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(54) **ELECTRIC SAFETY CONTACT ACTUATED BY A REMOVABLE ACTUATION KEY**

(57) An electric safety contact (1) with a removable actuation key (18) comprises a movable hook (11) for engaging the actuation key (18) when inserted into the body (2) of the electrical contact (1), wherein the front end (14) of said movable hook (11) is inclined in a manner to determine a lifting of the movable hook itself if during

an initial phase of insertion of the actuation key (18) into the body (2) of the electrical contact (1), this movable hook (11) is in a position not completely lifted in which it interferes with the removable key (18) during its insertion into the body (2).

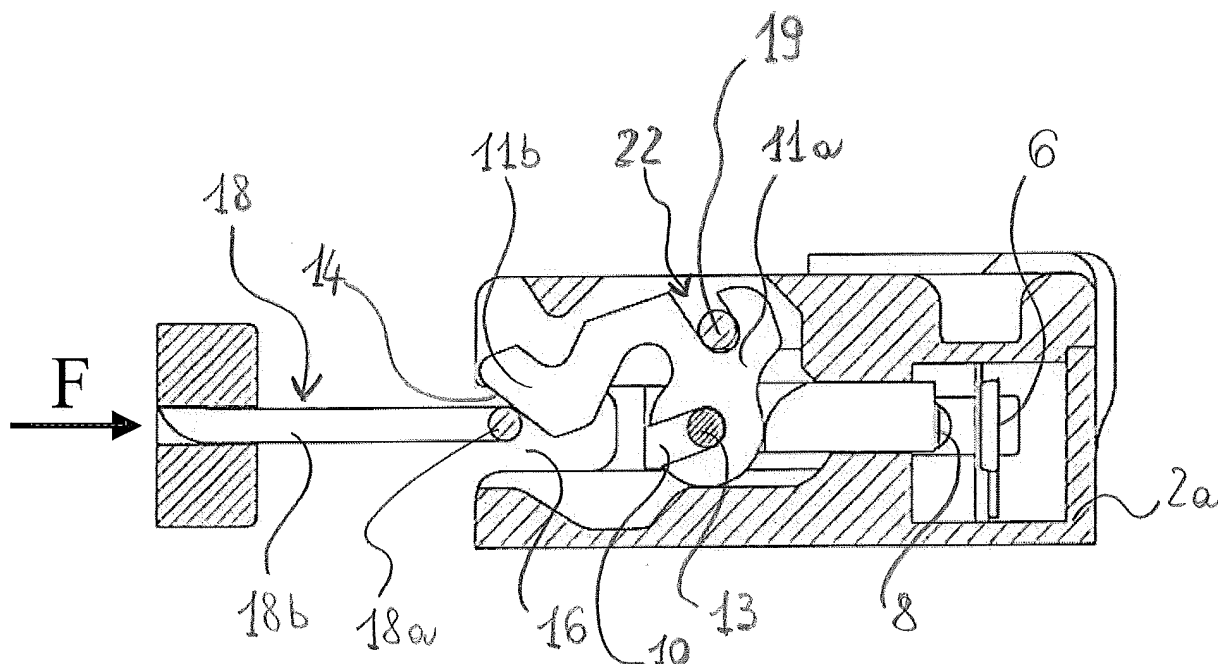


Fig. 8

Description

[0001] This invention relates to an electrical safety contact actuated by means of a removable actuation key, meaning an electrical contact in which the closing of the contacts is performed by a movable bridge contained within the contact body and not removable, whose actuation towards and away from the electrical contacts to be put into electrical communication with each other is ensured by an external removable actuation key.

[0002] Generally, this type of electrical safety contacts, although structurally complicated and cumbersome, is used if the type of use requires an electrical safety contact of the so-called waterproof type, since a more common electrical safety contact with removable bridge would not be suitable for use.

[0003] In this regard, it is sufficient to point out how the need to insert/remove at each actuation cycle the terminals of the removable bridge inside the body of the electrical safety contact necessarily require that said body provide access openings that are not able to assure any impermeability from splashes and the like of the electrical safety contact and of the electrical components contained therein.

[0004] Differently, the safety contacts actuated by means of a removable actuation key of the type specified above allow overcoming this problem thanks to the fact that the movable bridge and the relevant contact points remain in a protected position inside the body of the electrical safety contact by means of a removable actuation key, since it is therefore possible to ensure a high degree of impermeability of the electrical parts present inside the contact.

[0005] As previously highlighted, in the electrical safety contacts with actuation by means of a removable actuation key of the type specified above, the actuation of the internal movable bridge is performed by a removable actuation key that does not perform any electrical continuity function, being only provided for to activate the movement of a mobile shuttle that acts as a support for the movable bridge.

[0006] In fact, the insertion of the actuating key into the body of the electrical safety contact determines the advancement of the aforesaid shuttle towards an advanced limit stop position, with simultaneous closing of an electrical contact of the normally open type or an opening of an electrical contact of the normally closed type.

[0007] Following the removal of the actuation key from the body of the electrical contact, the return to the initial position of the shuttle is ensured by the thrust exerted by elastic means.

[0008] In the case of a normally open type electrical contact, if the fixed electrical contacts and the electrical contacts of the bridge are partially welded together, for example, due to excessive heating during use, the interruption of the electrical continuity between the contacts of the electrical safety contact upon the removal of the actuation key is in any case ensured by the fact that the

electric contact comprises hook means associated with the shuttle, which, upon reaching the advanced end configuration of the shuttle, engage the free end of the removable key inserted in the body of the electrical safety contact itself. Given the above, the forced removal of the key from the body of the electrical contact ensures, even in case of partial welding between the electrical contacts, the interruption of the electrical continuity inside the normally open safety contact, thanks to the fact that the free end of the actuation key moves the shuttle towards the back position by acting on the hook means associated with the shuttle.

[0009] However, it should be pointed out that the above-mentioned forced removal of the actuation key generally does not lead to complete retraction of the shuttle and the hook means associated with it, with the consequence that a subsequent re-insertion of the removable actuation key is obstructed or, even worse, it can lead to a closing condition of the electrical contact without the removable actuation key can be inserted in the body of the contact itself.

[0010] In accordance with known solutions, e.g. from the prior art document EP 0 920 043 A2, the above-mentioned undesired condition is avoided by limiting the height dimension of the activation channel of the actuation key, thus minimizing the permitted gaps to ensure the insertion of the actuation key into the channel of the electrical safety contact body.

[0011] Obviously, this solution involves a limited actuation range that requires a considerable accuracy of the positioning of the actuation key with respect to the body of the electrical safety contact itself that, when used, cannot always be guaranteed.

[0012] Furthermore, it can be seen that the electrical safety contacts with currently known actuation of the removable actuation key are characterized by the drawback of being structurally bulky, complicated and difficult to assemble, particularly for pieces intended for mass production on a large scale by automatic production lines.

[0013] The problem underlying this invention is that of devising and making available an electrical safety contact with actuation by means of a removable actuation key, which meets the need to allow a high range of actuation of the removable key with respect to the height of the insertion channel of the actuation key, a high degree of waterproofing, as well as the need to ensure in any case the interruption of the electrical continuity between the contacts following the removal, even forced, of the removal key from the body of the electrical safety contact, while ensuring a structural simplification of the electrical contact, so as to facilitate assembly, and reduce the overall dimensions of the electrical contact with respect to the corresponding electrical contacts of the prior art, such as for example the electrical contact of EP 0920043.

[0014] This problem is solved by an electrical safety contact actuated by means of a removable actuation key according to claim 1.

[0015] Further characteristics and the advantages of

the electrical safety contact with actuation by removable actuation key according to the invention will be apparent from the following description of some of its preferred embodiments, given by way of non-limiting example, with reference to the enclosed figures, wherein:

- Figure 1 is a schematic perspective view of an electrical safety contact with a removable actuation key according to the invention;
- Figure 1A shows a perspective view of the electrical safety contact of Figure 1 according to a different angle;
- Figures 2 to 4 show perspective views in partial section and exploded view of the electrical safety contact of Figure 1, namely of subsequent assembly steps;
- Figures 5 and 6 show flat views in longitudinal section of the electrical safety contact of Figure 1 and of the removable key in open contact and closed contact configurations, respectively;
- Figures 7 and 8 show flat views in longitudinal section of the electrical safety contact of Figure 1 and of the removable key in an intermediate condition between the configurations of Figures 5 and 6;
- Figure 9 shows an embodiment of the movable hook of the electrical safety contact of Figure 1;
- Figures 10a, 10b, 10c and 10d represent flat views of the hook of Figure 9 according to possible different embodiments and
- Figures 11a, 11b, 11c and 11d represent respective assembly sequences of the movable hook to the shuttle of the electrical safety contact of Figure 1.

[0016] With reference to the above-mentioned figures, 1 generically indicates a safety electric contact according to the invention with actuation by means of a removable actuation key 18.

[0017] In accordance with the shown embodiment, the electrical safety contact 1 comprises:

- a body 2 of electrically insulating material extended in a preset longitudinal direction X-X between a front end 2b and a rear end 2a;
- wiring means 5 for wiring electrical conductors;
- at least one passage formed in the body 2 to allow passage through the body 2 of electrical conductors with which to carry out the wiring to the above-mentioned wiring means 5;
- first electrical contacts 6 positioned near the rear end 2a of the body 2 and in electrical continuity with the above-mentioned terminals 5;
- a movable bridge 7 comprising second electrical contacts 8 intended to contact the above-mentioned first electrical contacts 6 to establish electrical continuity between said first electrical contacts 6;
- a shuttle 10 extending axially in said preset longitudinal direction X-X between a rear end 10a facing the rear end 2a of the body 2 and an opposed front end 10b;

- a movable hook 11 and
- elastic means 12 acting between the body 2 and the shuttle 10.

[0018] In accordance with the shown embodiment, the above-mentioned passage is identified by at least one passing-through opening formed in the body 2.

[0019] Preferably, the electrical safety contact comprises fluid-tight cable glands 4 positioned at the above-mentioned passage, or of the aforesaid at least one passing-through opening. Alternatively, it is possible to provide for the presence of resin, glue or other sealing elements to seal the above-mentioned passage in the presence of electrical conductors

[0020] In accordance with the shown embodiment, the above-mentioned wiring means 5 comprise two separate screw terminals suitable for clamping the terminals of external electrical conductors.

[0021] Alternatively, it is possible to provide connectors different from a screw terminal, as it is possible to provide that the above-mentioned wiring means comprise a welding, for directly welding the terminal of an external electrical conductor to the wiring means, connector means and the like.

[0022] Preferably, the above-mentioned shuttle 10 is supported and guided inside the body 2 to perform inside the body 2 a displacement having at least a translational displacement component in the above-mentioned longitudinal direction X-X (preferably to perform a displacement of only translation in the above-mentioned longitudinal direction X-X) and moving reversibly in said longitudinal direction X-X from a retracted limit stop position (see Fig. 5) towards an advanced limit stop position (see Fig. 6) in which the rear end 10a of said shuttle 10 is closer to said first electrical contacts 6.

[0023] The above-mentioned elastic means 12 act between the body 2 and the shuttle 10 to push the shuttle 10 towards the above-mentioned retracted limit stop position with a preset elastic preload (see Fig. 5), in which the shuttle 10 is therefore positioned by the elastic means 12 in the absence of forces applied by the removable actuation key 18, for example when the removable actuation key has been removed from the body 2 and therefore does not exert any action on the shuttle 10.

[0024] Thus, the above-mentioned retracted limit stop position (see Fig. 5) of the shuttle 10 corresponds to the position in which the shuttle is positioned by the elastic means 12 in the absence of forces applied by the removable actuation key 18, i.e. when the removable actuation key has been removed from the body 2 and therefore exercises no action on the shuttle 10.

[0025] Preferably, the above-mentioned hook 11 comprises a rear portion 11a, which is connected to the front end 10b of the shuttle 10 by means of articulated linking means, and an opposed front portion 11b shaped like a hook to engage an end portion of an external removable actuation key 18.

[0026] In the above-mentioned front portion 11b of the

movable hook 11, an outer front wall 14 can be identified facing away from the rear portion 11a.

[0027] The above-mentioned movable bridge 7 is associated in translation with the shuttle 10, preferably so as to be rigidly connected in translation to the shuttle 10, being it possible to envisage embodiments wherein the movable bridge 7 is supported by the shuttle 10 in a sprung way by the springs interposition.

[0028] Preferably, the movable bridge 7 is supported near the rear end 10a of the shuttle 10.

[0029] It should be noted that the second electrical contacts 8 of the movable bridge 7 are:

- in electrical contact with the first electrical contacts 6 associated with the body 2 when the shuttle 10 is in a first limit stop position selected between said retracted limit stop position and said advanced limit stop position, while
- they are electrically disconnected from the above-mentioned first electrical contacts 6 associated with the body 2 when the shuttle 10 is in a second end-stroke position different from the above-mentioned first limit stop position corresponding to the remaining limit stop position between the retracted limit stop position and the advanced limit stop position.

[0030] According to the shown embodiment, the electrical safety contact 1 is of the normally open (NO) type, and therefore the above-mentioned first limit stop position coincides with the above-mentioned advanced limit stop position.

[0031] Thus, when the shuttle 10 is in the above-mentioned advanced limit stop position (see Fig. 6), the second contacts 8 of the movable bridge 7 are in contact with the first contacts 6, thus establishing an electrical communication between said first contacts 6, so that the electrical safety contact 1 is in a closed contact configuration.

[0032] Differently, when the shuttle 10 is in the above-mentioned retracted limit stop position (see Fig. 5), the second contacts 8 of the movable bridge 7 are spaced from the above-mentioned first contacts 6 and the electrical safety contact 1 is in an open contact configuration.

[0033] In the body 2 a longitudinal passage 16 is identified, extended in the above-mentioned longitudinal direction X-X, which allows the reversible insertion in the body 2 of a removable actuation key 18 necessary for pushing the shuttle 10 towards the insertion advanced limit stop position (see Fig. 5).

[0034] In accordance with the preferred embodiment shown in the figures, in the body 2 there is an internal seat, extended in the longitudinal direction X-X, which identifies the above-mentioned longitudinal passage 16, in which the movable hook 11, the springs 12 and, partially, the shuttle 10 are housed inside the body 2.

[0035] The above-mentioned inner seat of the body 2 is open at the front end 2b of the body 2 itself, to allow axial insertion into said internal seat of the removable

actuation key 18 starting from the front end of the body 2 itself.

[0036] The above-mentioned articulated connecting means comprise a first pivot pin 13, supported by the shuttle 10 transversely to the longitudinal direction X-X, to make the movable hook 11 integral in translation to the shuttle 10 in the above-mentioned longitudinal direction X-X, at the same time allowing said movable hook 11 rotating reversibly with respect to the shuttle 10 itself:

- between a lifted limit stop position (see Fig. 5) in which the front portion 11b of the movable hook 11 does not obstruct the insertion in the longitudinal passage 16 of the removable actuation key 18 and
- a lowered limit stop operating position (see Fig. 6) in which the front portion 11b of the movable hook 11 overcomes said longitudinal passage 16 by obstructing it to engage an end portion of the removable actuation key 18 inserted in the above-mentioned longitudinal passage 16.

[0037] In this regard, it should be noted that the kinematic engagement performed by the above-mentioned articulated connecting means causes a translation in the longitudinal direction X-X of the shuttle 10 from the retracted limit stop position (see Fig. 5) to the advanced limit stop position (see Fig. 6) involves a corresponding translation in said longitudinal direction X-X also of said movable hook 11, as well as a simultaneous movement of said movable hook 11 from said lifted limit stop position to said lowered limit stop position and vice versa.

[0038] In the normal operation of the safety electric contact 1, the actuation key 18 acts only on the shuttle 10 without interfering with the movable hook 11, whose displacement between the lifted position and the lowered position, as said, is determined by the kinematics imposed by the articulated linking means following a translation of the shuttle 10 in the longitudinal direction X-X. Following the removal of the actuation key 18 from the longitudinal passage 16 of the body, the withdrawal of the shuttle 10 from the advanced limit stop position to the retracted limit stop position is ensured by the springs 12.

[0039] Differently, in an anomalous operating condition, for example if the second electrical contacts 8 of the movable bridge 7 remain stuck/welded with the first electrical contacts 6, the removal of the actuation key 18 involves action of the actuation key 18 on the front portion 11b of the hook 11 such as to cause a forced retraction of the shuttle 10 and the opening of the electrical contact.

[0040] With reference to a condition in which the above-mentioned front portion 11b of the movable hook 11 is positioned so as to interfere with the above-mentioned longitudinal passage 16 (for example, see Fig. 8), the above-mentioned outer front wall 14 of the front portion 11b of the movable hook 11 is advantageously inclined with respect to the longitudinal direction X-X by an angle smaller than 90°, to bring the movable hook 11 into

the above-mentioned lifted limit stop position when inside of the passage 16 said inclined front portion 11b is pushed, so that on the movable hook 11 a rotating torque is generated with respect to the first pin 13 such as to cause an opening rotation of the movable hook 11 towards the above-mentioned lifted limit stop position (see Fig. 5) when acting against said external front wall 14, for example through the removable key 18 as shown in Figure 8, with a force F parallel to the longitudinal direction X-X and having direction towards the shuttle 10.

[0041] This is the condition that occurs when the removable actuation key 18 is inserted into the body 2 while the movable hook 11 partially obstructs the longitudinal passage 16 being in an intermediate position (see Fig. 8) between the lifted limit stop position (see Fig. 5) and the lowered limit stop position (see Fig. 6).

[0042] Thus, the above-mentioned inclination of the outer front wall 14 of the front portion 11b of the movable hook 11 enables insertion into the above-mentioned longitudinal passage 16 of the body 2 of the removable actuation key 18 even when the movable hook 11 partially obstructs the above-mentioned longitudinal passage 16 being in an intermediate position (see Fig. 8) included between said lifted limit stop position (see Fig. 5) and said lowered limit stop position (see Fig. 8) between the lifted limit stop position (see Fig. 5) and said lowered limit stop position (see Fig. 6).

[0043] This is a condition that may occur, as shown in Figure 7, during the opening phase of the safety electrical contact 1, when the removable actuation key 18 can be removed, but the presence of impediments between the parts prevents a complete rotation of the movable hook 11 in the lifted limit stop position (see Fig. 5) due to the springs 12 acting on the shuttle 10, so that a portion of the front portion 11b of the movable hook 11 obstructs a part of the above-mentioned longitudinal passage 16 (see Fig. 8), resulting in an obstacle to a new insertion of the free end of the removable actuation key 18 in the above-mentioned longitudinal passage 16. Even, as shown in the initial part of the description, in the electrical safety contacts with actuation by previously known removable actuation key, the above-mentioned condition of partial obstruction of the longitudinal passage for insertion of the removable actuation key into the body of the safety electrical contact causes an undesired closing of the electrical safety contact itself without the removable actuation key being actually inserted, with the consequent impossibility of opening the electrical safety contact with the removal of the removable actuation key.

[0044] Differently, as stressed above, in the case of the safety electrical contact 1 according to the invention, the above-mentioned rotating torque generated by the pressure of the front end of the removable actuation key 18 on the outer front wall 14 of the front portion 11b conformed to hook of the movable hook 11, causes an opening rotation about the first pin 13 of the movable hook 11 towards the above-mentioned lifted limit stop position (see Fig. 5), so as to restore a correct configuration of

the safety electrical contact 1, obviously, with subsequent correct operation when closing it (see Fig. 6) following a further insertion of the removable actuation key 18.

[0045] In accordance with a further, additional or alternative aspect of the electrical safety contact 1 according to the invention, the above-mentioned first pivot pin 13 engages a first seat 15a present in the rear portion 11a of the movable hook 11, said first seat 15a constituting the bottom end of a first open slot 15 accessible from the outside of the rear portion 11a of the movable hook 11, so as to allow the above-mentioned open slot 15 of the rear portion 11a to be inserted on the first pivot pin 13.

[0046] Preferably, when said movable hook 11 is in its lifted limit stop position (see Fig. 5) the first open slot 15 is oriented so as to have the opening oriented towards the front end 2b of the body 2 (to the left in Fig. 5) or at the most rotated for not more than 90° with respect to said orientation.

[0047] Preferably, the above-mentioned articulated linking means also comprise:

- a second pin 19 supported by the body 2 parallel to the first pin 13 and
- a corresponding second slot 21, preferably present in the rear portion 11a of the movable hook 11, for housing said second pin 19 so as to allow relative rotation and relative translation between said second pin 19 and said second slot 21.

[0048] Preferably, also the above-mentioned second slot 21 is an open slot accessible from the outside of the rear portion 11a of the movable hook 11, to allow insertion of said second slot 21 on said second pivot pin 19.

[0049] According to what has been described above, the kinematic engagement between the first slot 15 and the first pin 13, as well as between the second slot 21 and the second pin 19 determines that a translation in the longitudinal direction X-X of the shuttle 10 from the retracted limit stop position (see Fig. 5) to the advanced limit stop position (see Fig. 6) involves a translation in said longitudinal direction X-X also of said movable hook 11, as well as a simultaneous movement of said movable hook 11 from said lifted limit stop position (see Fig. 5) to said lowered limit stop position (see Fig. 6) and vice versa.

[0050] Therefore, between the second slot 21 and the second pin 19, a desmodromic coupling is identified whose motion law is determined by the conformation of the second slot 21.

[0051] Preferably, the above-mentioned second pin 19 is positioned at a height of the body 2 different from the dimension to which the first pin 13 is located, preferably the second pin 19 is more widely spaced from the longitudinal axis X-X of said longitudinal passage 16 with respect to said first pin 13.

[0052] Preferably, the above-mentioned first pin 13 is positioned at said longitudinal passage 16, as shown in the figures.

[0053] With reference to a configuration in which the shuttle 10 is in the above-mentioned retracted limit stop position (see Fig. 5), in said longitudinal direction X-X the first pin 13 is more spaced than the second pin 19 from the rear end 2a of the body 2.

[0054] With reference to the removable actuation key 18 it should be pointed out that the latter comprises a stem 18b that ends with a free end 18a that, when inserted in the above-mentioned longitudinal passage 16 of the body 2, acts on the shuttle 10 for reversibly pushing the shuttle 10 from the retracted limit stop position (see Fig. 5) towards the advanced limit stop position (see Fig. 6) and being engaged by the front portion 11b of the movable hook 11.

[0055] The above-mentioned kinematism therefore allows to always ensure the correct insertion of the removable actuation key 18 in the longitudinal passage 16 of the body 2, ensuring a correct closing or opening condition of the safety electrical contact 1.

[0056] It should be noted that in the above-mentioned configuration in which the shuttle 10 is in the advanced end condition (see Fig. 6), the second electrical contacts 8 of the movable bridge 7 carried by the rear end 10a of the shuttle 10 are in contact against the above-mentioned first contacts 6 and, at the same time, the front free end 18a of the removable actuation key 18 is engaged by the front portion 11b of the movable hook 11, so that a retraction from this position of the removable actuation key 18, i.e. The removal of the removable actuation key 18 from the longitudinal passage 16 of the body 2, causes the shuttle 10 to move backward by the springs 12 and determines a simultaneous passage of the movable hook 11 from the above-mentioned lowered limit stop position (see Fig. 6) to the above-mentioned lifted limit stop position (see Fig. 5).

[0057] Only if a malfunction occurs and the action exerted by the springs 12 on the shuttle 10 is not sufficient to cause the shuttle 10 to move from the advanced limit stop position to the retracted limit stop position, the free end 18b of the actuation key 18 acts on the hook portion 11b causing the shuttle 10 to be dragged from the advanced limit stop position (see Fig. 6) to the retracted limit stop position (see Fig. 5), thus interrupting the electrical continuity between the first contacts 6.

[0058] With reference to Figures 11a, 11b, 11c and 11d, it is shown that they show in succession the sequence according to which it is possible to associate the movable hook 11 with the shuttle 10, essentially: first the movable hook 11 is assembled at the rear end 10b of the shuttle 10 and then it's possible to insert the hook-shuttle assembly in the longitudinal passage 16 of the body 2, starting from the front opening, then arranging to insert from above the bridge 7 on the front end 10a of the shuttle 10, so to prevent the hook-shuttle assembly from coming out of the longitudinal passage 16 of the body 2.

[0059] It should be pointed out that Figures 10a, 10b, 10c and 10d show respective flat views of the hook X of Figure 9 according to possible embodiments.

[0060] As can be appreciated from what has been described, the electrical safety contact with actuation by means of a removable actuation key according to the invention enables the above-mentioned requirements to be met and at the same time overcoming the drawbacks referred to in the introductory part of this description with reference to the prior art. In fact, the electrical safety contact with actuation by means of a removable actuation key allows to remedy the situation in which the removal of the removable actuation key, with the simultaneous passage of the safety electrical contact in an open electrical contact configuration, also occurs as a result of a partial reactivation of the internal mechanisms, in particular, of the hook 11.

[0061] Furthermore, it is evident that the possibility of the electrical safety contact according to the invention to ensure correct insertion of the removable actuation key into the longitudinal passage of the body, even if the movable hook is partially obstructing the above-mentioned longitudinal passage, does not require to minimize the height gaps necessary to allow the insertion of the removable actuation key into the above-mentioned longitudinal passage. Consequently, the electrical safety contact according to the invention allows to ensure a greater range of insertion of the key in the above-mentioned longitudinal passage with respect to the devices of the prior art.

[0062] Furthermore, the possibility of being able to mount the electrical safety contact without having to perform operations for inserting pins and the like once the movable hook has been inserted, makes it possible to considerably simplify the possibility of easily and quickly assembling the electrical safety contact with respect to the models previously known, also allowing to considerably contain the dimensions and overall dimensions of the electrical safety contact according to the invention with respect to the prior art models.

[0063] Obviously, a person skilled in the art, in order to meet contingent and specific needs, can make numerous changes and variations to the electrical safety contact with actuation by a removable actuation key according to the invention, all however contained within the scope of the invention, as defined by the claims below.

[0064] Thus, for example, where it is provided that between two coupled parts of a first part a slot and a second part identify a pin to engage said slot, it is possible to provide the dual case in which the second part identifies the slot and the first part identifies the pin to engage this slot.

[0065] If the electrical safety contact according to the invention is of the normally closed type (NC), the above-mentioned first limit stop position of the shuttle coincides with the above-mentioned retracted end position of the shuttle, as the first electrical contacts are positioned in such a way to be yieldingly displaced by the second electrical contacts carried by the movable bridge (in said longitudinal direction and away from the rear end of the body) when the shuttle is in the above-mentioned first

limit stop position coinciding with the retracted limit stop position.

Claims

1. An electric safety contact actuated by a removable actuation key comprising:

- a body (2) made of an electrically insulating material, extending along a preset longitudinal axis (X-X) between a front end (2b) and a rear end (2a); 10
- at least one passage formed in the body (2) for allowing electric wires to extend through said body (2); 15
- first electric contacts (6) associated with said body (2) and comprising a first contact (6a) and a second contact (6b), which are accommodated in said containing body (2) in a protected position and electrically insulated from each other; 20
- wiring means (5) for ensuring electrical continuity of said first contact (6a) and said second contact (6b) with external electric wires; 25
- a movable bridge (7) comprising second electric contacts (8), which are designed to contact said first electric contacts (6) to establish electrical continuity between said first electric contacts (6); 30
- a shuttle (10) axially extending along said preset longitudinal axis (X-X) between a rear end (10a) facing the rear end (2a) of said body (2) and an opposite front end (10b) - said shuttle (10) being supported and guided in said body (2) to be displaced in said body (2) with a movement that has at least a translational displacement component along said longitudinal axis (X-X) and to reversibly move along said longitudinal axis (X-X) from a backward limit stop position to a forward limit stop position in which the rear end (10a) of said shuttle (10) is closer to said rear end of said body (2) and 35 40
- a movable hook (11) comprising a rear portion (11a) connected to the front end (10b) of said shuttle (10) by articulated linking means and a hook-shaped front portion (11b) for engaging an end portion of a removable actuation key (18), said front portion (11b) having an outer front wall (14) facing away from said rear portion (11a); 45
- elastic means (12), acting on said shuttle (10) to bias with a preset elastic preload said shuttle (10) toward said backward limit stop position wherein: 50
- said movable bridge (7) is translationally associated with said shuttle (10); 55
- a longitudinal bridge (16) is defined in said body (2) and extends along said longitudinal

axis (X-X) to allow said removable actuation key (18) to be reversibly introduced into said body (2) and bias said shuttle (10) toward said forward limit stop position;

- said second electric contacts (8) of said movable bridge (7) are in electrical contact with said first electric contacts (6) associated with said body (2) when said shuttle (10) is in a first limit stop position selected from said backward limit stop position and said forward limit stop position and
- said second electric contacts (8) of said movable bridge (7) are electrically disconnected from said first electric contacts (6) associated with said body (2) when said shuttle (10) is in a second limit stop position, other from said first limit stop position,
- said articulated linking means comprise a first pivot pin (13) supported by said shuttle (10) transverse to said longitudinal axis (X-X), causing said movable hook (11) to be translationally rigidly joined to said shuttle (10) along said longitudinal axis (X-X), and allowing said movable hook (11) to reversibly pivot relative to said shuttle (10):

- between a lifted limit stop position in which said front portion (11b) allows a removable actuation key (18) to be introduced into said longitudinal passage (16) and
- a lowered limit stop operating position, in which said front portion (11b) extends beyond said longitudinal passage (16) and obstructs it to engage an end portion of a removable actuation key

(18) inserted in said longitudinal passage (16), **characterized in that**, when said front portion (11b) of said movable hook (11) is in such a position as to interfere with said longitudinal passage (16), said outer front wall (14) of said front portion (11b) is inclined to said longitudinal axis (X-X) to form an angle of less than 90°, such that movable hook (11) is moved to said lifted limit stop position when said inclined front portion (11b) is biased in said longitudinal passage (16), to generate on said movable hook (11) a rotating torque relative to said first pivot (13) which causes said movable hook (11) to pivot open toward said lifted limit stop position when said outer front wall (14) is acted upon by a force extending along an axis parallel to said longitudinal axis (X-X) and directed toward said shuttle (10), to allow a removable actuation key (18) to be intro-

- duced into said body (2) even when said movable hook (11) partially obstructs said longitudinal passage (16) and is in an intermediate position between said lifted limit stop position and said lowered limit stop position.
2. An electric safety contact as claimed in claim 1, wherein said first pivot pin (13) engages a first seat (15a) of said rear portion (11a) of said movable hook (11), said first seat (15a) defining the bottom end of a first open slot (15) which may be accessed from outside said rear portion (11a) of said movable hook (11) to allow said open slot (15) to fit upon said rear portion (11a) on said first pivot pin (13).
 3. An electric safety contact as claimed in claim 2 wherein, when said movable hook (11) is in said lifted limit stop position, said first open slot (15) is oriented with its opening facing the front opening (2b) of said body (2) or at most rotated not more than 90° relative to such orientation.
 4. An electric safety contact as claimed in claim 2 or 3, wherein said articulated linking means comprise:
 - a second pin (19) supported by said body (2) parallel to said first pin (13) and
 - a corresponding said second slot (21) formed in said movable hook (11) to accommodate said second pin (19), allowing a relative rotation and a relative translation between said second pin (19) and said second slot (21),
 wherein:
 - said second slot (21) is an open slot that can be accessed from outside said rear portion (11a) of said movable hook (11) to allow said second slot (21) to fit upon said second pivot pin (19) and
 - due to the kinematic engagement so established between said first slot (15) and said first pin (13) and between said second slot (21) and said second pin (19), a translation of said shuttle (10) along said longitudinal axis (X-X) from said backward limit stop position to said forward limit stop position also causes a translation of said movable hook (11) along said longitudinal axis (X-X) and a simultaneous movement of said movable hook (11) from said lifted limit stop position to said lowered limit stop position and vice versa, between said second slot (21) and said second pin (19), a desmodromic coupling being established between said second slot (21) and said second pin (19).
 5. An electric safety contact as claimed in claim 4, wherein said second pin (19) is located at a height of said body (2) other than the height at which said first pin (13) is located, and preferably said second pin (19) is at a greater distance from the longitudinal axis (X-X) of said longitudinal passage (16) than said first pin (13) .
 6. An electric safety contact as claimed in claim 4 or 5, wherein said first pin (13) is located level with said longitudinal passage (16).
 7. An electric safety contact as claimed in claim 4, 5 or 6 wherein, when said shuttle (10) is in said backward limit stop position, said first pin (13) is at a greater distance from the rear end (2a) of said body (2) than said second pin (19).
 8. An electric safety contact as claimed in any of claims 1 to 7, wherein said body (2) comprises an inner seat extending along said longitudinal direction (X-X) to define said longitudinal passage (16) and to accommodate said movable hook (11) and partially said shuttle (10), said inner seat being open at the front end (2b) of said body (2) to allow a removable actuation key (18) to be axially introduced into said inner seat.
 9. An electric safety contact as claimed in any of claims 1 to 8, wherein:
 - said first contacts (6) are located proximate to said rear end (2a) of said body (2) and
 - said second electric contacts (8) of said movable bridge (7) are in electrical contact with said first electric contacts (6) associated with said body (2) when said shuttle (10) is in said first limit stop position coinciding with said forward limit stop position, in which said shuttle (10) is pushed by a removable actuation key (18).
 10. An electric safety contact as claimed in any of claims 1 to 8, wherein said first contact and said second contact are in such positions as to be elastically moved by said second electric contacts of said movable bridge along said longitudinal axis, away from said rear end of said body, when said shuttle is in said first limit stop position coinciding with said backward limit stop position.
 11. An electric safety contact as claimed in any of claims 1 to 9, comprising a removable actuation key (18) comprising a stem with a free end (18a) longitudinally inserted in said longitudinal passage (16) of said body (2) to act upon said movable hook (11) to reversibly push said shuttle (10) from said backward limit stop position to said forward limit stop position and be engaged by said front portion (11b) of said movable hook.

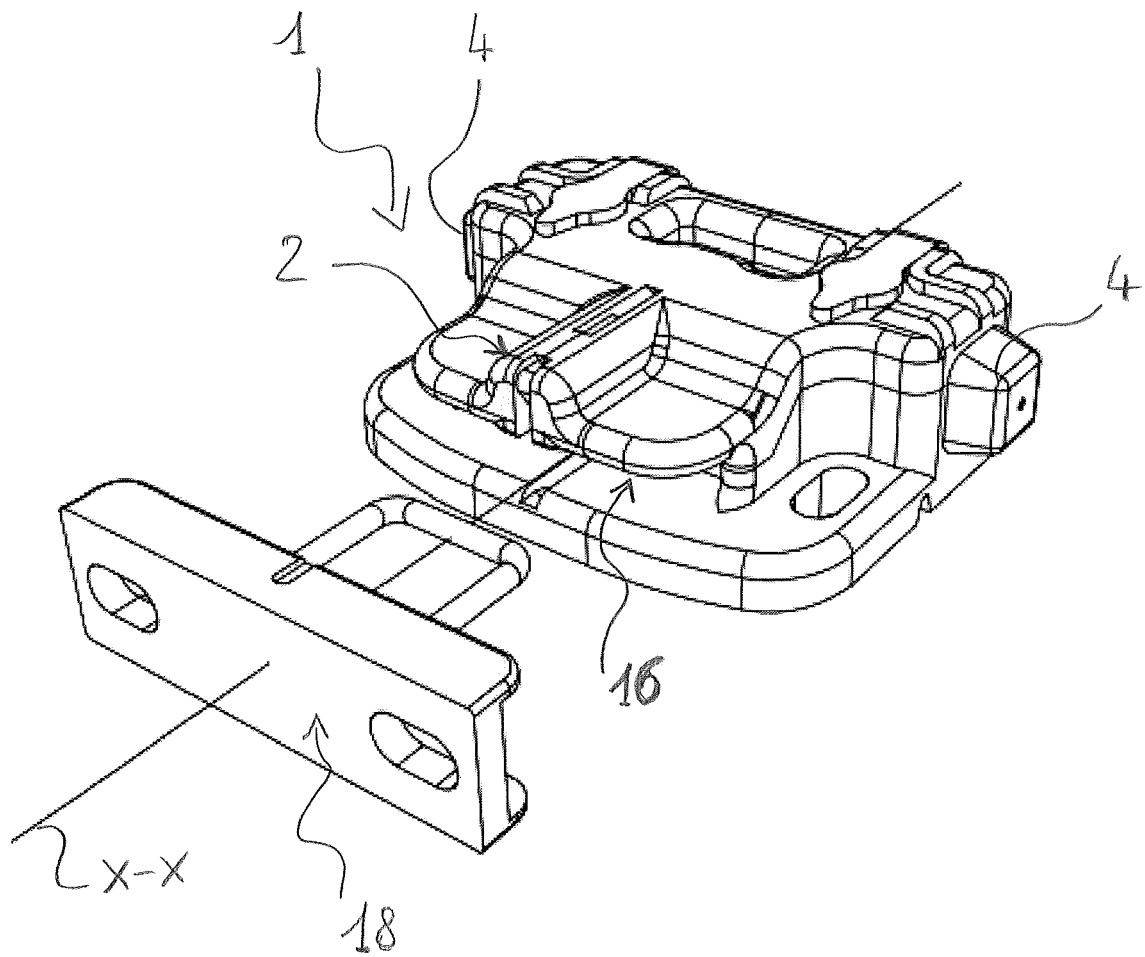


Fig. 1

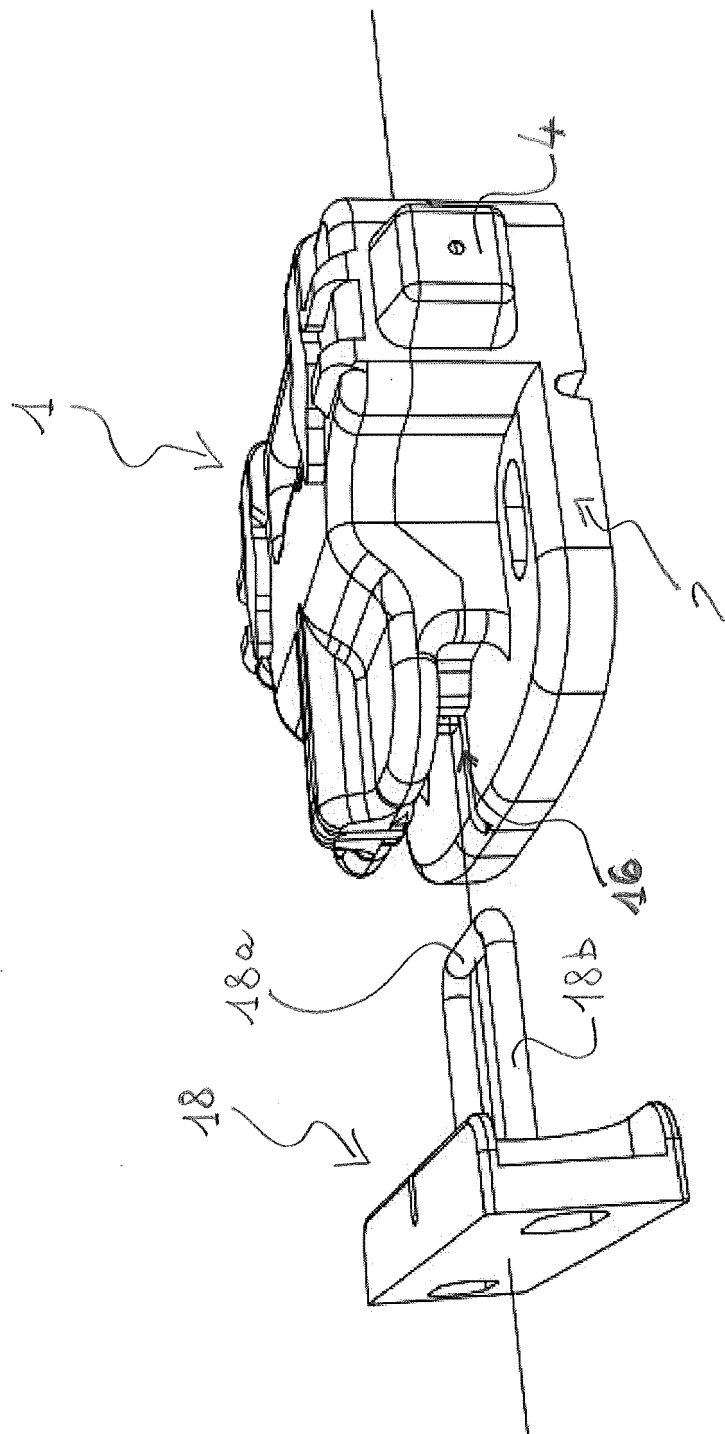


Fig. 1A

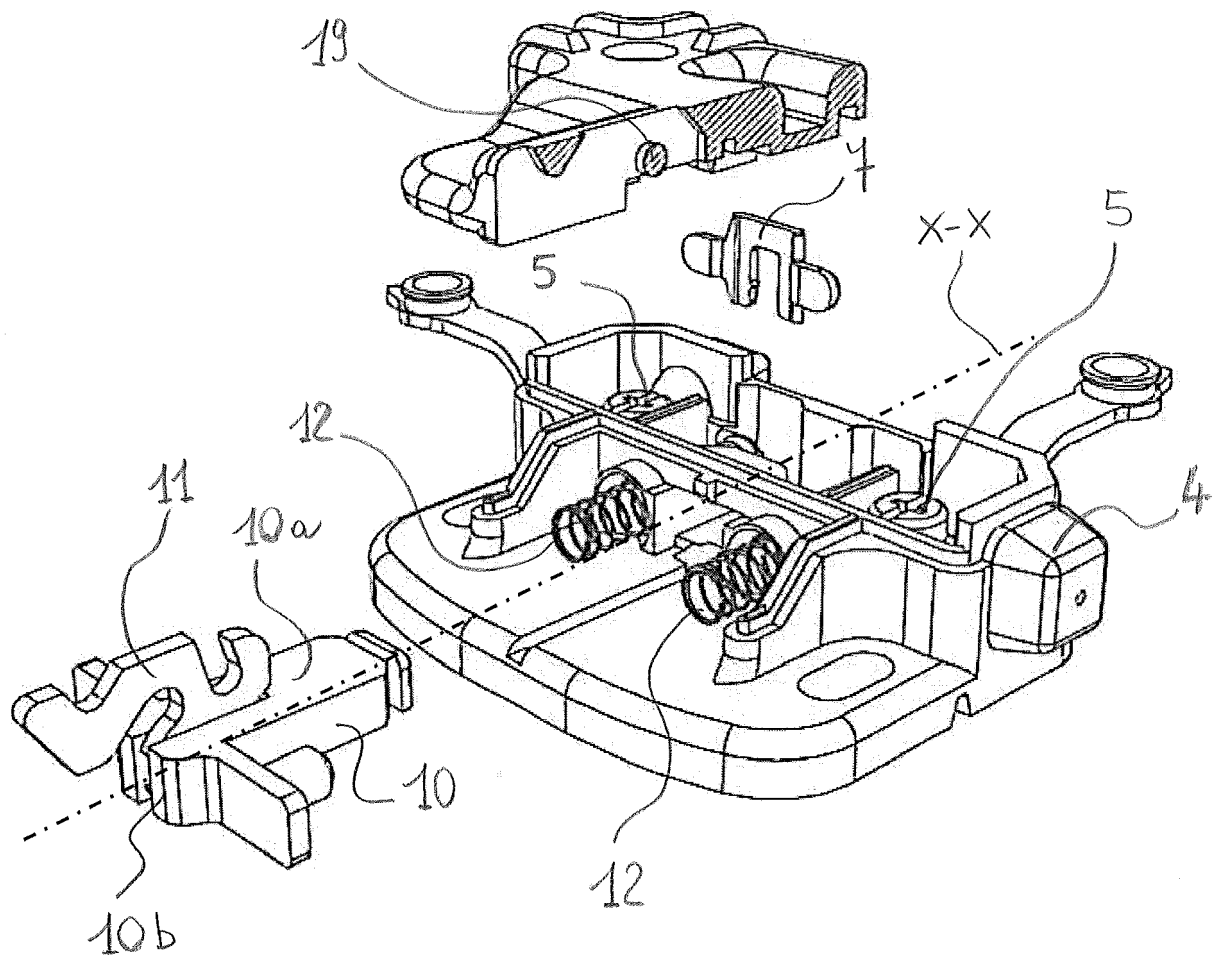


Fig. 2

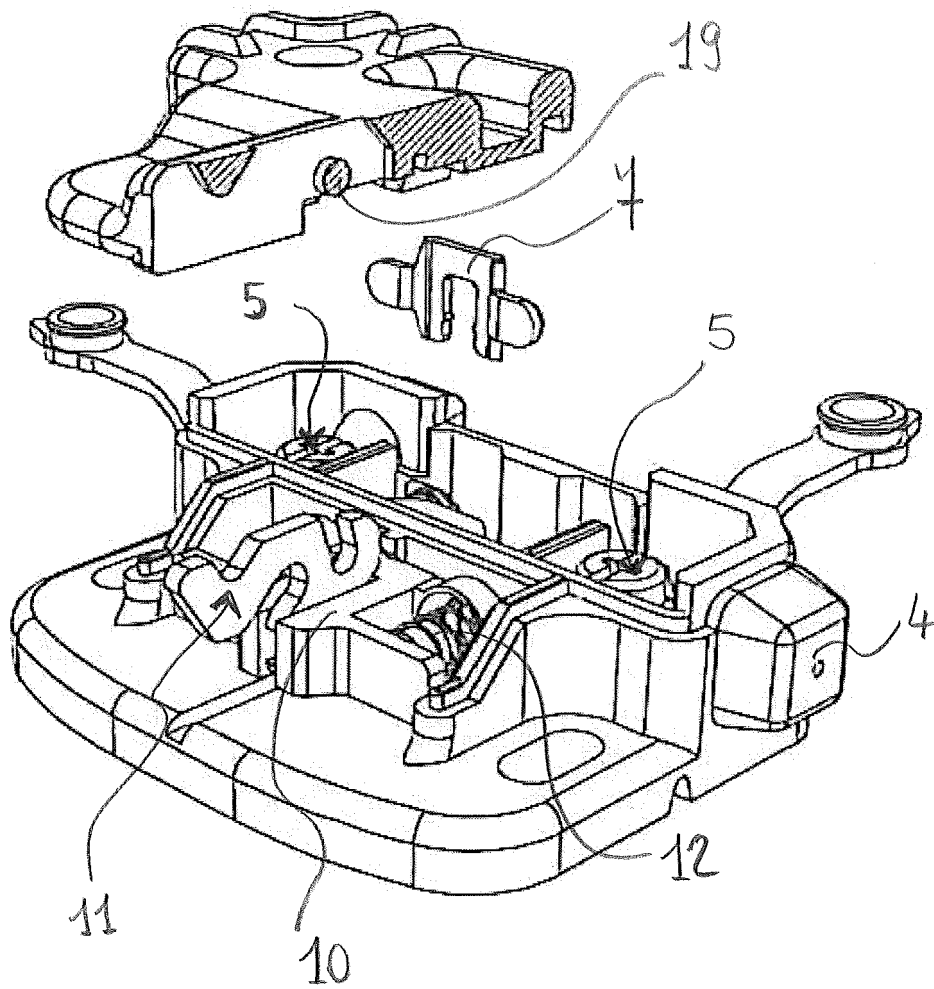


Fig. 3

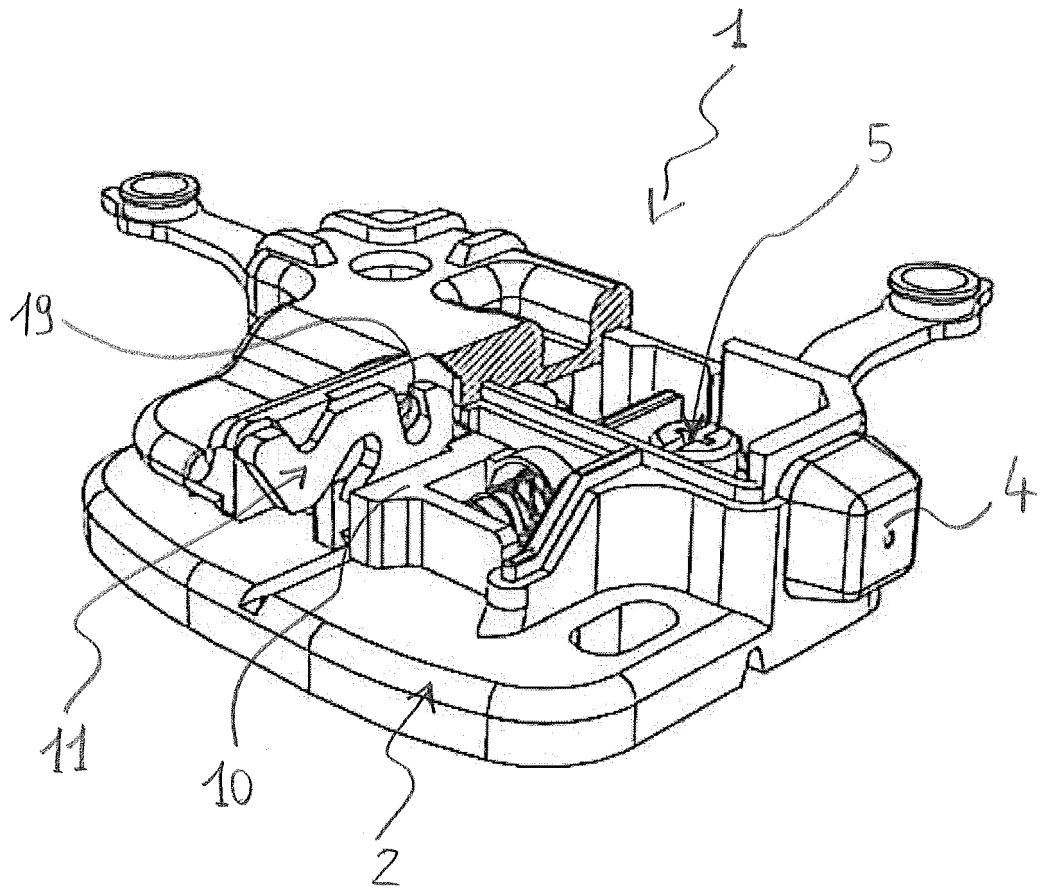
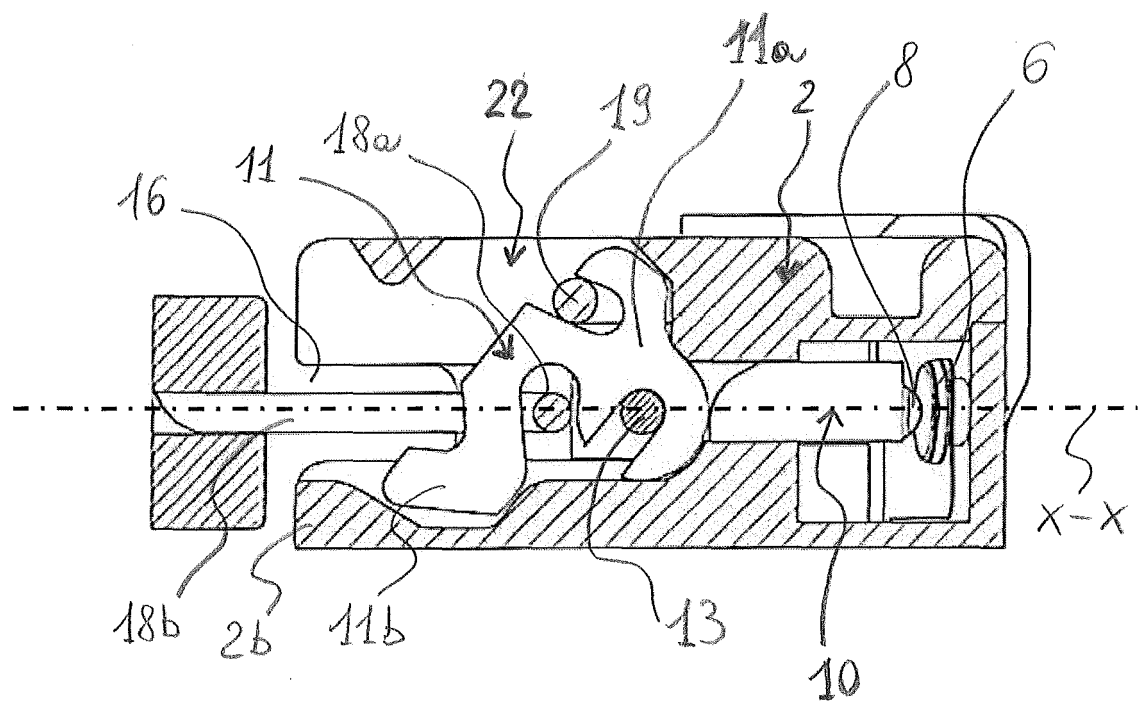
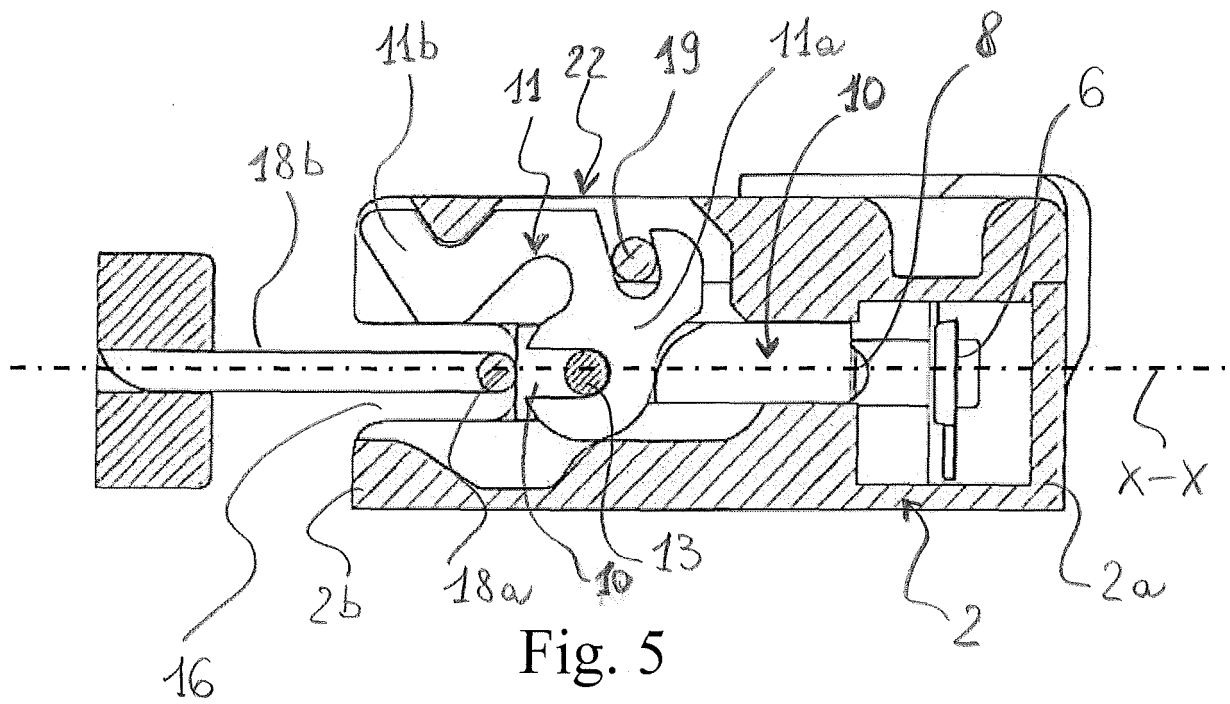


Fig. 4



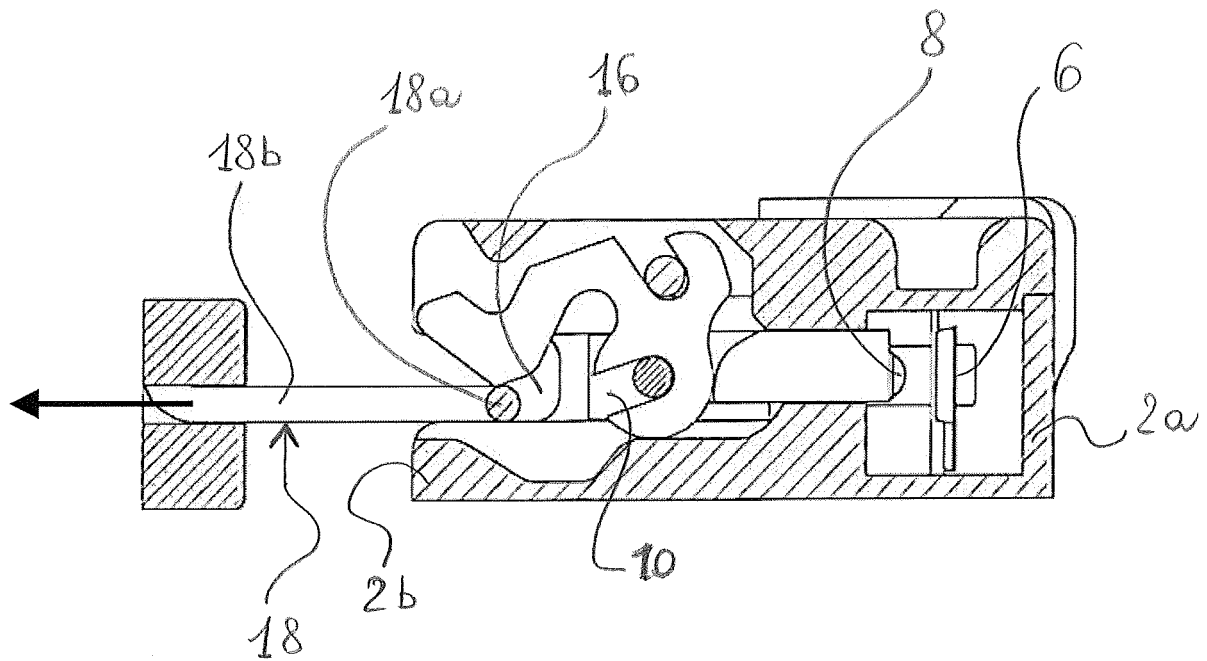


Fig. 7

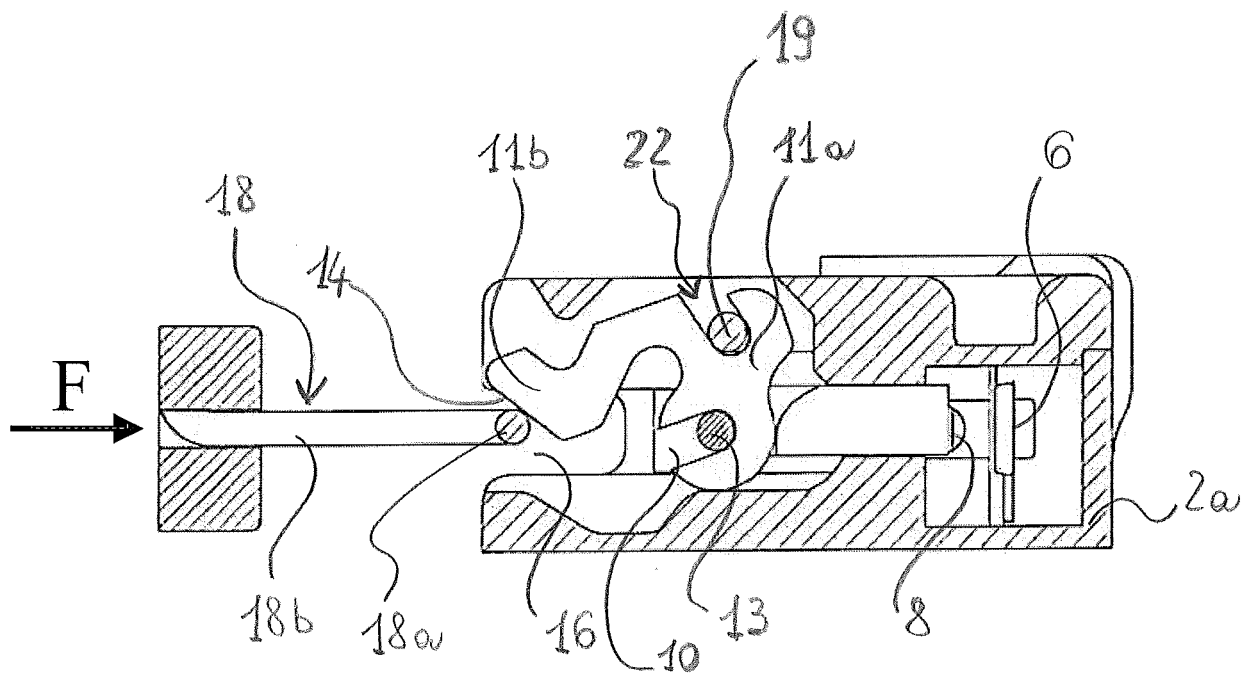


Fig. 8

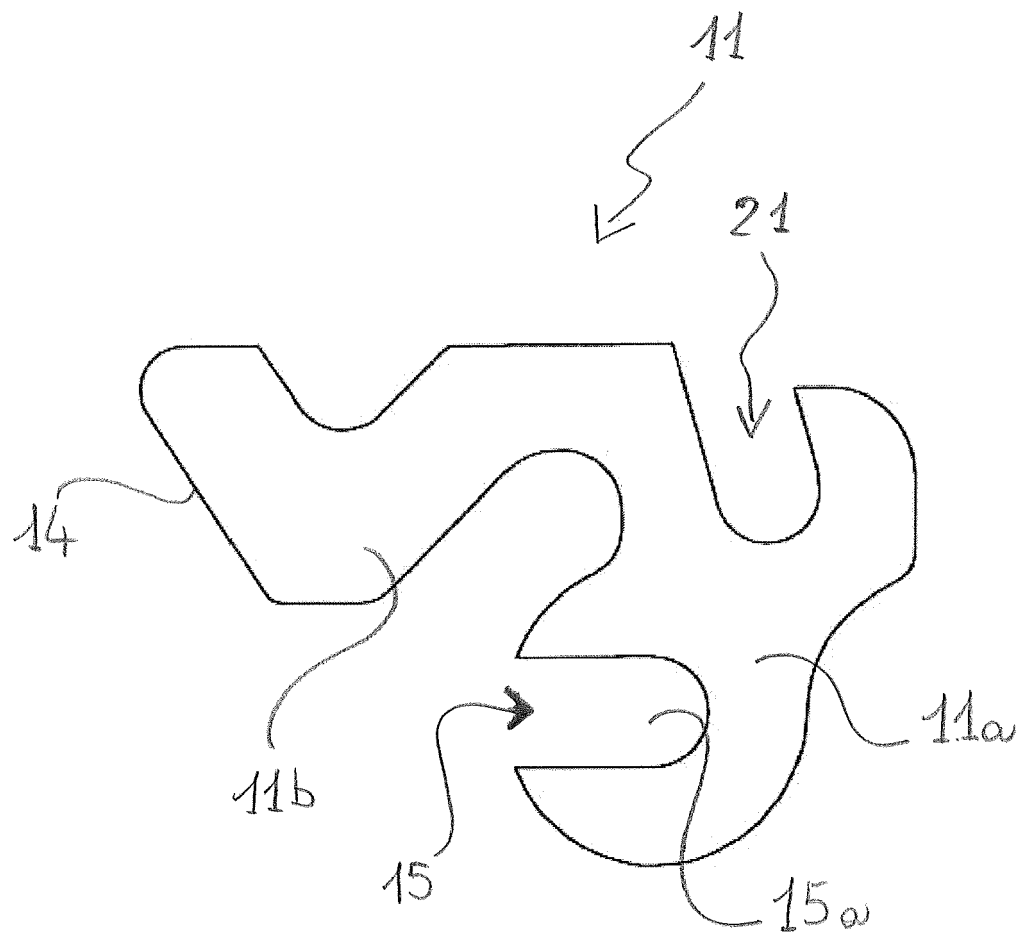


Fig. 9

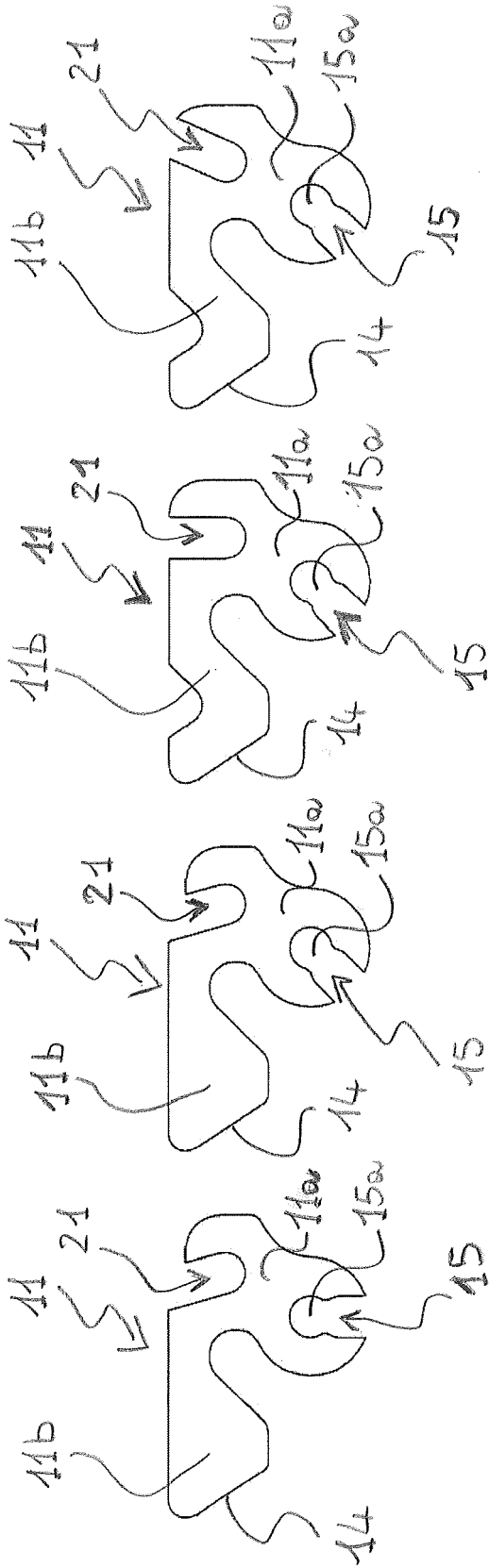


Fig. 10a

Fig. 10b

Fig. 10c

Fig. 10d

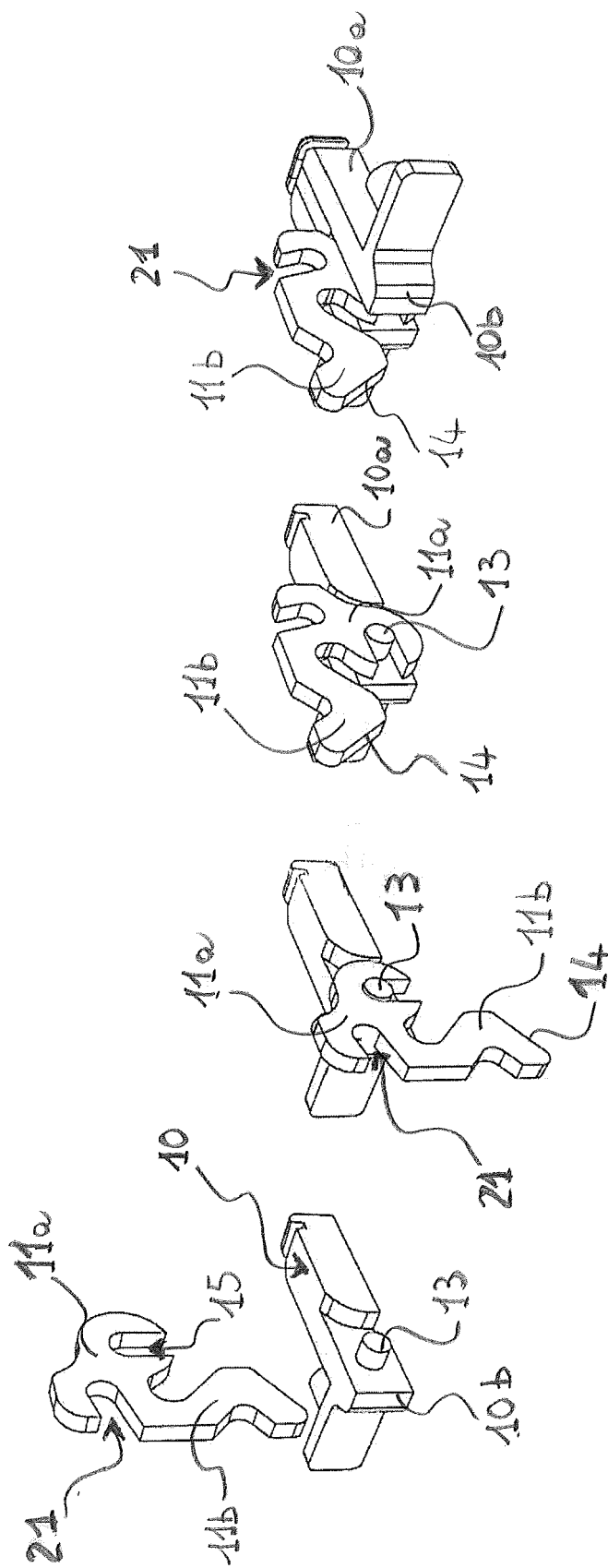


Fig. 11d

Fig. 11c

Fig. 11b

Fig. 11a



EUROPEAN SEARCH REPORT

Application Number
EP 18 18 2489

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Place of search Munich		Date of completion of the search 21 November 2018	Examiner Rucha, Johannes
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