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(72) Inventors:

• **Araújo Friedmann, Gabriel**
89256-900 Jaraguá do Sul, SC (BR)

• **Decker De Souza, Fábio**
89256-900 Jaraguá do Sul, SC (BR)

(74) Representative: **Petraz, Gilberto Luigi et al**
GLP S.r.l.

Viale Europa Unita, 171
33100 Udine (IT)

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(71) Applicant: **Weg Drives and Controls Automação**
Ltda.

89256-900 Jaraguá do Sul - SC (BR)

(54) **MOLDED CASE CIRCUIT BREAKER AND ASSEMBLY METHOD**

(57) The present invention describes a molded case circuit breaker, comprising:

a trigger device provided with at least one rotating bar;
a fixed adjustment bar arranged, in a movable and rotatable manner, on said rotating bar of the trigger device and in the direction of movement of an operating handle;
a plurality of bimetals provided, in their upper portion, with transverse distance adjustment elements;
wherein said circuit breaker further comprises a variable adjustment disarming bar disposed upon said fixed disarming bar, said variable adjustment disarming bar having concave surfaces;

wherein the concave surfaces are arranged, respectively, on the flat contact surfaces;
wherein the concave surfaces each comprise an inclined portion projecting frontally to the upper portion of a plurality of bimetals; and
wherein the variable adjustment disarming bar extends along the length of the fixed disarming bar; and a circuit test button comprising a first drive bar physically associated with said fixed disarming bar and a second actuation bar physically associated with said variable adjustment disarming bar.

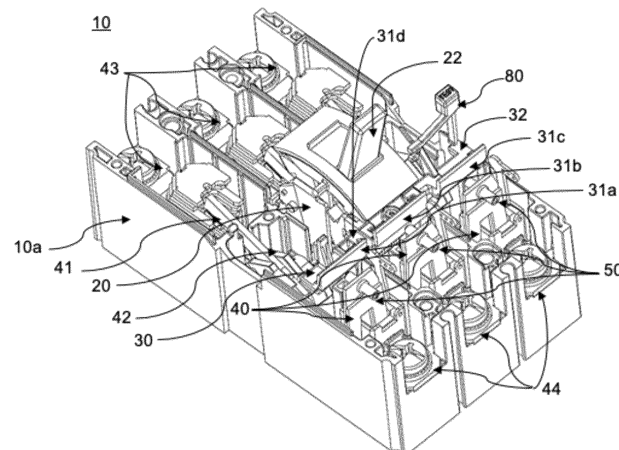


Fig. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to a molded case circuit breaker. More specifically, the present invention relates to a molded case circuit breaker comprising a fixed adjustment disarming bar and an optional variable adjustment disarming bar.

BACKGROUND OF THE INVENTION

[0002] As is common knowledge for the person skilled in the art, molded case circuit breakers can have their operation 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 the connection of input and output terminals, connected to the electrical power supply network to be protected.

[0003] Thus, it can be seen that circuit breakers fundamentally work in a similar way to electrical switches, i.e., they work to change the electrical conduction state of an electrical circuit between the "on" (ON) and "off" (OFF) states. In addition to operating automatically, conventional circuit breakers also include an operating handle that can be operated by a user.

[0004] It is preferable that the temperature of the electrical path operates by being related to a predetermined time delay within a range where the temperature of the electrical path does not exceed the permissible temperature to be regulated, so that the circuit breaker cannot be operated by such a predetermined overcurrent as a limit. In this sense, the determination of the delay in the demonstration characteristic corresponds to the time since the moment in that the overcurrent flows and the bimetal starts to bend before the opening/closing mechanism can be operated by the rotation of an adjustable disarming bar.

[0005] Such delay time is determined by adopting an initial clearance between a bimetal element and a trigger bar and a rotational distance of the disarming bar from a point in time when the bimetal comes into contact with the disarming bar until a point in time when the disarming bar rotates and begins to operate an opening and closing mechanism, having adjustments and calibration of this operating time and defined distances being an important factor so that it activates said electrical contact opening mechanism and promotes electrical interruption.

DESCRIPTION OF THE STATE OF THE ART

[0006] According to the state of the art, molded case thermal-magnetic circuit breakers can be configured to use fixed disarming bars or disarming bars adjustable to the current range.

[0007] When compared to molded case circuit breakers with adjustable disarming bars, circuit breakers with fixed disarming bars have a simpler construction, since they do not require additional parts to adjust the current range.

[0008] In any case, molded case circuit breakers with adjustable bars have a construction that is similar to that of circuit breakers with fixed disarming bar adjustment and thermal disarming, so it would be desirable for the more economical construction of fixed adjustment circuit breakers to be used as a basis for the manufacture of circuit breakers with adjustable disarming bars, without major conceptual modifications.

[0009] Therefore, there is a need to provide molded case circuit breakers with adjustable disarming shafts that are simpler to manufacture and cost-effective, so that from the construction of fixed circuit breakers, an alternative implementation of triggers that can be adjusted to the current range could be incorporated, simply by adding support elements in the variable adjustment configuration.

DESCRIPTION OF THE STATE OF THE ART

[0010] The prior art describes in patent KR10-2015-0111473 a trigger mechanism of a circuit breaker, capable of adjusting a trigger time interval, including a bimetal element, a guide cap that is provided to the bimetal and a hole, a hollow hole-shaped guide rod connected to the hole in the guide cap; a control bar that has a partially protruding structure being connected by penetration into the hollow hole in the guide rod; and an adjustable disarming bar that is spaced from the control bar, being capable of being in contact with the control bar by an operation of the bimetal element. The patent teaches an inclined cross-section in a part facing the control rod, which can cause a different distance and consequently, different delay times of the tripping of the interrupting device.

[0011] Patent CN214068673U describes a molded case circuit breaker with thermally adjustable device. The adjustable device includes an adjusting rod movably arranged on the pull rod and combined with a bimetallic strip of a thermal magnetic trigger and a combined adjusting knob, which is rotatably arranged on the upper cover corresponding to the adjusting rod, and wherein the upper end of said adjusting knob is provided with an adjusting groove exposed outside the upper cover, the lower end of the adjusting knob is provided with a lever portion combined with the adjusting rod, and the adjusting lever is provided with a limit groove combined with the lever portion inserted into the limit groove and constitutes the connection between the adjusting knob and the adjusting rod, and in that the adjusting rod moves with the adjusting knob and can abut against the bimetallic plate.

[0012] Furthermore, the prior art describes patent KR10-2271519B1 having an adjustable transverse bar assembly and a disarming set comprising the same. Said

transverse bar assembly comprises an assembly of a transverse bar and a snap bar engaged by said transverse bar. The transverse bar and the snap bar are rotatably coupled so as to be rotatable about the same axis. This transverse adjustment bar has adjustable parts such as screws in contact with bimetals on inclined adjustment surfaces.

[0013] Additionally, patent KR10-2275002B1 is known for a thermally adjustable trigger mechanism of a molded case circuit breaker that includes a bimetal, a contact element formed on one side of the bimetal and an adjustable trigger bar that is operated when the bimetal is deformed to push the contact element into a state where the contact member is separated from the bimetal. The adjustable trigger bar comprises a contact surface that has planes with different heights (inclined plane) towards the contact member in a position of touching and separating the contact member. The device is assembled in two parts by protrusions of a movable bar in insertion spaces through slight deformation. This adjustment bar only operates after assembly between parts that are intended to be assembled in a plane perpendicular to the adjustment units, such as screws, and the end result is a variable adjustment bar.

[0014] However, the problem with the state of the art is that adapting the construction of molded case circuit breakers to adjustable triggers units is complex in its manufacture, requiring specific devices for this construction, not allowing interchangeability of these with fixed adjustment devices in a simple manner, and therefore, it can be better managed in the administration of components for different types of construction of fixed/mobile adjustment device in industrial process.

SUMMARY OF THE INVENTION

[0015] It is an object of the present invention to provide a molded case circuit breaker comprising a variable adjustment device of simple and economical construction.

[0016] It is another objective of the present invention to provide a molded case circuit breaker with variable adjustment device with additive modularized construction, from the construction of a fixed adjustment molded case circuit breaker.

[0017] Another objective is to achieve safe bearing of a variable adjustment disarming bar with additive modularized construction, without requiring additional fastening components. These objectives are achieved by means of a molded case circuit breaker having a circuit breaker base and at least one circuit breaker cover, comprising:

an operating mechanism provided with a bar and a trigger;
a fixed disarming bar, movably and rotatably arranged on a rotating bar of a trigger and in the direction of movement of an operating handle of said

circuit breaker;

wherein said fixed disarming bar comprises flat contact surfaces, wherein said flat contact surfaces project vertically from the upper surface of a fixed adjustment disarming bar transverse to the movement of an operating handle of said circuit breaker; at least one bimetal, provided and distributed in its upper portion, with at least one transverse distance adjustment element, where preferably said at least one bimetal is arranged frontally and parallel to the flat contact surfaces of said fixed disarming bar; wherein a distance between the distance adjustment transverse elements and the fixed adjustment bar is preferably constant during operation of said circuit breaker;

comprising a variable adjustment disarming bar which can be disposed upon said fixed disarming bar, wherein said variable adjustment disarming bar contains at least one concave surface that can be disposed on an upper edge of said fixed disarming bar so as to engage said edge of said fixed disarming bar;

said variable adjustment disarming bar comprising an inclined surface that projects frontally towards the upper portion of at least one bimetal;

wherein said concave surfaces of said variable-adjustment disarming bar are disposed and fit respectively on the flat contact surfaces;

wherein the variable adjustment disarming bar may additionally extend along the length of the fixed disarming bar.

[0018] It is common for each portion of the inclined vertical contact surface of the variable adjustment disarming bar, used for possible distance adjustments in relation to at least one bimetal, to be present preferably in at least one of the interruption poles of a circuit breaker, with one of the embodiments shown in the drawings being in 3 poles, but not limited to this, and may be single-pole, two-pole, four-pole, etc. Additionally, according to the present invention, the circuit breaker cover comprises, on its internal surface, seats, where at least one surface edge of said fixed disarming bar or said variable adjustment disarming bar can be accommodated in a rotatable manner.

[0019] Said circuit breaker could be constructed, as already known in the state of the art, having an intermediate casing, or additional cover, without prejudice to the present invention.

[0020] The present invention also consists in the fact that a central concave surface comprises a central horizontal portion of said variable adjustment disarming bar, which overlaps said inclined portion, projecting towards the plurality of bimetals, said central horizontal portion in the shape of a "U" having a recess, which defines said horizontal portion, where a current adjustment dial is arranged vertically.

[0021] In the present invention, said current adjust-

ment dial comprises a vertical eccentric bar which is guided by the recess surface of said central horizontal portion, and can modify the adjustment position of the variable adjustment disarming bar.

[0022] Furthermore, in one embodiment, the distance between the transverse distance adjustment elements and the concave surfaces is changed by actuating the current adjustment dial, in one example, preferably positioned in the central position of a 3-pole interrupting circuit breaker. This occurs through transverse distance adjustment elements, such as adjustment screws, which touch said inclined portion of said variable adjustment disarming bar, which moves laterally, by the action of turning a vertical eccentric bar of said current adjustment dial, guided by said recess of said horizontal portion, preferably in a "U" shape.

[0023] The present invention further comprises a circuit test button, said circuit test button comprising a first drive bar physically associated with the fixed disarming bar and a second drive bar physically associated with the variable adjustment disarming bar, wherein said circuit test button is disposed behind said fixed disarming bar relative to said distance adjustment transverse elements.

[0024] Still according to the present invention, the circuit breaker cover comprises a hole where the circuit test button is disposed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The objectives and advantages of the present invention will become clearer through the brief, detailed description of the drawings and non-limiting examples presented at the end of this document:

Figure 1 illustrates a top perspective view of a molded case circuit breaker, without cover and having a fixed adjustment bar, in accordance with a preferred embodiment of the present invention.

Figure 2 illustrates a top perspective view of an operating mechanism in accordance with a preferred embodiment of the present invention.

Figure 3 illustrates a top perspective view of the molded case circuit breaker, without cover, with a variable adjustment disarming bar added above the fixed disarming bar, in accordance with a preferred embodiment of the present invention.

Figure 4 illustrates a bottom perspective view of a circuit breaker cover in accordance with a preferred embodiment of the present invention.

Figure 5 illustrates another top perspective view of the molded case circuit breaker, without cover, containing the variable adjustment disarming bar, in accordance with a preferred embodiment of the present invention.

Figure 6 illustrates a top perspective view of the fixed disarming bar of the circuit breaker, in accordance with a preferred embodiment of the present invention.

Figure 7 illustrates a top perspective view of the variable adjustment disarming bar in accordance with a preferred embodiment of the present invention.

Figures 8a and 8b show a first initial position, front and side, respectively, for preparing the vertical seating of the variable adjustment disarming bar assembly on the fixed adjustment bar, according to a preferred embodiment of the present invention.

Figures 9a and 9b show an intermediate position of frontal and lateral preparation, respectively, for vertical seating of the variable adjustment disarming bar assembly on the fixed adjustment bar, according to a preferred embodiment of the present invention.

Figures 10a and 10b show a final front and side positioning position, respectively, of vertical and side seating of the variable adjustment disarming bar assembly on the fixed adjustment disarming bar, according to a preferred embodiment of the present invention.

Figure 11 shows a bottom perspective view of the variable adjustment disarming bar mounted on the fixed adjustment bar, in final mounting position, according to a preferred embodiment of the present invention.

Figure 12 shows a top perspective view of the variable adjustment disarming bar mounted on the fixed adjustment bar, in final mounting position, according to a preferred embodiment of the present invention.

Figure 13 shows a top view of the fixed disarming bar, fixed on the operating mechanism, in addition to presenting at least one distance adjustment transverse element, according to a preferred embodiment of the present invention.

Figure 14 shows a top view of the variable disarming bar, fixed on the fixed adjustment disarming bar and of the operating mechanism, in addition to at least one distance adjustment transverse element and a current adjustment dial, at an initial thermal range of operation of said circuit breaker, according to a preferred embodiment of the present invention.

Figure 15 shows a top view of said variable disarming bar mounted upon said fixed adjustment disarming bar and of the said operating mechanism, in addition to at least one distance adjustment transverse element and a current adjustment dial, at an intermediate thermal range of operation of said circuit breaker, according to a preferred embodiment of the present invention.

Figure 16 shows a top view of the variable disarming bar mounted on the fixed adjustment disarming bar and the operating mechanism, in addition to at least one distance adjustment transverse element and a current adjustment dial, at a maximum final thermal operating range of said circuit breaker, according to a preferred embodiment of the present invention.

Figure 17 shows a top perspective view of the circuit breaker comprising a current adjustment dial, for

adjusting a trigger function in a variable thermal operating range, associated with the variable adjustment disarming bar, associated with at least one bimetal of the circuit breaker, according to a preferred embodiment of the present invention.

Figure 18 shows a longitudinal cross-sectional view of the circuit breaker shown in Figure 17 of said circuit breaker, showing a current path pole comprising the variable adjustment disarming bar, mounted on the fixed adjustment bar, at least one distance adjustment transverse element, associated with at least one bimetal of the circuit breaker, and the other various interrupting components of the circuit breaker, according to a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0026] Although the present invention may be susceptible to different embodiments, a preferred embodiment is shown in detail, where the present description should be considered an exemplification of the problem-solving principles and is not intended to limit the understanding to what has been illustrated and described in the present invention.

[0027] According to Figure 1, the present invention describes a preferred embodiment of a molded case circuit breaker (10), comprising a circuit breaker base (10a). In this view, said circuit breaker is presented without a top cover (10b) (partially seen in its internal portion in Figure 4). Furthermore, according to Figures 1 and 2, said circuit breaker (10) comprises an operating mechanism (20), which acts in the event of a short-circuit or overcurrent fault.

[0028] Furthermore, according to Figure 1, the circuit breaker (10) comprises a fixed adjustment disarming bar (30), arranged in a movable and rotatable manner, on the bar (21), and associated with the operating movement of a handle (22), capable of switching said circuit breaker (10) on or off, manually. Said fixed adjustment disarming bar (30) is installed and operates in a rotatable manner, to control a trigger function, synchronously or not, opening at least one movable contact (41a) in relation to at least one fixed contact (41b) (seen in Figure 18), between the power supply terminals (43) and the load terminals (44), associated with a system of rotary contacts (42), associated with at least one bimetal (40), in at least one of the poles of said circuit breaker (10), in the aforementioned occurrence of a fault in the electrical circuit associated therewith. The person skilled in the art is commonly aware that the power terminals (43) or the load terminals (44) can be coupled alternately in their functions. Further, in a preferred embodiment, said fixed adjustment disarming bar (30) (best seen in Figure 6) comprises at least one flat contact surface (31a, 31b, 31c), wherein when additionally provided with at least one lateral flat contact surface (31a, 31c) and a central flat contact surface (31b) project vertically from an upper surface (32) of said fixed

disarming bar (30).

[0029] The bimetal (40) is known to have at least two materials with different thermal expansion coefficients, which causes deformation at one of its ends when subjected to a rise or fall in temperature.

[0030] The function of the fixed adjustment disarming bar (30) is to transfer a deformation resulting from any of the bimetals (40), in at least one pole of the interruption path, between the supply terminals (43) and the load terminals (44) by short-circuit or overcurrent faults, for example, to which said circuit breaker (10), in order to protect the circuit, results in disengagement of said operating mechanism (20), interrupting the circuit and opening a movable contact (41a) with respect to at least one fixed contact (41b) of a system of rotary contacts (42). Additionally, the bimetal (40), sensitive to changes in current resulting from said faults in at least one of the poles of said circuit breaker (10), comprises in its upper portion at least one distance adjustment transverse element (50), wherein at least one bimetal (40) is arranged frontally and parallel to at least one flat contact surface (31a, 31b, 31c).

[0031] Once the distance between at least one distance adjustment transverse element (50) and the fixed adjustment disarming bar (30) has been calibrated, said distance should preferably be constant during operation of the circuit breaker (10), comprising a fixed adjustment. The calibration adjustment, in this case, is made in a factory environment, with no possibility of subsequent modification without disassembling said circuit breaker (10). Thus, when an abnormal current occurs in at least one of the poles of the circuit breaker (10), at least one of at least one bimetal (40) of said at least one pole is deformed, connected to at least one distance adjustment transverse element (50), which can then reach and touch at least one of the flat contact surfaces (31a, 31b, 31c) of the fixed adjustment disarming bar (30), which can rotate.

[0032] In Figure 2 the operating mechanism (20) can be observed. As previously stated, the fixed adjustment disarming bar (30) (better observed in Figure 6) is fixed and bearing through at least one support (26) and a screw (not shown) through a threaded hole (27) in said bar (21). When rotating, said fixed adjustment disarming bar (30) allows the release of a trigger (23) in said operating mechanism (20), which, actuated by a preload spring (24), can cause a disengagement of said operating mechanism (20) and move, through a connecting rod (25) said rotary contact system (42), and, consequently, open at least one movable contact (41a) in relation to at least one fixed contact (41b) of said rotary contact system (42), interrupting the circuit and turning off said circuit breaker (10).

[0033] According to Figure 3, in a preferred embodiment of the present invention, said circuit breaker (10) additionally comprises the mounting of a variable adjustment disarming bar (60) (best seen in Figure 7) disposed upon said fixed adjustment disarming bar (30) and extending along the length of said fixed disarming bar (30),

wherein said variable adjustment disarming bar (60) contains at least one concave surface (61a, 61b and 61c) (best seen in Figures 7, 8b, 9b and 10b). Said concave surfaces (61a, 61b, 61c), when assembled upon said fixed disarming bar (30), are disposed, respectively, on an edge (33), adjacently so that the flat surfaces (31a, 31b, 31c) surround said edge (33), ensuring a positioning of said variable adjustment disarming bar (60) upon said fixed disarming bar (30).

[0034] Further, according to Figure 3, at least one concave surface (61a, 61b, 61c) of said variable adjustment bar (60) comprises an inclined portion (62) that projects toward the upper portion of at least one bimetal (40). Said central concave surface (61b) further comprises a horizontal portion (63) above said inclined portion (62) that projects toward at least one said bimetal (40), said horizontal portion (63) having a recess (64) wherein a current adjustment dial (70) is disposed. Said current adjustment dial (70) comprises an eccentric bar (71) that can move laterally the position of said variable adjustment bar (60) relative to the fixed disarming bar (30) by contacting said recess surface (64) (best seen in Figure 14).

[0035] According to Figure 4, in a preferred embodiment of the present invention, a circuit breaker top cover (10b) of said circuit breaker (10) can be viewed, which comprises on its internal surface seats (11) where at least one central curved surface (31d) of the fixed adjustment disarming bar (30) which accommodates when a rotation of said fixed adjustment disarming bar (30) occurs. Alternatively, said circuit breaker cover (10b) of said circuit breaker (10) on its internal surface comprises seats (12), where a central curved surface (61d) of said variable adjustment disarming bar accommodates in a rotatable manner, when assembled in an additive manner, in addition to a support face (13) for a stroke limiter (31e) of said fixed disarming bar (30) (better seen in Figure 6), and a hole (83) for passing the test button (80) (seen in Figure 5). Said circuit breaker top cover (10b) of said circuit breaker (10) also has internal side walls (14) and a through hole (15), for the passage of eccentric bar (71) of current adjustment dial (70) (seen in Figure 3).

[0036] In this sense, the current adjustment dial (70), by means of the eccentric bar (71), has the function of changing the distance between the distance adjustment transverse elements (50) in relation to at least one inclined portion (62). Thus, when the current adjustment dial (70) is actuated, the variable adjustment disarming bar (60) moves laterally on the fixed disarming bar (30) (better observed in Figure 7), which can be closer or further away from said distance adjustment transverse elements (50), increasing or reducing a gap between them.

[0037] According to Figures 3 and 5, in a preferred embodiment of the present invention, said circuit breaker (10) comprises a circuit test button (80), said circuit test button (80) comprising a drive bar (81), physically associated with said fixed disarming bar (30), and a spring-

loaded return bar (82), physically associated with a seat (not shown) of the inner surface of said cover (10b). Said circuit test button (80) is disposed in a hole (83) provided in the circuit breaker cover (10b) (seen in Figure 4), so that said circuit test button (80) is positioned above said fixed disarming bar (30).

[0038] In this sense, alternatively, said circuit test button (80) can perform a triggering test when actuated, causing the fixed adjustment disarming bar (30) fixed and bearing via at least one support (26), or the variable adjustment disarming bar (60) (if this is additively mounted), are rotated and, consequently, said support (26) moves the trigger (23) of the operating mechanism (20), interrupting the associated electrical circuit, through said rotary contact system (42).

[0039] Figure 6 shows, in a preferred embodiment of the present invention, a top perspective view of at least one lateral flat contact surface (31a, 31c) and of the central flat contact surface (31b), which projects vertically from an upper surface (32). Additionally, it shows a limit wall (31f) of the fixed adjustment disarming bar (30), projecting above and below said upper surface (32) of said fixed disarming bar (30), in addition to a lower surface (31g), contained in said flat contact surfaces (31a, 31b, 31c) and a rotary stroke limiter arm (31e). A hole (31i) is also provided, used for the passage of a fastener (31j) (seen in Figure 13), to fix said fixed disarming bar (30) in the hole (27) of the operating mechanism (20), (seen in Figure 2) of said circuit breaker (10).

[0040] Figure 7 shows, in a preferred embodiment of the present invention, a top perspective view of the variable adjustment disarming bar (60), at least one central curved surface (61d), at least one concave seating surface (61a, 61b, 61c) (also seen in Figures 8b, 9b, 10b), at least one inclined portion (62), and also said preferably horizontal portion (63), comprising a recess (64) for receiving of an said eccentric bar (71) (seen in Figure 3), positioned above said inclined portion (62), which projects towards at least one bimetal (40) (seen in Figure 3), and lock latch (65).

[0041] Figure 8a shows a front view of the variable adjustment disarming bar (60) in a first vertical assembly seating preparation position, on the upper part of the fixed adjustment disarming bar (30), where at least one latch (65) is seen, so that it can slide vertically in at least one free space (34) until at least one concave surface (61a, 61b and 61c) (seen in Figures 7 and 8b) can touch an upper edge (33) of said fixed adjustment disarming bar (30), of at least one flat contact surface (31a, 31b, 31c), in a preferred embodiment of the present invention.

[0042] Figure 8b is a side view of the variable adjustment disarming bar (60) in a first vertical mounting position from the top of the fixed adjustment disarming bar (30). In this first position there can also be seen a said concave surface (61a, 61b, 61c) aligned vertically with said edge (33) of at least one said flat contact surface (31a, 31b, 31c), in a preferred embodiment of the present invention.

[0043] Figure 9a shows a front view of the variable adjustment disarming bar (60) in a second mounting seating position on top of the fixed adjustment disarming bar (30), where at least one latch (65) is seen, positioned vertically aligned with at least one free space (34) of said fixed adjustment disarming bar (30) where the concave surface (61a, 61b and 61c) (seen in Figure 8b) can touch an upper edge (33) of at least one flat contact surface (31a, 31b, 31c) of said fixed adjustment disarming bar (30) (also seen in Figure 9b). In this position, in Figure 9b, said latch (65) can also be seen in side view in vertical locking preparation position (seen in Figures 9a, in a preferred embodiment of the present invention.

[0044] Figure 10a shows a front view of the variable adjustment disarming bar (60) in a final mounting seating position on top of the fixed adjustment disarming bar (30), where at least one latch (65) is seen, in horizontal lateral displacement after the second preparatory mounting position, so that it can vertically prevent a removal of the variable adjustment disarming bar (60) from said fixed adjustment disarming bar (30) (also seen in Figure 10b). In this position, said vertical latch (65) can be seen in Figures 10a and 10b together with at least one concave surface (61a, 61b and 61c), involving at least one edge (33) and which engages at least one lower surface (31g), having in between at least one flat contact surface (31a, 31b, 31c), in addition to a lateral limit (66) (seen in Figure 7), which can touch the limit wall (31f) (seen in Figure 6) of said fixed adjustment disarming bar (30), in a preferred embodiment of the present invention.

[0045] Figure 11 shows a bottom perspective view of the variable adjustment disarming bar (60) mounted in the final operating position next to the fixed adjustment disarming bar (30), and where at least one upper edge (33) and at least one lower surface (31g) of said fixed adjustment disarming bar (30) can be seen being surrounded by at least one concave surface (61a, 61b, 61c) (best seen in figure 7), and at least one latch (65).

[0046] Figure 12 shows a top perspective view of the variable adjustment disarming bar (60) mounted in the final operating position next to the fixed adjustment disarming bar (30), in which it can be seen that said variable adjustment disarming bar (60) can slide laterally over said fixed adjustment disarming bar (30) according to the action of the adjustment of said distance adjustment transverse element (50), capable of modifying a triggering response time of a thermomagnetic set (not shown) and at least one bimetal (40) in contact and which results in a disengagement of said operating mechanism (20), opening a movable contact (41a) in relation to at least one fixed contact (41b) of a rotary contact system (42) of said circuit breaker (10), according to a current circulating in the electrical circuit, which said circuit breaker (10) protects and monitors.

[0047] This assembly system, known as "poka-yoke", is completed after the cover (10b) of said circuit breaker (10) has been assembled, which limits said sliding lateral displacement of the variable disarming bar (60) upon said

fixed adjustment disarming bar (30), through internal side walls (14) of said cover (10b), increasing or reducing the spacing of at least one inclined portion (62) in relation to distance adjustment transverse elements (50) of at least one bimetal (40), capable of effecting a trigger disarm and interrupting a circulating current in the circuit that said circuit breaker (10) protects and monitors. In this way, said latching (65) (seen in Figure 7) is not capable of aligning with said at least one free space (34), due to the presence of said cover (10b) and prevents a disassembly between them, until said cover (10b) is removed.

[0048] Figure 13 shows in a top view the fixed disarming bar (30) mounted on the operating mechanism (20) by means of the fastener (31j), which passes through the hole (31i) (seen in Figure 6) of said fixed disarming bar (30) and reaches the hole (27) of said operating mechanism (20). It is possible to observe the flat contact surface (31a, 31b, 31c) projecting vertically and frontally to at least one distance adjustment transverse element (50), allowing a fixed distance adjustment only on the inside of the circuit breaker (10).

[0049] As shown in Figure 3, in a preferred embodiment of the present invention, the inclined portion (62) of the variable disarming bar (60) is projected vertically with respect to a current adjustment dial (70) and frontally inclined with respect to at least one distance adjustment transverse element (50), allowing a variable adjustment of a distance between them. The adjustment can be carried out through said current adjustment dial (70) (seen in Figures 3, 14, 15 and 16), arranged through a through hole (15) in the upper outer part of the cover (10b), so that a desired thermal nominal value for the operation of the circuit breaker (10) is set. Said adjustment occurs with the aid of an eccentric bar (71) of said current adjustment dial (70), which when rotated, being guided and limited by the surface of the recess (64), causes a lateral sliding of said adjustment eccentric bar (71), this sliding being provided by at least one concave surface (61a, 61b and 61c) of said variable disarming bar (60), which is seated on at least one upper edge (33) of the fixed adjustment disarming bar (30), and where said variable disarming bar (60), after a sequential assembly, is vertically prevented from being removed, as previously explained in Figures 10a and 10b. This impediment is complemented, in a preferred embodiment, by the seats (11, 12), or additionally, by way of example, by the internal side walls (14), of said cover (10b).

[0050] Figure 14 shows an illustrative example of an initial adjustment embodiment of the current adjustment dial (70), in a top view, where the variable disarming bar (60) variable disarming bar (60) is mounted on the fixed adjustment disarming bar (30) (seen in Figure 6) in a final vertical mounting seating position (seen in Figures 10a and 10b). Said fixed disarming bar (30) and said variable disarming bar (60) meet with their left faces aligned (67a), resulting in an initial thermal graduation of operation of the circuit breaker (10).

[0051] Figure 15 shows an illustrative example of an

adjustment embodiment, in a top view, comprising the variable disarming bar (60) mounted on the fixed adjustment disarming bar (30) (seen in Figure 6), in a final vertical mounting position (seen in Figures 10a and 10b). An intermediate adjustment of the graduation of the current adjustment dial (70) can be seen, with the inclined portion (62) projecting vertically and frontally inclined in relation to at least one distance adjustment transverse element (50), where said fixed disarming bar (30) and said variable disarming bar (60) in this position meet with the left faces presenting an intermediate displacement (67b), and as a consequence said distance adjustment transverse element (50) approaches said inclined portion (62), resulting in said intermediate thermal graduation of operation of said circuit breaker (10).

[0052] Figure 16 shows an illustrative example of maximum final adjustment embodiment, in a top view comprising the variable disarming bar (60) mounted on the fixed adjustment disarming bar (30) (seen in Figure 6), in a final vertical assembly seating position (seen in Figures 10a and 10b). A maximum final adjustment of the current adjustment dial (70) can be seen, having the inclined portion (62) projected vertically and frontally inclined in relation to the at least one distance adjustment transverse element (50), where said fixed adjustment bar (30) and said variable adjustment bar (60) meet with the left faces presenting a maximum final displacement (67c), limited by said lateral limit (66) of said variable adjustment bar (60) (best seen in Figure 7), and as a consequence the distance adjustment transverse element (50) approaches even more to said inclined portion (62), being able to reach a maximum final thermal graduation of operation of the circuit breaker (10).

[0053] Figure 17 shows a top perspective view of the assembled circuit breaker (10), object of the present invention, comprising a circuit breaker base (10a), a circuit breaker cover (10b), a manual operating handle (22), a current adjustment dial (70) for adjusting a trigger function in a variable thermal operating range, associated with the fixed disarming bar (30) or the variable adjustment disarming bar (60) (best seen in Figures 6 to 16), in addition to the indication of a cross-section in the "XY" plane, shown in Figure 18 of the circuit breaker (10).

[0054] Figure 18 shows a longitudinal sectional view in the "XY" plane, shown in Figure 17, of said circuit breaker (10), comprising a fixed adjustment disarming bar (30), arranged in a movable and rotatable manner, on the bar (21) of the operating mechanism (20) and associated with the operating movement of a handle (22) of the circuit breaker (10), capable of switching said circuit breaker (10) on or off, manually. The variable disarming bar (60) is installed on the edge (33) of the fixed adjustment disarming bar (30) (illustrated in Figures 8a to 12), so as to perform a trigger function at a variable thermal operating gradation, synchronously or not, opening at least one moving contact (41a) in relation to at least one fixed contact (41b) between the power supply terminals (43) and the load terminals (44), associated with a system

of rotating contacts (42), associated with at least one bimetal (40), in at least one of the current path poles of said circuit breaker (10), in the aforementioned occurrence of typical short-circuit or overcurrent faults.

[0055] In addition to the embodiment presented above, the same inventive concept may be applied to other possible uses, without prejudice to the present invention.

[0056] Although the present invention has been described with respect to certain preferred embodiments, it is to be understood that it is not intended to be limited to such particular embodiments. Rather, it is intended to encompass all possible alternatives, modifications, and equivalencies within the spirit and scope of the present invention as defined in the scope of the appended claims.

[0057] In a non-limiting example, the person skilled in the art knows that the bimetals could be provided with an inclined surface on the upper part, facing the distance adjustment elements (such as screws), fixed on the variable adjustment bar. This solution would be obvious and should be considered within the scope of the present invention.

Claims

1. Molded case circuit breaker (10) having a circuit breaker base (10a) and at least one circuit breaker cover (10b), comprising:

an operating mechanism (20) provided with a bar (21) and a trigger (23) ;

a fixed disarming bar (30) fixed and bearing through at least one support (26) on said bar (21) of said trigger (23);

said fixed disarming bar (30) comprising at least one flat contact surface (31a, 31b, 31c) projecting vertically connected to an upper surface (32) of said fixed disarming bar (30);

at least one bimetal (40) provided, in its upper portion, with at least one distance transverse adjustment element (50), said at least one bimetal (40) arranged frontally and parallel to said flat contact surface (31a, 31b, 31c) of said fixed disarming bar (30);

wherein a distance between the distance adjustment transverse elements (50) and the fixed adjustment bar (30) comprises a constant adjustment;

characterized in that a variable adjustment disarming bar (60) can be disposed upon said fixed disarming bar (30), wherein said variable adjustment disarming bar (60) contains at least one concave surface (61a, 61b, 61c) disposed on the upper edge (33) of said fixed disarming bar (30) so as to engage said edge (33) of said fixed disarming bar (30);

said variable adjustment disarming bar (60) having an inclined surface (62) that projects frontally

- towards the upper portion of at least one bimetal (40).
2. Circuit breaker, according to claim 1, **characterized in that** said variable adjustment disarming bar (60) can extend along the length of the fixed disarming bar (30).
 3. Circuit breaker, according to claim 1, **characterized in that** said variable adjustment disarming bar (60) has vertical locking latches (65) in conjunction with at least one said concave surface (61a, 61b, 61c), surrounding at least one said edge (33) and at least one said lower surface (31g), having in between at least one said flat contact surface (31a, 31b, 31c).
 4. Circuit breaker, according to claim 1, **characterized in that** said circuit breaker cover (10b) comprises, on its internal surface, seats (11) where the flat contact surface (31a, 31b, 31c) accommodates when said bar (21) moves.
 5. Circuit breaker, according to claim 1, **characterized in that** said variable adjustment disarming bar (60) comprises a horizontal portion (63) above the inclined portion (62), said horizontal portion (63) having a recess (64) wherein a current adjustment dial (70) is disposed.
 6. Circuit breaker, according to claim 4, **characterized in that** said horizontal portion (63) of said variable adjustment disarming bar (60) projects toward at least one said bimetal (40).
 7. Circuit breaker, according to claim 4, **characterized in that** said current adjustment dial (70) comprises a vertical eccentric bar (71) that can modify the adjustment position of said variable adjustment disarming bar (60) by contacting a surface of the recess (64).
 8. Circuit breaker, according to claim 4, **characterized in that** said horizontal portion (63) of said variable adjustment disarming bar (60) has said horizontal portion (63) in a "U" shape.
 9. Circuit breaker, according to claim 3, **characterized in that** the distance between the distance adjustment transverse elements (50) and at least one of the inclined surfaces (62) is displaced laterally by means of the actuation of the current adjustment dial (70).
 10. Circuit breaker, according to claim 1, **characterized in that** it may additionally comprise a circuit test button (80), said circuit test button (80) comprising a drive bar (81), physically associated with said fixed disarming bar (30), and a return bar (82), physically associated with a seat on the external surface of said cover (10b).
 11. Circuit breaker, according to claim 8, **characterized in that** said circuit test button (80) is disposed above said fixed adjustment disarming bar (30).
 12. Circuit breaker, according to claim 1, **characterized in that** said circuit breaker cover (10b) may additionally comprise a hole (83) where said circuit test button (80) may be disposed.
 13. Circuit breaker assembly method, **characterized in that** comprises the steps of:
 - a) positioning said variable adjustment disarming bar (60) in a first position, preparing for vertical assembly seating, on the upper part of said fixed adjustment disarming bar (30), so that at least one latch (65) can slide vertically in at least one free space (34) until at least one said concave surface (61a, 61b and 61c) can touch an upper edge (33) of said fixed adjustment disarming bar (30); and
 - b) sliding said previously inserted variable adjustment disarming bar (60) to the position where said concave surface (61a, 61b and 61c) can touch and engage said upper edge (33) of said fixed adjustment disarming bar (30), where at least one vertical latch (65) engages at least one said lower surface (31g), having in between at least one said flat contact surface (31a, 31b, 31c), positioned after a horizontal lateral displacement.

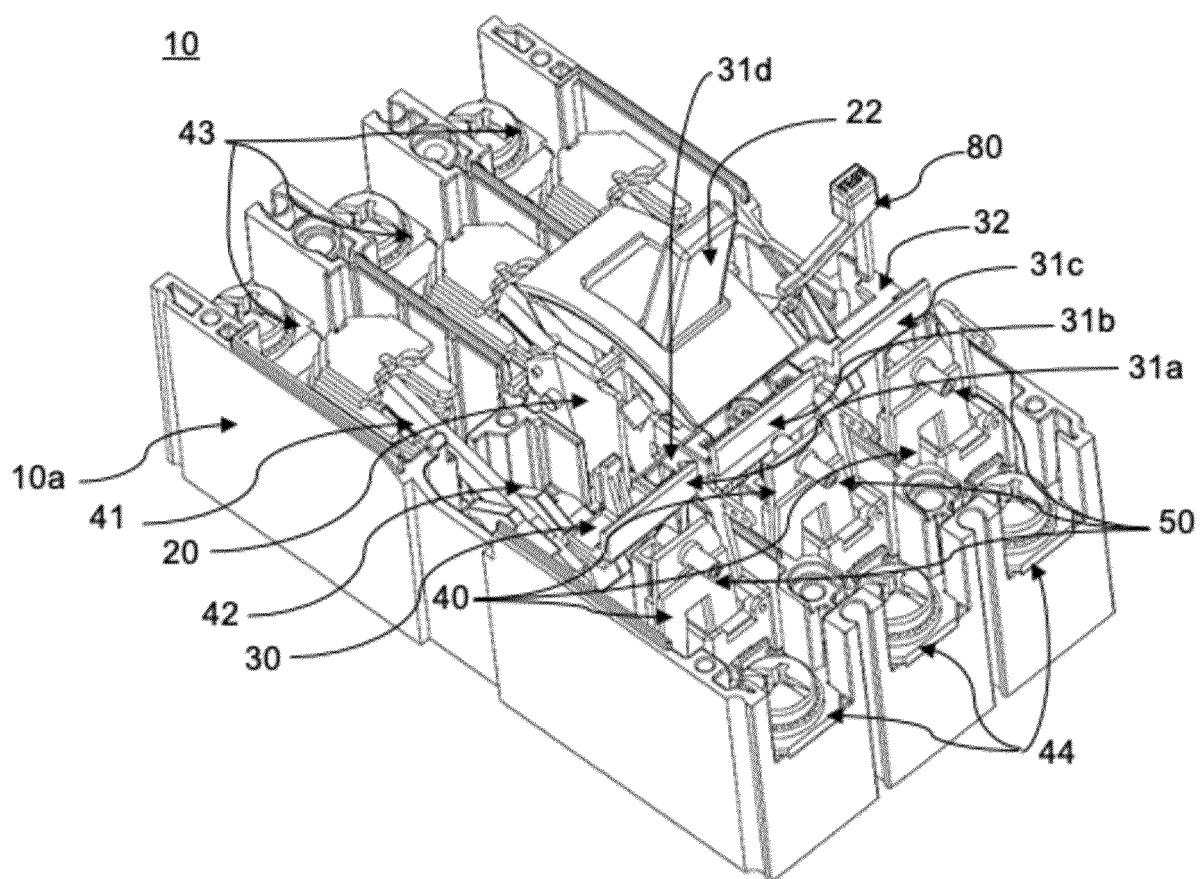


Fig. 1

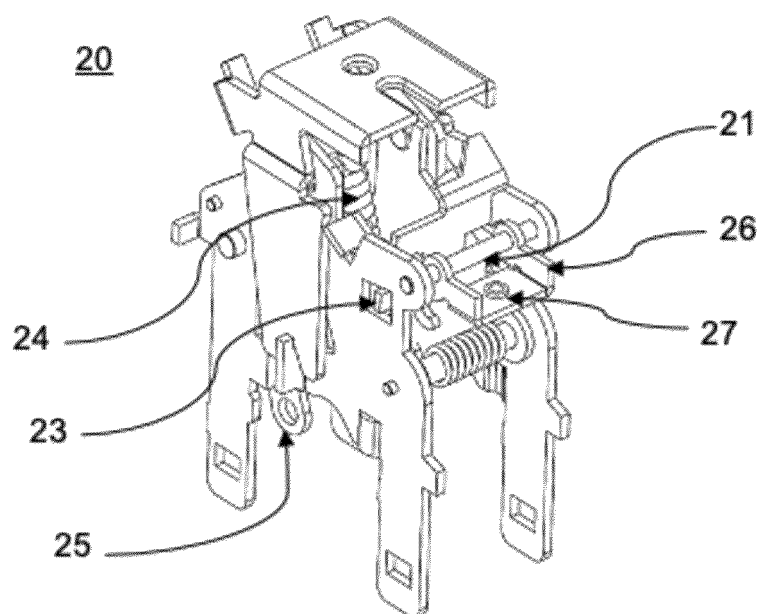


Fig. 2

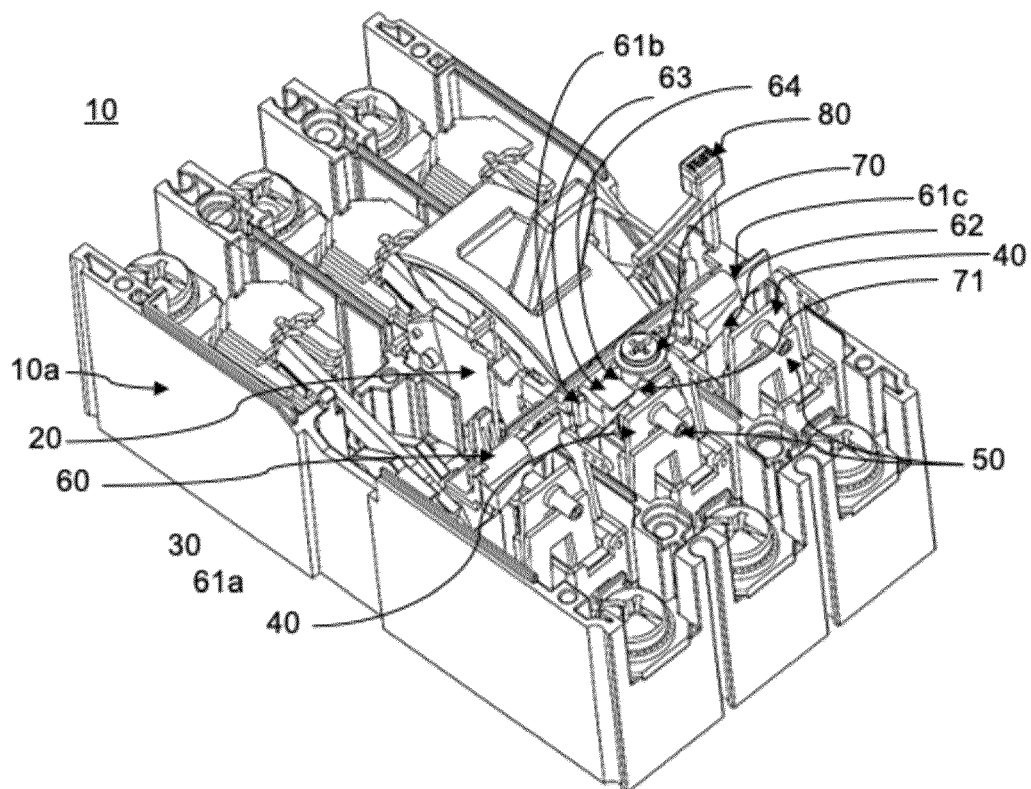


Fig. 3

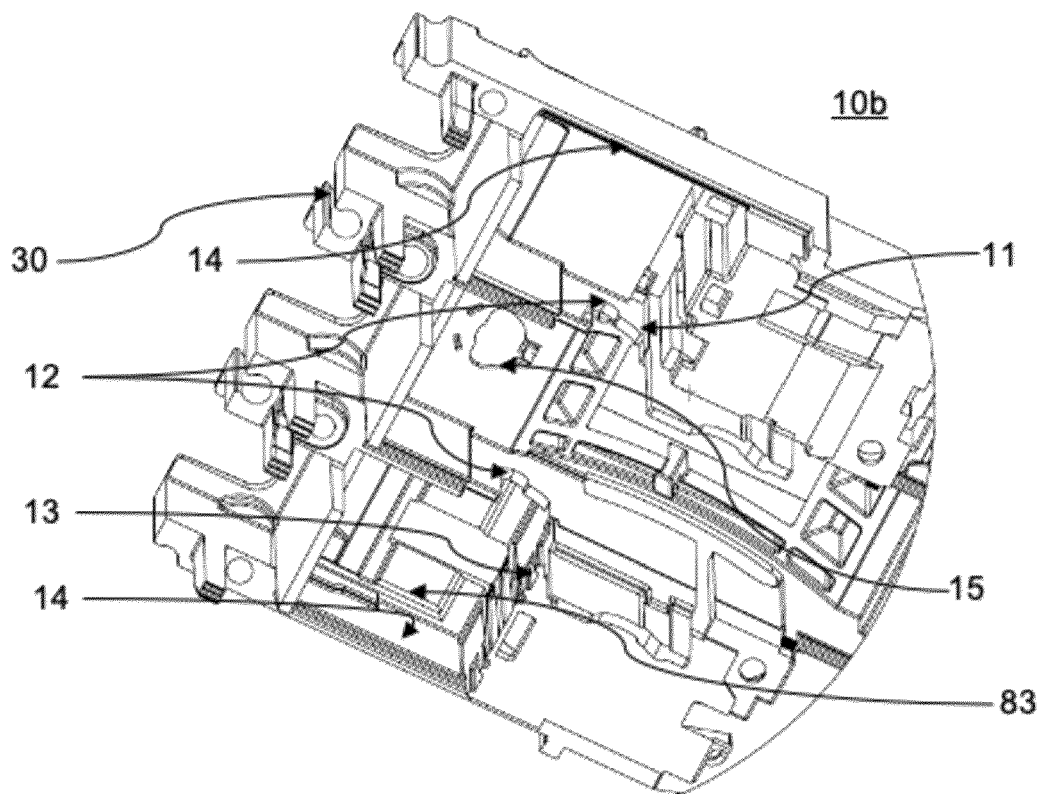


Fig. 4

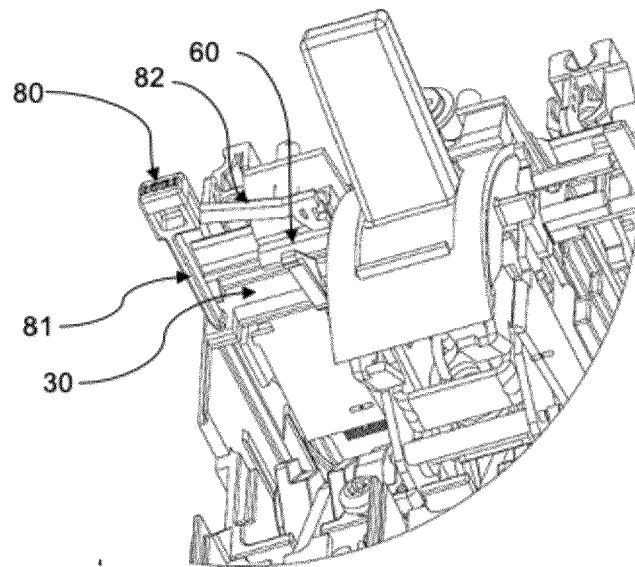


Fig. 5

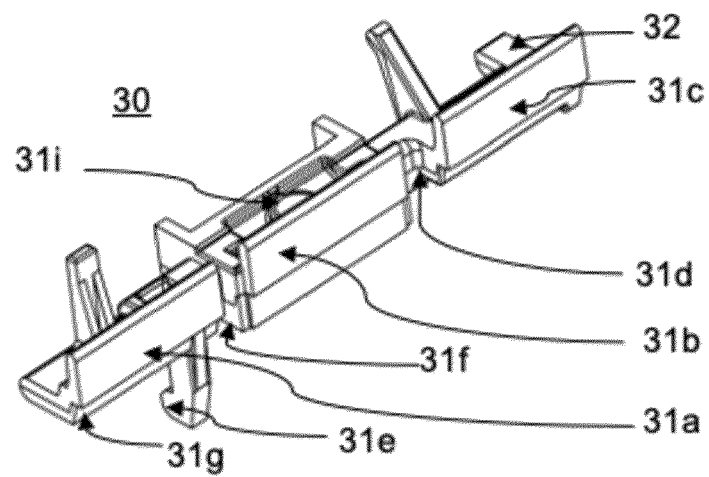


Fig. 6

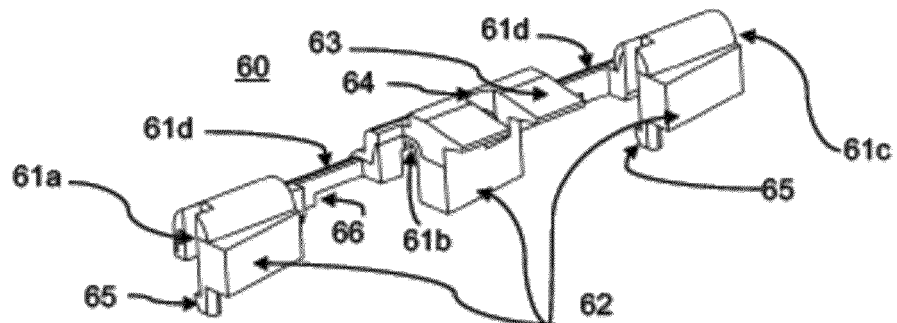


Fig. 7

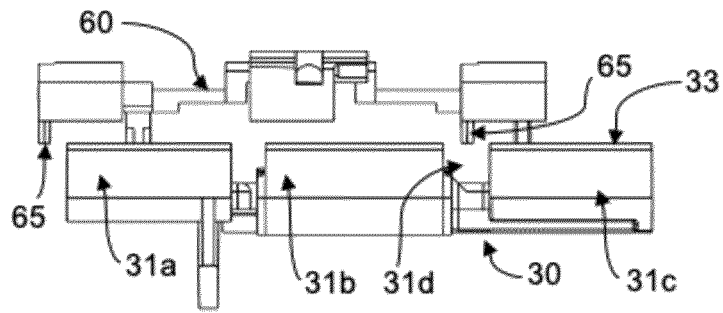


Fig. 8a

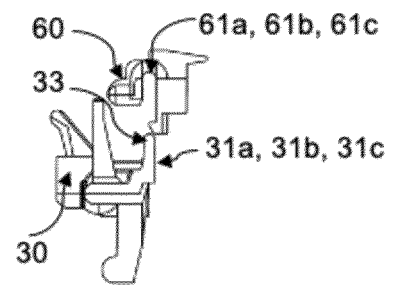


Fig. 8b

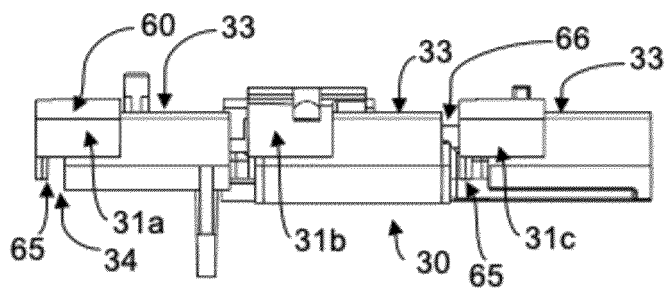


Fig. 9a

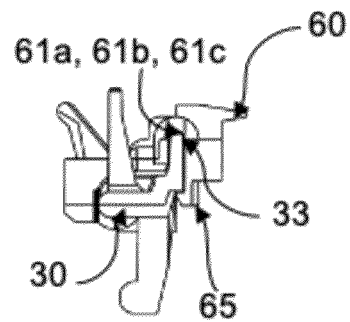


Fig. 9b

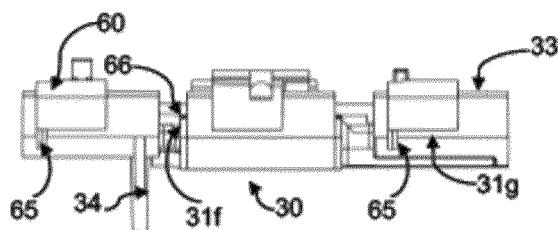


Fig. 10a

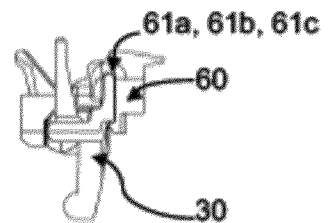


Fig. 10b

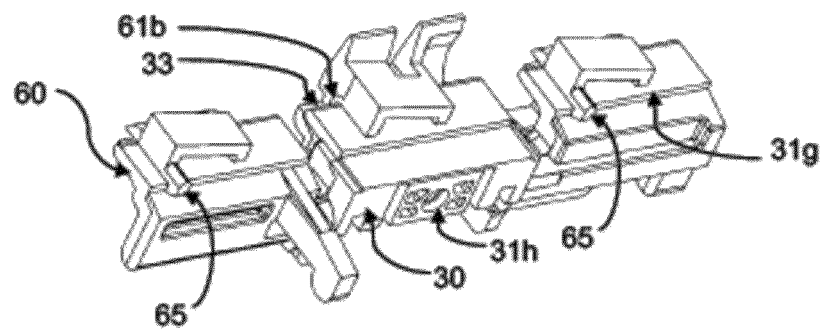


Fig. 11

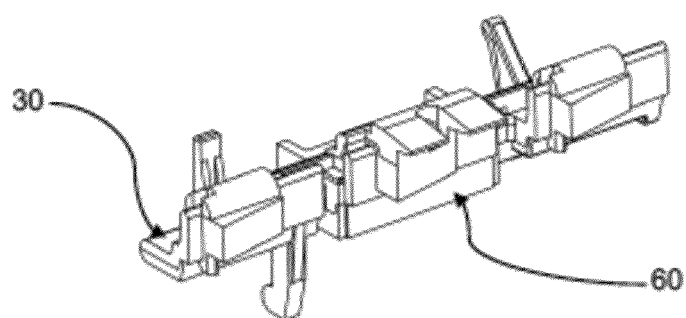


Fig. 12

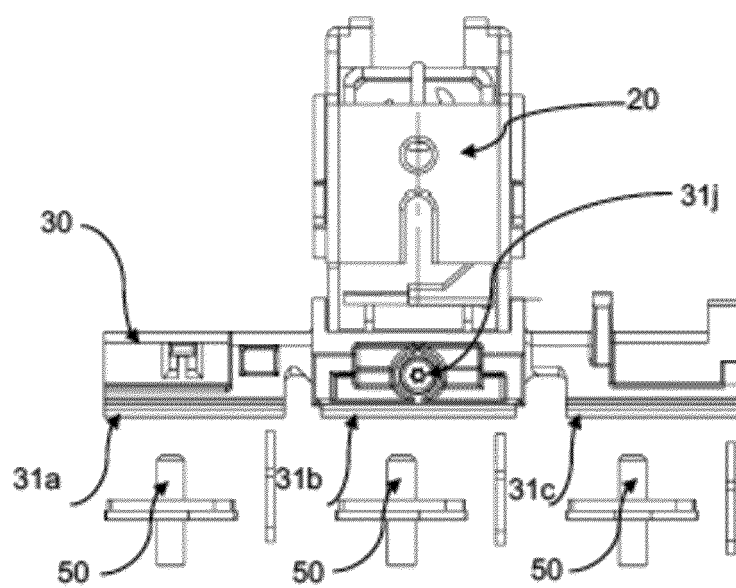


Fig. 13

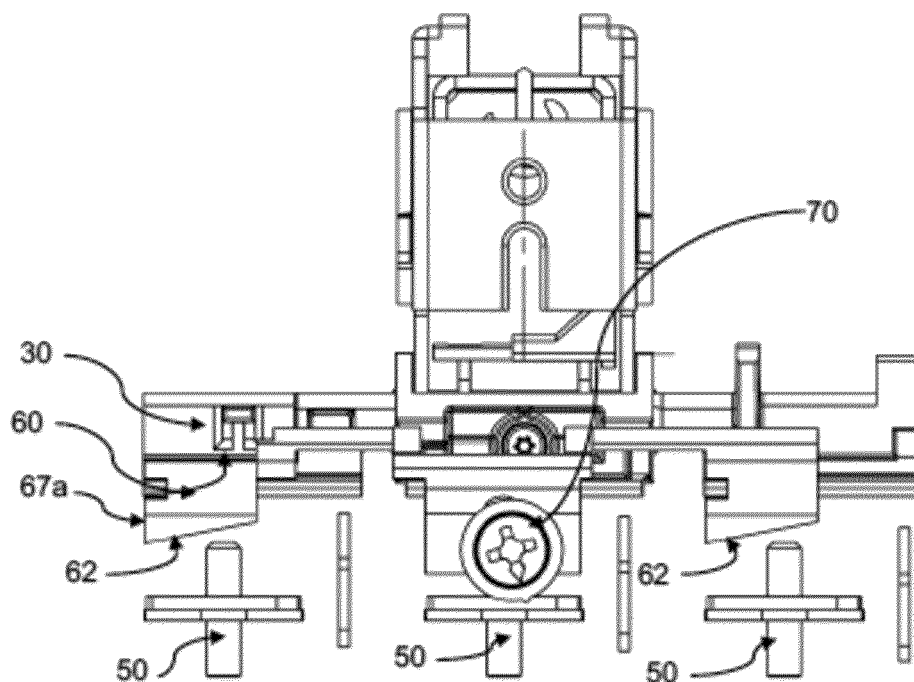


Fig. 14

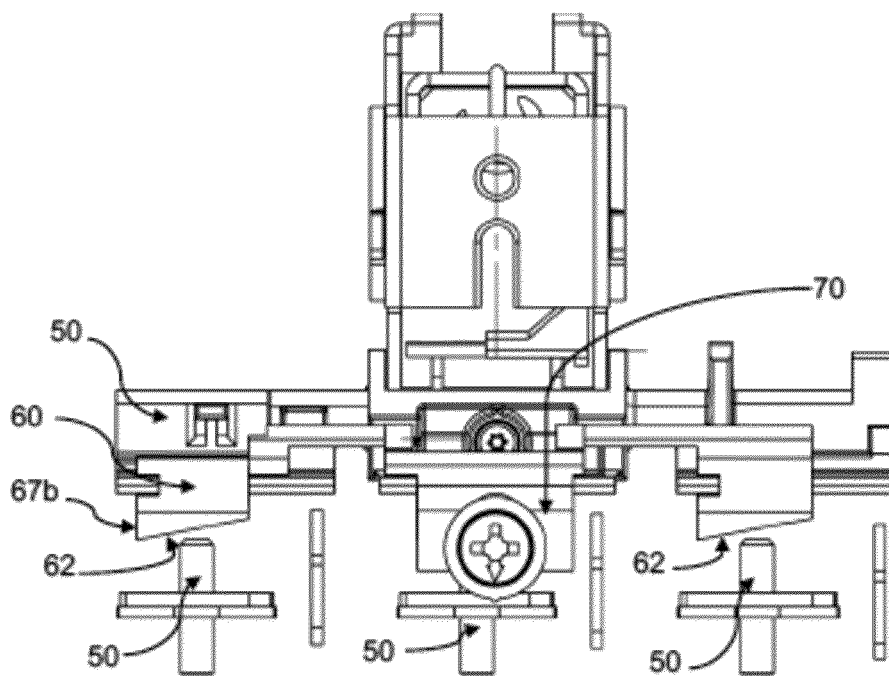


Fig. 15

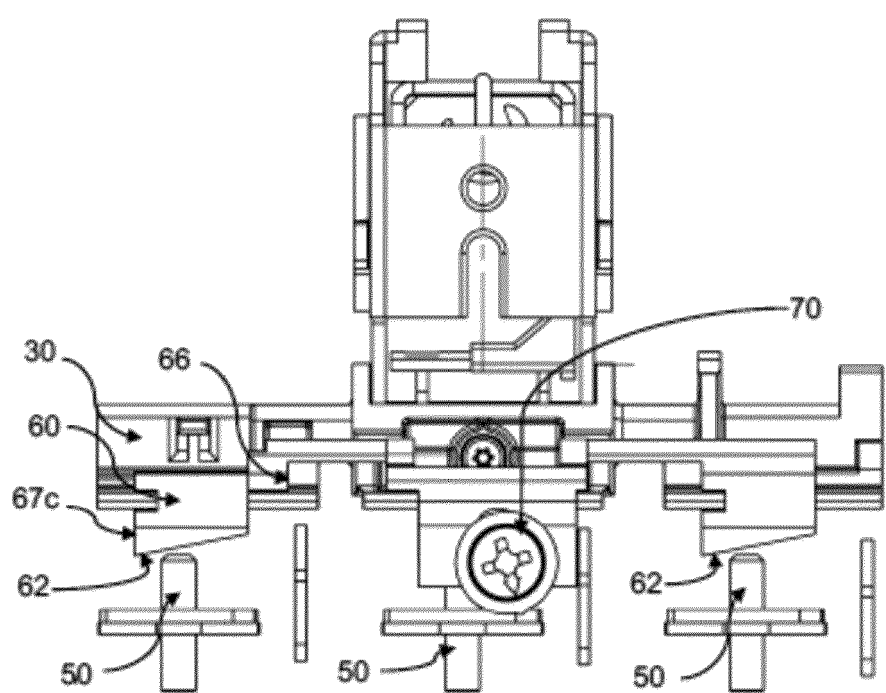


Fig. 16

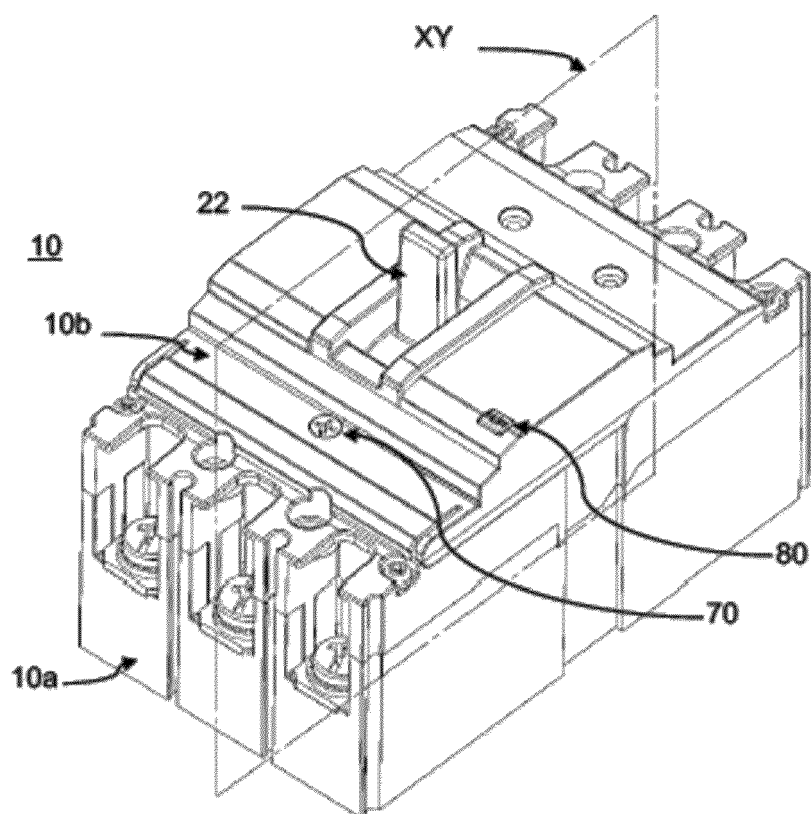


Fig. 17

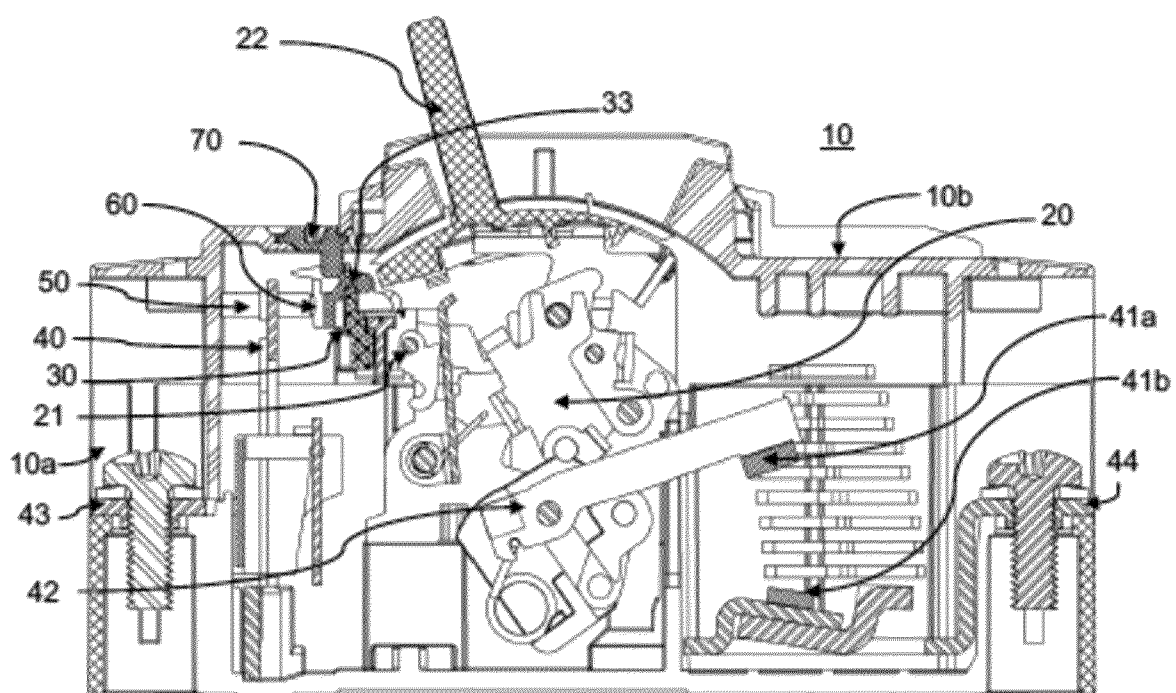


Fig. 18



EUROPEAN SEARCH REPORT

Application Number

EP 24 22 2594

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	KR 2015 0111473 A (HYUN DAI HEAVY IND CO LTD [KR]) 6 October 2015 (2015-10-06) * paragraphs [0087] - [0093] * * figures 1-6 *	1-13	INV. H01H71/74 ADD. H01H83/04 H01H83/22
A	EP 3 242 314 B1 (LSIS CO LTD [KR]) 6 March 2019 (2019-03-06) * paragraphs [0011] - [0028] * * paragraphs [0032] - [0042] * * figures 1-8 *	1-13	
			TECHNICAL FIELDS SEARCHED (IPC) H01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 April 2025	Examiner Glamann, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 24 22 2594

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 20150111473 A	06-10-2015	NONE	

EP 3242314 B1	06-03-2019	CN 107346717 A	14-11-2017
		EP 3242314 A1	08-11-2017
		ES 2726923 T3	10-10-2019
		KR 20170003883 U	15-11-2017
		US 2017323753 A1	09-11-2017

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 1020150111473 [0010]
- CN 214068673 U [0011]
- KR 102271519 B1 [0012]
- KR 102275002 B1 [0013]