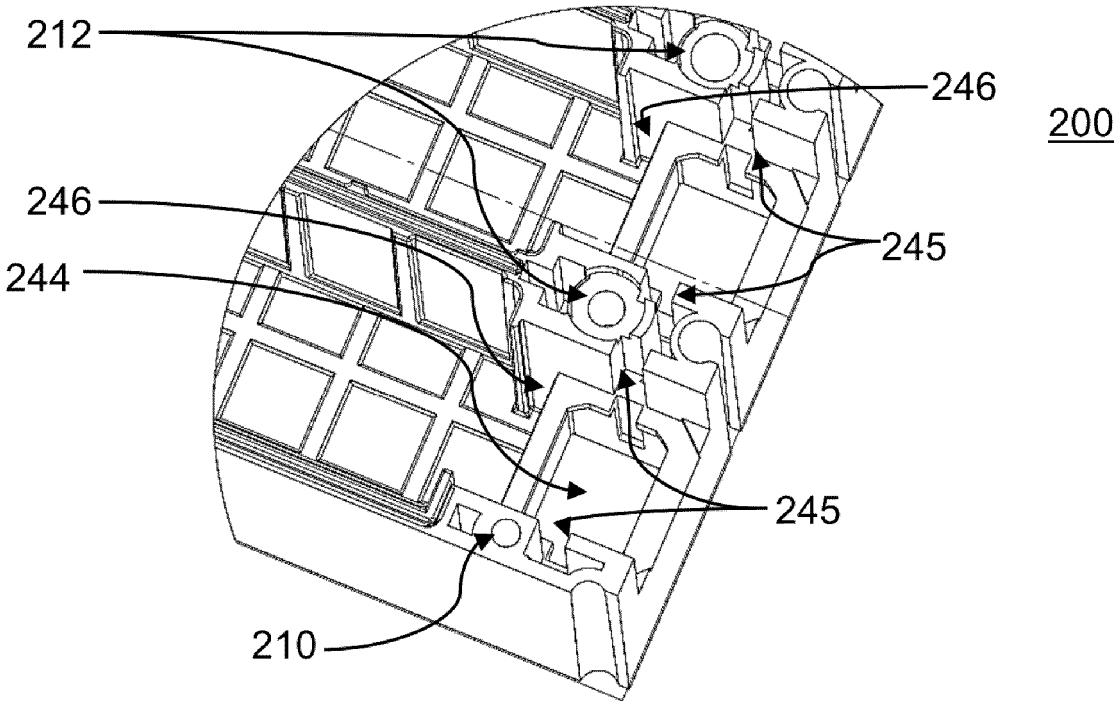
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Fig. 16

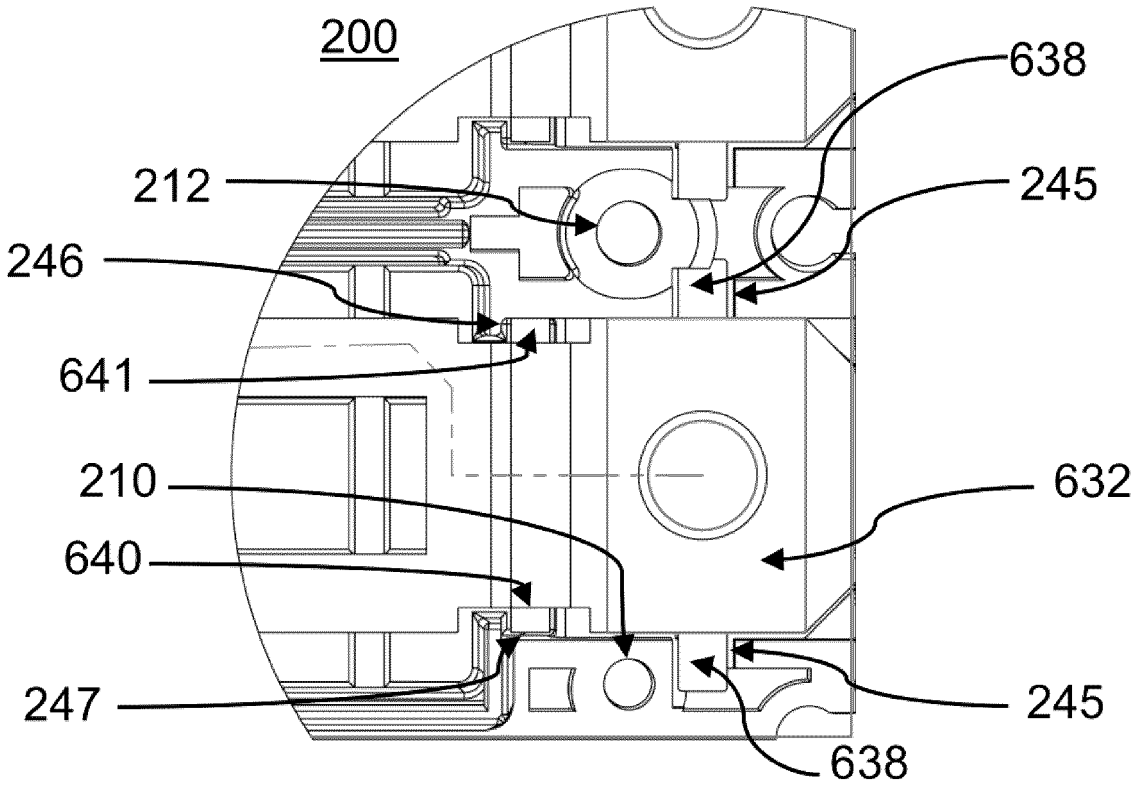

Fig. 17

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EUROPEAN SEARCH REPORT

Application Number
EP 24 22 2035

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H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	23 April 2025	Glaman, C

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