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- **Ranjan, Nitesh**
5443 Niederrohrdorf (CH)
- **Lantz, Gabriel**
8005 Zürich (CH)
- **Abplanalp, Markus**
5405 Baden-Dättwil (CH)
- **Rager, Felix Theodor Erich**
5314 Kleindöttingen (CH)

(71) Applicant: **ABB Schweiz AG**
5400 Baden (CH)

(74) Representative: **Zimmermann & Partner**
Patentanwälte mbB
Postfach 330 920
80069 München (DE)

(72) Inventors:
• **Babou, Yacine**
5405 Baden-Dättwil (CH)

(54) **CONTACT ASSEMBLY CONFIGURED FOR A LOAD BREAK SWITCH, LOAD BREAK SWITCH AND METHOD OF QUENCHING AN ELECTRIC ARC WITHIN A LOAD BREAK SWITCH**

(57) A contact assembly (105) for a load break switch (100) including:
a stationary contact unit (110); and
a movable contact unit (120) configured to move between a closed position and an open position, wherein
an electric current i) flowing along a current path (140) through the stationary contact unit (110) and the movable contact unit (120) and ii) including an electric arc (142) between the stationary contact unit (110) and the movable contact unit (120) is adapted to generate a magnetic field enabling a Lorentz force (144) to act on the electric arc (142), wherein
iii) a structure (122) of the movable contact unit (120) is adapted to form the current path (140) or iv) a structure (112) of the stationary contact unit (110) and a structure (122) of the movable contact unit (120) are adapted to form the current path (140), such that in both cases iii), iv) the Lorentz force (144) enlarges a path of the electric arc (142), to facilitate quenching or extinguishing the electric arc (142), and
in the closed position, the structure (122,112) is configured to allow the current flowing through the movable contact unit (120) and the stationary contact unit (110) to flow along a current path (140) that is unaffected by the structure (122,112).

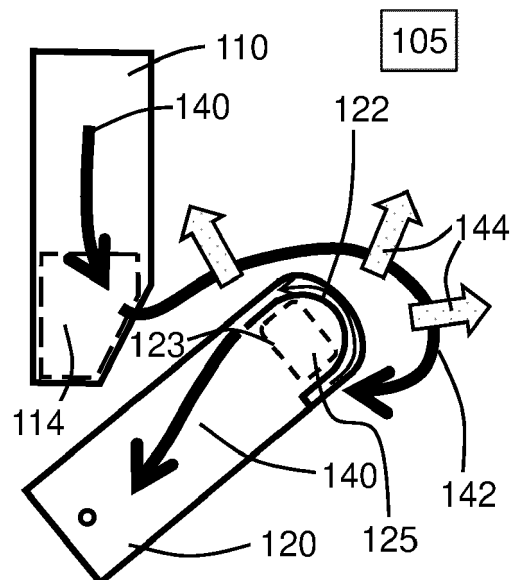


Fig. 2c

Description

TECHNICAL FIELD

[0001] Embodiments of the present disclosure relate to a contact assembly configured for a load break switch, a load break switch, especially a medium voltage load break switch or disconnecter, and a method of quenching an electric arc established when opening a load break switch.

BACKGROUND

[0002] A load break switch used in a medium voltage power distribution range circuit generally includes a pair of electrodes, one being stationary and the other movable to open and close the circuit. When opening the switch, when a gap is established between the electrodes, a current-carrying arc is generated between the electrodes. In such a load break switch, the arc acts on the electrodes due to the consequences of the arc current flowing through the load break switch, increasing the erosion effect on the electrodes, and increasing the mechanical stress on the load break switch when a mechanical force is applied to the movable electrode to open the load break switch.

[0003] Accordingly, it would be beneficial to improve the structure of the switch or switch electrodes in such a way as to facilitate quenching the electric arc during the opening movement in a minimum of time, reduce arc damage and, at the same time, avoid space-wasting efforts to extinguish the arc, and control the location at which the electric arc is attached to.

TERMS AND DEFINITIONS

[0004] This application uses terms whose meaning is briefly explained here.

[0005] The term axial refers to a longitudinal axis of an element or unit. The term longitudinal refers to a direction in which the element has the greatest spatial extension. The term lateral refers to a direction perpendicular to the longitudinal axis, in which the object has the second largest extension. An axial direction refers to a direction parallel to the longitudinal axis of the element.

[0006] Value ranges defined as x_1 , or x_2 , etc. to y_1 , or y_2 , etc. mean that the values are within intervals such as x_1 to y_1 , or x_1 to y_2 , or x_2 to y_1 , or x_2 to y_2 , etc.

[0007] A curved electric arc is mathematically regarded as a 3D bowed curve which is expressed in parametric terms as $r(s)$, where r is the radius or distance from the centre of curvature of the entire curve or arc to a point on the curve or arc, and s is the distance along the curve or arc from the beginning of the curve or source of the arc to said point. A bowed curve is to be considered as an open loop or partial loop and has a loop angle that is understood as the angle between $r(0)$ and $r(s_{\max})$, where $r(0)$ is the radius at $s = 0$ at the beginning of the curve,

and $r(s_{\max})$ is the radius at $s = s_{\max}$ at the end of the curve. The centre of curvature of the entire curve is to be considered as intersection point of two infinitely close normal lines to the curve at $s = s_{\max}/2$, which corresponds to the standard definition of Cauchy when applied at $s = s_{\max}/2$. The terms "centre of curvature of the entire curve", "centre of the curve" and "centre of the arc" are to be considered identical in meaning.

[0008] A radial or outward direction is understood as pointing from the centre of the curve to a point on the curve, away from the centre of the curve; the radial direction is oriented outwards as seen from the center of the curve.

[0009] An open position is characterized by no electric current flowing through a contact assembly including a movable contact unit and a stationary contact unit when a voltage is applied between the movable contact unit and the stationary contact unit.

[0010] A closed position is characterized by the movable contact unit and the stationary contact unit being electrically connected by means of a galvanic contact.

[0011] An intermediate position is a position between the closed and open position and is characterized by an electric current flowing through the contact assembly, wherein i) the electric current comprises an electric arc between the stationary contact unit and the movable contact unit, or ii) the stationary contact unit is not galvanically connected to, or is spaced from, the movable contact unit. In the intermediate position, the movable contact unit is separated from the stationary contact unit by a distance shorter than the distance in the open position. An electric arc can in fact only occur in the intermediate position, and the term loop is used only with regard to the current path within the movable contact unit or the stationary contact unit, or to the current arc.

[0012] The closed, intermediate and open positions are movement states of the movable contact unit or of the contact assembly, thus constituting successive positions of an opening movement, and/or electrical connection states of a contact assembly or a load break switch.

[0013] A first end region of the movable or stationary contact unit includes a contact region which is at least partially electrically conductive and which, in the closed state or the intermediate state, allows the flow of an electric current between the movable contact unit and stationary contact unit. If necessary, the whole first end region of the movable or stationary contact unit can be identical with the corresponding contact region.

[0014] An opening direction is the direction of movement of the contact region of the movable contact unit, from the closed position to the open position, especially along a tangent to the movement trajectory of the contact region.

[0015] A full cut through an object is a cut or section through the object that forms an elongated opening between two opposite faces of the object.

SUMMARY

[0016] According to an aspect of the present disclosure, a contact assembly for a load break switch is provided. The contact assembly includes a stationary contact unit and a movable contact unit, wherein the movable contact unit is configured to move between a closed position and an open position. An electric current flows along a current path through the stationary contact unit and the movable contact unit and includes an electric arc between the stationary contact unit and the movable contact unit. The electric current, especially i) the electric arc and/or ii) the current within the stationary contact unit and/or the movable contact unit, is adapted to generate a magnetic field perpendicular to the current path, especially to the path of the electric arc, and/or to a plane enclosing the current path, especially the path of the electric arc.

[0017] In interaction with the electric current, the magnetic field is adapted to generate a Lorentz force that acts on the electric arc.

[0018] A structure of the stationary contact unit and/or a structure of the movable contact unit is adapted to form the current path, such that the Lorentz force enlarges a path of the electric arc, to facilitate quenching or extinguishing the electric arc. Each solution of the "and/or" combination may include at least a structure with features which are different from the features included in the structures of the other solutions.

[0019] First, a structure of the movable contact unit is adapted to form the current path such that the Lorentz force enlarges a path of the electric arc. Second, a structure of the stationary contact unit is adapted to form the current path such that the Lorentz force enlarges a path of the electric arc. Third, a structure of the stationary contact unit and a structure of the movable contact unit is each adapted to form the current path such that the Lorentz force enlarges the path of the electric arc path. That means that the magnetic field generated by the electric current flowing through the movable contact unit and/or the stationary contact unit, particularly by the electric arc, in interaction with the electric current, is adapted to generate a Lorentz force that pushes the electric arc to a direction away from the movable contact unit. The shape of the path of the electric current in interaction with the resulting Lorentz force are adapted to enlarge the path of the electric arc and to facilitate quenching or extinguishing the electric arc.

[0020] The contact region of the movable contact unit may establish an electrical contact to the contact region of the stationary contact unit in the closed or intermediary position. The contact region of the movable contact unit may include at least one point of contact which, in the closed position, allows an electric current to flow between the stationary contact unit and the movable contact unit via the point of contact.

[0021] The stationary contact unit and the movable contact unit have a structure wherein each of them sep-

arately is adapted or both together are adapted to enable a Lorentz force generated by the electric current including the electric arc and flowing through the contact assembly to act on the electric arc in a direction substantially radial to the electric arc. The structure is adapted to guide the current flowing through the contact region of the movable contact unit and/or the contact region of the stationary contact unit in a current path formed each as a partial loop.

[0022] The Lorentz force resulting thereof is adapted to guide the electric arc in a path formed as a partial loop around the point of contact and/or to enlarge a path length of the electric arc.

[0023] In the closed position, the structure is configured to allow the current flowing through the movable contact unit and/or the stationary contact unit to flow along a current path that is unaffected by the structure. In particular, the current path in the movable contact unit and/or the stationary contact unit is essentially linear or straight and/or does not form a partial loop.

[0024] According to another aspect of the present disclosure, a load break switch is provided. The load break switch includes a contact assembly as described above, and at least one splitter plate arranged next to the contact assembly. The at least one splitter plate includes especially a plurality of splitter plates particularly arranged parallel to each other and at a distance from each other.

[0025] i) A structure of the movable contact unit is adapted to form the current path or ii) a structure of the stationary contact unit and a structure of the movable contact unit are adapted each to form the current path, such that in both cases i), ii) the Lorentz force pushes the electric arc towards the splitter plate, to facilitate quenching or extinguishing the electric arc.

[0026] According to another aspect of the present disclosure, a method of quenching an electric arc between a stationary contact unit and a movable contact unit of a load break switch is provided. The movable contact unit moves between a closed position and an open position via a position in which the electric arc is established between the stationary contact unit and the movable contact unit.

[0027] An electric current i) flowing along a current path through the stationary contact unit and the movable contact unit and ii) including an electric arc between the stationary contact unit and the movable contact unit generates a magnetic field enabling a Lorentz force to act on the electric arc.

[0028] The method comprises a step of forming a path of the electric arc enabled by a structure of the movable contact unit and/or a structure of the stationary contact unit to direct the Lorentz force towards at least one splitter plate of the load break switch and to push the electric arc towards the splitter plate, thus enabling quenching the electric arc. The "and/or" wording provides three alternative solution to a specific problem, analogous to the above description part regarding the contact assembly.

[0029] The contact assembly, the load break switch

and the method of the present disclosure provide a concept for facilitating quenching the electric arc during the opening movement in a minimum of time, thus reducing arc damage while avoiding space-wasting efforts to extinguish the arc and improve controlling the location at which the electric arc is attached to.

[0030] Further aspects, advantages and features of the present disclosure are apparent from the dependent claims, the description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] So that the manner in which the above recited features of the present disclosure can be understood in detail, a more particular description of the present disclosure, briefly summarized above, may be had by reference to typical embodiments. The accompanying drawings relate to embodiments of the present disclosure and are described in the following:

Fig. 1 shows a schematic side view of a load break switch known from prior art in an intermediate position of an opening movement;

Figs. 2a-2c show schematic side views of a contact assembly in successive positions of an opening movement according to embodiments described herein;

Fig. 3 shows a load break switch in an open position;

Figs. 4a, 4b show schematic side views of contact assemblies according to embodiments described herein;

Fig. 4c shows in detail section A of Fig. 4a;

Figs. 5a-5e show schematic side views of movable contact units according to embodiments described herein;

Fig. 6a-6d show schematic side views of stationary contact units according to embodiments described herein;

Fig. 7 shows a flowchart of a method of quenching an electric arc between a stationary contact unit and a movable contact unit of a load break switch.

DETAILED DESCRIPTION OF EMBODIMENTS

[0032] Reference will now be made in detail to the various embodiments of the present disclosure, one or more examples of which are illustrated in the figures. Within the following description of the drawings, the same reference numbers refer to the same components. Generally, only the differences with respect to individual embodiments are described. Each example is provided by

way of explanation and is not meant as a limitation of the present disclosure. Features illustrated or described as part of one embodiment can be used on or in conjunction with other embodiments to yield yet a further embodiment. It is intended that the description includes such modifications and variations.

[0033] The present invention relates to a load-break switch particularly adapted for use in medium voltage power distribution systems in the range about 1 to about 52 kilo-volts (kV), especially at most to 42 kV for peak currents of up to about 100 kilo-amperes (kA).

[0034] Fig. 1 shows a schematic side views of a load break switch 10 known from prior art in an intermediate position of an opening movement. The load break switch 10 includes a pair of electrodes, one electrode 12 being stationary and the other electrode 14 movable to close and open a circuit. The movable electrode 14 is rotatable about a pivot and is configured to move from a closed position (not shown) via the intermediate position shown in Fig. 1 to an open position (not shown).

[0035] In the intermediate position, a current-carrying electric arc is generated between the electrodes 12, 14 due to the voltage applied. The current 140 flowing through the electrodes 12, 14 and the electric arc 142 generate an electromagnetic field. The direction of the arrows related to the current flow 140 indicate the flowing direction of the current, that may as well flow in the opposite direction.

[0036] However, in the position of Fig. 1 in which the electric arc has been established between the electrodes 12, 14, the electromagnetic force generated by the magnetic field of the current in interaction with the current itself is not stationary over time and can fluctuate considerably in direction and intensity, due to the shape of the current path contributing to its generation. For this reason, the arc has a long lifetime and can therefore cause considerable damage to the electrodes 12, 14.

[0037] Figs. 2a-2c show schematic side views of a contact assembly 105 for a load break switch in successive positions of an opening movement according to embodiments of the present invention. Details explained with illustrative reference to Figs. 2a-2c shall not be understood as limited to the elements of Figs. 2a-2c. Rather, those details may also be combined with further embodiments explained with illustrative reference to the other figures.

[0038] According to embodiments described herein, a contact assembly 105 may include a stationary contact unit 110, and a movable contact unit 120. The movable contact may be rotatable about a pivot 126 or fulcrum and the movable contact unit 120 and may be configured to move from a closed position shown in Fig. 2a via a threshold position shown in Fig. 2b and an intermediate position shown in Fig. 2c to an open position. Generally, the movable contact unit 120 and may be configured to move between a closed position and an open position.

[0039] The closed position may include a multitude of closed positions, the intermediary position may include

a multitude of intermediary positions, and the open position may include a multitude of open positions, each position in combination with corresponding and differing tilt angles of the movable contact unit 120.

[0040] An electric current may flow along a current path 140 through the stationary contact unit 110 and the movable contact unit 120 and may include an electric arc 142 between the stationary contact unit 110 and the movable contact unit 120. The electric current, especially i) the electric arc 142 and/or ii) the current within the stationary contact unit 110 and/or the movable contact unit 120, may be adapted to generate a magnetic field perpendicular to the current path 140, especially to the path of the electric arc 142, and/or to a plane enclosing the current path 140, especially the path of the electric arc 142. In interaction with the electric current, the magnetic field may be adapted to generate a Lorentz force 144 that acts on the electric arc 142.

[0041] A structure of the movable contact unit 120 may be adapted to form the current path 140 such that the Lorentz force 144 enlarges a path of the electric arc 142. Similarly, a structure of the stationary contact unit 110 and a structure of the movable contact unit 120 may each be adapted to form the current path 140 such that the Lorentz 144 force enlarges the path of the electric arc 142. That means that the magnetic field generated by the electric current flowing through the movable contact unit 120 and/or the stationary contact unit 110, especially by the electric arc 142, in interaction with the electric current, may be adapted to generate a Lorentz force 144 that pushes the electric arc 142 to a direction away from the movable contact unit 120. The arc root is driven to a stable point on one or both contact units 110, 120, which stabilizes the arc 142. The shape of the path 140 of the electric current in interaction with the resulting Lorentz force 144 may be adapted to enlarge the path of the electric arc 144, to improve controlling the location at which the electric arc is attached to and to facilitate quenching or extinguishing the electric arc 144.

[0042] The contact region 123 of the movable contact unit 120 may establish a galvanic electrical contact to the stationary contact unit 110 in the closed position, and the feeding region 124 is located axially opposite the contact region 123. Especially, the contact region 123 is in the axial direction near a first end or within or a first end region of the movable contact unit 120. The movable contact unit 120 may be configured to move between the closed position and the open position via the intermediate position

The stationary contact unit 110 may include a contact region 114 located in axial direction close to a first end or within or a first end region of the stationary contact unit 110 that establishes galvanically an electrical contact to the movable contact unit 120 in the closed position.

[0043] The contact region 123 of the movable contact unit 120 and the contact region 114 of the stationary contact unit 110 may include each at least one point of contact which, in the closed position, allows an electric cur-

rent to flow through the contact assembly 105 via the point of contact. The at least one point of contact may include several points of contact, for example 2 or 5 or 10 or more points of contact. The point of contact 125 of the movable (or stationary) contact unit 110 (or 120) may fill up at least partially an area of the contact region 123 (or 114). Typically, the point of contact may fill up less than 100%, or 80%, or 60% and more than 10%, or 20%, or 40% the area of the contact region 123, 114. The point of contact can be fixed contact or a sliding contact.

[0044] A fixed contact means that the operatively coupled elements (stationary contact unit 110, movable contact unit 120) have galvanic contact with each other in a single position of the movable contact unit 120. A sliding contact means that the operatively coupled elements are in galvanic contact with each other in a multitude of positions; the elements are thus slidably electrically connected to each other galvanically. The closed sliding or fixed contact can be reopened.

[0045] The entire contact region 123, 114 of the movable contact unit 120 and/or of the stationary contact unit 110 can be electrically conducting. However, the galvanic electrical contact in the closed position can be established between the movable contact unit 120 and the stationary contact unit 110 via the point of contact or via the contact region 123, 114 of the movable contact unit and of the stationary contact unit.

[0046] The stationary contact unit 110 and the movable contact unit 120 may have a structure wherein each of them separately is adapted or both together are adapted, in the intermediate position, to enable a Lorentz force 144 generated by the electric current including the electric arc 142 and flowing through the contact assembly 105 to act on the electric arc 142 in a substantially radial direction to the electric arc 142. The structure may be adapted to guide the current flowing through the contact region 123 of the movable contact 120 unit and/or the contact region 114 of the stationary contact unit 110 in a current path 140 formed each as a partial loop. The Lorentz force 144 resulting thereof may be adapted to guide the electric arc 142 in a path formed as a partial loop around the point of contact 125 and/or to push the electric arc 142 in radial direction, thus enlarging a path length of the electric arc 142.

[0047] In the closed position, the structure is configured to allow the current flowing through the movable contact unit 120 and/or the stationary contact unit 110 to flow along a current path 140 that is unaffected by the structure. In particular, the current path 140 in the movable contact unit 120 and/or the stationary contact unit 110 is essentially linear or straight and/or does not form a partial loop.

[0048] The contact assembly 105 may include a first feed line for electrically connecting the stationary contact unit 110 to an external power circuit such as a power circuit. The contact assembly 105 may also include a second feed line for electrically connecting the movable contact unit 120, especially the feed region 124 of the

movable contact unit 120, to the external power circuit.

[0049] The movable contact unit 120 and the stationary contact unit 110 can include or be made of an electrically conductive material, in particular a metal such as copper, copper alloy, aluminum or the like. The opening movement of the movable contact unit 120 may be effected or caused by the action of a mechanical opening force, which in particular may be exerted by means of an actuator (not shown) connected to the movable contact unit 120.

[0050] As soon as the movable contact unit 120, coming from the closed position and moving under the action of the mechanical opening force in the opening direction, reaches the intermediate position so that an electric arc 142 is created and an arc current begins to flow, an electromagnetic force in terms of a Lorentz force 144 may begin to act on the electric arc 142. Said Lorentz force 144 is generated by the magnetic field of the current in interaction with the current itself.

[0051] In the prior technique (Fig. 1), an electromagnetic force generated by the magnetic field of the current in interaction with the current itself can fluctuate considerably in direction and intensity, due to the shape of the current path 140, 142. In contrast to that, the current path 140 shown in Fig. 2c, within movable contact unit 120, and path of the electric arc 142, have each the form of a partial loop. The magnetic field generated this way has a high uniformity inside the loop 142, which results in greater stability and temporal stationarity of the electric arc 142 as compared with known structures generating arc loops 142 with wider openings, wherein the loop angle of a loop determines the opening width of the loop. Based on the uniformity of the magnetic field and the form of the current loop 140, 142, some technical effects may be achieved.

[0052] An effect consists in that the Lorentz force 144 has a direction essentially radial to the opening movement or to the trajectory of the point of contact 125 of the movable contact unit 120. A further effect consists in that the Lorentz force 144 has an improved stationarity over time and fluctuates considerably less in direction and intensity. The arc root is driven to a stable point on one or both contact units 110, 120, which stabilizes the arc 142. Such a Lorentz force 144 pushes the electric arc radially outward, away from the centre of the arc bow 142, and contributes advantageously to a stable and strong enlargement of the arc path 142, thus facilitating quenching the electric arc 142 during the opening movement in a minimum of time, and reducing arc damage on the contact units 110, 120.

[0053] Regardless of the current loop 142 generated in the intermediate position by the specific structure of the stationary and/or movable contact unit 120 adapted to enable a Lorentz force 144 generated by the current loop 142 to push the electric arc 142 radially outward, in the closed position the current path 140 is unaffected by said structure of the stationary and/or movable contact unit 110, 120. Particularly, in the closed position the cur-

rent flows along a straight path 140 through the contact assembly 105.

[0054] According to prior art, a magnetic field with sufficient uniformity, strength and stationarity is commonly generated by additional devices, such as coils or permanent magnets. Such devices can have considerable sizes, which in turn take up a considerable amount of space. According to the present invention, however, the magnetic field can be generated by the structure of the stationary contact unit 110 and/or movable contact unit 120 alone without the need for additional devices. The present solution is therefore considerably more space-saving than known variants and allows the construction of smaller switches.

[0055] According to embodiments described herein, the structure of the movable contact unit 120 and/or the stationary contact unit 110 may include at least one barrier zone 112, 122 through which the flow of electric current is obstructed or prevented. In the intermediate position, said barrier zone 112, 122 may be configured to guide the current flow through the contact region 123 of the movable contact unit 120 and the contact region 114 of the stationary contact unit 110 in a current path 140 formed as a partial loop and/or an electric arc 142 formed as a partial loop, so that the Lorentz force 144 pushes the electric arc 142 radially outwards. This may facilitate quenching the electric arc 142 during the opening movement in a minimum of time, and reducing arc damage on the contact units 110, 120.

[0056] The barrier zone 112, 122 can be configured as a loop enlarging arrangement within the structure of the movable contact unit 120 and/or the stationary contact unit 110. The loop enlarging process pushes the electric arc 142 radially outwards and facilitates quenching the electric arc 142 during the opening movement in a minimum of time. The barrier zone 112, 122 can as well be configured as an arrangement guiding the current through a channel region 128 or through a channel of the movable or stationary contact unit 120, 110. The barrier zone 112, 122 can as well be configured as an arrangement that specifies or controls a location at which the electric arc 142 is attached to.

[0057] In the intermediate position, the barrier zone 122 within the movable contact unit 120 can be configured to inhibit a flow of electric current from the electric arc 142 or from the contact region 123 of the movable contact unit 120 to the feed region 124 of the movable contact unit 120. This feature may have the effect of guiding the current into a zone near the surface of the contact region 123 of the movable contact unit 120, i.e. into a channel region 128 between the barrier zone 122 and an outer zone of the movable contact unit 120, such that the current path 140 and/or the arc path 142 is formed into a loop and the Lorentz force 144 pushes the electric arc radially outwards. Guiding the current through the channel region 128 or through a channel has the effect of enabling to control the location at which the electric arc 142 is attached to.

[0058] The barrier zone 122 within the movable contact unit 120 can be configured, in the intermediate position, to narrow the electric current path 140 or to inhibit the electric current flow within the movable contact unit 120. This may force the current path 140 and/or the arc path 142 to form a loop and the Lorentz force 144 to push the electric arc radially outwards. A root of the arc 142 is moving along the channel region 116, 128, which expands the arc 142 radially outwards.

[0059] The barrier zone 112, 122 can be determined by a material gap or an electrically insulating material. The barrier zone 112, 122 thus can form an obstacle that the electric current has to circumvent. Alone or in combination with the boundary of the movable or stationary contact unit 110, the barrier zone 112, 122 can form a channel 116, 128 guiding the current and shaping or determining the current path 140 and/or the arc path 142. Guiding the current through the channel region 116, 128 or through a channel has the effect of enabling to control the location at which the electric arc 142 is attached to. The barrier zone 112, 122 can therefore be adapted to bring the current path 140, particularly the arc path 142, into a loop shape which produces the effects and advantages already described.

[0060] The partial loop of the current path 140 and/or the electric arc 142 can be an open loop with a loop angle of 3° or 60° or 120° to 180° or 240° or 320°. A partial loop 140 configured as an almost complete loop may have a loop angle of 3° and may be configured such that the beginning and the end of the loop are electrically separated from each other.

[0061] According to embodiments described herein, the contact region 123 of the movable contact unit 120 can be arranged between the barrier zone 122 and the first end of the movable contact unit 120. This provides the effect to allow the current flowing in the closed position through the movable contact unit 120 and the stationary contact unit 110 to flow along a current path 140 that is unaffected by the barrier zone 122 of the movable contact unit 120.

[0062] Further, the contact region 114 of the stationary contact unit 110 is arranged i) beside or ii) below or iii) beside and below the barrier zone 112 of the stationary contact unit 110. This provides the effect to allow the current flowing in the closed position through the movable contact unit 120 and the stationary contact unit 110 to flow along a current path 140 that is unaffected by the barrier zone 112 of the stationary contact unit 110.

[0063] According to embodiments described herein, in the closed position, that includes the threshold position shown in Fig. 2b, the barrier zone 122, 112 of the movable contact unit 120 and/or of the stationary contact unit 110 may be configured to guide the current flowing through the contact region 123 of the movable contact unit 120 and the contact region 114 of the stationary contact unit 110 in a current path 140 that is either straight or only slightly curved. This means that the current path is essentially not affected by the barrier zone 122, 112.

[0064] Similarly, in the intermediate position shown in Fig. 2c, the barrier zone 122, 112 of the movable contact unit 120 and/or of the stationary contact unit 110 can be configured to guide the current flowing through the contact region 123 of the movable contact unit 120 and the contact region 114 of the stationary contact unit 110 in a current path 140 formed as a partial loop and an electric arc 142 formed as a partial loop. The current path 140 and the arc path 142 of Fig. 2c form two sequential open loops.

[0065] The right loop 142 of Fig. 2c is established by the electric arc 142 and is an open loop with a loop angle of about 145°. Due to the small loop angle, the current of the right loop 140 generates a strong and uniform magnetic field. Based on said magnetic field and because the electric arc 142 contributes directly to the Lorentz force creation, the Lorentz force 144 therefore acting directly on the electric arc 142, it is clear that the Lorentz force 144 associated with the right loop 142 is particularly effective, thus strongly pressing the electric arc 142 radially outwards. An additional effect is that the attachment points of the electric arc 142 to the contact units 110, 120 are stabilized and predictable.

[0066] Figs. 4a, 4b show schematic side views of contact assemblies for a load break switch according to embodiments described herein. Details explained with illustrative reference to Figs. 4a, 4b shall not be understood as limited to the elements of Figs. 4a, 4b. Rather, those details may also be combined with further embodiments explained with illustrative reference to the other figures.

[0067] Within the contact assembly 105 of Fig. 4a, the movable contact unit 120 is in the intermediate position, wherein a current-carrying electric arc is generated between the contact units 110, 120 due to the voltage applied. The structure of the movable contact unit 120 and the structure of the stationary contact unit 110 may each include at least one barrier zone 122, 112 through which the flow of electric current in the threshold or intermediate position is obstructed or prevented.

[0068] The barrier zone 122 of the movable contact unit 120 may comprise an insulating coating 121 covering at least partially the first end of the movable contact unit 120, to prevent the electric arc 142 to attach to the covered parts of the movable contact unit 120. The insulating coating 121 of the movable contact unit 120 may include or be made of an insulating material such as ceramic or plastic.

[0069] The barrier zone 112 of the stationary contact unit 110 may comprise an insulating coating 111 covering at least partially the first end of the stationary contact unit 110, to prevent the electric arc 142 to attach to the covered parts of the stationary contact unit 110. The insulating coating 111 of the stationary contact unit 110 may include or be made of an insulating material such as ceramic or plastic.

[0070] The insulating coating 111, 121 may have the effect of guiding the current into a channel region between the barrier zone and an outer zone of the movable

or stationary contact unit 120, 110, such that the current path 140 and/or the arc path 142 is formed into a loop and the Lorentz force 144 pushes the electric arc radially outwards. Guiding the current through the channel region or through a channel has the effect of enabling to control the location at which the electric arc 142 is attached to.

[0071] Within the contact assembly 105 of Fig. 4b, the movable contact unit 120 is in the intermediate position. The structure of the stationary contact unit 110 may include at least one barrier zone 112 through which the flow of electric current in the threshold or intermediate position is obstructed or prevented.

[0072] Fig. 4c shows in detail section A of Fig. 4a according to embodiments described herein. Details explained with illustrative reference to Fig. 4a shall not be understood as limited to the elements of Fig. 4a. Rather, those details may also be combined with further embodiments explained with illustrative reference to the other figures.

[0073] Fig. 4c shows how arc 142 and current 140 flow into each other in channel 128. The electric arc 142 and the electric current 140 have each the form of an open loop. The shape of the current 140 is determined by the shape of channel 128. The continuation of the right leg of the U-cut of the barrier 122 to the exterior of the movable contact unit 120 forces the current 140 into channel 128. Guiding the current through the channel 128 or through a channel region has the effect of enabling to control the location at which the electric arc 142 is attached to. The arc root is moving along the channel region 116, 128, which expands the arc 142 radially outwards.

[0074] Fig. 3 shows a load break switch 100 in an open position according to embodiments of the present invention. Details explained with illustrative reference to Fig. 3 shall not be understood as limited to the elements of Fig. 3. Rather, those details may also be combined with further embodiments explained with illustrative reference to the other figures.

[0075] The load break switch 100 may include a contact assembly 105, and at least one splitter plate 130 arranged next to the contact assembly 105. The at least one splitter plate 130 may include a plurality of splitter plates 130 particularly arranged parallel to each other and at a distance from each other.

[0076] i) A structure of the movable contact unit 120 is adapted to form the current path 140 or ii) a structure of the stationary contact unit 110 and a structure of the movable contact unit 120 are adapted each to form the current path 140, such that in both cases i), ii) the Lorentz force 144 pushes in the intermediate position the electric arc 142 towards the splitter plate 130, to facilitate quenching or extinguishing the electric arc 142.

[0077] During the opening movement, in the intermediate position, the arc root is driven to a stable point on one or both contact units 110, 120, which stabilizes the arc 142. Once the arc 142 is close to the splitter plates 130, the closeness may help to stabilize the arc position further by attracting or pushing the arc 142 to the splitter

plates 130.

[0078] Within the break switch 100 of Fig. 3, the movable contact unit 120 is in the open position, wherein no electric current flows through the contact assembly 105 when a voltage is applied between the movable contact unit 120 and the stationary contact unit 110. The structure of the movable contact unit 120 may include at least one barrier zone 122 through which the flow of electric current in the threshold or intermediate position is obstructed or prevented.

[0079] Figs. 5a-5e show schematic side views of movable contact units 120 according to embodiments described herein. Details explained with illustrative reference to Figs. 5a-5e shall not be understood as limited to the elements of Figs. 5a-5e. Rather, those details may also be combined with further embodiments explained with illustrative reference to the other figures.

[0080] The movable contact unit 120 of Fig. 5a is similar to or of the same kind as the movable contact unit 120 of the contact assembly 105 of Figs. 2a-2c, 3 and 4a, 4c. The barrier zone 122 within the movable contact unit 120 can be designed as a U-shaped full cut or groove within the contact region 123 of the movable contact unit 120 open towards the feed region 124 of the movable contact unit 120. Full cut may refer to going through the full thickness of the contact unit 120, 110, perpendicular to the drawing plane.

[0081] The cut can have the shape of an upside-down U and may include, following the structure of the letter U, two feet connected by a circular arc. One leg of the U-cut which is positioned further ahead in the opening direction is continued by a lateral, linear or bowed cut, which enters an external space of the movable contact unit 120. The circular arc of the U-cut may be arranged at a distance from the first end of the movable contact unit 120 which is about 2% to 5% or 4% to 10% of the width of the movable contact unit 120, particularly at a distance of about 5 mm. The U-cut can be approximately parallel to an outer contour of the movable contact unit 120. The cut can as well have the shape of a horseshoe.

[0082] Given the context that a contact unit 110, 120, both movable and stationary, is a 3D object, a full cut according to embodiments described herein can be understood as a cut or section through the object that forms an elongated opening between two opposite faces of the object. The cut can have a uniform or varying width along its axial course. A width or an average width of the cut can amount to 1 %, 3 %, or 5 % to 7 %, 10 % or 15 % of the lateral extent of the contact unit 110, 120.

[0083] The movable contact unit 120 of Fig. 5b includes a barrier zone 122 that can be designed as a full cut formed as a circular arc within the contact region 123 or between contact region 123 and first end of the movable contact unit 120, the arc being open towards the feed region 124 of the movable contact unit 120. The arc can be circular, elliptical or may have any rounded shape. The circular arc may have a loop angle of 180° or 220° to 270° or 330°, especially of about 300° to 330°. One

end of the cut which is positioned further ahead in the opening direction can be continued by a lateral, particularly linear cut, which enters the external space of the movable contact unit 120. The top end of the circular arc of the cut may be arranged at a distance from the first end of the movable contact unit 120 which is about 2% to 5% or 4% to 10% from the of the width of the movable contact unit 120, particularly at a distance of about 5 mm.

[0084] The movable contact unit 120 of Fig. 5c includes a barrier zone 122 that can be designed as an electrically non-conducting space or material below an electrically conducting deflection cover 127 on the top end of movable contact unit 120, above the contact region 123. The deflection cover 127 can be fixed on a side of the movable contact unit 120 facing a direction opposite the opening direction. The cover can be bowl-shaped with an arc-shaped sectional profile formed as an open loop that has a loop angle of 160° or 200° to 220° or 240°.

[0085] The movable contact unit 120 of Fig. 5d includes a barrier zone 122 that can be designed as an opening that is circular or otherwise round in shape. The opening can be located between the contact region 123 and the first end of the movable contact unit 120, above the contact region 123. A peripheral part of the cut which is positioned further ahead in the opening direction may enter the external space of the movable contact unit 120. The opening can be filled up by an electrically non-conducting space or material.

[0086] The movable contact unit 120 of Fig. 5e includes a barrier zone 122 that can be designed as a full cut that has the shape of an inverted V. One of the two legs of the cut, in particular the longer one, that is positioned further ahead in the opening direction, may enter the external space of the movable contact unit 120.

[0087] Fig. 6a-6c show schematic side views of stationary contact units 110 according to embodiments described herein. Details explained with illustrative reference to Figs. 6a-6c shall not be understood as limited to the elements of Figs. 6a-6c. Rather, those details may also be combined with further embodiments explained with illustrative reference to the other figures.

[0088] The barrier zone 112 within the stationary contact unit 110 may be designed to direct, especially in the intermediate or the non-closed position, the current into a channel region 116 between the barrier zone 112 and an outer zone of the stationary contact unit 110 closest to the movable contact unit 120. Guiding the current through the channel region 116 or through a channel has the effect of enabling to control the location at which the electric arc 142 is attached to. The arc root is moving along the channel region 116, 128, which expands the arc 142 radially outwards.

[0089] An outer edge portion of the stationary contact unit 110 close to its first end and facing the opening direction may be inclined at an angle with respect to an axial direction of the stationary contact unit 110, the angle being in the range, for example, of 10°, 20° or 30° to 40°, 50° or 60, especially in the range of 30° to 40°.

[0090] The barrier zone 112 within the stationary contact unit 110 can be designed as a full cut in the contact region 114 of the stationary contact unit 110.

[0091] The barrier zone 112 within the stationary contact unit 110 may have an elongated and/or linear shape.

[0092] The stationary contact unit 110 of Fig. 6a is similar to or of the same kind as the stationary contact unit 110 of the contact assembly 105 of Figs. 4a, 4b. The barrier zone 112 within the stationary contact unit 110 may be inclined at an angle with respect to an axial direction of the stationary contact unit 110, the angle being in the range, for example, of 10°, 20° or 30° to 40°, 50° or 60, especially in the range of 30° to 40°, as shown in Fig. 6a, or in the range of 20° to 30°, as shown in Fig. 6b. The cut can end in a lateral outer space of the stationary contact unit 110 facing the opening direction and can be parallel to an outer edge portion of the stationary contact unit 110 facing the opening direction.

[0093] The barrier zone 112 within the stationary contact unit 110 can be designed as a full cut with an elongated, curved shape, the cut ending in an outer space laterally of the stationary contact unit 110 facing the opening direction, as shown in Fig. 6c. The curved shape may be opened in a direction opposed the moving direction.

[0094] The stationary contact unit 110 of Fig. 6d may have at the inclined outer edge portion an electrically conducting, preferably linear, rod or bar attached to the inclined outer edge portion and extending in the moving direction beyond the edge of the inclined outer edge of the stationary contact unit 110. The barrier zone 112 is formed in the space between corpus of the stationary contact unit 110 and the electrically conducting rod.

[0095] The barrier zone 112 within the stationary contact unit 110 can be designed to direct, especially in the intermediate or the non-closed position, the current flowing into the electric arc 142 in a region of the stationary contact unit 110 closest to the movable contact unit 120.

[0096] Functionally, the barrier zone 112, 122 within the structure of the movable or stationary contact unit 110, 120 according to embodiments described herein, especially the barrier zone 112, 122 shown in Figs. 4a-4e and 5a-5c, is a loop enlarging arrangement of the electric arc 142 that may cause pushing the electric arc 142 radially outwards towards the splitter plate 130 and facilitate quenching the electric arc 142 during the opening movement in a minimum of time.

[0097] Functionally, the barrier zone 122, 112 according to embodiments described herein, especially the barrier zone 112, 122 shown in Figs. 5a-5e and 6a-6d, is an arrangement within the structure of the movable or stationary contact unit 110, 120 configured, in the intermediate position, to inhibit a flow of electric current between electric arc 142 or contact region 114, 123 and the feed region of the corresponding contact unit 110, 120. Said arrangement is configured to guide the electric current into a zone near the surface of the contact region 114, 123 of the corresponding contact unit 110, 120 such that the current path 140, 142 is formed into a loop and the

Lorentz force 144 pushes the electric arc 142 radially outwards towards the splitter plate.

[0098] Functionally, the barrier zone 112, 122 according to embodiments described herein, especially the barrier zone 112, 122 shown in Figs. 5a-5e and 6a-6d, is an arrangement within the structure of the movable or stationary contact unit 120, 110 configured, in the intermediate position, to narrow the electric current path 140 or to inhibit the electric current flow between the electric arc 142 or the contact region 123, 114 and the feed region of the corresponding contact unit 120, 110. This may force the current path 140, 142 to form a loop and the Lorentz force 144 to push the electric arc 142 radially outwards towards the splitter plate.

[0099] As shown in Fig. 3, the at least one splitter plate may include a plurality of splitter plates 130, especially at least 3, or 7, or 15, or 30 splitter plates 130.

[0100] The splitter plates 130 can be made of a ferromagnetic material, such as iron, nickel, cobalt.

[0101] The splitter plates 130 can be provided in an arc chamber, and can be stacked parallel to each other. The electric arc 142 generated in the intermediate position can be pulled into the arc chamber due to electromagnetic forces. The arc chamber may contain wall elements which, in the presence of the electric arc, produce a deionising gas which helps to extinguish the electric arc. The electric arc gets elongated, and then splits into a series of several electric arcs and the arc voltage starts increasing. Splitter plates 130 may also help in cooling of the electric arc.

[0102] A large number of plates allows synergetic use of the effect of rapid arc expansion based on the structural properties of the load break switch 100 to extinguish the electric arc fast and efficient.

[0103] Fig. 7 shows a flowchart of a method of quenching an electric arc between a stationary contact unit 110 and a movable contact unit 120 of a load break switch 100. Details explained with illustrative reference to Fig. 7 shall not be understood as limited to the steps or elements of Fig. 7. Rather, those details may also be combined with further embodiments explained with illustrative reference to the other figures.

[0104] The load break switch 100 used to carry out the method may include a stationary contact unit 110 and a movable contact unit 120 adapted to provide a galvanic contact to the stationary contact unit 110. As shown in Fig. 7, the method of quenching an electric arc 142 between the stationary contact unit 110 and the movable contact unit 120 of the load break switch 100 may include the following steps s1 and s2.

[0105] Step s1 may include moving the movable contact unit 120 between a closed position and an open position via a position in which an electric arc 142 is established between the stationary contact unit 110 and the movable contact unit 120.

[0106] An electric current i) flowing along a current path 142 through the stationary contact unit 110 and the movable contact unit 120 and ii) including an electric arc 142

between the stationary contact unit 110 and the movable contact unit 120 may generate a magnetic field enabling a Lorentz force 144 to act on the electric arc 142.

[0107] Step s2 may include forming a path of the electric arc 142 enabled by iii) a structure of the movable contact unit 120 or iv) a structure of the stationary contact unit 110 and a structure of the movable contact unit 120 to direct the Lorentz force 144 towards at least one splitter plate 130 of the load break switch 100 and to push the electric arc 142 towards the splitter plate 130, thus enabling quenching the electric arc 142.

[0108] In the closed position, the current may flow through the stationary contact unit 110 and the movable contact unit 120 on a path 140 that is unaffected by the steps or measures for quenching the electric arc 142. Particularly, the current flows along a straight path 140 through the contact assembly 105.

[0109] This written description uses examples to disclose the disclosure, including the best mode, and also to enable any person skilled in the art to practice the described subject-matter, including making and using any apparatus or system and performing any incorporated methods. Embodiments described herein provide an improved load break switch and method of quenching an electric arc established when opening a load break switch, which facilitate quenching the electric arc during the opening movement in a minimum of time, reduce arc damage and, at the same time, avoid space-wasting efforts to extinguish the arc. While various specific embodiments have been disclosed in the foregoing, mutually non-exclusive features of the embodiments described above may be combined with each other. The patentable scope is defined by the claims, and other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal language of the claims.

REFERENCE SIGNS

[0110]

10	load break switch (prior art)
12	stationary electrode (prior art)
14	movable electrode (prior art)
16	splitter plate (prior art)
100	load break switch
105	contact assembly
110	stationary contact unit
111	insulating coating of the stationary contact unit
112	barrier zone of the stationary contact unit, structure adapted to form the current path
114	contact region of the stationary contact unit
116	channel region between barrier zone and first end of the stationary contact unit
120	movable contact unit
121	insulating coating of the movable contact unit

122	barrier zone of the movable contact unit, structure adapted to form the current path	
123	contact region of the movable contact unit	
124	feed region of the movable contact unit	
125	point of contact of the movable contact unit	5
126	pivot of the movable contact unit	
127	deflection cover	
128	channel region between barrier zone and first end of the movable contact unit	
130	splitter plate	10
140	current path, loop formed by the current path, left loop	
142	electric arc, loop formed by the electric arc, right loop	
144	Lorentz force	15

Claims

1. A contact assembly (105) for a load break switch (100) including:
 - a stationary contact unit (110); and
 - a movable contact unit (120) configured to move between a closed position and an open position, wherein
 - an electric current i) flowing along a current path (140) through the stationary contact unit (110) and the movable contact unit (120) and ii) including an electric arc (142) between the stationary contact unit (110) and the movable contact unit (120) is adapted to generate a magnetic field enabling a Lorentz force (144) to act on the electric arc (142), wherein
 - a structure (112) of the stationary contact unit (110) and/or a structure (122) of the movable contact unit (120) is adapted to form the current path (140), such that the Lorentz force (144) enlarges a path of the electric arc (142), to facilitate quenching or extinguishing the electric arc (142), and
 - in the closed position, the structure (122,112) is configured to allow the current flowing through the movable contact unit (120) and the stationary contact unit (110) to flow along a current path (140) that is unaffected by the structure (122,112).
2. The contact assembly (105) according to claim 1, wherein
 - the structure of the movable contact unit (120) and/or the stationary contact unit (110) includes at least one barrier zone (112, 122) through which the flow of electric current is obstructed or prevented; and/or
 - the barrier zone (112,122) is determined by a material gap or an electrically insulating material.
3. The contact assembly (105) according to any of

claims 1 or 2, wherein
 the movable contact unit (120) has a contact region (123) located in axial direction close to a first end of the movable contact unit (120), the contact region (123) establishing an electrical contact to the stationary contact unit (110) in the closed position, and a feeding region located in the axial direction opposite the contact region (123), and/or is configured to move between the closed position and the open position via an intermediate position; and/or
 the stationary contact unit (110) has a contact region (114) located in axial direction close to a first end of the stationary contact unit (110) that establishes an electrical contact to the movable contact unit (120) in the closed position.

4. The contact assembly (105) according to any of claims 1 to 3, wherein, in the intermediate position, the barrier zone (122) of the movable contact unit (120) and/or of the stationary contact unit (110) is configured to guide the current flowing through the contact region (123) of the movable contact unit (120) and the contact region (114) of the stationary contact unit (110) in a current path (140) formed as a partial loop and/or an electric arc (142) formed as a partial loop; and/or
 the partial loop of the current path (140) and/or the electric arc (142) is an open loop with a loop angle of 3° or 60° or 120° to 180° or 240° or 320°.
5. The contact assembly (105) according to any of claims 1 to 4, wherein
 the barrier zone (112,122) within the structure of the movable contact unit (120) and/or the stationary contact unit (110) is i) a loop enlarging arrangement of the electric arc (142) and/or ii) an arrangement guiding the current through a channel region (128) or through a channel of the movable or stationary contact unit (120,110) and/or iii) an arrangement that specifies or controls a location at which the electric arc (142) is attached to.
6. The contact assembly (105) according to any of claims 1 to 5, wherein, in the intermediate position, the barrier zone (122) within the movable contact unit (120) is configured to inhibit a flow of electric current from the electric arc (142) or the contact region (123) of the movable contact unit (120) to the feeding region of the movable contact unit (120); and/or
 the barrier zone (122) within the movable contact unit (120) is configured to guide the current into a channel region (128) between the barrier zone (122) and an outer zone of the movable contact unit (120); and/or
 the barrier zone (122) within the movable contact unit (120) is configured to narrow the electric current path (140) within the movable contact unit (120).

7. The contact assembly (105) according to any of claims 1 to 6, wherein,
the contact region (123) of the movable contact unit (120) is arranged between the barrier zone (122) and the first end of the movable contact unit (120), to allow the current flowing in the closed position through the movable contact unit (120) and the stationary contact unit (110) to flow along a current path (140) that is unaffected by the barrier zone (122) of the movable contact unit (120); and/or
the contact region (114) of the stationary contact unit (110) is arranged i) beside or ii) below or iii) beside and below the barrier zone (112) of the stationary contact unit (110), to allow the current flowing in the closed position through the movable contact unit (120) and the stationary contact unit (110) to flow along a current path (140) that is unaffected by the barrier zone (112) of the stationary contact unit (110).
8. The contact assembly (105) according to any of claims 1 to 7, wherein
the barrier zone (122) of the movable contact unit (120) comprises a U-shaped full cut within the contact region (123) of the movable contact unit (120) open in the axial direction towards the feeding region of the movable contact unit (120), wherein one leg or end of the U-cut which is positioned further ahead in the opening direction is continued by a lateral cut, which enters an external space of the movable contact unit (120); and/or
the barrier zone (122) of the movable contact unit (120) comprises an electrically non-conducting space between the contact region (123) of the movable contact unit (120) and an electrically conducting cover that covers the contact region (123) of the movable contact unit (120) and that is connected at one of its ends to the movable contact unit (120); and/or
the barrier zone (122) of the movable contact unit (120) comprises an insulating coating (121) covering at least partially the first end of the movable contact unit (120), to prevent the electric arc (142) to attach to the covered parts of the movable contact unit (120); and/or
the insulating coating (121) of the movable contact unit (120) includes an insulating material such as ceramic or plastic.
9. The contact assembly (105) according to any of claims 1 to 8, wherein
the barrier zone (112) of the stationary contact unit (110) comprises a full cut in the contact region (114) of the stationary contact unit (110); and/or
the full cut (112) of the stationary contact unit (110) has an elongated and/or linear shape; and/or
the full cut (112) of the stationary contact unit (110) is inclined at an angle with respect to an axial direction of the stationary contact unit (110), the angle being in the range, for example, of 10°, 20° or 30° to 40°, 50° or 60°; and/or
the barrier zone (112) of the stationary contact unit (110) comprises an insulating coating (111) covering at least partially the first end of the stationary contact unit (120), to prevent the electric arc (142) to attach to the covered parts of the stationary contact unit (120); and/or
the insulating coating (111) of the stationary contact unit (110) includes an insulating material such as ceramic or plastic.
10. The contact assembly (105) according to any of claims 1 to 9, wherein
the barrier zone (112) within the stationary contact unit (110) meets an outer space at the first end of the stationary contact unit (110); and/or
the barrier zone (112) within the stationary contact unit (110) is designed to direct, especially in the intermediate or the non-closed position, the current into a channel region (116) between the barrier zone (112) and an outer zone of the stationary contact unit (110) closest to the movable contact unit (120).
11. The contact assembly (105) according to any of claims 1 to 10, wherein
the movable contact unit (120) includes at least one point of contact (125) which, in the closed position, allows an electric current to flow between the stationary contact unit (110) and the movable contact unit (120) via the point of contact (125), wherein especially the point of contact (125) is located in the contact region (123) of the movable contact unit (120); and/or
the movable contact unit (120) includes a pivotable element, wherein particularly the pivotable element is mounted pivotably about a pivot point (126) and/or the point of contact (125) of the movable contact unit (120) moves when the pivotable element is pivoted.
12. The contact assembly (105) according to any of claims 1 to 11, wherein
the open position is **characterized by** no electric current flowing through the contact assembly (105) when a voltage is applied between the movable contact unit (120) and the stationary contact unit (110); and/or
the closed position is **characterized by** the movable contact unit (120) and the stationary contact unit (110) being galvanically connected; and/or
the intermediate position is **characterized by** an electric current flowing through the contact assembly (105), wherein i) the electric current comprises an electric arc (142) between the stationary contact unit (110) and movable contact unit (120), or ii) the stationary contact unit (110) is not galvanically connected to, or is spaced from, the movable contact unit (120).

13. A load break switch (100) including:

a contact assembly (105) according to any of claims 1 to 12; and
 at least one splitter plate (130) arranged next to the contact assembly (105), wherein
 i) a structure of the movable contact unit (120) is adapted to form the current path (140) or ii) a structure of the stationary contact unit (110) and a structure of the movable contact unit (120) are adapted to form the current path (140), such that in both cases iii), iv) the Lorentz force (144) pushes the electric arc (142) towards the splitter plate (130), to facilitate quenching or extinguishing the electric arc (142).

forming a path of the electric arc (142) enabled by a structure of the stationary contact unit (110) and/or a structure of the movable contact unit (120) to direct the Lorentz force (144) towards at least one splitter plate (130) of the load break switch (100) and to push the electric arc (142) towards the splitter plate (130), thus enabling quenching the electric arc (142).

14. The load break switch (100) according to claim 13, wherein

the at least one splitter plate (130) includes a plurality of splitter plates (130), especially at least 3, or 7, or 15, or 30 splitter plates (130); and/or
 the splitter plates (130) are made of a ferromagnetic material, such as iron, nickel, cobalt.

15. The load break switch (100) according to any of claims 13 or 14, wherein

the load break switch (100) comprises an insulation gas with a global warming potential lower than the one of SF6 over an interval of 100 years, and wherein the insulation gas preferably comprises at least one gas component selected from the group consisting of: CO2, O2, N2, H2, air, N2O, a hydrocarbon, in particular CH4, a perfluorinated or partially hydrogenated organofluorine compound, and mixtures thereof; and/or

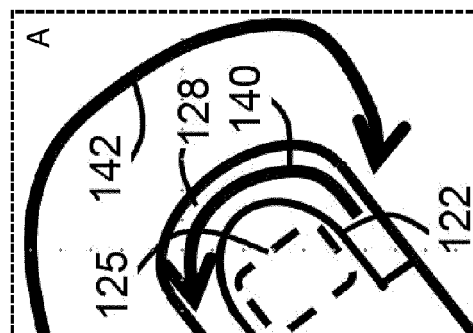
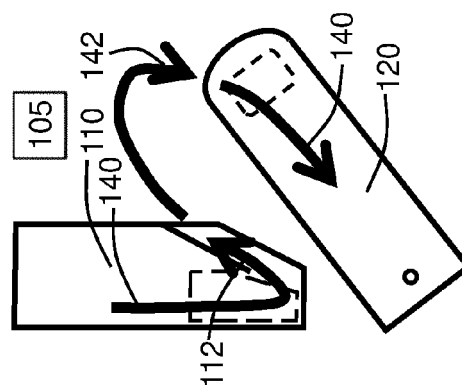
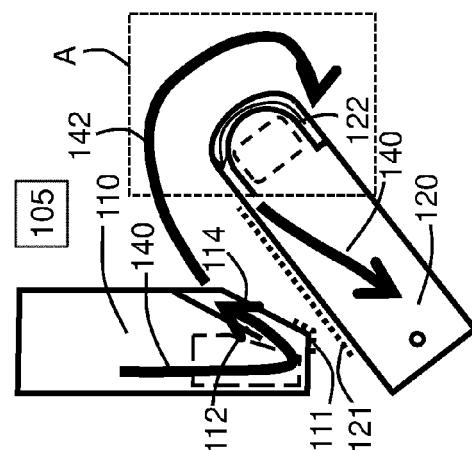
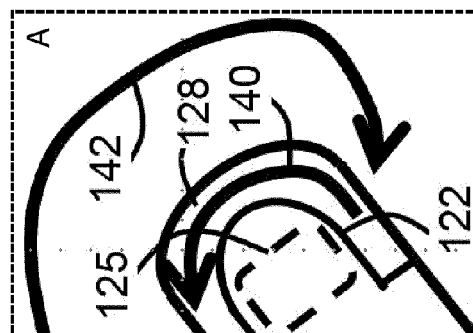
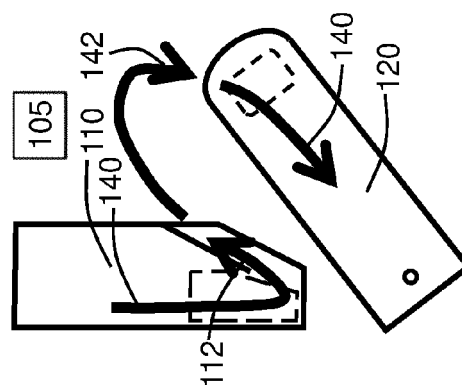
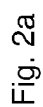
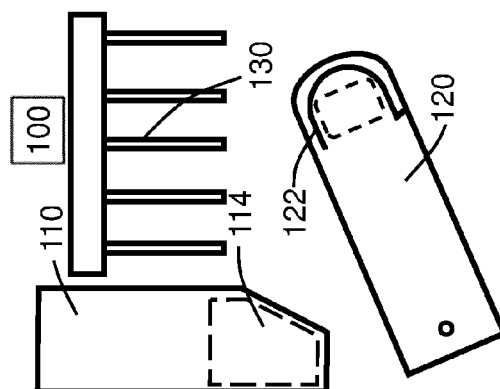
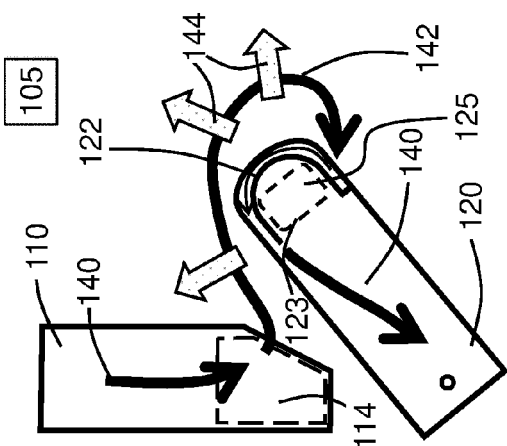
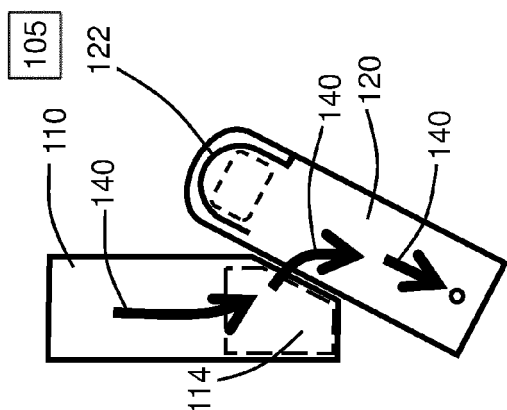
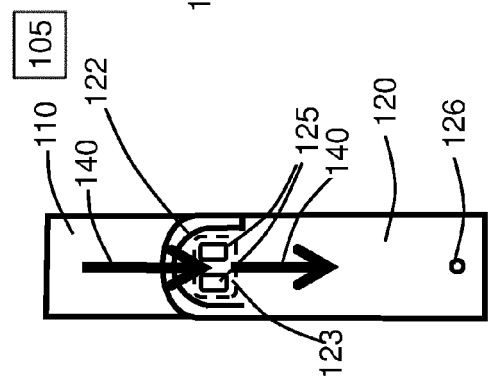
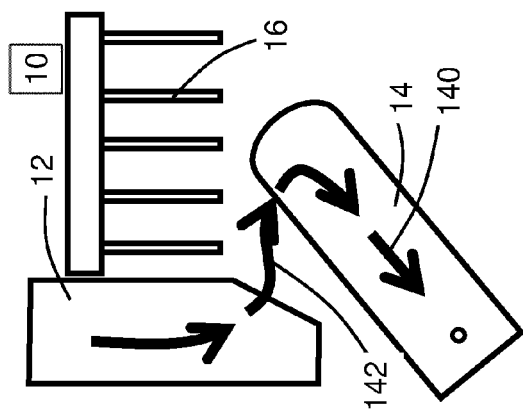
the insulation gas comprises a background gas, in particular selected from the group consisting CO2, O2, N2, H2, air, in a mixture with an organofluorine compound selected from the group consisting of: fluoroether, oxirane, fluoramine, fluoroketone, fluoroolefin, fluoronitrile, and mixtures and/or decomposition products thereof; and/or

the load break switch (100) has a rated voltage of at most 52 kV, in particular 12 kV or 24 kV or 36 kV or 52 kV.

17. The method according to claim 16, wherein in the closed position, the current flows through the stationary contact unit (110) and the movable contact unit (120) on a path that is unaffected by the steps or measures for quenching the electric arc (142).

16. A method of quenching an electric arc (142) between a stationary contact unit (110) and a movable contact unit (120) of a load break switch (100), the movable contact unit (120) moving between a closed position and an open position, wherein

an electric current i) flowing along a current path (140) through the stationary contact unit (110) and the movable contact unit (120) and ii) including an electric arc (142) between the stationary contact unit (110) and the movable contact unit (120) generates a magnetic field enabling a Lorentz force (144) to act on the electric arc (142), comprising:



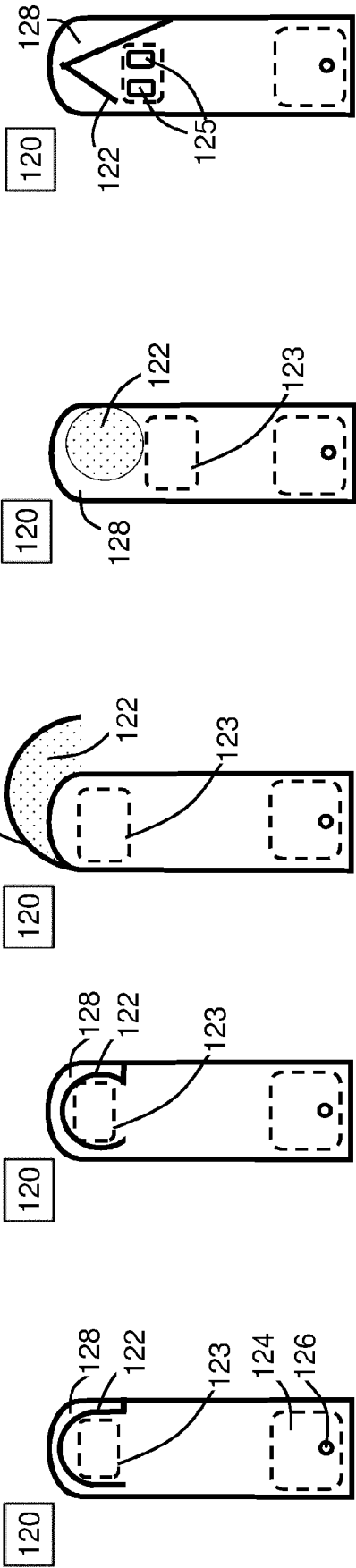


Fig. 5e

Fig. 5d

Fig. 5c

Fig. 5b

Fig. 5a

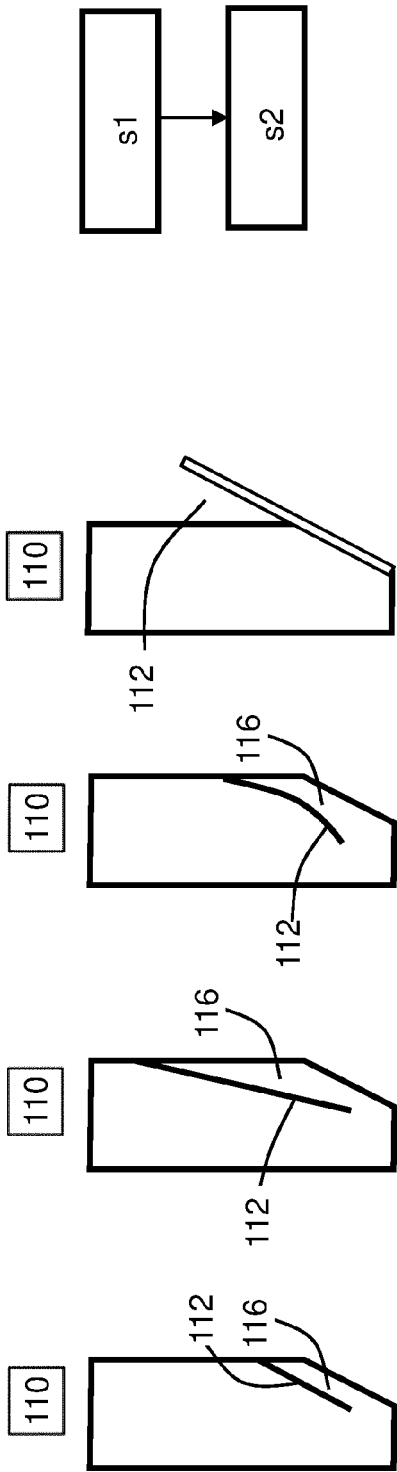


Fig. 6a

Fig. 6b

Fig. 6c

Fig. 6d

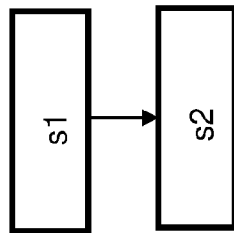


Fig. 7

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