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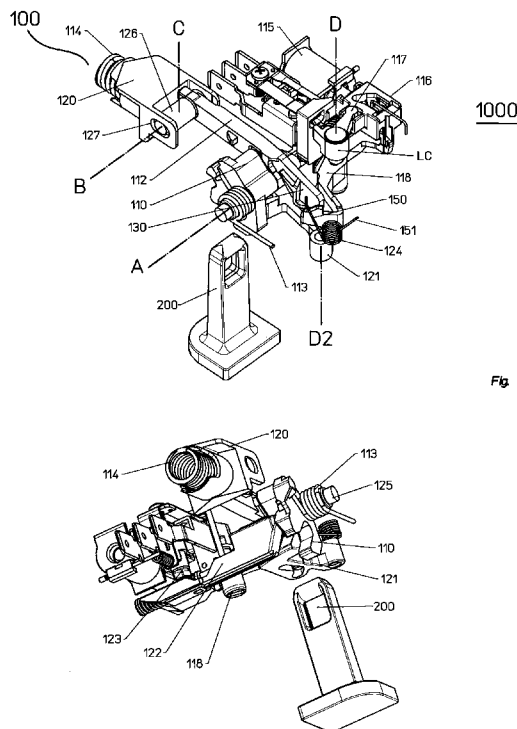


Fig. 1

(57) Abstract: A closing and opening device (1000) for doors and/or panels and/or similar components, in particular of electrical household appliances such as washing machines, dishwashers and similar electrical household appliances, said device comprising a closing and opening assembly (100) comprising a closing and opening element (110) adapted to be alternatively engaged and disengaged by a striker latch (200) adapted to be rigidly fixed to said panel, wherein said closing and opening element (110) can be switched by rotation about a first rotation axis (A) between a first position and a second position, wherein the reciprocal engagement arising from pushing said striker latch (200) against said closing and opening element (110) results in a first switching by rotation of said closing and opening element (110) from said first position to said second position, wherein said closing and opening assembly (100) comprises



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a locking lever (112) which can be switched by rotation about a second rotation axis (B), and wherein the switching by rotation of said closing and opening element (110) from said first position to said second position results in the rotation of said locking lever (112) between a first position and a second position in which it engages and locks said closing and opening element (110) in said second closing position.

DEVICE FOR CLOSING AND OPENING PANELS, IN PARTICULAR PANELS OF ELECTRICAL HOUSEHOLD APPLIANCES SUCH AS WASHING MACHINES AND THE LIKE

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TECHNICAL FIELD OF THE INVENTION

The present invention belongs to the field of electrical household appliances such as washing machines, dishwashers and/or similar electrical household appliances. In particular, the present invention relates to a closing and opening device, in particular for panels, doors or the like, for example of electrical household appliances of the aforesaid type. In detail, the present invention relates to a device of the aforesaid type, adapted to allow the opening of the panel in emergency situations and/or automatically, for example, respectively, but not by way of limitation, independent of the closed panel electric striker and at the end of the washing cycle. The present invention further relates to a closing and opening system comprising a closing and opening device of the aforesaid type, as well as to an electrical household appliance (for example, a washing machine or a similar electrical household appliance) equipped with a device and/or system of the aforesaid type.

20 BACKGROUND ART

The most common closing and opening devices and/or systems employed for electrical household appliances, such as, for example, washing machines and/or similar electrical household appliances, essentially comprise an actual closing (and opening) assembly usually applied to the housing of the electrical household appliance and a striker element (latch or hook) usually fixed to the panel of the same electrical household appliance. The closing and opening assembly further comprises, according to the most common solutions, a closing element which can be switched by rotation between a first opening position and a second closing position and vice versa, where the closing element, in the closing position, engages the corresponding striker element of the panel, thus securing the closing of the panel itself, while, conversely, in the opening position, it allows the disengagement of the striker element and thus the opening of the panel.

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For example, automatic switching devices and/or system, i.e., in which the switching of the closing and opening element arises automatically following the pushing of the latch or hook, and thus following the user pushing the panel, are known. In systems of this type, striker devices and/or solutions for verifying the effective closing of the panel, as well as locking system for locking the panel in the closing position, are further provided.

Although Figures from 1 to 3 relate to a device and/or system according to an embodiment of the present invention, hereafter, with reference to Figures from 1 to 3, a description will be given of the operating procedures of the closing and opening device which are in common with those of the devices of the known type, in particular produced and marketed by the applicant.

In Figures from 1 to 3, reference numeral 1000 identifies a closing system comprising a closing assembly 100 (adapted, as anticipated, to be applied to the housing of the electrical household appliance) and a striker element (latch or hook) 200 usually fixed to the door of the same electrical household appliance. The closing assembly further comprises a closing and opening element 110 (also called closing cam) which can be switched by rotation (see the following description), a locking and control lever (112), a release spring 113, a safety spring 114, a solenoid 115, a switching slide 116, a switching lever 117, an opening lever 118, a safety slide 120 and an opening spring 124.

Furthermore, the assembly 100 comprises a safety slider 122 and an actuator 123. The closing and opening element 110 is rotatable about a first rotation axis A, defined by a rotation pin 125 on which the spiral portion of the release spring 113 is engaged, where the lever 112 is rotatable about a second rotation axis B defined by a rotation pin 126, the opposite ends of which are each housed in a corresponding seat 127 defined by the safety slide 120.

Furthermore, an engagement and locking pin 128 protrudes from the cam 110, extending in the extension direction opposite to that of the rotation pin 125, where, on the free end of the lever 112 opposite to the rotation pin 127, shapings are obtained comprising a first protrusion 131 and a second protrusion 132 both with at least one half-circle-shaped part, where, however, the concavity of the half-circle part of the protrusion 131 faces the free end of the lever 112, while the

concavity of the half-circle part of the protrusion 132 substantially faces the engagement pin 128.

In the open-panel condition, the safety slider 122 is pushed into engagement against the element or cam 110 (from the left to the right in Figure 1) by a
5 compression spring positioned so as to act pushing the end portion of the slider 122 opposite to the cam 110. Furthermore, the safety slider 122, in the position of Figure 1, in which it locks the cam 110 avoiding any possible switching by rotation, also locks the actuator 123, preventing it from translating in a direction transverse to that of translation of the slider 122, which, in particular, may descend and
10 position itself in interference with the cursor 122. With regard to the actuator 123, it should be noticed that the same is responsible for the alternating activation and deactivation of the electric module, where the electric module, when activated, generates the electrical acceptance essential for the operation of the electrical household appliance, while, conversely, when deactivated, it denies the aforesaid
15 electrical acceptance and the electrical household appliance may not be started and/or operated. The actuator 123, in the position of Figure 1, denies in fact the acceptance to the electric module, while, conversely, in the position of Figure 2F (in which it has descended with respect to the position of Figure 1 and is positioned in interference with the cursor 122), it generates the acceptance to the
20 electric circuit.

During the closing of the panel (not shown for clarity purposes), the progressive approach of the panel to the main body of the electrical household appliance (equipped with the device 100) first results in the engagement of the safety slider 122 (of an inclined end surface of the slider 122) by the striker latch or hook 200
25 (Figure 2b) and thus in the translation of the safety slider 122 moving away from the element 110, with relative release of the element 110.

The retraction of the slider 122 following the pushing of the hook 200 thus results in the release of the cam 110, and in the switching by translation (according to the procedures described above) of the actuator 123 (at this point, no longer blocked or constrained by the safety slider 122), where the effect of the switching of the
30 actuator 123 is, as anticipated, that of activating the electric module which thus

generates the electrical acceptance required to start the electrical household appliance.

Furthermore, the end of the latch or hook 200 engages the fork portion of the element 110, where the progressive reciprocal engagement of the latch 200 in the fork of the element 110 results in a switching by clockwise rotation (with respect to the Figures) of the element 110 from the opening position of Figures 1 and 2A, in which the hook may come out from the fork of the element 110, to the intermediate positions of Figures from 2B to 2D and, subsequently, to the closing position of Figures from 2E to 2F, in which the hook may not come out from the fork of the element 110. Furthermore, when the closing position is reached, the element 110 is locked in said closing position by the lever 112 according to the following procedures.

The rotation of the element 110 from the opening position towards the closing one, with a consequent loading of the spring 113, results in the engagement of the lever 112 by the pin 128, where, in particular, an inclined surface 180 (Figures 2c, 2d) of the protrusion 131 connected to the part or portion with the concavity facing the free end of the lever 112 is engaged by the pin 128, and therefore where the lever 112 is rotated counterclockwise (the free end of the lever 112, opposite to the rotation pin 126, is raised with respect to the starting position, Figure 2D), compressing the safety spring 114. Continuing with the rotation of the element 110, with a consequent further loading of the spring 113, the inclined surface 180 of the protrusion 131 disengages from the pin 128 (Figure 2E), where the lever 112 is thus rotated in the opposite direction (clockwise, with respect to the Figures) by virtue of the elastic reaction of the spring 114, and where, in the same manner, the element 110 is also rotated backwards (towards the opening position) by virtue of the action of the spring 113, the aforesaid opposite rotations of the lever 112 and of the cam 110 ceasing, however, at the moment when the engagement pin 128 engages the concavity of the protrusion 131 (Figure 2F), being the cam 110 thereby locked in the closing position. In fact, any further rotation of the cam 110 towards the opening position, with a consequent release of the hook 100 from the fork of the element 110, may only occur by previously releasing the lever 112 (the

concavity of the protrusion 131) from the pin 128, the reciprocal release of the lever 112 from the pin 128 occurring according to the following procedures.

Starting from the closing position of Figure 2F, with reference to the following Figures 3A and 3B, it is apparent how a further clockwise rotation of the cam 110,

5 and therefore a further compression of the spring 113, first results in a sliding of the pin 128 into the concavity of the protrusion 131, and thus in the pin 128 coming out from the concavity of the protrusion 131. At this point, the cam 110 is again free to rotate in a counterclockwise direction by virtue of the elastic reaction of the spring 113, where, by virtue of the shape of the protrusion 131 which, as depicted,
10 has a variable thickness and therefore defines an inclined surface 133, the pin 128, during the counterclockwise rotation of the cam 110, engages, in fact, said inclined surface 133 of the protrusion 131, and where the counterclockwise rotation of the cam 110 thus results in a push on the lever 112 by the pin 128. Thereby, the lever is rotated about a third rotation axis C (Figure 4B) moving away
15 from the cam 110, with a consequent reciprocal release of the lever 112 and of the cam 110 which, following the pushing of the spring 113, may again rotate in a counterclockwise direction until reaching again the opening position, with a consequent automatic release of the hook 200 from the fork of the cam 110, and therefore with an automatic opening of the panel.

20 The closing devices and/or systems of the known type, even those according to the most recent background art, although being appreciable from different points of view (construction and operation simplicity, good reliability, limited overall manufacturing and/or installation costs) also present some drawbacks which the present invention intends to overcome.

25 A first drawback relates to the fact that the opening of the panel by pushing the panel itself according to the procedures described above may only be obtained by a user who is, in any case, outside the electrical household appliance, where, conversely, in the rare, but not impossible, case of a child trapped into the electrical household appliance, any push by the child on the panel, and therefore
30 outwardly, would have no effect other than to increasingly engage the cam 110 and the lever 112 in the locking position.

A further drawback or dissatisfaction factor is related to the fact that the opening of the panel according to the procedures summarized above necessarily requires the intervention of the user who, in any case, is called to act by pushing the panel itself; in fact, in the devices of the known type, the electrical components are only adapted to “allow” the opening of the panel, which in fact, without the essential intervention of the user itself, remains in any case closed. Obviously, in the case, for example, of a washing machine, but also of a dishwasher, the washing cycle may be completed in the absence of users and/or relevant operators, where the prolonged closing of the panel after the completion of the washing cycle prevents or, in any case, delays the drying of the laundry and may lead to bad smells arising in the laundry itself. Furthermore, the closed-panel condition does not allow to “visually” perceive if the washing cycle is actually completed or not, with the risk of opening the panel under unfinished-washing conditions. It is therefore clear that it would be extremely advantageous to have a solution allowing the panel to be opened also by pushing the panel itself from the inside of the electrical household appliance, and/or allowing the spontaneous and automatic opening of the panel once the washing cycle is complete.

It is therefore the main object of the present invention to overcome or at least minimize the drawbacks summarized above and observed in the closing devices and/or systems according to the background art.

In particular, it is a first object of the present invention to provide a closing and opening device which allows the panel to be opened also by means of pushing the panel itself from the inside the electrical household appliance.

It is a further object of the present invention to provide a solution which allows the spontaneous and automatic opening of the panel, for example, once the washing cycle is complete or, in any case, by means of a programming which may be set by the user.

Finally, the closing and opening device and/or system according to the present invention shall be characterized by reduced size and bulk, as well as be applicable to electrical household appliances of the known type according to equally simple and cost-effective procedures, as well as not require substantial modifications to said electrical household appliances.

DESCRIPTION OF THE PRESENT INVENTION

The present invention is based on the general consideration that the above predefined objects may be achieved and, in particular, the operation and reliability requirements, in compliance with safety regulations, may be met by means of a device including a locking lever, not only rotatable about one or more rotation axes, but also translatable along a predefined translation direction, where the translation of the locking lever, in at least one translation direction, results in the reciprocal release of the locking lever and of the opening and closing element or cam.

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Based on the above considerations, and in view of the problems and/or drawbacks observed in the closing and opening devices and/or systems according to the background art, according to a first embodiment, the present invention relates to a closing and opening device (1000) for doors and/or panels and/or similar components, in particular of electrical household appliances such as washing machines, dishwashers and similar electrical household appliances, said device comprising a closing and opening assembly (100) comprising a closing and opening element (110) adapted to be alternatively engaged and disengaged by a striker latch (200) adapted to be rigidly fixed to a said panel or door, where said closing and opening element (110) can be switched by rotation about a first rotation axis (A) between a first position and a second position, where the reciprocal engagement arising from pushing said striker latch (200) against said closing and opening element (110) results in a first switching by rotation of said closing and opening element (110) from said first position to said second position, where said closing and opening assembly (100) comprises a locking lever (112) which can be switched by rotation about a second rotation axis (B), and where the switching by rotation of said closing and opening element (110) from said first position to said second position results in the rotation of said locking lever (112) between a first position and a second position in which it engages and locks said closing and opening element (110) in said second closing position; where said device comprises first rotatable switching means (LC, 121), where the rotation of said first switching means (LC, 121) in a first direction of rotation results in the positioning of at least part of said first rotatable switching means (LC, 121) in

interference with said closing and opening element (110) and therefore in the impossibility for said closing and opening element (110) to be switched from said second position to said first position, and where the rotation of said first switching means (LC, 121) in a second direction of rotation opposite to the first one results in the positioning of at least part of said first rotatable switching means (LC, 121) in a position in which it does not interfere with said closing and opening element (110) and therefore in the possibility for said closing and opening element (110) to be switched from said second position to said first position.

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10 According to an embodiment, the translation of said locking lever (112) in the said first translation direction results in the rotation of said locking lever (112) about said third rotation axis (C).

According to an embodiment, said locking lever (112) comprises a switching protrusion, where said closing and opening assembly (100) comprises fixed switching means, and where the translation of said locking lever (112) in said first translation direction results in the progressive reciprocal engagement of said protrusion and said fixed switching means, thus in the rotation of said locking lever (112) about said third rotation axis (C), and thus in the reciprocal disengagement of said closing and opening element (110) and said locking lever (112).

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20 According to an embodiment, said protrusion of said locking lever (112) comprises an inclined and tapered engagement surface, where the progressive engagement of said protrusion and said fixed switching means by translation of said locking lever in said first translation direction results in the progressive rotation of said locking lever (112) about said third rotation axis (C).

25 According to an embodiment, during the rotation of said first switching means (LC, 121) in said second direction of rotation, said locking lever (112) is rotated about a third rotation axis (C) different both from said first rotation axis (A) and from said second rotation axis (B), and is therefore released from said closing and opening element (110).

30 According to an embodiment, said first switching means (LC, 121) are rotatable about a fourth rotation axis (D) substantially parallel to said third rotation axis (C).

According to an embodiment, said first rotatable switching means (LC) comprise a switching lever (LC) and a locking and/or safety lever (121) rotated by said

switching lever (LC), where the rotation of said lever (LC) in said first direction of rotation results in the interfering positioning of said locking and/or safety lever (121) with said closing and opening element (110), and where the rotation of said switching lever (LC) in said second direction of rotation opposite to the first one
5 results in the positioning of said locking and/or safety lever (121) in a position non-interfering with said closing and opening element (110).

According to an embodiment, said first switching means comprise a torsion spring (124) rotated by said switching lever (LC) and comprising a spiral portion and two substantially linear portions (150, 151) respectively extending from the opposite
10 ends of said spiral portion, where the rotation of said switching lever (LC) in said second direction of rotation results in the rotation of said compression spring (124) and in a pushing on said locking lever (112) by one of said substantially linear portions (150, 151) of said spring (124), and therefore in the rotation of said locking lever (112) about said third rotation axis (C), and ultimately in the release
15 of said locking lever (112) from said closing and opening element (110).

According to an embodiment, said device comprises a translatable switching slide (116), where the translation of said switching slide (116) in a first translation direction thereof results in the rotation of said lever (LC) in said second direction of rotation and therefore into the positioning of said locking and/or safety lever (121)
20 in a position non-interfering with said closing and opening element (110).

According to an embodiment, said device comprises electric means for switching by translation said switching slide.

According to an embodiment, said electric means comprise a solenoid (115).

According to an embodiment, said locking lever (112) can be further switched by
25 translation, where, with said closing and opening element (110) engaged and locked by said locking lever (112) in said second position, the rotation of said closing and opening element (110) towards said first position results in the translation of said locking lever (112) in a first translation direction and in the reciprocal disengagement of said closing and opening element (110) and said
30 locking lever (112), and therefore in the possibility for said closing and opening element (110) to switch by rotation until reaching said first position.

It is a further object of the present invention a closing and opening system for doors and/or panels and/or similar components, in particular of electrical household appliances such as washing machines, dishwashers and similar electrical household appliances, said system comprising a striker latch or hook adapted to be rigidly fixed to a said panel, said system comprising a closing and opening device according to one of the embodiments summarized above.

Finally, it is the object of the present invention an electrical household appliance such as, for example, a washing machine, comprising at least one panel, said electrical household appliance comprising a device according to one of the embodiments summarized above and a striker element rigidly fixed to said panel.

Any further embodiments of the present invention are defined in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be further clarified below by means of the following detailed description of the possible embodiments depicted in the drawings, in which corresponding or equivalent features and/or component parts of the present invention are identified by the same reference numerals. It should be noted, however, that the present invention is not limited to the embodiments described below and depicted in the drawings; conversely, all those variants and/or modifications of the embodiments described below and depicted in the accompanying drawings, which will become apparent to those skilled in the art, are within the scope of the present invention.

In the drawings:

- Figures 1 and 2A show perspective views of a device and of a closing and opening system according to an embodiment of the present invention;
- Figures from 2B to 2F show perspective views of the device and of the system according to an embodiment of the present invention during the respective closing steps;
- Figures from 3A to 3D show perspective views of the device and of the system according to an embodiment of the present invention during the respective opening steps;

- Figures from 4A to 4C show perspective views of the device and of the system according to an embodiment of the present invention during the opening steps and according to innovative procedures;
- 5 - Figures from 5A to 5D show perspective views of the device and of the system according to an embodiment of the present invention during the opening steps and according to further innovative procedures;
- Figures 5E and 5F show perspective views of details of the device and of the system according to an embodiment of the present invention;
- 10 - Figures from 6A to 6C show perspective views of further peculiarities of the device according to the present invention and the relative operating procedures.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

The present invention finds particular application in the field of electrical household appliances such as washing machines, dishwashers and similar electrical household appliances, this being the reason why, below, the present invention will be described with particular reference to the applications thereof in the field of electrical household appliances, in particular of a washing machine.

However, it should be pointed out that the possible applications of the present invention are not limited to those described below. Conversely, the present invention finds convenient application in all cases in which the closing and the opening of a panel are required to be reliable, simple, safe, and in accordance with the safety standards.

The procedures for opening and closing by means of simply pushing the panel from the outside have been clarified previously and a further description is thus omitted for synthesis purposes. Therefore, with reference to Figures from 4A to 4C, a description will be given below of the procedures for opening the panel by pushing the panel from the inside of the electrical household appliance (or, alternatively, by pulling the panel from the outside) offered by the peculiarities of the closing and opening device according to the embodiment of the present invention depicted therein.

A first peculiarity relates to the locking lever 112 which, as depicted in the Figures, comprises a protrusion 140 placed along the lever 112, midway between the

rotation pin 126 and the free end of the lever 112, where the protrusion 140 has a thickness decreasing until having a substantially null thickness towards the pin 126 and thus defines an inclined pushing surface 141.

5 A second peculiarity relates to the fact that the slots 142 in which the opposite end portions of the pin 127 are housed have an oblong shape and therefore define a secondary axis of a length substantially equal to the diameter of the pin 127 and a main axis of a length greater than the outer diameter of the pin 127, the translation in two opposite translation directions of the pin 127 (and therefore of the lever 112) thus being possible along a direction substantially parallel to the main axis of each of the slots 142. Furthermore, a third peculiarity relates to the fact that the device
10 100 comprises a fixed switching block 143, for example fixed to the device cover (not shown for clarity purposes).

From the foregoing it is therefore clear that starting from the closing position (for example of Figure 2F) any pushing from the inside or pulling from the outside of
15 the panel results in the rotation of the cam 110 towards the opening position (and therefore counterclockwise with respect to the Figures), where the rotation of the cam 110 in said counterclockwise rotation direction results in a pushing exerted on the protrusion 131 by the pin 128, and therefore in a translation of the lever 112 against the resistance exerted by the safety spring 114 (from the right to the left
20 with respect to the Figures). Obviously, during the aforesaid translation of the lever 112, the tapered or inclined surface 141 of the protrusion 140 meets the fixed switching block 143, where the reciprocal and progressive engagement or contrast of the protrusion 140 and of the block 143 results in a pushing on the lever 112 and therefore in the rotation of the lever 112 about the rotation axis C (rotation
25 allowed by the above shape of the slots 142) moving away from the cam 110 and until the pin 128 is released from the protrusion 131.

With the pin 128 released from the projection 131 (and therefore with the cam 110 released from the lever 112), the cam is free to rotate, by virtue of the elastic reaction of the release spring 113, towards the opening position and until reaching
30 the opening position in which the hook 200 may come out from the fork of the cam 110 and the panel may therefore be opened.

Below, with reference to Figures from 5A to 5F, a description will be given of further peculiarities of the device according to the embodiment depicted therein, as well as of the relative procedures for the automatic release of the hook 200 from the cam 110 and therefore for the automatic opening of the panel.

- 5 Assuming, for clarity of exposition, to start from the closing situation of Figure 2F, and, furthermore, supposing that the completion of the washing cycle results in an electrical impulse to the solenoid 115, the solenoid itself will re-enter, translating the switching slide 116 which thus approaches the solenoid 115 (it is translated from the right to the left with respect to the Figures).
- 10 In a seat for housing the slider 116, the end of the arm 117 of a switching lever LC, rotatable about a rotation axis D, is housed, where the lever LC, in addition to said first arm 117, comprises a second arm 118 substantially opposite to the arm 117, and where the translation of the slide 116 approaching and moving away from the solenoid 115 thus results in the rotation of the lever LC and therefore of the arms
- 15 117 and 118 in a counterclockwise direction and in a clockwise direction (with respect to the Figures), respectively. Furthermore, the second arm 118 comprises an end 161 engaged in a shaped seat 160 of a further safety and locking lever 121, said further safety and locking lever 121 being rotatable with respect to a rotation axis D2 substantially parallel to the rotation axis D. Thereby, during the
- 20 counterclockwise rotation of the switching lever LC (therefore generated by the translation of the slide 116 approaching the solenoid 115), the free end 161 of the arm 118 (opposite to the rotation axis D and engaged in the seat 160 of the lever 121) rotates (in the same direction of rotation of the arm 118 and therefore in an counterclockwise direction with respect to the Figures) the lever 121, where the
- 25 end of the lever 121 opposite to the rotation axis D2 thus positions itself in a position non-interfering with the cam 110 (Figures 5D and 5E). Furthermore, the linear portion 150 of the spring 124 is rotated by the end of the arm 118 (clockwise, with respect to the Figures) with a consequent elastic loading of the spiral portion 151 of the spring 124. Furthermore, the free end of the linear portion
- 30 150 of the spring 124 is positioned, with respect to the free end of the lever 112, so that the linear portion 150 of the spring 124, during the aforesaid rotation

thereof induced by the rotation of the switching lever LC, engages and rotates (about the axis C) the lever 112, which is thus released from the cam 110.

At this point, the cam 110, following the pushing of the spring 113, automatically switches into the opening position, being the hook 200 thus automatically ejected
5 from the fork of the cam 100, the panel being thus automatically opened.

Conversely, at the beginning of the washing cycle, the action of the solenoid 115 results in a translation of the slide 116 moving away from the solenoid 115 (from the left to the right with respect to the Figures), with a consequent clockwise rotation of the lever LC and of the lever 121, where the end of the lever 121
10 opposite to the rotation axis D2 thus positions itself in interference with the cam 110 (Figure 2F), preventing any accidental and/or unwanted rotation thereof towards the opening position.

Further features and the relative operating procedures of the device according to an embodiment of the present invention are clarified below with reference to
15 Figures from 6A to 6C.

As depicted, the device, on the path of the slider 122 and on the opposite part with respect to the cam 110, comprises a striker with a seat 171 adapted to be engaged with the end of the slider 122 according to the following procedures.

Starting from the closing position of the cam 110 (thus engaged by the latch 200)
20 depicted in Figure 6A, and assuming a break in the reel or shaft 111 of the cam 110, the cam would be free to switch from the closing position to the opening position, being the reel or shaft 111, in fact, under conditions of integrity of the cam 110, in interference with the lever 121 according to the procedures described above.

Said accidental switching of the cam 110 is, however, avoided by the slider 122
25 which, following the pushing of the relative spring and no longer obstructed by the reel 111, translates to engage the seat 171 (Figure 6C), thereby positioning itself in interference with the second reel (still intact) of the cam 110, and therefore preventing the cam 110 from switching to the opening position, thus preventing the
30 opening of the panel.

It has thus been shown, by means of the above detailed description of the embodiments of the present invention depicted in the drawings, that the present

invention allows to achieve the desired results and to overcome or at least limit the drawbacks observed in the background art.

In particular, by means of the present invention, a closing and opening device is provided, which allows the release of the latch 200 from the cam 110 and thus the
5 opening of the panel simply by means of pushing or pulling the panel respectively from the inside and from the outside of the electrical household appliance.

The device according to an embodiment of the present invention further allows the automatic release of the hook 200 from the cam 110 and thus the automatic opening of the panel, for example, at the end of the washing cycle.

10 Finally, the closing and opening device and/or system according to the present invention is characterized by reduced size and bulk, and is applicable to electrical household appliances of the known type according to equally simple and cost-effective procedures, and it does not require substantial modifications to said electrical household appliances.

15 Although the present invention has been previously clarified by means of the detailed description of the embodiments depicted in the drawings, the present invention is not limited to the embodiments described and depicted in the drawings; conversely, all those variants and/or modifications of the embodiments described below and depicted in the accompanying drawings, which will become
20 apparent to those skilled in the art, fall within the scope of the present invention. For example, according to embodiments, the device according to the present invention may only implement the peculiarities adapted to allow the opening arising from pushing or pulling the panel or only those adapted to allow the automatic opening of the panel.

25 The scope of protection of the present invention is therefore defined by the claims.

CLAIMS

1. A closing and opening device (1000) for doors and/or panels and/or similar components, in particular of electrical household appliances such as washing machines, dishwashers and similar electrical household appliances, said device comprising a closing and opening assembly (100) comprising a closing and opening element (110) adapted to be alternatively engaged and disengaged by a striker latch (200) adapted to be rigidly fixed to a said panel or door, wherein said closing and opening element (110) can be switched by rotation about a first rotation axis (A) between a first position and a second position, wherein the reciprocal engagement arising from pushing said striker latch (200) against said closing and opening element (110) results in a first switching by rotation of said closing and opening element (110) from said first position to said second position, wherein said closing and opening assembly (100) comprises a locking lever (112) which can be switched by rotation about a second rotation axis (B), and wherein the switching by rotation of said closing and opening element (110) from said first position to said second position results in the rotation of said locking lever (112) between a first position and a second position in which it engages and locks said closing and opening element (110) in said second closing position; **characterized in that** it comprises first rotatable switching means (LC, 121), **in that** the rotation of said first switching means (LC, 121) in a first direction of rotation results in the positioning of at least part of said first rotatable switching means (LC, 121) in interference with said closing and opening element (110) and therefore in the impossibility for said closing and opening element (110) to be switched from said second position to said first position, **and in that** the rotation of said first switching means (LC, 121) in a second direction of rotation opposite to the first one results in the positioning of at least part of said first rotatable switching means (LC, 121) in a position in which it does not interfere with said closing and opening element (110) and therefore in the possibility for said closing and opening element (110) to be switched from said second position to said first position.
2. A device (1000) according to claim 1, **characterized in that**, during the rotation of said first switching means (LC, 121) in said second direction of rotation, said locking lever (112) is rotated about a third rotation axis (C) different both from

said first rotation axis (A) and from said second rotation axis (B), and is therefore released from said closing and opening element (110).

3. A device (1000) according to claim 2, **characterized in that** said first switching means (LC, 121) are rotatable about a fourth rotation axis (D) substantially parallel to said third rotation axis (C).

4. A device (1000) according to one of claims from 1 to 3, **characterized in that** said first rotatable switching means (LC) comprise a switching lever (LC) and a locking and/or safety lever (121) rotated by said switching lever (LC), **in that** the rotation of said lever (LC) in said first direction of rotation results in the interfering positioning of said locking and/or safety lever (121) with said closing and opening element (110), **and in that** the rotation of said switching lever (LC) in said second direction of rotation opposite to the first one results in the positioning of said locking and/or safety lever (121) in a position non-interfering with said closing and opening element (110).

5. A device (1000) according to one of claims from 1 to 4, **characterized in that** said first switching means comprise a torsion spring (124) rotated by said switching lever (LC) and comprising a spiral portion and two substantially linear portions (150, 151) respectively extending from the opposite ends of said spiral portion, **and in that** the rotation of said switching lever (LC) in said second direction of rotation results in the rotation of said compression spring (124) and in a pushing on said locking lever (112) by one of said substantially linear portions (150, 151) of said spring (124) and therefore into the rotation of said locking lever (112) about said third rotation axis (C) and ultimately into the release of said locking lever (112) from said closing and opening element (110).

6. A device (1000) according to the preceding claim 4 or 5, **characterized in that** it comprises a translatable switching slide (116), **and in that** the translation of said switching slide (116) in a first translation direction thereof results in the rotation of said lever (LC) in said second direction of rotation and therefore in the positioning of said locking and/or safety lever (121) in a position non-interfering with said closing and opening element (110).

7. A device (1000) according to the preceding claim 6, **characterized in that** it comprises electric means for switching by translation said switching slide.

8. A device (1000) according to claim 7, **characterized in that** said electric means comprise a solenoid (115).

9. A device (1000) according to any one of the preceding claims from 1 to 8, **characterized in that** said locking lever (112) can be further switched by translation, **and in that**, with said closing and opening element (110) engaged and locked by said locking lever (112) in said second position, the rotation of said closing and opening element (110) towards said first position results in the translation of said locking lever (112) in a first translation direction and in the reciprocal disengagement of said closing and opening element (110) and said locking lever (112), and therefore in the possibility for said closing and opening element (110) to switch by rotation until reaching said first position.

10. A device (1000) according to claim 9, **characterized in that** the translation of said locking lever (112) in said first translation direction results in the rotation of said locking lever (112) about said third rotation axis (C).

11. A device (1000) according to claim 10, **characterized in that** said locking lever (112) comprises a switching protrusion, **in that** said closing and opening assembly (100) comprises fixed switching means, **and in that** the translation of said locking lever (112) in said first translation direction results in the progressive reciprocal engagement of said protrusion and said fixed switching means, therefore into the rotation of said locking lever (112) about said third rotation axis (C), and therefore into the reciprocal disengagement of said closing and opening element (110) and said locking lever (112).

12. A device (1000) according to claim 11, **characterized in that** said protrusion of said locking lever (112) comprises an inclined and tapered engagement surface, **and in that** the progressive engagement of said protrusion and said fixed switching means by translation of said locking lever in said first translation direction results in the progressive rotation of said locking lever (112) about said third rotation axis (C).

13. A closing and opening system for doors and/or panels and/or similar components, in particular of electrical household appliances such as washing machines, dishwashers and similar electrical household appliances, said system comprising a striker latch or hook (200) adapted to be rigidly fixed to a said panel,

characterized in that said system comprises a closing and opening device (1000) according to one of claims from 1 to 12.

14. An electrical household appliance, for example a washing machine comprising at least one panel, **characterized in that** said electrical household appliance
5 comprises a device (1000) according to one of claims from 1 to 11 and a striker element (200) rigidly fixed to said panel.

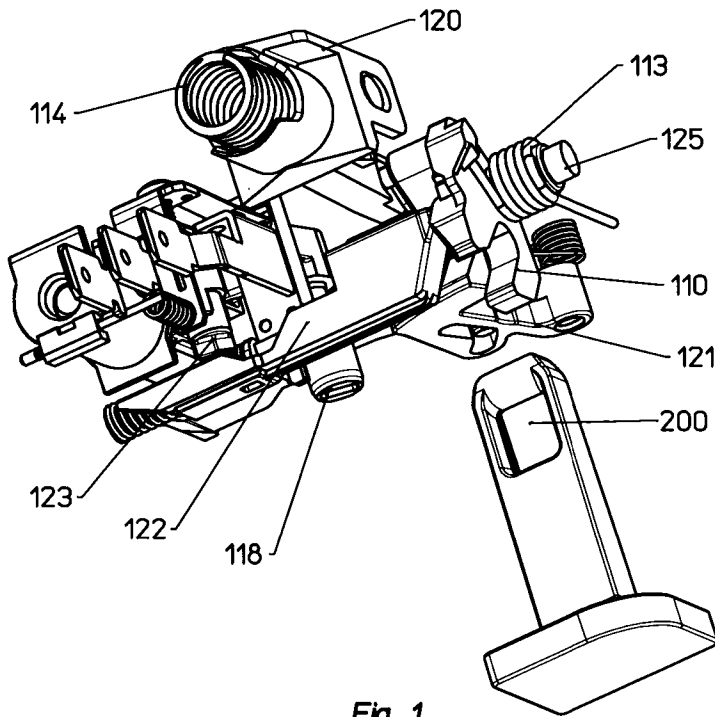
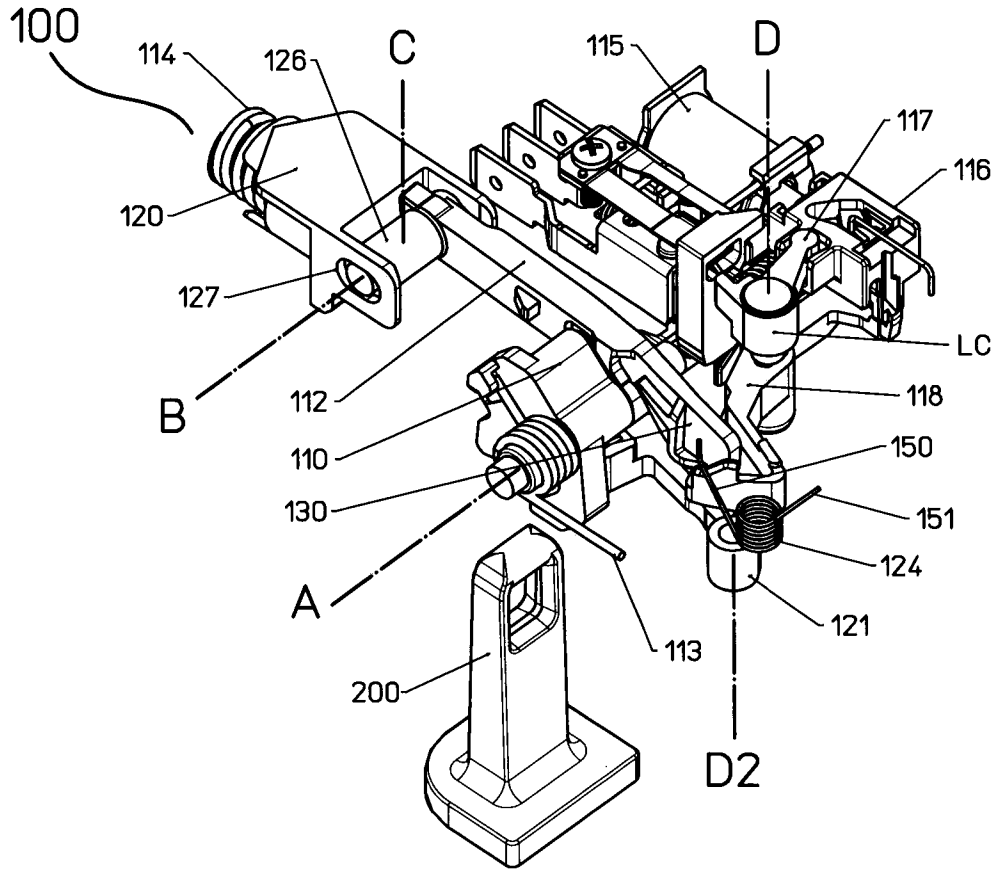


Fig 1

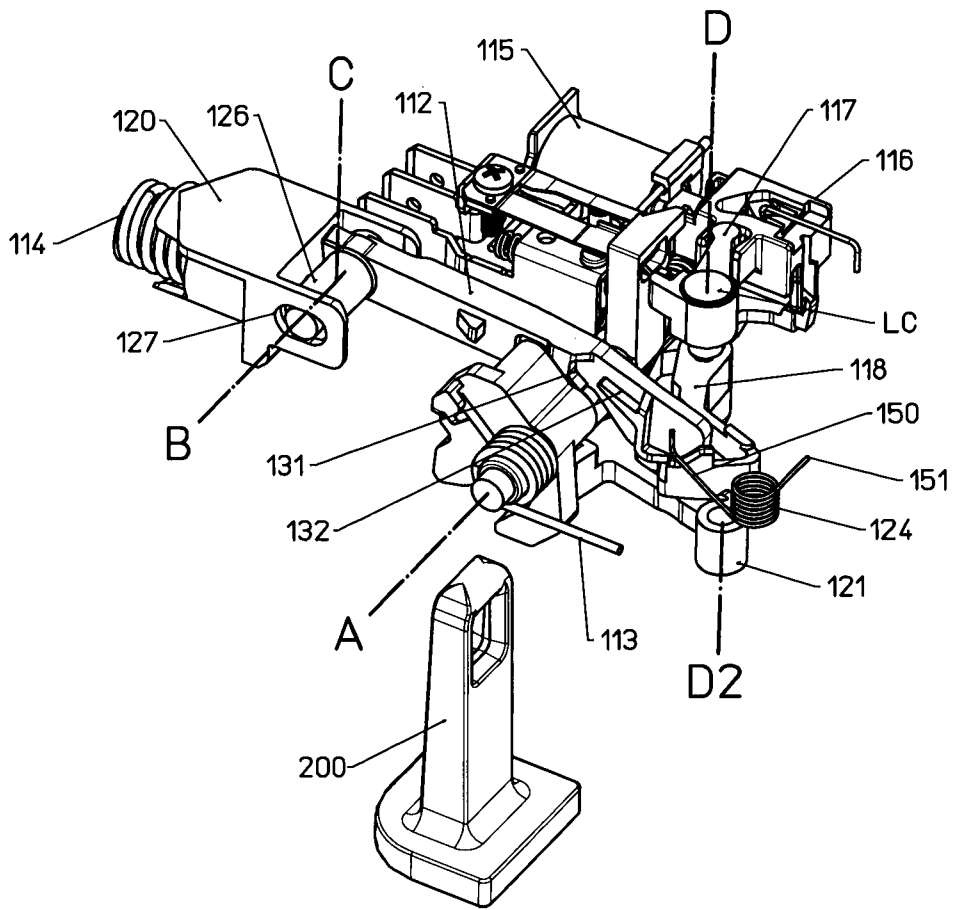


Fig. 2A

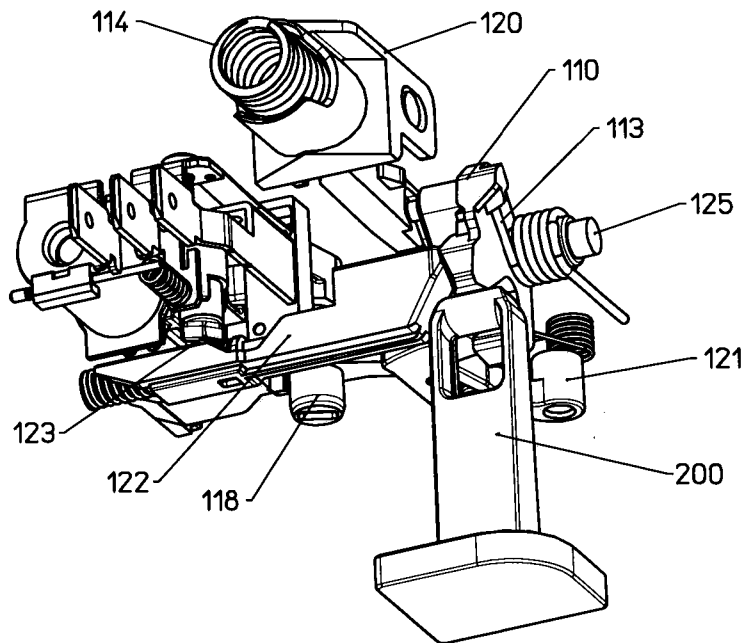
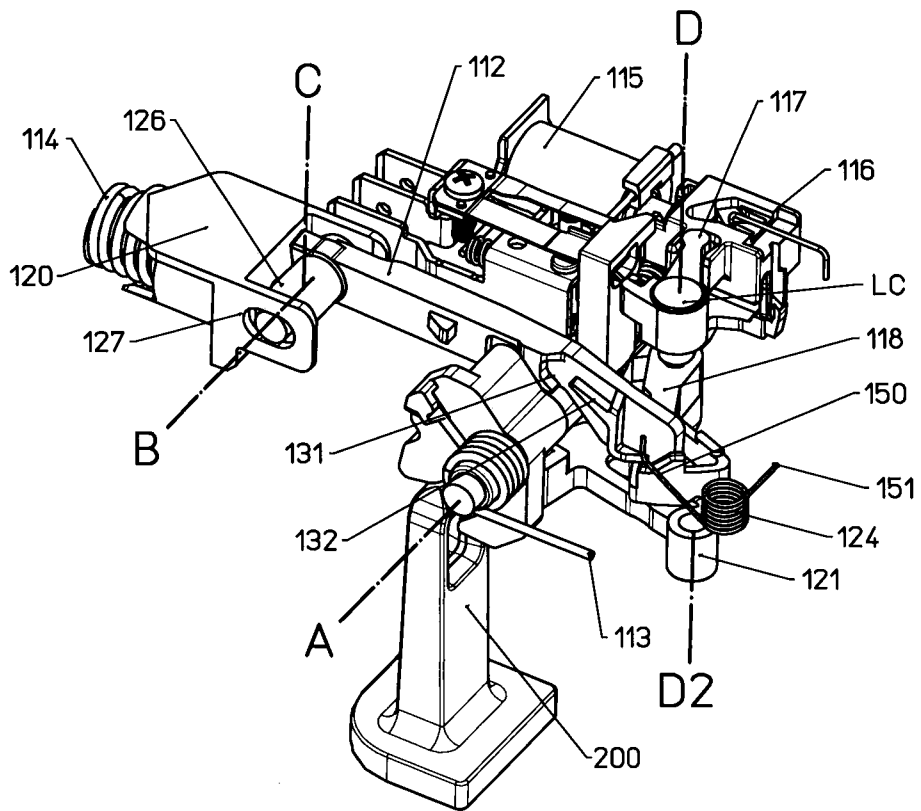


Fig. 2B

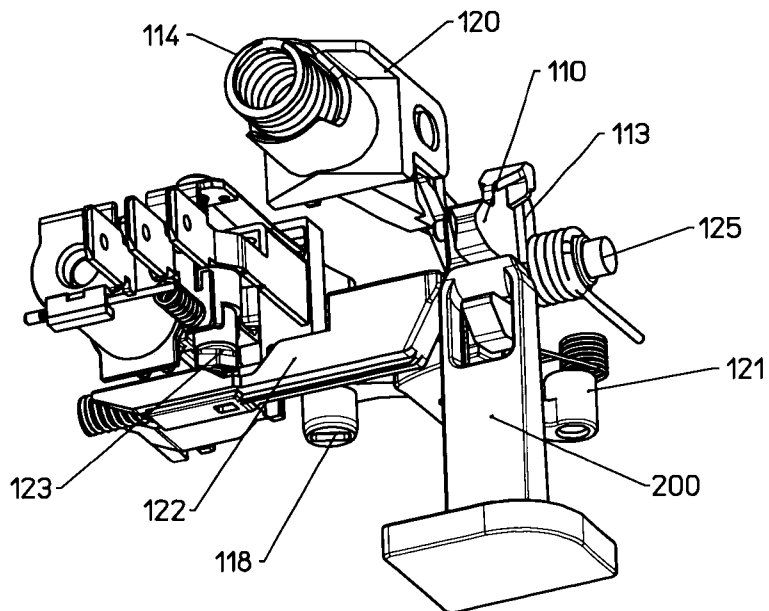
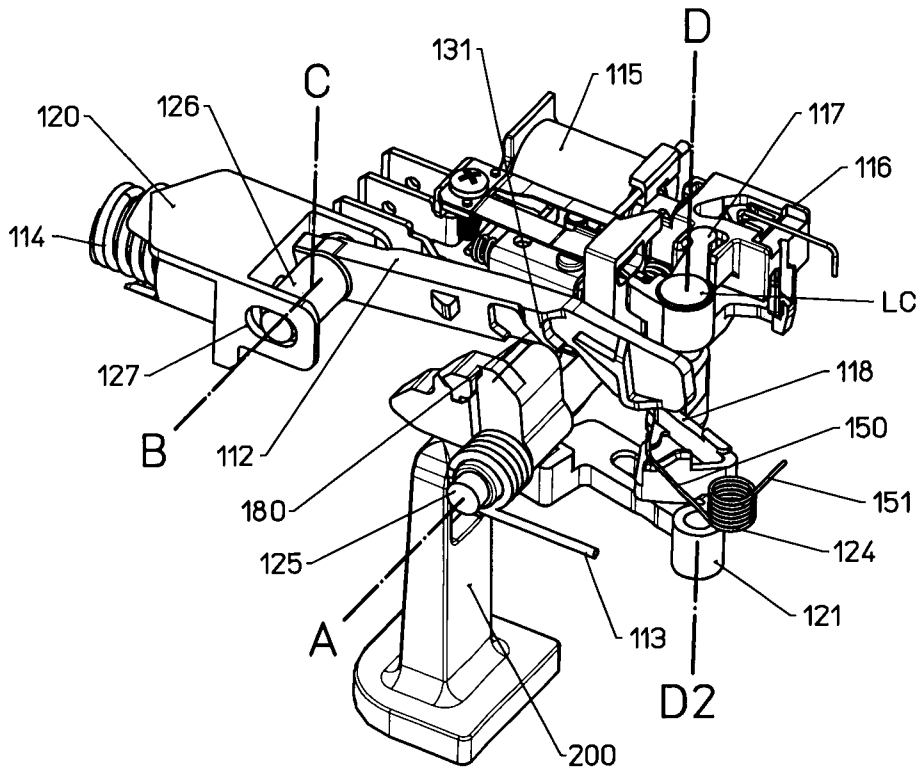


Fig. 20

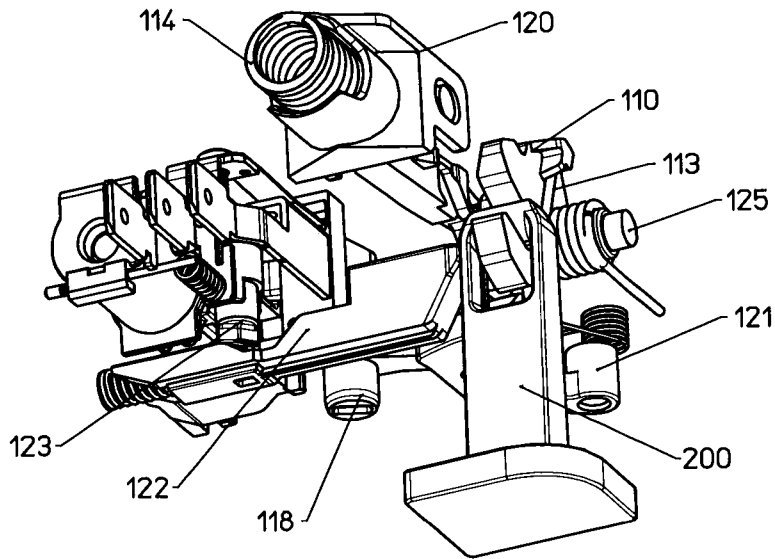
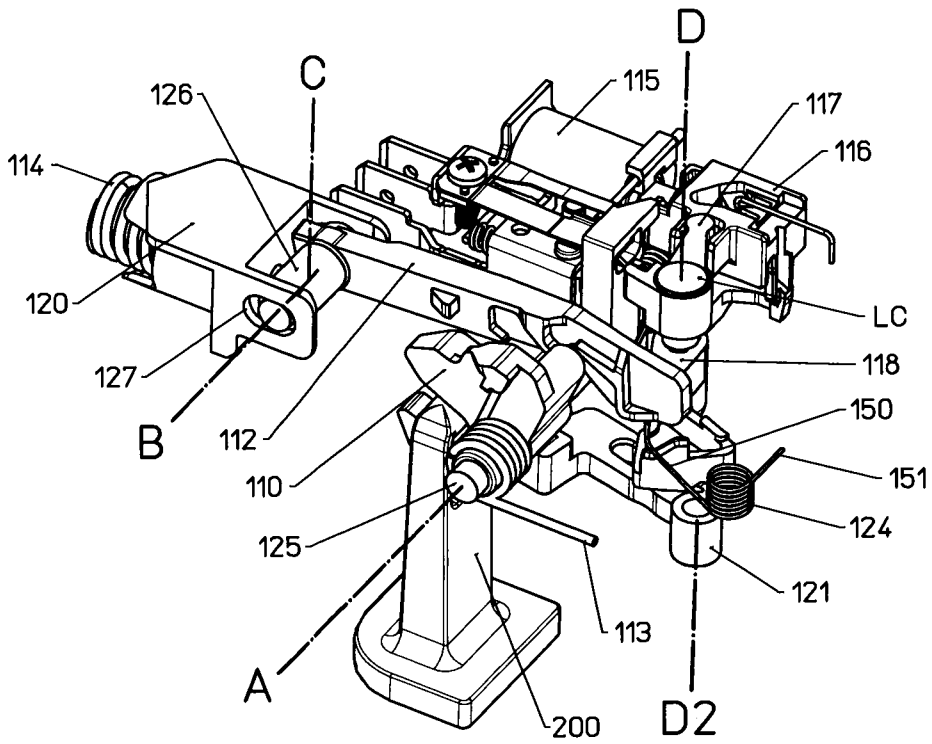


Fig. 2E

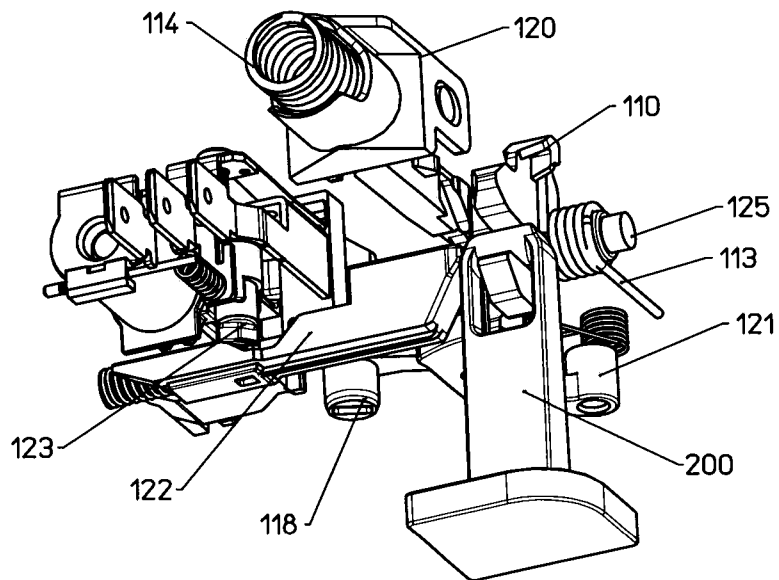
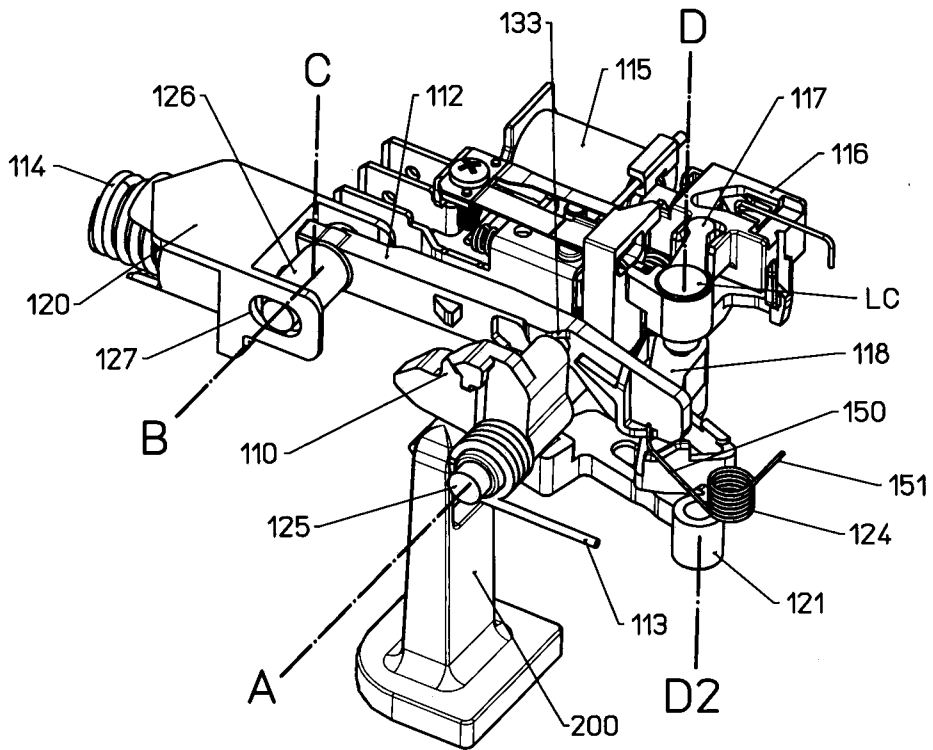


Fig. 2F

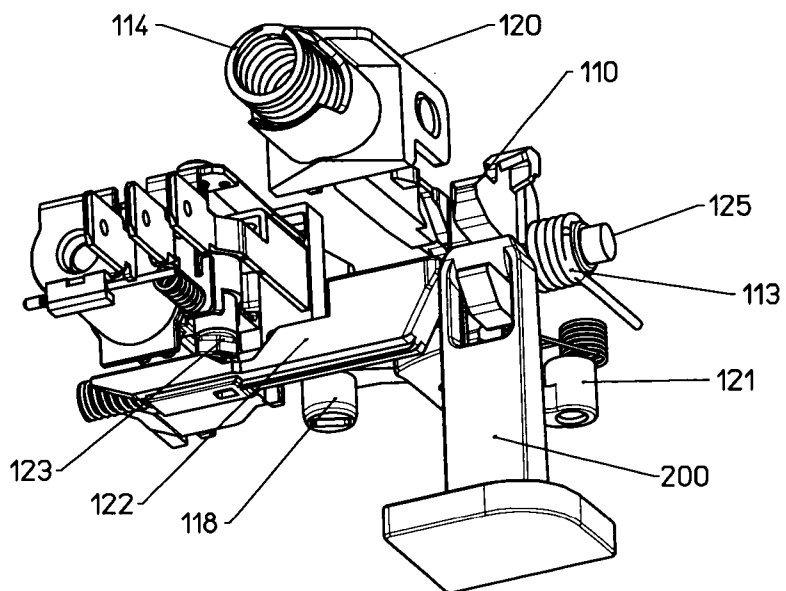
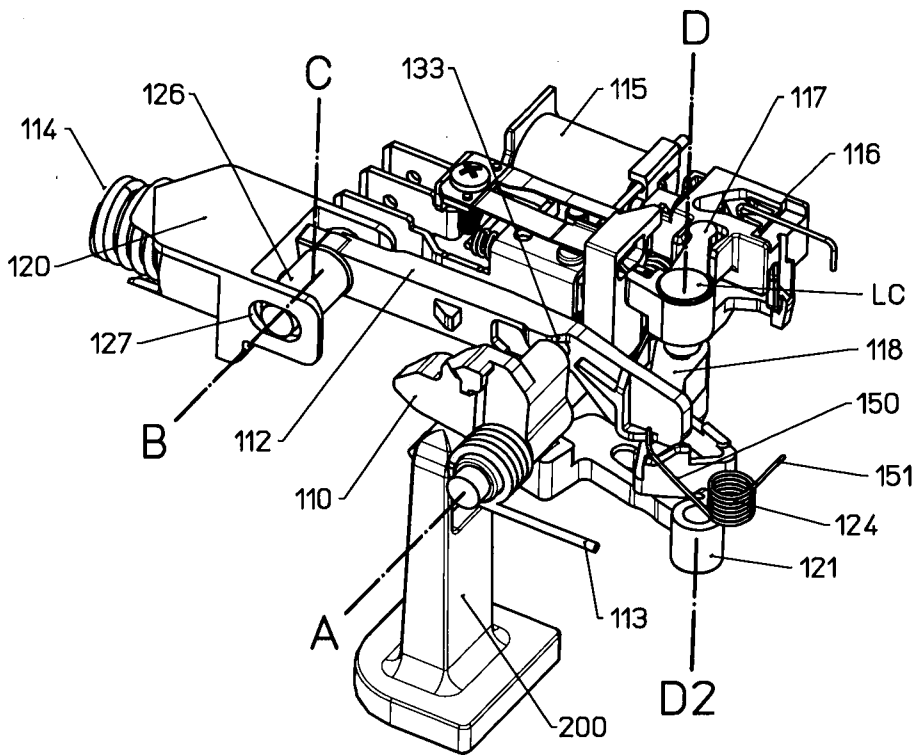


Fig. 3A

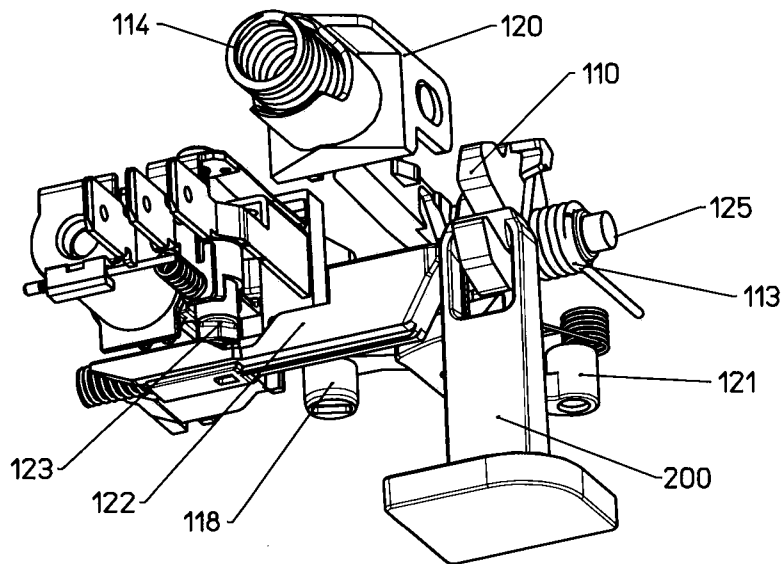
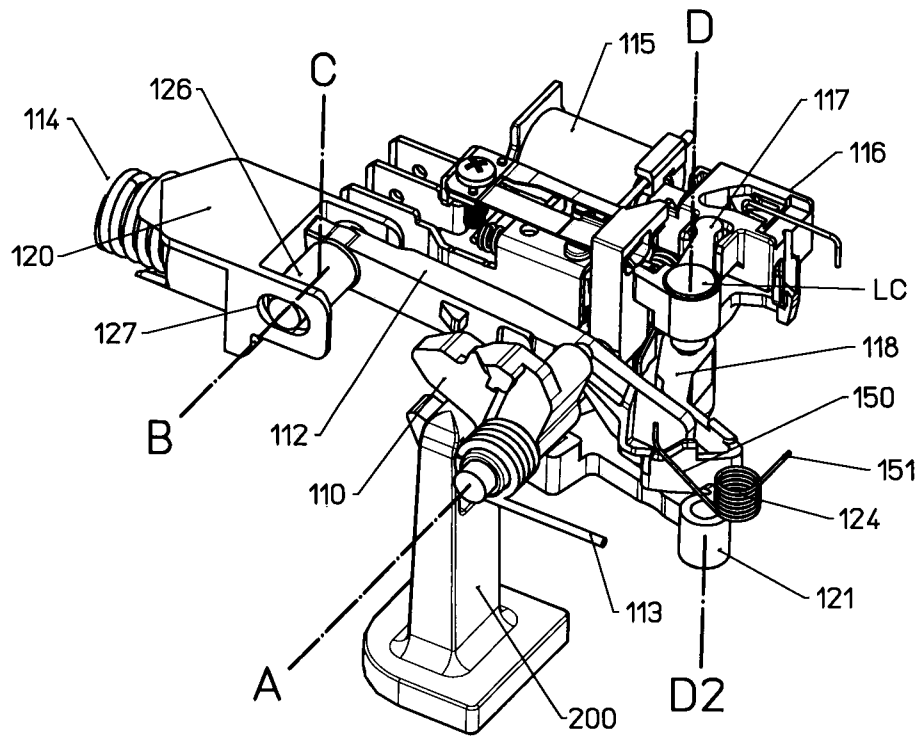


Fig. 3B

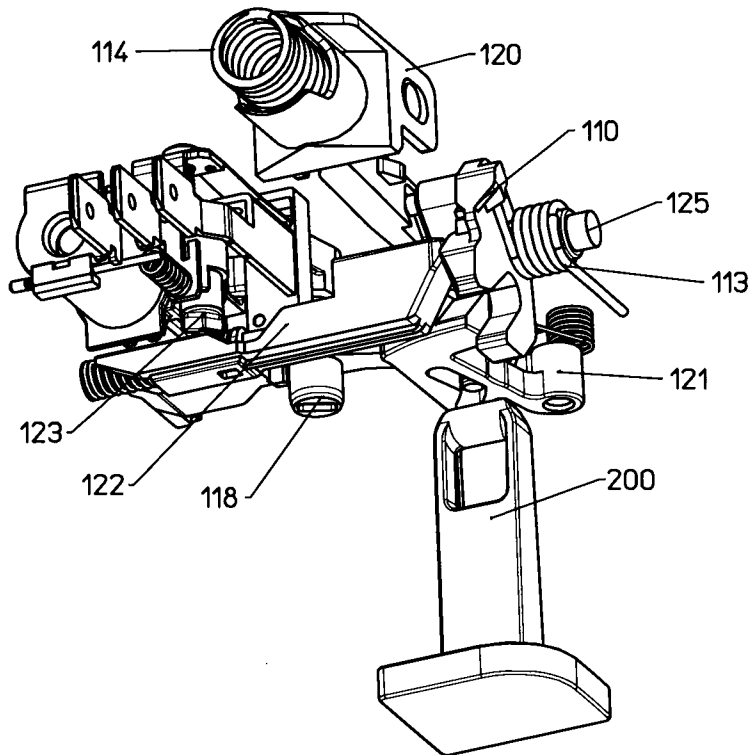
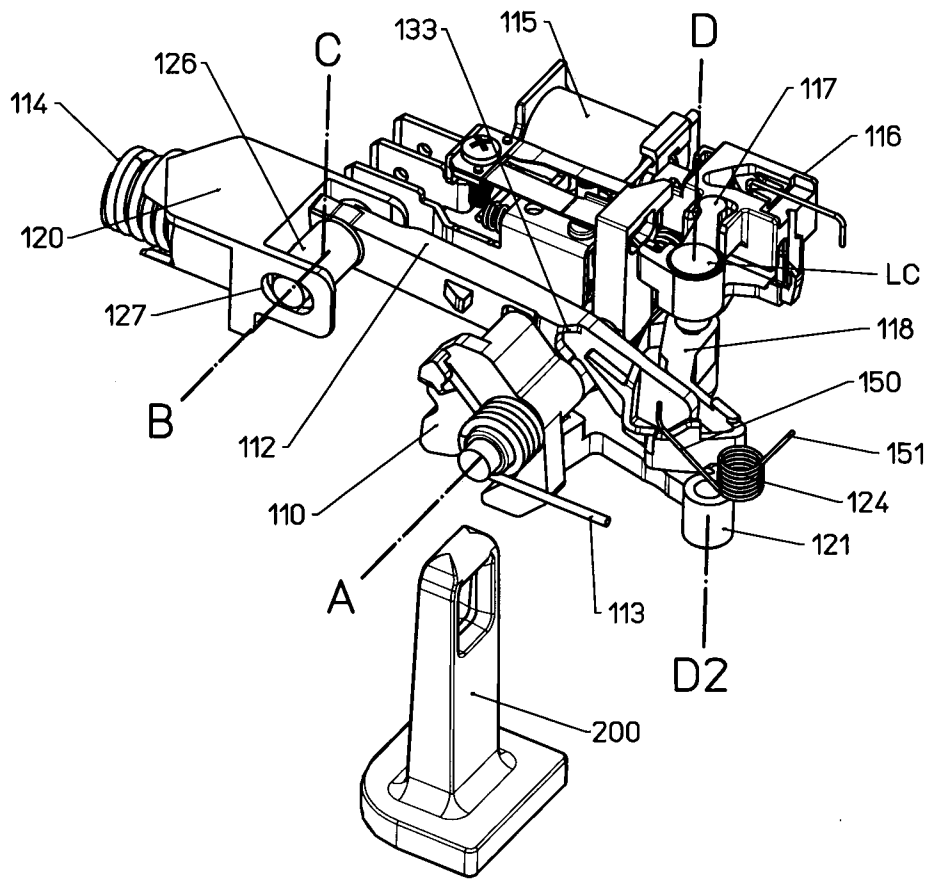


Fig. 3D

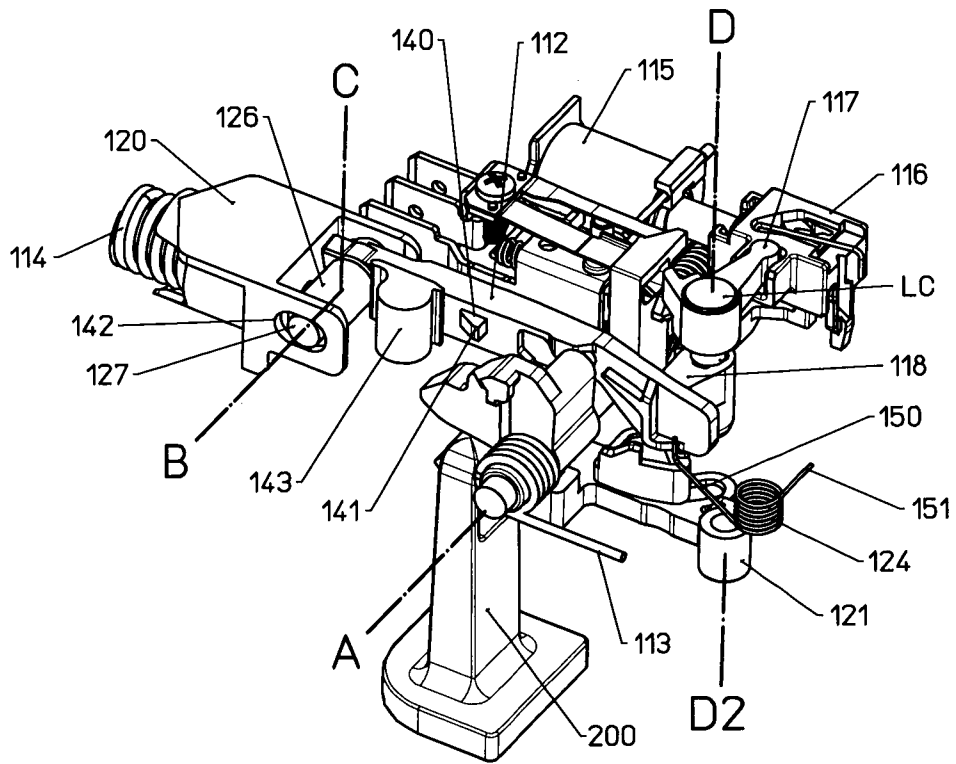


Fig. 4A

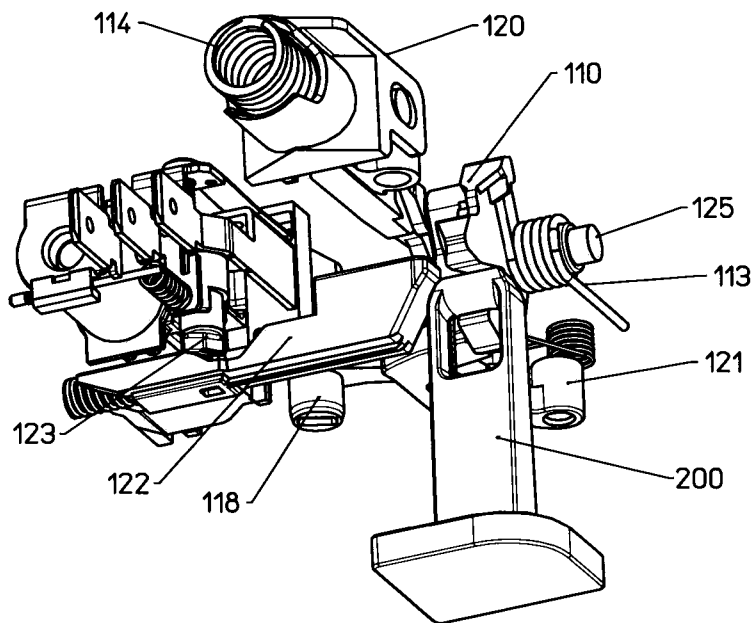
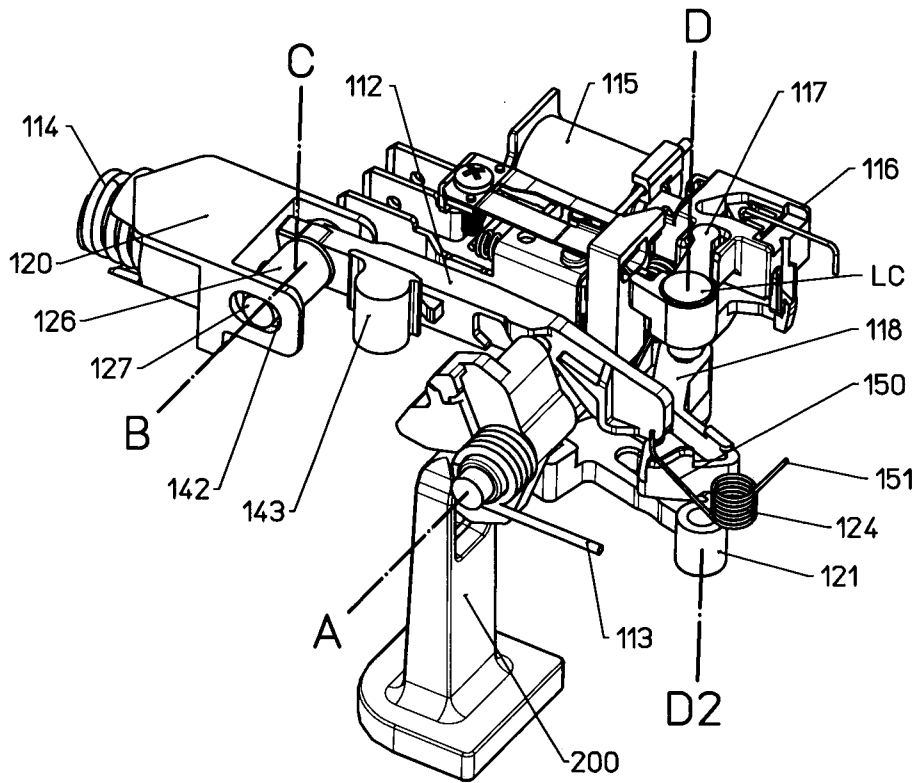


Fig. 4B

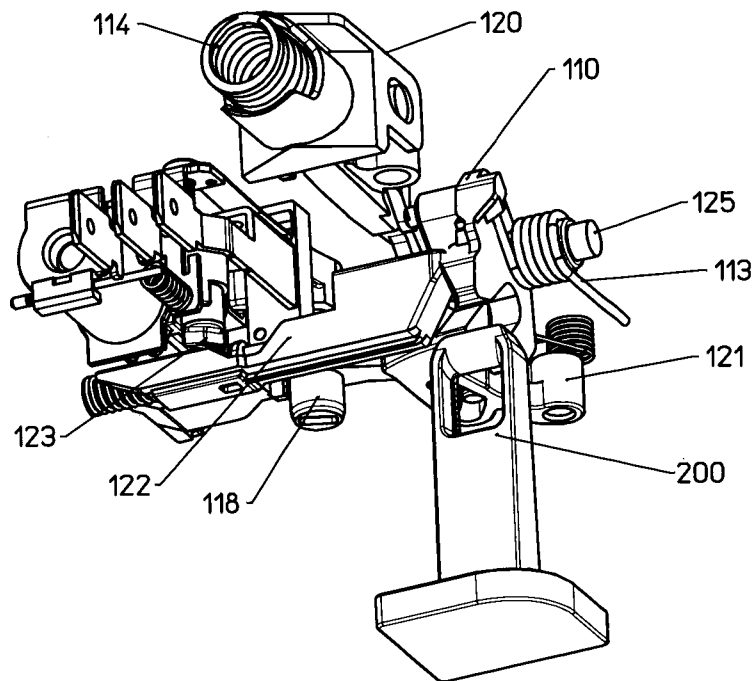
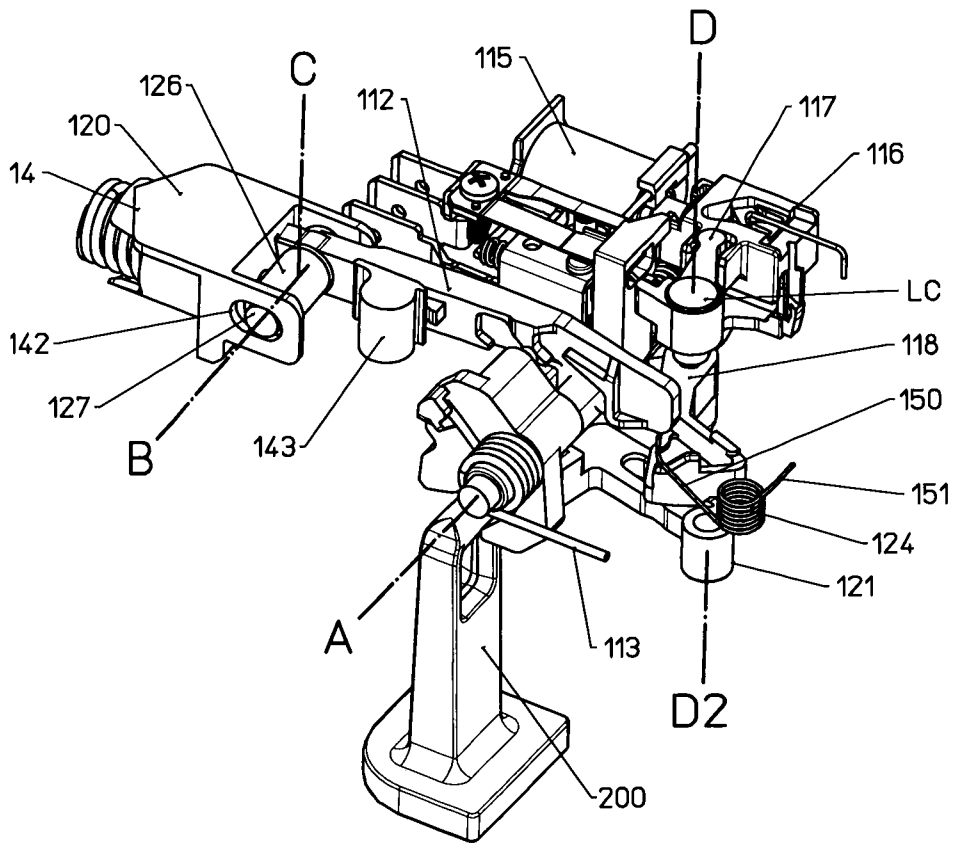


Fig. 4C

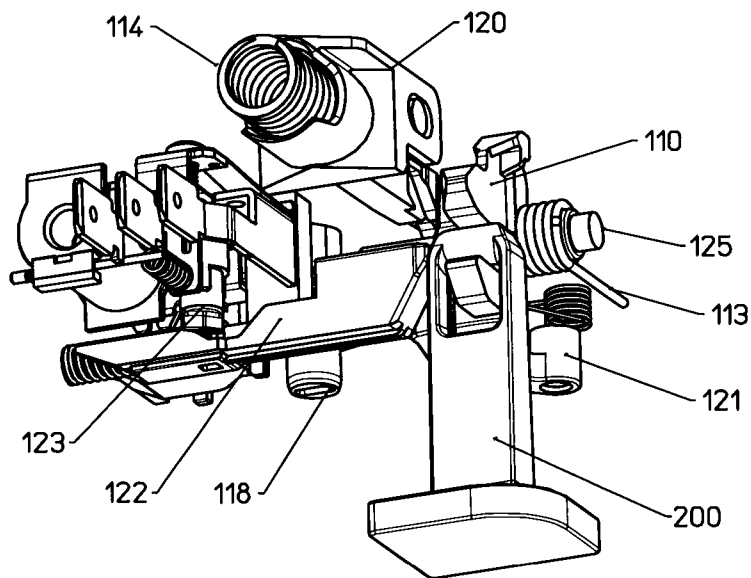
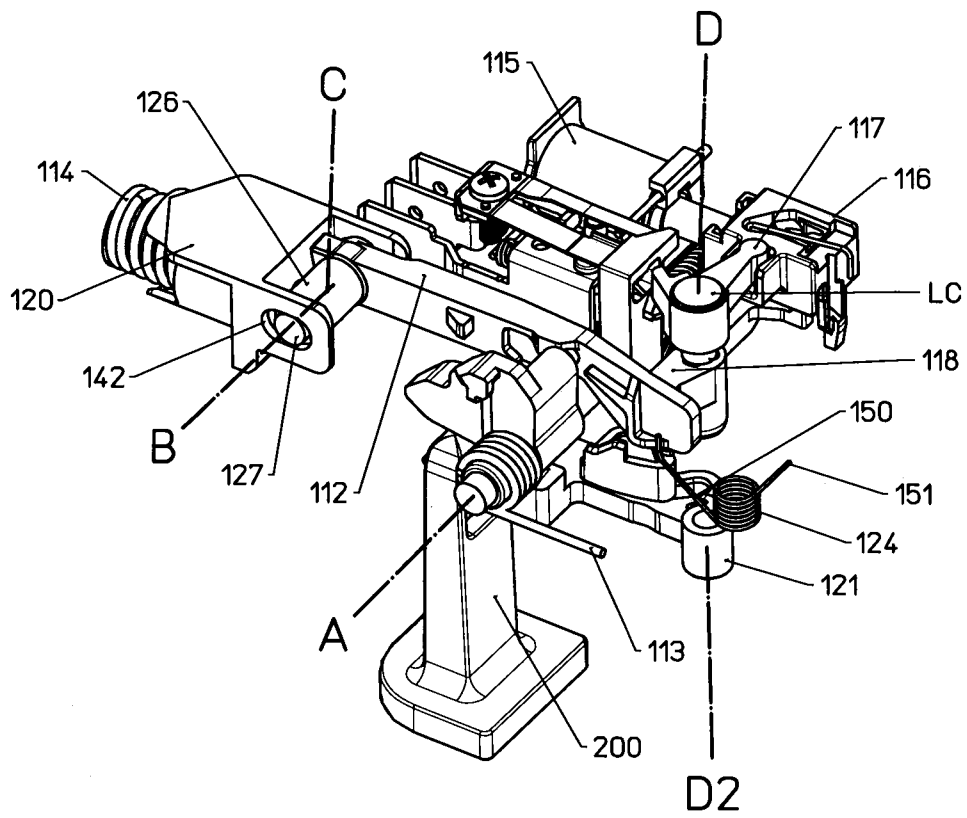


Fig. 5A

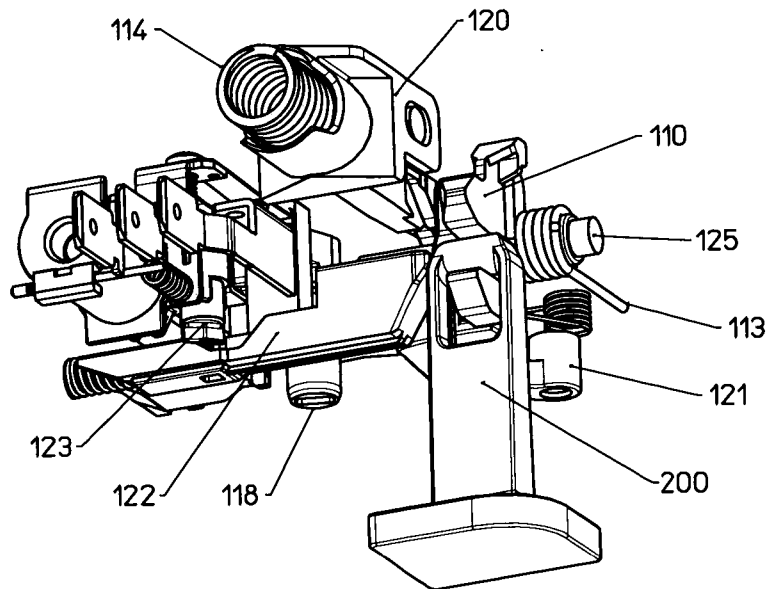
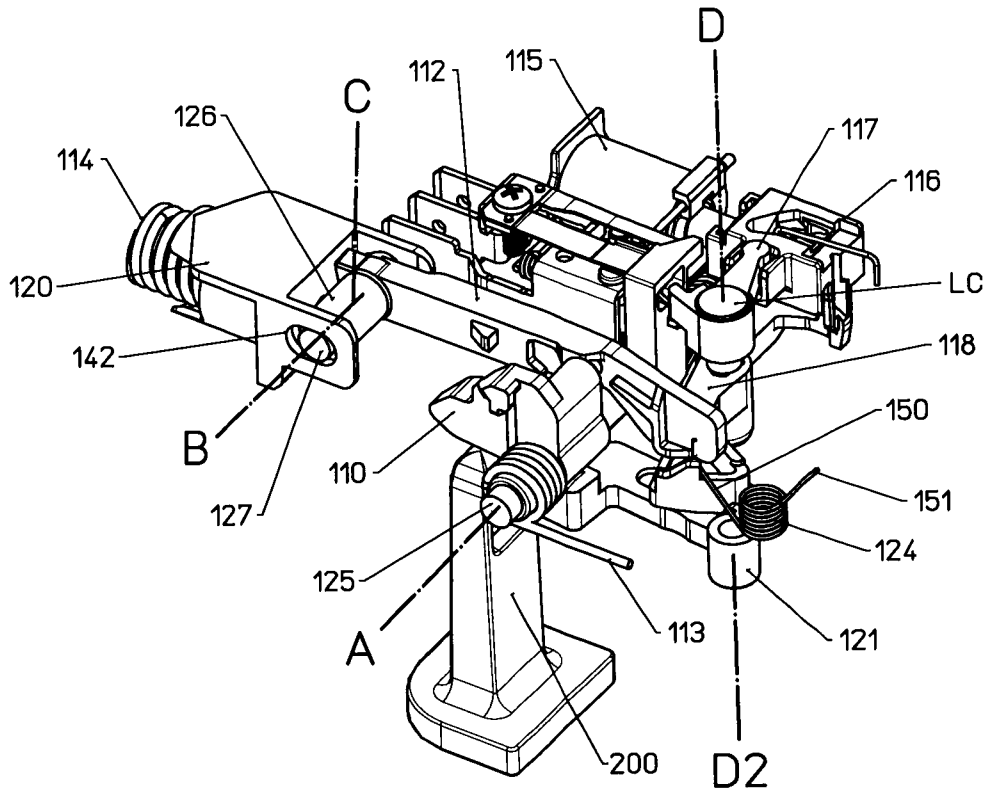


Fig. 5B

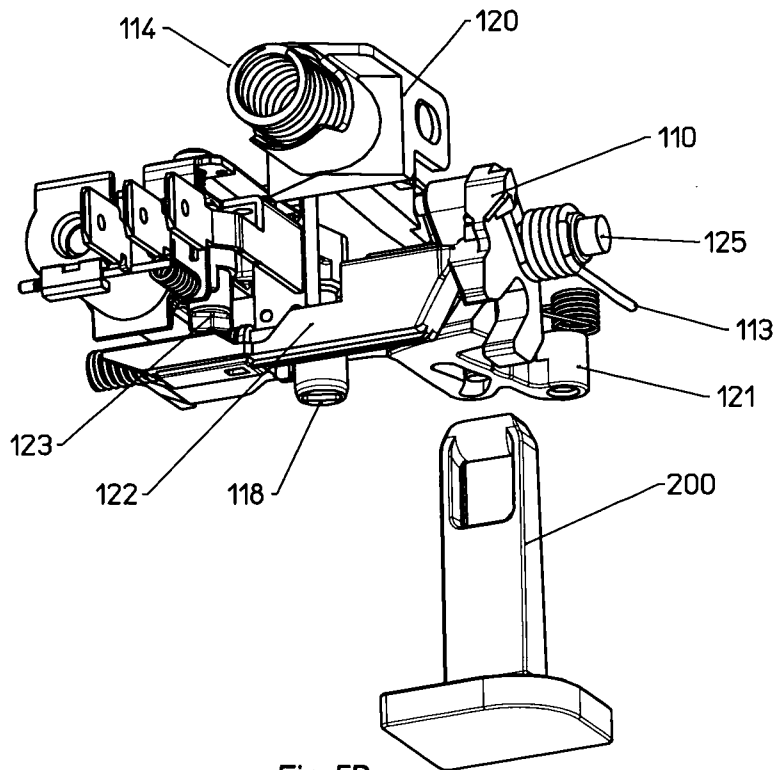
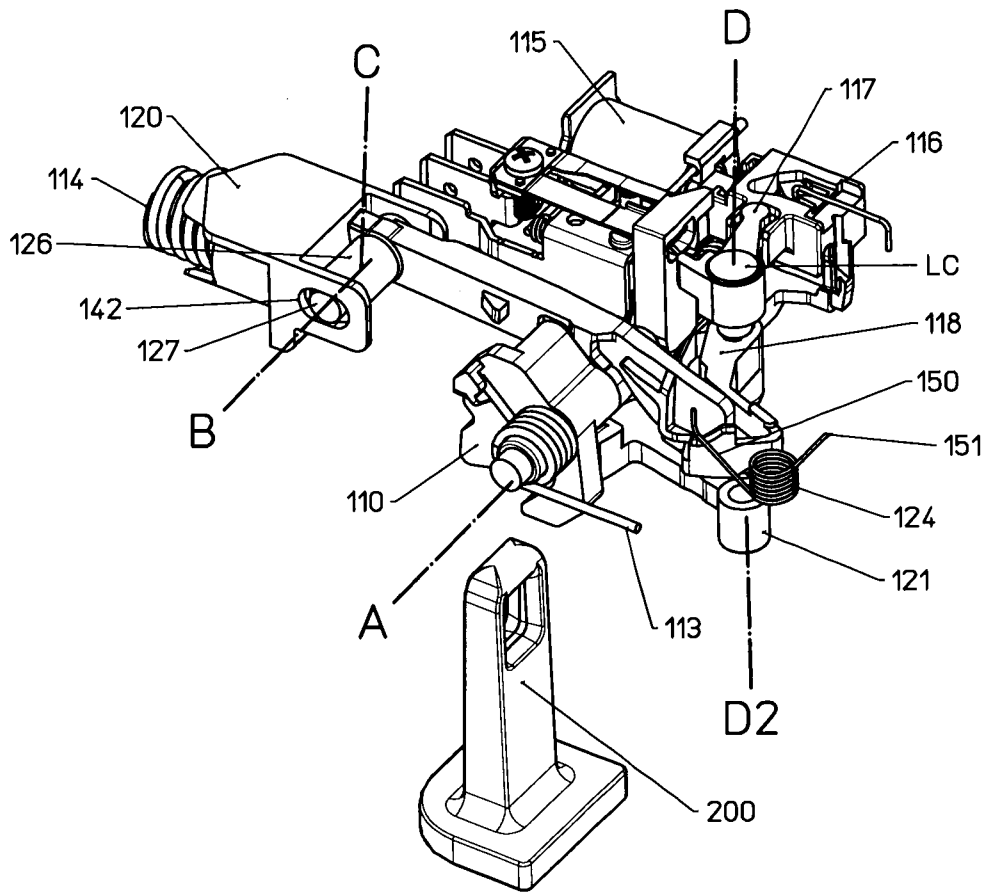


Fig. 5D

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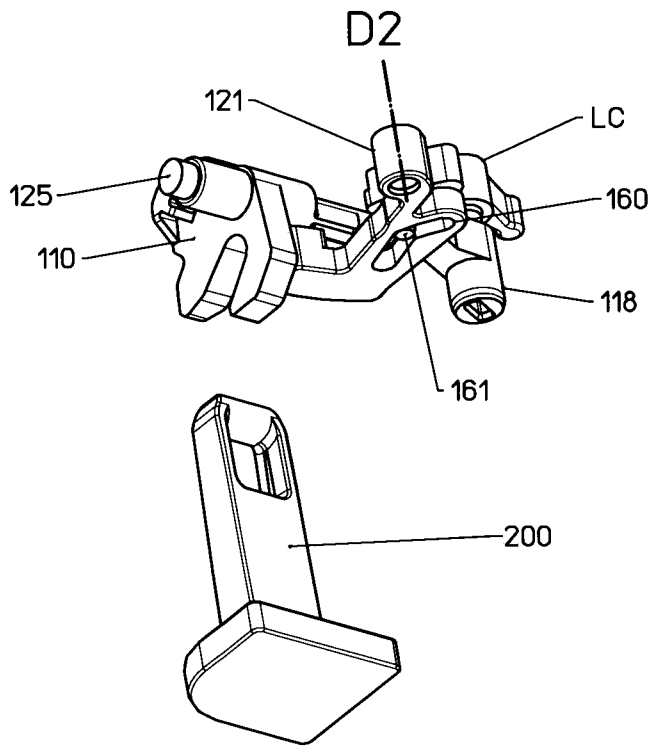


Fig. 5E

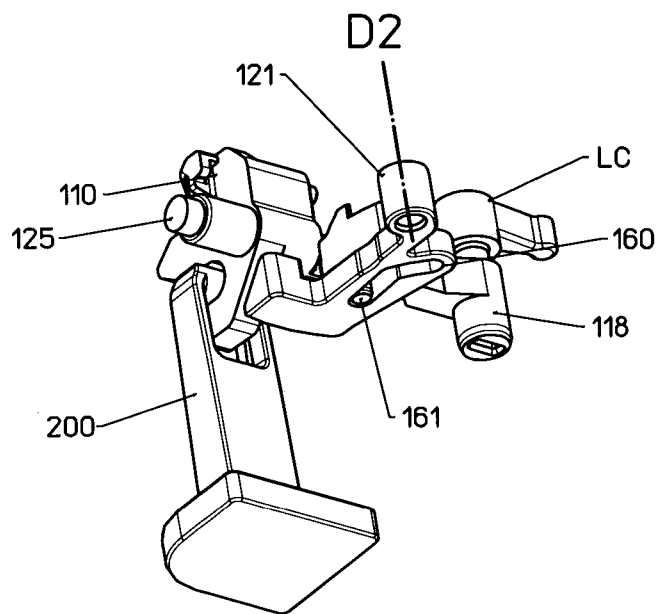


Fig. 5F

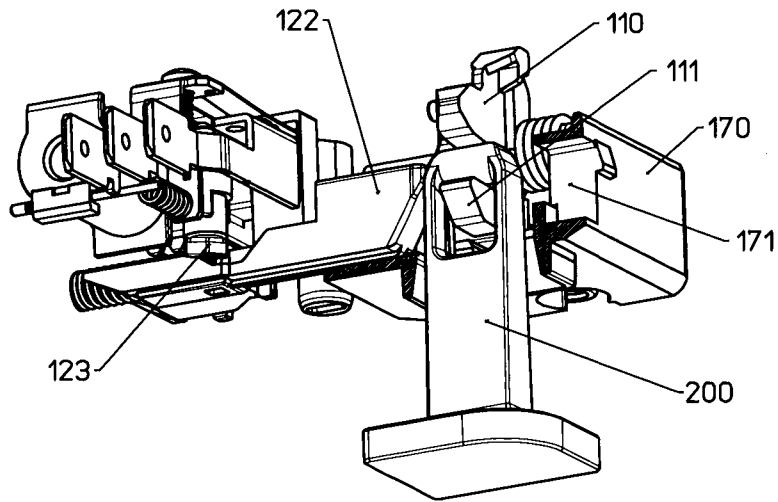


Fig. 6A

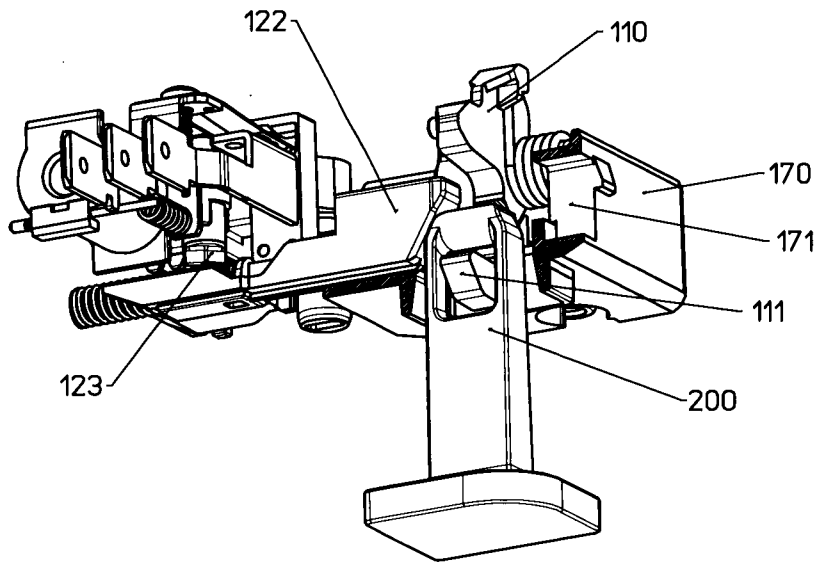


Fig. 6B

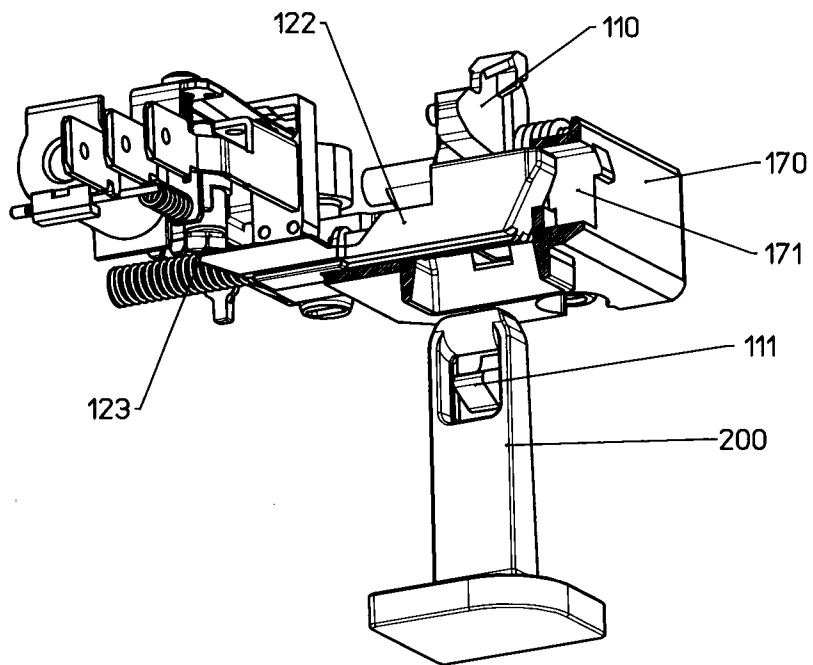


Fig. 6C

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2018/059243

A. CLASSIFICATION OF SUBJECT MATTER
 INV. D06F39/14 A47L15/42 E05B65/10
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
 Minimum documentation searched (classification system followed by classification symbols)
 D06F A47L E05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2017/155627 A1 (ILLINOIS TOOL WORKS [US]) 14 September 2017 (2017-09-14) page 4, line 10 - page 5, line 17 page 7, line 8 - page 9, line 11 figures 1,2 -----	1, 13, 14
X	WO 2015/140306 A1 (ELETTROTECNICA ROLD S R L [IT]) 24 September 2015 (2015-09-24) page 4, line 8 - page 8, line 32; figures 1-9 -----	1, 13, 14
X	EP 2 087 829 A1 (BITRON SPA [IT]) 12 August 2009 (2009-08-12) paragraphs [0018], [0021]; figures 5a,5b,8a,8b,9a-9c -----	1, 13, 14

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 11 January 2019	Date of mailing of the international search report 22/01/2019
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Kising, Axel
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2018/059243

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2017155627 A1	14-09-2017	CN 108699757 A WO 2017155627 A1	23-10-2018 14-09-2017

WO 2015140306 A1	24-09-2015	EP 3119936 A1 PL 3119936 T3 WO 2015140306 A1	25-01-2017 30-11-2018 24-09-2015

EP 2087829 A1	12-08-2009	NONE	
