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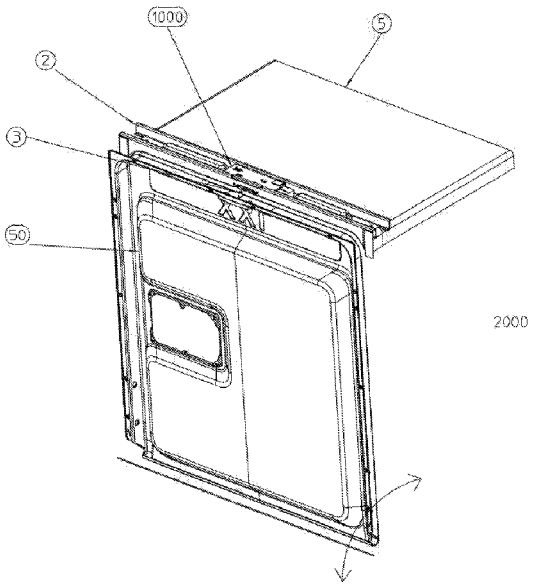

fig. 1

(57) Abstract: A device (1000) for closing and opening doors and/or hatches and/or similar components, in particular of household appliances, such as washing machines, dishwashers, and the like, said device comprising an opening and closing assembly (100) comprising an opening and closing element (8) adapted to be alternately engaged and disengaged by a backing pin (3) adapted to be firmly fixed to said hatch or door, wherein said opening and closing element (8) is switchable by rotation about a first rotation axis (A) in a first rotation direction from a first position to a second position, and in a second rotation direction, opposite to said first rotation direction, from said second position to said first position, wherein the mutual engagement by pushing of said backing pin (3) against said opening and closing element (8) results in a first switching by rotation of said opening and closing element (8) from said first position to said second position in which said backing pin (3) is retained by said opening and closing element (8), wherein said opening and closing assembly (100) comprises a locking lever (9) switchable between a first own position thereof and a second own position thereof, and wherein the switching by rotation of said opening and closing element (8) about said first rotation axis (A) from said first position to said second position results in the switching of said locking lever (9) from said first own position thereof to said second own position thereof in which it engages and locks said opening and closing element (8).

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DEVICE FOR CLOSING AND OPENING HATCHES, IN PARTICULAR OF HOUSEHOLD APPLIANCES, SUCH AS DISHWASHERS OR THE LIKE

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TECHNICAL FIELD OF THE INVENTION

The present invention belongs to the field of household appliances, such as dishwashers, washing machines, cooking ovens, refrigerators, and/or similar household appliances. In particular, the present invention relates to an opening and closing device, in particular for doors, hatches, or the like, e.g., of household appliances of the aforesaid type, but also pieces of furniture, e.g., of modular kitchens with closing doors. In detail, the present invention relates to a device of the aforesaid type adapted to allow the opening of the hatch according to different modes and/or actions by a user but also to inhibit one or more of said opening modes. In even greater detail, the present invention relates to a device of the aforesaid type in which, according to innovative methods, the closing of the hatch results in the generation of an electrical consent signal adapted to allow the starting of the functions of the household appliance (e.g., the washing cycle) while the opening of the hatch results in the inhibition of at least some of the functions of the household appliance, in particular in the impossibility of starting and carrying out the washing cycle (in the case of dishwashers and/or washing machines). The present invention further relates to a closing and opening system comprising a closing and opening device of the aforesaid type and to a household appliance (e.g., a washing machine or similar appliance) equipped with a device and/or system of the aforesaid type.

BACKGROUND ART

The most widespread and commonly used closing and opening devices and/or systems for household appliances, e.g. dishwashers and/or similar household appliances, essentially comprise a closing (and opening) assembly itself, usually applied to the casing of the household appliance, and a backing element (or latch or pin) usually fastened to the hatch of the appliance itself. According to the most common solutions, the closing and opening assembly further comprises a "U"-shaped closing and opening element, commonly named "wheel", switchable by rotation between a first opening position, in which it is positioned and arranged to

receive the backing pin and be engaged and rotated by the backing pin on the hatch, and a second closing position, in which it retains the backing pin, thus guaranteeing the closing of the hatch itself, while on the contrary, the switching of the closing element to the opening position results in the disengagement of the backing pin, and thus the possibility of opening the hatch.

For example, devices and/or systems of the push-to-open type are known, in which the switching of the closing and opening element from the closing position to the opening position, and thus ultimately the opening of the hatch, is achieved by the user pushing the hatch. Furthermore, in the systems of this type, feedback solutions and/or devices are provided for checking whether the hatch is actually closed, as well as locking systems for locking the hatch in the closing position.

Pull-to-open type devices and/or systems are also known, in which the switching of the closing and opening element from the closing position to the opening position, and thus ultimately the opening of the hatch, is achieved by the user pulling the hatch. Also, in the systems of this type, feedback solutions and/or devices can be provided for checking whether the hatch is actually closed, as well as locking systems for locking the hatch in the closing position.

Furthermore, devices and/or systems of the so-called automatic opening type are also known, in which the switching of the closing and opening element from the closing position to the opening position, and thus the opening of the door, takes place automatically by means of electrical means which, once the washing cycle has been completed, electrically activate the closing and opening element causing it to switch from the closing position to the opening position, and thus ultimately causing the opening of the hatch.

Finally, closing and opening devices are known that are capable of providing the appliance with an open door and a closed door electrical signal, and receiving an electrical load from the appliance used to activate the automatic hatch opening function.

The closing devices and/or systems of the type briefly summarized above, event those according to the most recent prior art, although appreciable from many points of view (simplicity of construction and operation, good reliability, overall low

manufacturing and/or installation costs), have some drawbacks which the present invention intends to overcome.

A first drawback of the devices according to the prior art of the push-to-open type relates to the fact that they necessarily involve the use of an actuator, wherein the push-to-open function is available only when the appliance is connected to the power network. On the contrary, it would be desirable for a push-to-open function to be always available to the user regardless of whether the appliance is connected to the power network or not. Furthermore, a device which guarantees the push-to-open function by using only mechanical components would be desirable.

A further drawback or factor of dissatisfaction is related to the fact that the opening of the hatch by pushing according to the methods summarized above necessarily requires the intervention of the user who is still called to push on the hatch itself, where the action of pushing on the hatch may be unwelcome to the user.

Another drawback is related to the fact that in devices of known type the pull-to-open function requires an excessive effort by the user such as to generate in the user an undesirable feeling and in particular the perception of a failure or malfunction.

A further drawback, perhaps more serious than those mentioned above and common to all devices and/or systems according to the prior art, and therefore both to those of the push-to-open type and to those of the pull-to-open type, as well as to those of the automatic opening type, is related to the fact that neither of them combines more than two of the aforesaid push-to-open, pull-to-open or automatic opening functions; indeed, there are no known devices in which it is possible to open the hatch by means of a function chosen from the push-to-open, pull-to-open and automatic opening functions.

Furthermore, the devices of known type do not allow the inhibition or exclusion of one of the opening functions, whereas on the contrary experience has shown that being able to exclude one or more of the opening functions is useful, e.g., to exclude the push-to-open function for safety reasons, in particular to prevent the hatch from being opened by children.

Lastly, devices of the known type capable of supplying the household appliance with an open door and closed door electrical signal and of receiving an electrical load from the household appliance used to activate the automatic hatch opening function always comprise two separate electrical circuits, one of which is dedicated generating the open door or closed door signal and the other for the automatic opening, wherein the presence of two separate electrical circuits complicates the wiring operations, making them expensive, with obvious repercussions both in practical terms as well as on the final cost of the device and the household appliance.

It is thus the main object of the present invention to overcome, or at least minimize, the drawbacks outlined above and found in the closing devices and/or systems according to the prior art.

In particular, it is a first object of the present invention to provide a closing and opening device which allows the hatch to be opened according to each of the three push-to-open, pull-to-open and automatic opening modes, in particular according to at least either of push-to-open or the pull-to-open mode independently of the connection of the device (of the household appliance) with the electrical power network.

It is a further object of the present invention to provide a closing and opening device which allows a user to override or inhibit, with simple and immediate actions, at least one of either the push-to-open or the pull-to-open mode, in particular the push-to-open function.

It is a further object of the present invention to make available a solution which allows the spontaneous and automatic opening of the hatch, e.g. upon the completion of the washing cycle or in any case by means of user-settable programming.

Finally, the closing and opening device and/or system according to the present invention must be characterized by an electrical circuit which is simplified yet adapted to supply the appliance with an open door and a closed door electrical signal, and to receive an electrical load appliance used to activate the automatic hatch opening function.

It is a further object of the present invention to make available a closing and opening device characterized by small size and footprint, simple construction, low production costs and reliability, and applicable to household appliances of known types in a similarly simple manner and at similarly low cost and without requiring substantial modifications of said household appliance.

DESCRIPTION OF THE PRESENT INVENTION

The present invention is based on the general consideration that the predetermined objects set forth above can be achieved, and in particular that functional and reliability requirements can be met, by means of a device comprising a locking lever having the purpose of engaging and locking the closing and opening element or wheel in the closing position, wherein with the closing and opening wheel locked in the closing position by the locking lever, each of the pushing and pulling actions applied by the user on the hatch results in the mutual disengagement of the closing and opening wheel and locking lever.

Based on the considerations described above, as well in consideration of problems and/or drawbacks found in the closing and opening devices and/or systems according to the prior art, according to a first embodiment a device for closing and opening doors and/or hatches and/or similar components, in particular of household appliances, such as washing machines, dishwashers, refrigerators, cooking ovens, and similar household appliances, comprises an opening and closing assembly comprising an opening and closing element adapted to be alternately engaged and disengaged by a backing pin adapted to be firmly fixed to said hatch or door, wherein said opening and closing element is switchable by rotation about a first rotation axis in a first rotation direction from a first position to a second position, and in a second rotation direction, opposite to said first rotation direction, from said second position to said first position, wherein the mutual pushing engagement of said backing pin against said opening and closing element results in a first switching by rotation of said opening and closing element from said first position to said second position in which said backing pin is retained by said opening and closing element, wherein said opening and closing assembly comprises a locking lever switchable between a first own position thereof and a second own position thereof, and wherein the switching by rotation of said opening

and closing element about said first rotation axis from said first position to said second position results in the switching of said locking lever from said first own position thereof to said second own position thereof in which it engages and locks said opening and closing element; wherein said device comprises a selection lever which is adapted to be switched between a first position and a second position, wherein with said selection lever in said second position and with said opening and closing element engaged and locked in said second position by said locking lever, the rotation of said opening and closing element in said first rotation direction beyond said second position results in said opening and closing element and locking lever being mutually engaged, and wherein with said selection lever in said second position and with said opening and closing element engaged and locked in said second position by said locking lever, the rotation of said opening and closing element in said first rotation direction beyond said second position results in said opening and closing element and locking lever being mutually engaged, wherein with said opening and closing element and locking lever mutually disengaged, said opening and closing element is free to be switched to said second position in which it releases said backing pin, and wherein with said opening and closing element and locking lever mutually engaged, said opening and closing element is not free to be switched to said second position in which it releases said backing pin.

According to an embodiment, said selection lever is switchable between said first position and second position by roto-translation.

According to an embodiment, said selection lever comprises a backing member accessible from the outside of said device, wherein said selection lever is switchable between said first position and said second position by manual action on said backing member.

According to an embodiment, said backing member is housed in a seat of said device and positionable in a first position and a second position of said seat corresponding to said first position and second position of said selection lever, respectively.

According to an embodiment, with said selection lever in one of said first position and second position, and with said opening and closing element engaged and

locked in said second position by said locking lever, the rotation of said opening and closing element in said second rotation direction results in the mutual disengagement of said opening and closing element and locking lever, wherein with said opening and closing element and locking lever mutually disengaged, said opening and closing element is free to be switched to said second position in which it releases said backing pin. According to an embodiment, said locking lever is switchable by rotation about a second rotation axis parallel to said first rotation axis, wherein the switching by rotation of said opening and closing element about said first rotation axis from said first position to said second position results in said locking lever being switched by rotation about said second rotation axis from said first own position thereof to said second own position thereof in which it engages and locks said opening and closing element in said second closing position.

According to an embodiment, said locking lever has a first engagement geometry, wherein said closing and opening element has a second engagement geometry, wherein the switching by rotation of said opening and closing element about said first rotation axis from said first position to said second position results in the mutual engagement of said first engagement geometry and second engagement geometry, said locking lever being switched by rotation about said second rotation axis from said first own position thereof to said second own position thereof in which it engages and locks said opening and closing element in said second closing position.

According to an embodiment, said locking lever is also switchable by translation in a plane perpendicular to said first rotation axis and by rotation about a third rotation axis, wherein with said opening and closing element engaged and locked in said second position by said locking lever, the rotation of said opening and closing element in said second rotation direction from said second position to said first position results in the switching of said locking lever both by translation onto said plane and by rotation about said third rotation axis, and in the mutual positioning in a position in which the mutual releasing of the opening and closing element and the backing pin is possible.

According to an embodiment, said device comprises elastic thrust means, wherein the switching by roto-translation of said locking lever from said second position to said first position and to an intermediate position takes place against the elastic resistance of said elastic thrust means, and wherein the switching by roto-translation of said locking lever from said intermediate position to said second position is promoted by the elastic thrust of said elastic thrust means.

According to an embodiment, said elastic thrust means comprise a pushing lever and a spring, wherein said pushing lever is adapted to be switched by rotation about a fourth rotation axis parallel to said first rotation axis, wherein the rotation of said pushing lever in a first rotation direction is contrasted by the elastic resistance of said spring, and wherein the rotation of said pushing lever in a second rotation direction opposite to said first rotation direction is promoted by the elastic thrust of said spring.

According to an embodiment, the device comprises a switching slide translatable between a first own position thereof and a second own position thereof, wherein, with said opening and closing element engaged and locked in said second position by said locking lever, the translation of said switching slide from said first own position thereof to said second own position thereof results in said locking lever being switched by rotation about a fifth rotation axis, and in that the rotation of said locking lever about said fifth rotation axis results in said opening and closing element and locking lever being mutually disengaged.

According to an embodiment, said locking lever has a first backing member, wherein said switching slide has a second backing member, wherein the translation of said switching slide from said first own position thereof to said second own position thereof results in said first backing member and second backing member being mutually engaged, and thus said locking lever being switched by rotation about said fifth rotation axis and said opening and closing element and locking lever being mutually disengaged.

According to an embodiment, said device comprises electric means for causing the translation of said switching slide from said second own position thereof to said first own position thereof.

According to an embodiment, a household appliance, such as a washing machine, a dishwasher, a refrigerator or a cooking oven, or similar household appliance, comprises a main body defining a treatment chamber comprising an access opening and a door or hatch which is adapted to be switched by rotation between a first opening position, in which it allows access to said treatment chamber through said access opening, and a second closing position, in which said access opening is closed by said door or hatch, wherein said household appliance comprises an opening and closing device applied to said main body and a backing pin fixed to said door or hatch, and wherein said opening and closing device is a device according to one of the embodiments above, and wherein the switching by rotation of said door or hatch from said opening position to said closing position results in said opening and closing element being engaged by said backing pin, and thus in said opening and closing element being switched by rotation about said first rotation axis from said first position to said second position in which said backing pin is retained by said opening and closing element.

According to an embodiment, said access opening is delimited by a front crosspiece, wherein said opening and closing device is arranged in a housing or seat obtained in said front crosspiece.

According to an embodiment, a system for opening and closing doors and/or hatches and/or similar components, in particular of household appliances such as washing machines, dishwashers, and similar household appliances comprising a main body defining a treatment chamber comprising an access opening and a door or hatch which is adapted to be switched by rotation between a first opening position, in which it allows access to said treatment chamber through said access opening, and a second closing position, in which said access opening is closed by said door or hatch, it comprises an opening and closing device adapted to be fixed to the main body of one said household appliance and a backing pin adapted to be firmly fixed to a hatch or door of one said household appliance, wherein said device is a device according to one of the embodiments above.

According to an embodiment, a device for closing and opening doors and/or hatches and/or similar components, in particular of household appliances, such as washing machines, dishwashers, refrigerators, cooking ovens, and similar

household appliances, comprises an opening and closing assembly comprising an opening and closing element adapted to be alternately engaged and disengaged by a backing pin adapted to be firmly fixed to said hatch or door, wherein said opening and closing element is switchable by rotation about a first rotation axis in a first rotation direction from a first position to a second position, and in a second rotation direction, opposite to said first rotation direction, from said second position to said first position, wherein the mutual pushing engagement of said backing pin against said opening and closing element results in a first switching by rotation of said opening and closing element from said first position to said second position in which said backing pin is retained by said opening and closing element; wherein said device comprises a consent lever switchable by rotation and adapted to be engaged and disengaged alternately by said backing pin, wherein the mutual engagement by pushing said backing pin against said closing and opening element results in a mutual engagement by pushing also against said consent lever and thus also in the switching by rotation of said consent lever in said first rotation direction; wherein said device comprises an electrical circuit comprising a first terminal, a second terminal, and an electrical contact switchable between a first position, in which the electrical circuit between said first terminal and said second terminal is open, and a second position, in which the electrical circuit between said first terminal and said second terminal is closed by said switchable electrical contact, wherein the switching of said consent lever in said first rotation direction results in the switching of said electrical contact from said first position to said second position and thus in the closing of the electrical circuit between said first terminal and said second terminal, and wherein, with the contact in said second position, the switching of said consent lever by rotation in a second direction rotation opposite to said first rotation direction results in the switching of said contact from said second position to said first position and thus in the opening of the electrical circuit between said first terminal and said second terminal.

According to an embodiment, said electrical contact comprises a fixed portion and an elastic portion and switchable between said first position and said second position, wherein with said consent lever in said first position said elastic portion is subject to elastic deformation, wherein with said consent lever in said second

position said elastic portion is not subject to elastic deformation, wherein the switching of said consent lever in said first rotation direction results in the elastic return of said elastic portion of said electrical contact from said first position to said second position and thus in the closing of the electrical circuit between said first terminal and said second terminal, and wherein, with said elastic portion of said contact in said second position, the switching of said consent lever by rotation in a second direction rotation opposite to said first rotation direction results in the elastic deformation of said elastic portion of said electric contact from said second position to said first position and thus in the opening of the electrical circuit between said first terminal and said second terminal.

According to an embodiment, said electrical circuit comprises a third terminal, wherein said third terminal is placed in permanent electrical contact with said second terminal.

According to an embodiment, said third terminal is placed in permanent electrical contact with said second terminal by means of said fixed portion of said electrical contact.

According to an embodiment, said electric circuit comprises a solenoid, wherein the closing the electric circuit between said first terminal and said second terminal results in the passage of electric current through said solenoid and thus in the electric energizing of said solenoid.

According to a first embodiment, said opening and closing assembly comprises a locking lever switchable between a first own position thereof and a second own position thereof, wherein the switching by rotation of said opening and closing element about said first rotation axis from said first position to said second position results in the switching of said locking lever from said first own position thereof to said second own position thereof in which it engages and locks said opening and closing element.

According to an embodiment, said device comprises a switching slide translatable in a first translation direction and a second translation direction opposite to said first translation direction and connected to said solenoid so that the electrical energizing of said solenoid results in the translation of said slide in said first translation direction, wherein, with said closing and opening element engaged and

locked in said second position by said locking lever, the translation of said switching slide in said first translation direction results in the switching of said locking lever by rotation about a second rotation axis, and in that the rotation of said locking lever about said second rotation axis results in the mutual disengagement of said closing and opening element and locking lever.

According to an embodiment, said locking lever has a first backing member, wherein said switching slide has a second backing member, wherein the translation of said switching slide in said first translation direction results in said first backing member and second backing member being mutually engaged, and wherein said locking lever being switched by rotation about said second rotation axis and in said opening and closing element and locking lever being mutually disengaged.

According to an embodiment, said device is adapted to be connected to both an electric current source and a control unit, wherein the closing of the electric circuit between said first terminal and said second terminal results in the generation of an electric signal which can be processed by said control unit.

According to an embodiment, a system for opening and closing doors and/or hatches and/or similar components, in particular of household appliances such as washing machines, dishwashers and similar household appliances comprising a main body which defines a treatment chamber comprising an access opening and a door or hatch which is adapted to be switched by rotation between a first opening position, in which access to said treatment chamber is allowed through said access opening, and a second closing position, in which said access opening is closed by said door or hatch, comprises an opening and closing device adapted to be fixed to the main body of one said household appliance and a backing pin adapted to be firmly fixed to a hatch or door of one said household appliance, wherein said opening and closing device is an opening and closing device according to one of the embodiments described above.

According to an embodiment, a household appliance, such as a washing machine, a dishwasher, a refrigerator and a cooking oven or similar household appliance, comprises a main body which defines a treatment chamber comprising an access opening and a door or hatch which is adapted to be switched by rotation between

a first opening position, in which it allows access to said treatment chamber through said access opening, and a second closing position, in which said access opening is closed by said door or hatch, wherein said household appliance comprises an opening and closing device applied to said main body and a backing pin fixed to said door or hatch, wherein said opening and closing device is a device according to one or more of the embodiments above, wherein the switching by rotation of said door or hatch from said opening position to said closing position results in said opening and closing element being engaged by said backing pin, and thus in said opening and closing element being switched by rotation about said first rotation axis from said first position to said second position in which said backing pin is retained by said opening and closing element, and wherein the mutual engagement by pushing said backing pin against said closing and opening element results in a mutual engagement by pushing also against said consent lever and thus also in the switching by rotation of said consent lever in said first rotation direction, and thus in the switching of said electric contact from said first position to said second position and finally in the closing of the electric circuit between said first terminal and second terminal.

According to an embodiment, said access opening is delimited by a front crosspiece, and said opening and closing device is arranged in a housing or seat obtained in said front crosspiece.

According to an embodiment, said door or hatch is switchable by rotation about its own substantially horizontal rotation axis, wherein with said door or hatch in said closing position said backing member pin is oriented in a substantially vertical direction.

According to an embodiment, said appliance is a dishwasher, wherein the rotation axis of said door or hatch, with said dishwasher in a working or operating position, is positioned near the floor or ground.

According to an embodiment, said household appliance comprises a control unit and an electrical current source connected both to said electrical circuit of said closing and opening device, wherein closing the electrical circuit between said first terminal and said second terminal results in generating and sending an electrical

signal to said control unit, and in enabling the functions of said household appliance by said control unit.

According to an embodiment, said control unit is adapted to detect the operating state of said household appliance and to control the electrical energizing of said solenoid according to the state of said functions.

Further possible embodiments of the present invention are defined by the claims.

BRIEF DESCRIPTION OF THE FIGURES

In the following, the present invention will be further explained by means of the following detailed description of the possible embodiments thereof as 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 must be noted however that the present invention is not limited to the embodiments described in the following and depicted in the accompanying drawings; on the contrary, all the variants and/or changes to the embodiments described below and depicted in the accompanying drawings which will appear obvious and immediate to a person skilled in the art fall within the scope of the present invention.

The present invention finds particularly advantageous application in household appliances, such as washing machines, dishwashers, cooking ovens, and similar appliances, this being the reason why, hereafter, the present invention will be elucidated with reference to its implementation in a dishwasher. However, it is worth noting that the possible applications of the present invention are not limited to dishwashers, washing machines, ovens, refrigerators, and similar appliances; on the contrary, the present invention is adapted to be implemented in an equally convenient manner in furniture with a hatch, such as, e.g., modular kitchen furniture, and in any case in which access to a space is regulated by opening and closing a door or hatch.

In the drawings:

Figure 1 shows a perspective view of a household appliance equipped with an opening and closing system according to an embodiment;

Figure 1a shows a perspective view of a detail of the household appliance in figure 1;

Figure 2 shows a perspective view of the closing and opening device according to an embodiment;

Figures from 3 to 5 show perspective views of component parts of the device and the system according to an embodiment;

Figures 6 through 8 show plan views of the device and system according to an embodiment during the various steps of the function or push-to-open mode;

Figures 9 to 11 show perspective views and views of component parts of the device according to an embodiment during the steps of the automatic opening function or mode;

Figures from 12 to 14 show plan views of additional component parts of the device according to an embodiment form during the steps of the function or pull-to-open mode;

Figures from 15 to 16 show further peculiarities of the device according to an embodiment;

Figure 17 shows further details of the device according to an embodiment;

Figures 18 and 19 show modes for excluding or inhibiting the push-to-open function in a device according to an embodiment;

Figures 20 and 21 show the electrical circuit and the related diagram of a device according to an embodiment;

Figures 22 and 23 show the electrical circuit and related diagram of a device according to an embodiment.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

In particular, the present invention is applied in the field of dishwashers, this being the reason why the present invention is described hereafter with particular reference to its applications in the field of dishwashers.

However, it is worth specifying that the possible applications of the present invention are not limited to those described hereafter. On the contrary, the present invention is conveniently applied also in the case of household appliances, such as washing machines, dryers, and similar household appliances, as well as in all cases in which it is necessary close and open a hatch to reliably, easily, safely and in different manners (see the preceding description).

In figures 1 and 1a, reference numeral 2000 identifies a dishwasher; as depicted, the dishwasher 2000 comprises a main body 5, which defines a front access opening to a treatment (washing) chamber or tank within the main body 5. The access to the chamber through the front opening is regulated by means of a hatch 50 switchable by rotation (see double arrow) about a horizontal rotation axis (with the dishwasher in a position of use) and positioned at the bottom, i.e. close to the floor or supporting plane of the dishwasher 2000. In particular, the hatch 50 is switchable by rotation between a closed position (shown in figure 1) in which it isolates the washing chamber from the outside, and an open position (not shown), in which it allows access to the washing chamber. The dishwasher 2000 is equipped with a closing and opening system comprising a closing and opening device 1000 housed in a recess formed in an upper crosspiece 2 of the body 5, and a backing member pin or pawl 3 attached to the upper edge (opposite to the rotation axis) of the hatch 50. The switching the hatch 50 from the opening position to the closing position results in the engagement of the device 1000 by the pawl 3, in particular in the locking of the pawl 3 by the device 1000, and thus of the hatch 50 in the closing position (in which the washing program can be started), in the manner described below with reference to figures from 2 to 6.

As depicted, the device 1000 (hereinafter possibly referred to as the lock) comprises a support 6 in which are housed: a metal plate 11 and a slide 16 adapted to provide (see the description below) the closed or open door signal and to open the hatch 50 according to the automatic opening mode, respectively; a U-shaped closing and opening element or wheel 8, a first helical spring 14 the function of which is to push the wheel 8 towards the opening position (see the description below); a solenoid assembly 15 and solenoid slide 16 with relative second spring 150, the function of which is to automatically open the hatch at the end of the washing cycle (see description below); a lock lever 9, a push lever 12, and respective third spring 13, the function of said third spring 13 and push lever 12 being to act in push and rotation on lever 9 (see description below). Finally, references 7, 10, and 17 respectively identify a cover adapted to close the support 6 protecting the components of the lock 1000 from dust and water, a consent lever, and a selection lever.

The closing and opening element 8 (as anticipated, also referred to as closing and opening wheel or cam) is switchable by rotation about a first rotation axis A, defined by a rotation pin on which the spiral portion of the spring 14 is coupled, wherein the locking lever 9 is rotatable about a second rotation axis B parallel to said first rotation axis B, wherein the locking lever 9 is further translatable in a plane perpendicular to said first rotation axis A and said second rotation axis B, as well as switchable by rotation about a third rotation axis C parallel to said axis A and about a further axis lying on a plane parallel to said translation plane.

When the hatch is open, the wheel 8 is positioned in the opening position shown in figure 2 with the U-shaped portion facing outwards; when the hatch is closed, the backing member pin 3 is first approached to wheel 8 until it is housed in the U-shaped portion of wheel 8; continuing the closing until the hatch is positioned in the final closing position, the pin 3 engages the wheel 8 imparting a rotation to it in a first direction around the axis A (counterclockwise relative to figure 2 and against the elastic resistance of the spring 14) until it switches to the final closing position of figure 5, in which it retains the backing member pin 3 and thus keeps the hatch 50 in the closing position.

Furthermore, the switching of the wheel 8 from the opening position (figure 2) into the closing position (figure 5), results in the feeding and in particular in the switching by rotation about the axis B (counterclockwise relative to figure 2 and against the resistance of the lever 12 and the spring 13) of the locking lever 9 from its own first initial position (figure 2) into its own second final position (figure 5). For this purpose, the lever 9 has an engagement geometry 90 which protrudes from the surface of the lever 9 facing towards the wheel 8, wherein the wheel 8 is equipped with an engagement pawl 18 (figure 3) which extends parallel to the rotation axes A and B, and wherein the switching by rotation of the wheel 8 from the opening position into the closing position results in the mutual engagement of the geometries 90 and 18, and thus in the switching by rotation about the axis B of the lever 9 from the initial position to the final position. Furthermore, the geometries 90 and 18 are shaped so as to be mutually engaged also with the lever 9 in the final position of figure 5, in particular to lock the wheel 8 in the closed position preventing its automatic rotation in a second direction of rotation

(counterclockwise relative to the figures) opposite to said first rotation direction, from the closing position into the opening position under the elastic thrust of the spring 14 and thus preventing the spontaneous opening of the hatch. Indeed, the hatch 50 can only be opened by disengaging the locking lever 9 and the wheel 8, and in particular the respective engagement geometries 90 and 18, so that the wheel 8 can switch to the opening position by means of the spring force 14, which frees the pin 3 and thus the door 50.

As anticipated, according to the present invention, the mutual release of the lever 9 and the wheel 8 is possible in several and various manners as described below.

A first mode, named push-to-open, is shown in figures from 6 to 8; as shown in figure 6, in the closed hatch position in which the wheel 8 is locked by the lever 9 in the closing position and the lever 9 is in its own second position, the engagement pawl 18 and the geometry 90 are mutually engaged, and the commutation of the wheel 8 to the opening position is prevented by the contrast between the pawl 18 and the geometry 90 of the lever 9, the latter being maintained in the second (locking) position of figure 6 by the push of the lever 12 generated by the spring 13.

The design of the geometries 90 and 18 is such that, with the wheel 8 locked in the closing position by the lever 9, a further rotation of the wheel 8 in the first rotation direction (clockwise relative to the figures) beyond the closing position, results in the release of the pawl 18 from the geometry 90; in practice, the rotation of the wheel 8 beyond the closing position occurs without further rotation of the lever 9. With the pawl 18 released from the geometry 90, the lever 9, by virtue of the action of the lever 12 generated by the spring 13, immediately switches by rotating (clockwise relative to the figures) from the second locking position to the first position, wherein at the same time the wheel 8, released from the lever 9, switches by rotating (counterclockwise relative to the figures), under the bias of the spring 14, from the second locking position into the first opening position in which it expels the backing pin 3 from the U-shaped portion, thereby opening the hatch 50. Obviously, the rotation of the wheel 8 in the first rotation direction and beyond the second closing position can be obtained by a user by pushing against the closed hatch 50; in this respect, it is worth noting that such a push is possible by

virtue of the clearance afforded by the hatch in the closing position, said clearance being due, for example, to the gasket arranged between the hatch 50 and the main body 5 of the dishwasher, thus wherein the push on the hatch by the user results in advancement of the backing member pin 3 which, in turn, results in the rotation described above of the wheel 8 in the first direction of rotation and beyond the second closing position.

A second mode called "automatic opening" mode is shown in the figures from 9 to 11; as shown in figure 9, the device 1000 comprises a slide 16 adapted to be put into translation by means of a solenoid 15, wherein the translation of the slide 16 in a first translation direction (from the left to the right relative to the figures) is due to the traction action applied by the solenoid 15 and occurs against the elastic bias of the spring 150, while the translation of the slide 16 in a second translation direction opposite to the first (from right to left relative to the figures) is due to the pushing by the spring 150 in the absence of traction by the solenoid 15.

Furthermore, the slide 16 has a backing member 160 on its upper face (facing the locking lever 9), which backing member defines an inclined plane 162; the lever 9, on its face facing the slide 16, also has an end backing member 93 which defines its own inclined plane 94. With the locking lever 9 in the second locking position, the mutual position of the backing members 160 and 93 is as shown in figure 11.

It is thus apparent that with the lever 9 and the slide 16 positioned as in figure 11, the translation of the slide 16 in the first translation direction indicated by the arrow results in the engagement of the backing member 93 by the backing member 160, in particular of the inclined plane 94 by the inclined plane 162; the result is a rotation of the lever 9 (see the arrow in figure 11) about a substantially horizontal rotation axis (and perpendicular to the rotation axes A and B), and thus the release of the engagement geometry 90 of the lever 9 from the pawl 18. At this point, the lever 9, by virtue of the action of the spring 13 and the lever 12 switches by rotating (clockwise relative to figure 5) from the second locking position to the first unlocking position, wherein at the same time the wheel 8, released from the lever 9, switches by rotating (counterclockwise relative to figure 5), under the bias of the spring 14, from the second locking position into the first opening position in which

it expels the backing pin 3 from the U-shaped portion, thereby opening the hatch 50.

Obviously, the traction on the slide 16 by the solenoid 15 occurs by electrically powering the solenoid 15, the electric powering of the solenoid 15 being in particular possible, e.g., by virtue of an end-of-wash signal generated by a dishwasher control unit; in particular, according to the present invention (see the following description), said end-of-wash signal or cycle ultimately results in the electric powering of the solenoid 15. Alternatively, the activation of the solenoid 15 may be achieved by a user pressing a button on a hand control or control panel of the dishwasher.

A third mode, named “pull-to-open”, is shown in figures from 12 to 14.

As shown in figure 12, the lever 12, by virtue of the spring 13, applies a permanent and continuous pushing on the lever 9; with the locking lever 9 in the second locking position, the mutual position of the lever 9 and the lever 12 is as shown in figure 12.

It is thus apparent that with the lever 9 positioned as in figure 12, a rotation of the wheel 8 around the rotation axis A, and thus in the second rotation direction (counterclockwise relative to the figures), from the closing position towards the opening position (e.g. said rotation deriving from a traction applied by a user on the hatch 50 and aimed at opening the door) results in a push by the pawl 18 on the engagement geometry 90 of the lever 9, and thus in a translation of the lever 9 (from right to left relative to the figures, see the arrow in figure 12), as well as in the simultaneous rotation of the lever 9 in a clockwise direction (relative to the figures, see the arrow in figure 12) about a movable rotation axis and parallel to the rotation axes A and B with consequent repositioning of the locking lever 9, wheel 8 and pawl 18, in a position in which it is possible to release the backing member pin 3 and wheel 8. Said roto-translation of lever 9 from the locked position (figure 12), identifiable as the first equilibrium position, takes place against the resistance of lever 12 and spring 13 to the position in figure 13, identifiable as the intermediate position. On the contrary, from the intermediate position of figure 13, the roto-translation of the lever 9 is due to the pushing applied by the lever 12 and by the spring 13, thus wherein the lever 9, under the bias of the spring 13 and the

lever 12, reaches the unlocking position of figure 14, and wherein at the same time the wheel 8 reaches the opening position (figure 14) where the pin 3 is ejected by the wheel 8 with the consequent opening of the hatch 50.

Further peculiarities of the device 1000 according to the present invention are shown in figures from 15 to 19.

According to the embodiment illustrated there, the device 1000 indeed comprises a selection lever 17 switchable between a first position (figure 18) and a second position (figure 17); for this purpose, the support 6 of the device comprises a U-shaped through seat 172, through which a selection pawl 171 extends, said pawl 171 thus being accessible for a user or operator and manually operable. Again, as shown, the repositioning of the pawl 171 at a first end of seat 172 (figure 16a) results in the positioning of the selection lever 17 at said second position (figure 17), while the positioning of the pawl 171 at a second end of seat 172 (figure 16b) results in the positioning of the lever 17 at said first position. It is worth noting that the lever 17 is subjected to the elastic thrust action of a spring 175, wherein the repositioning of the lever 17 in said first position and second position occurs partly against the resistance of the spring 175 and partly with the aid of the pushing of the spring 175.

With the selection lever 17 in the first position of figures 18 and 19, the push-to-open mode or function is inhibited and thus not available. Indeed, if we imagine that the hatch is closed in the manner previously explained starting from the opening position of figure 18a, and thus a clockwise rotation of the wheel 8, with consequent counterclockwise rotation of the lever 9, it can be seen that the lever 9, during its rotation towards its second locking position, encounters the selection lever 17 subjecting it to a translation (from the left to the right relative to the figures) against the elastic bias of the spring 175. When the lever 9 reaches the locking position and the lever 17 is released from the lever 9, the lever 17 can resume the starting position it had in the open hatch situation. In this manner, the lever 17 is positioned on the return path of the lever 9 from the locking position to the unlocking position, inhibiting its switching by rotation from the locking position to the unlocking position. At this point, a pushing action against the hatch 50 still results in the rotation of the wheel 8 beyond the closing position and the release of

the pawl from the engagement geometry 90 of the lever 9. But when the pushing action ceases, since the locking lever cannot switch to the first position due to interference with the lever 17, during the rotation of the wheel 8 towards the opening position, the pawl will again engage the geometry 90 of the lever 9, which will lock the wheel 8 again in the closing position.

With selector lever 17 in the first position (figures 18 and 19), both the pull-to-open function and the automatic opening function remain available.

Indeed, as shown in figure 19, a pull on the hatch, and thus the rotation of the wheel 8 towards the opening position, results in the previously clarified roto-translation of the lever 9, and thus in a release of the lever 9 from the lever 17, wherein the lever 9 will be free to reach the unlocking position and the wheel 8 will thus be free to reach the opening position.

Similarly, the activation of the solenoid 15 and the consequent translation of the slide 16 result, as explained, in a rotation of the lever 9 about a rotation axis perpendicular to the rotation axes A and B, and thus again in the release of the lever 9 from the lever 17, in particular, in the positioning of the lever 9 above the lever 17, wherein the lever 9 and the wheel 8 will be free to reach their respective unlocking and opening positions according to the methods described above.

Further peculiarities of the device 1000 will be clarified below with reference to figures from 19 to 23.

As shown, the device 1000 comprises a consent lever 10 shaped and positioned so that a rotation of the wheel 8 from the first opening position into the second closing position results in a rotation of the lever 10 in the opposite direction from a first position into a second position. The lever 10, in said first position, is positioned below an elastic electric contact keeping it raised; on the contrary, the lever 10, in said second position, is released from the contact 24, where the contact 24 closes in the circuit between the terminals 22 and 19. Therefore, the switching of the wheel 8 from the open position to the closing position, results in the closing of the electrical circuit between the terminals 22 and 19, and in particular in the generation of a signal (closed hatch) receivable by a control unit, wherein said control unit upon receiving said closed hatch signal 50, can enable the functions of the household appliance 2000, e.g., the washing cycle, at least in part.

Furthermore, in the closed hatch situation, and thus with the electrical circuit closed between the terminals 22 and 19, the circulation of electrical current in the circuit, e.g., controlled by the control unit at the end of the washing cycle, results in the activation of the solenoid 15, and thus in the opening of the hatch 50.

According to the embodiment in figures 20 and 21, the electrical circuit comprises a third terminal; in this configuration, the electrical contact comprises a rigid portion by which the terminals 19 and 20 are permanently connected, and an elastic portion adapted to be switched to alternately open and close the electrical circuit between the terminals 22 and 19 in the manner clarified above.

In brief, by means of the electrical configurations shown in figures from 20 to 23, it is possible to generate both a closed hatch signal and an open hatch signal, whereby a dishwasher control unit, based on said signals, respectively enables and inhibits the dishwasher functions.

The control unit can also control (e.g., at the end of the washing cycle, and with a closed hatch signal), the sending of electric current to the solenoid 15 and thus the opening of the hatch 50.

We have thus demonstrated by means of the detailed description of the embodiments of the present invention shown in the drawings given above that the present invention makes it possible to obtain the desired objects and to overcome or at least limit the drawbacks found in the prior art.

In particular, the present invention provides an opening and closing device which:

makes it possible to overcome, or at least minimize, the drawbacks outlined above and found in the closing devices and/or systems of the prior art;

allows the hatch to be opened according to each of the three push-to-open, pull-to-open, and automatic opening modes, in particular according to at least one of the push-to-open and pull-to-open modes independently of the connection of the device (of the household appliance) with the electrical power network;

allows a user to override or inhibit, by simple and immediate means, at least one of either the push-to-open or the pull-to-open mode, in particular the push-to-open mode;

allows the hatch to be opened spontaneously and automatically, e.g., upon completion of the washing cycle or in any case by means of user-settable programming;

is characterized by a simplified electrical circuit yet adapted to both provide the appliance with an open door and a closed door electrical signal, and receive an electrical load appliance used to activate the automatic hatch opening function;

is characterized by small size and footprint, simple construction, low production costs and reliability, and applicable to household appliances of known types in a similarly simple manner and at similarly low cost and without requiring substantial modifications of said household appliance.

Although the present invention is explained above by means of a detailed description of the embodiments thereof shown in the drawings the present invention is obviously not limited to the embodiments described above and shown on the drawings; on the contrary, all the variants and/or changes to the embodiments described and shown on the accompanying drawings are comprised in the object of the present invention and will be apparent and immediate to a person skilled in the art. For example, according to variations in the embodiments, the device according to the present invention may implement only the peculiarities adapted to allow opening by pushing or pulling on the hatch or only those which allow the hatch to open automatically.

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

CLAIMS

1. A device (1000) for opening and closing doors and/or hatches and/or similar components, in particular of household appliances, such as washing machines, dish washers, fridges, cooking ovens and similar household appliances, said device comprising an opening and closing assembly (100) comprising an opening and closing element (8) adapted to be alternately engaged and disengaged by a backing pin (3) adapted to be firmly fixed to one said hatch or door, wherein said opening and closing element (8) is adapted to be switched by rotation about a first rotation axis (A) in a first rotation direction from a first position to a second position, and in a second rotation direction, opposite to said first rotation direction, from said second position to said first position, wherein the mutual thrust engagement of said backing pin (3) against said opening and closing element (8) results in said opening and closing element (8) being switched by rotation from said first position to said second position in which said backing pin (3) is retained by said opening and closing element (8), wherein said opening and closing assembly (100) comprises a locking lever (9) adapted to be switched between a first own position thereof and a second own position thereof, and wherein the rotational switching of said opening and closing element (8) about said first rotation axis (A) from said first position to said second position results in said locking lever (9) being switched from said first own position thereof to said second own position thereof in which it engages and locks said opening and closing element (8); **characterized in that** said device (1000) comprises a selection lever (17) which is adapted to be switched between a first position and a second position, **in that** with said selection lever (17) in said second position and with said opening and closing element (8) engaged and locked in said second position by said locking lever (9), the rotation of said opening and closing element (8) in said first rotation direction beyond said second position results in said opening and closing element (8) and locking lever (9) being mutually engaged, **and in that**, with said selection lever (17) in said first position and with said opening and closing element (8) engaged and locked in said second position by said locking lever (9), the rotation of said opening and closing element (8) in said first rotation

direction beyond said second position does not result in said opening and closing element (8) and locking lever (9) being mutually engaged, **in that** with said opening and closing element (8) and locking lever (9) mutually disengaged, said opening and closing element (8) is free to be switched to said second position in which it releases said backing pin (3), and **in that** with said opening and closing element (8) and locking lever (9) mutually engaged, said opening and closing element (8) is not free to be switched to said second position in which it releases said backing pin (3).

2. A device (1000) according to claim 1, **characterized in that** said selection lever (17) is adapted to be switched between said first position and second position by roto-translation.

3. A device according to one of claims 1 and 2, **characterized in that** said selection lever (17) comprises a backing member (171) which is accessible from the outside of said device (1000), **and in that** said selection lever (17) is adapted to be switched between said first position and second position by manually acting on said backing member (171).

4. A device (1000) according to claim 3, **characterized in that** said backing member (171) is accommodated in a seat (172) of said device (1000) and is adapted to be placed in a first position and a second position inside said seat (172) corresponding to said first position and second position of said selection lever (17), respectively.

5. A device (1000) according to one of claims 1 to 4, **characterized in that** with said selection lever (17) in one of said first position and second position, and with said opening and closing element (8) engaged and locked in said second position by said locking lever (9), the rotation of said opening and closing element (8) in said second rotation direction results in said opening and closing element (8) and locking lever (9) being mutually disengaged, and **in that** with said opening and closing element (8) and locking lever (9) mutually disengaged, said opening and closing element (8) is free to be switched to said second position in which it releases said backing pin (3).

6. A device (1) according to claims 1 to 5, **characterized in that** said locking lever (9) is adapted to be switched by rotation about a second rotation axis (B)

parallel to said first rotation axis (A), and **in that** the switching of said opening and closing element (8) by rotation about said first rotation axis (A) from said first position to said second position results in said locking lever (9) being switched by rotation about said second rotation axis from said first own position thereof to said second own position thereof in which it engages and locks said opening and closing element (8) in said second closing position.

7. A device (1000) according to claim 6, **characterized in that** said locking lever (9) has a first engagement geometry (90), **in that** said opening and closing element (8) has a second engagement geometry (18), and **in that** the switching of said opening and closing element (8) by rotation about said first rotation axis (A) from said first position to said second position results in said first engagement geometry and second engagement geometry (18) being mutually engaged and in said locking lever (9) being switched by rotation about said second rotation axis (B) from said first own position thereof to said second own position thereof in which it engages and locks said opening and closing element (8) in said second closing position.

8. A device (1000) according to one of claims 1 to 7, **characterized in that** said locking lever (9) is also adapted to be switched by translation onto a plane perpendicular to said first rotation axis (A) and by rotation about a third rotation axis (C), **in that** with said opening and closing element (8) engaged and locked in said second position by said locking lever (9), the rotation of said opening and closing element (8) in said second rotation direction from said second position to said first position results in said locking lever (9) being switched both by translation onto said plane and by rotation about said third rotation axis (C), **and in that** said opening and closing element (8) is free to be switched to said second position in which it releases said backing pin (3).

9. A device (1000) according to claim 8, **characterized in that** said device comprises elastic thrust means (12), **in that** the switching by roto-translation of said locking lever (9) from said second position to said first position and up to an intermediate position takes place against the elastic resistance of said elastic thrust means, **and in that** the switching by roto-translation of said

locking lever (9) from said intermediate position to said second position is promoted by the elastic thrust of said elastic thrust means.

10. A device (1000) according to claim 9, **characterized in that** said elastic thrust means comprise a thrust lever (12) and a spring (13), **in that** said thrust lever is adapted to be switched by rotation about a fourth rotation axis (D) parallel to said first rotation axis (A), **in that** the rotation of said thrust lever (12) in a first rotation direction is contrasted by the elastic resistance of said spring (13), **and in that** the rotation of said thrust lever (12) in a second rotation direction opposite to said first rotation direction is promoted by the elastic thrust of said spring (13).

11. A device (1000) according to one of claims 1 to 10, **characterized in that** it comprises a switching slide (16) which is adapted to be translated between a first own position thereof and a second own position thereof, **in that**, with said opening and closing element (8) engaged and locked in said second position by said locking lever (9), the translation of said switching slide (16) from said first own position thereof to said second own position thereof results in said locking lever (9) being switched by rotation about a fifth rotation axis (E), **and in that** the rotation of said locking lever (9) about said fifth rotation axis (E) results in said opening and closing element (8) and locking lever (9) being mutually disengaged.

12. A device (1000) according to claim 11, **characterized in that** said locking lever (9) has a first backing member (93), **in that** said switching slide (16) has a second backing member (160), and **in that** the translation of said switching slide (16) from said first own position thereof to said second own position thereof results in said first backing member (93) and second backing member (160) being mutually engaged, and thus in said locking lever (9) being switched by rotation about said fifth rotation axis (E) and in said opening and closing element (8) and locking lever (9) being mutually disengaged.

13. A device (1000) according to claim 11 or 12, **characterized in that** said device (1000) comprises electric means for causing said switching slide (16) to translate from said second own position thereof to said first own position thereof.

14. A household appliance (2000) such as a washing machine, a dishwasher, a fridge and a cooking oven or similar household appliance, said household appliance comprising a main body defining a treatment chamber comprising an access opening and a door or hatch which is adapted to be switched by rotation between a first opening position, in which it allows accessing said treatment chamber through said access opening, and a second closing position, in which said access opening is closed by said door or hatch, wherein said household appliance (1000) comprises an opening and closing device applied to said main body and a backing pin (3) fixed to said door or hatch, **characterized in that** said opening and closing device (1000) is a device (1000) according to one of claims 1 to 13, **and in that** the switching by rotation of said door or hatch from said opening position to said closing position results in said opening and closing element (8) being engaged by said backing pin (3), and thus in said opening and closing element (8) being switched by rotation about said first rotation axis (A) from said first position to said second position in which said backing pin (3) is retained by said opening and closing element (8).

15. A household appliance (2000) according to claim 14, **characterized in that** said access opening is delimited by a front crosspiece, **and in that** said opening and closing device (1000) is arranged in a housing or seat obtained in said front crosspiece.

16. A system for opening and closing doors and/or hatches and/or similar components, in particular of household appliances such as washing machines, dishwashers and similar household appliances comprising a main body defining a treatment chamber comprising an access opening and a door or hatch which is adapted to be switched by rotation between a first opening position, in which it allows accessing said treatment chamber through said access opening, and a second closing position, in which said access opening is closed by said door or hatch, said system comprising an opening and closing device adapted to be fixed to the main body of one said household appliance and a backing pin (3) adapted to be firmly fixed to a hatch or door of one said

household appliance, **characterized in that** said device is a device according to one of claims 1 to 13.

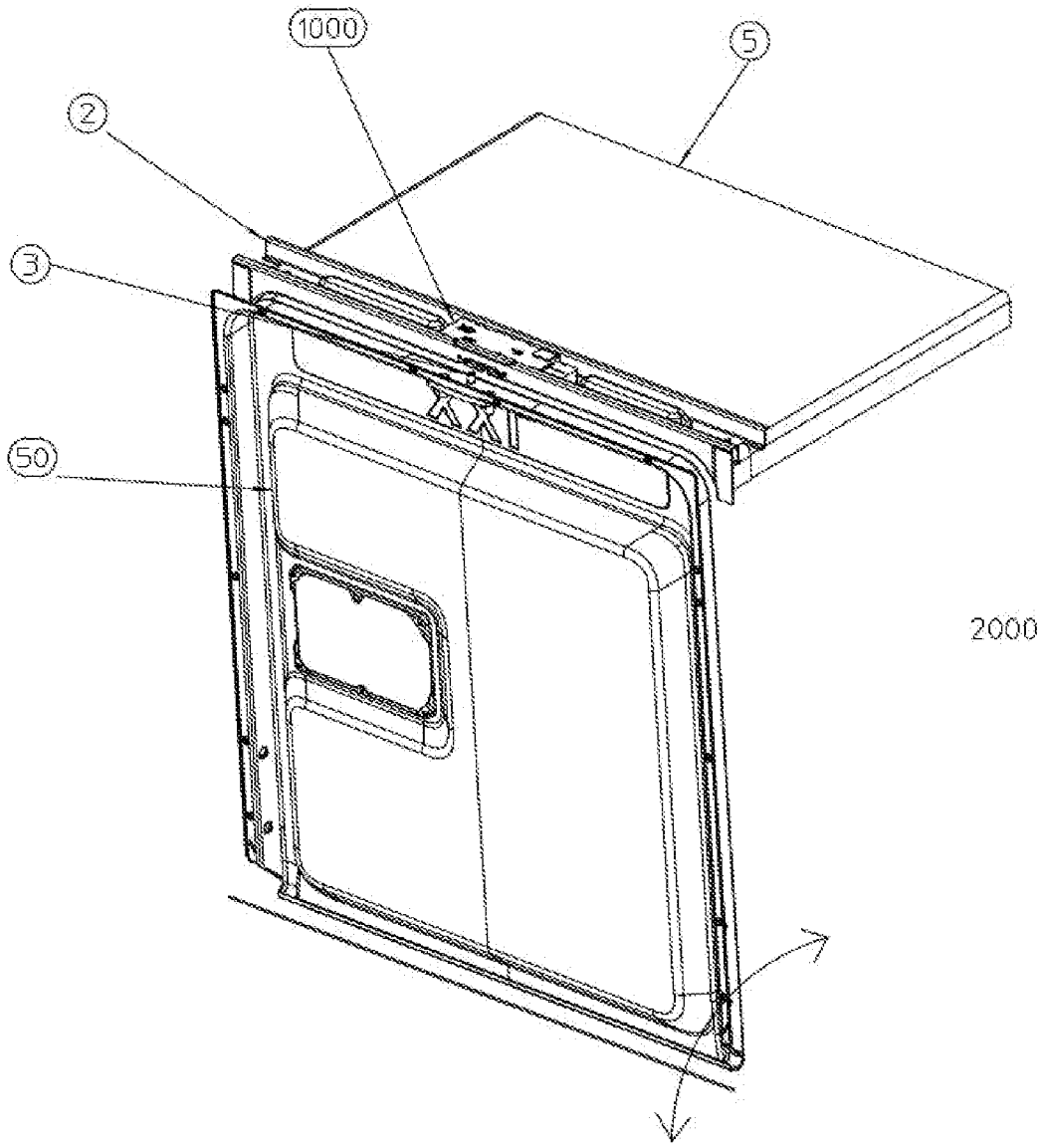


fig. 1

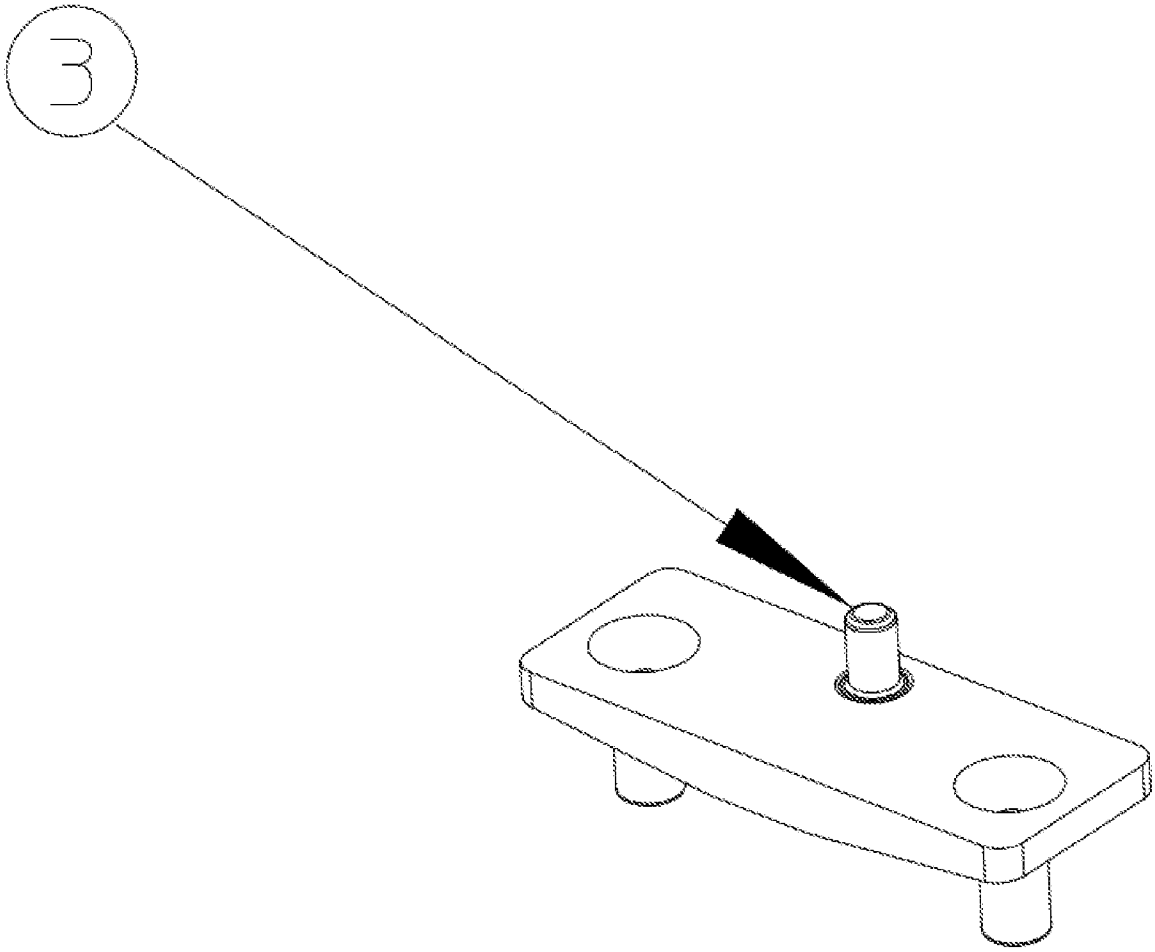


fig. 1a

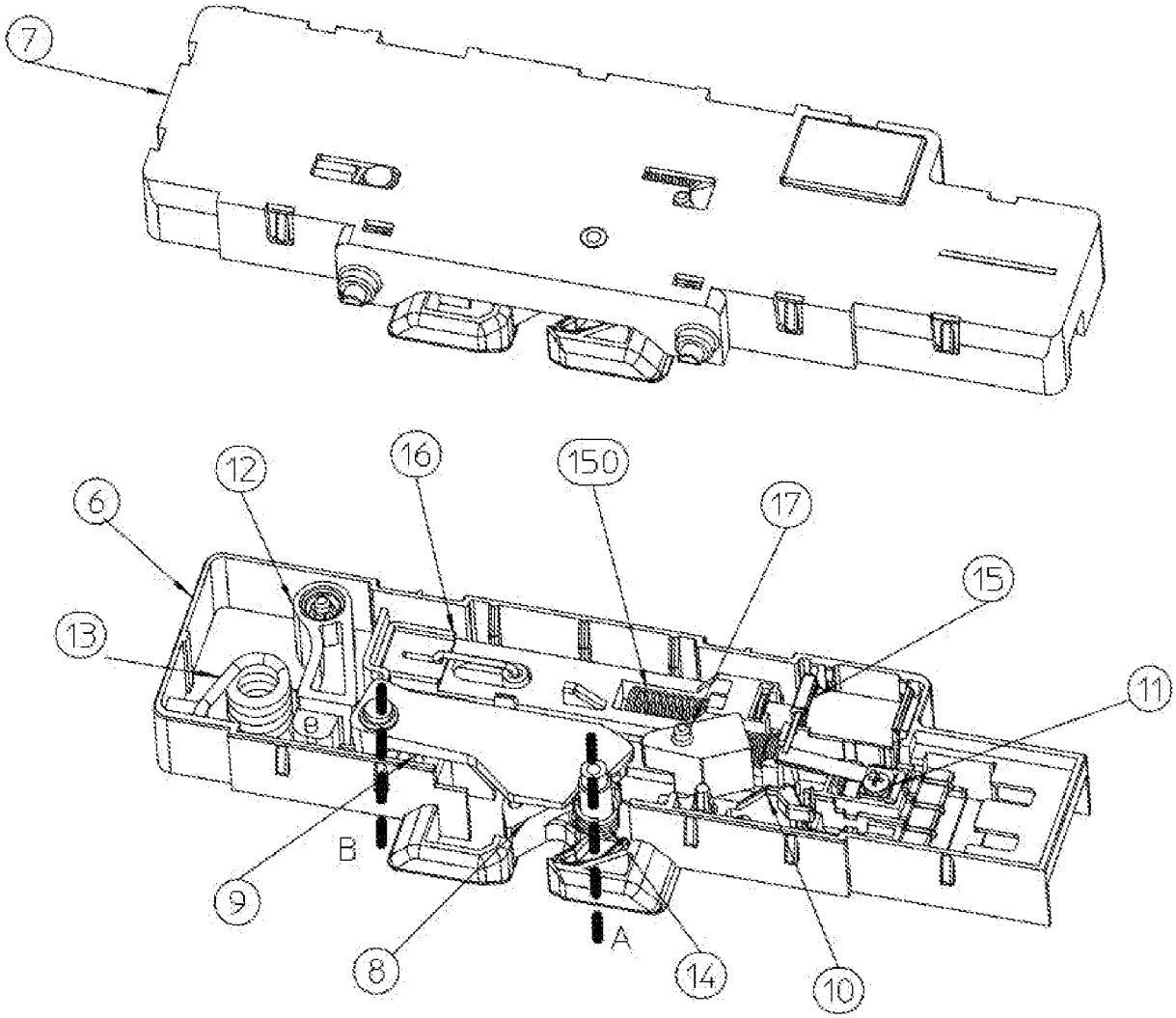


fig. 2

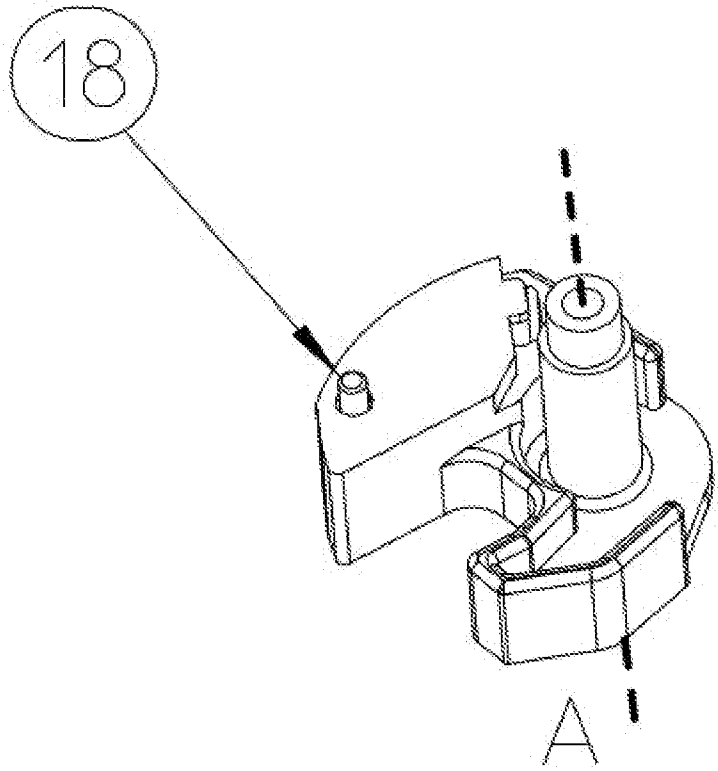


fig. 3

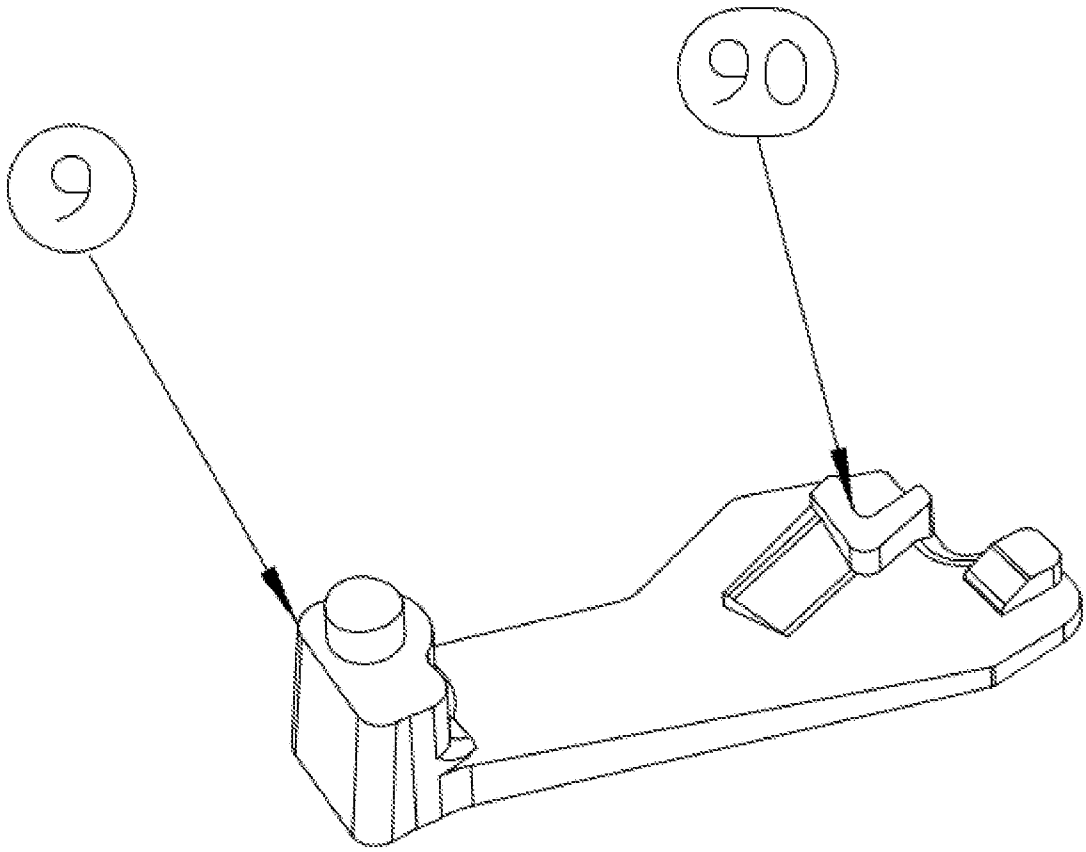


fig. 4

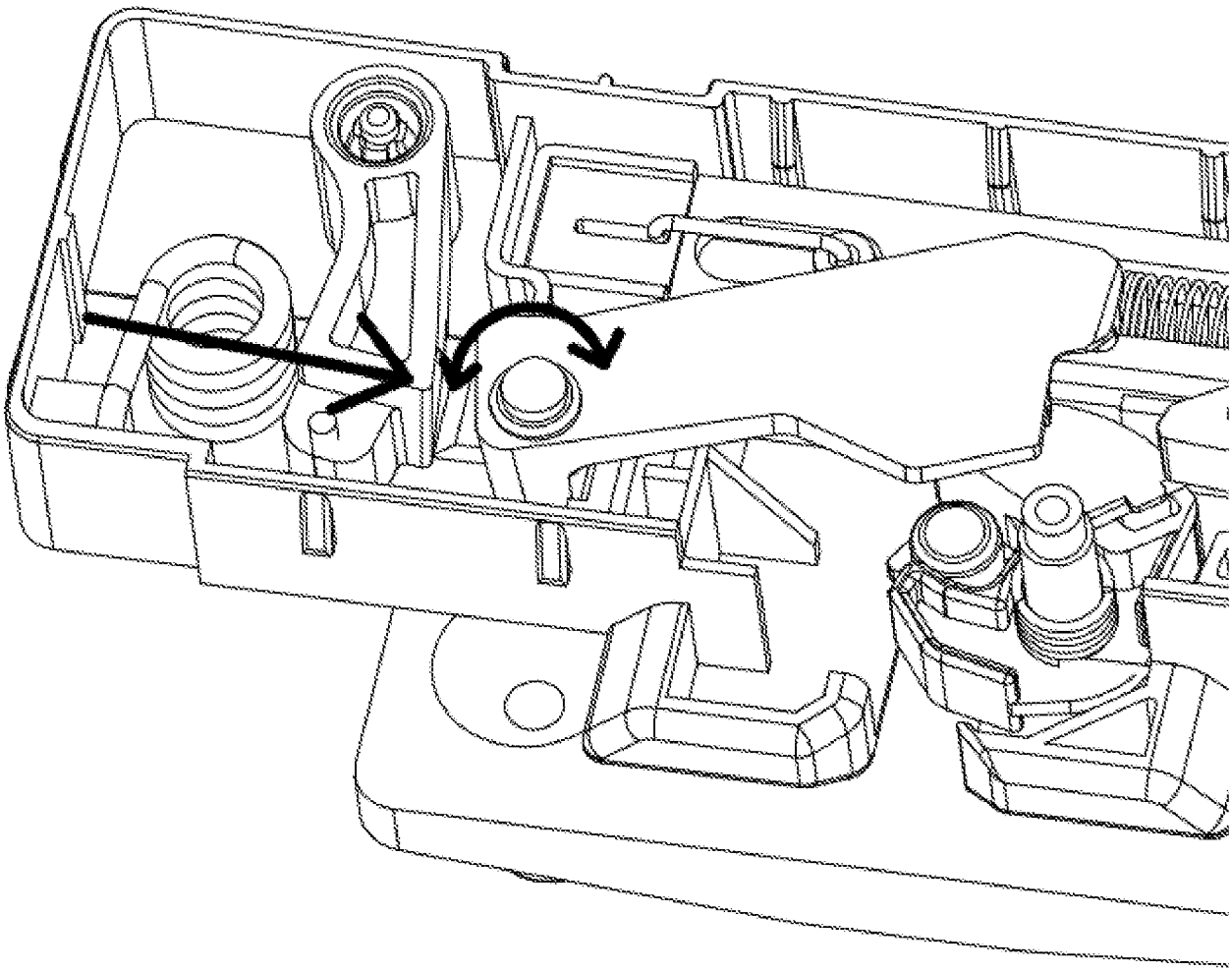


fig 5

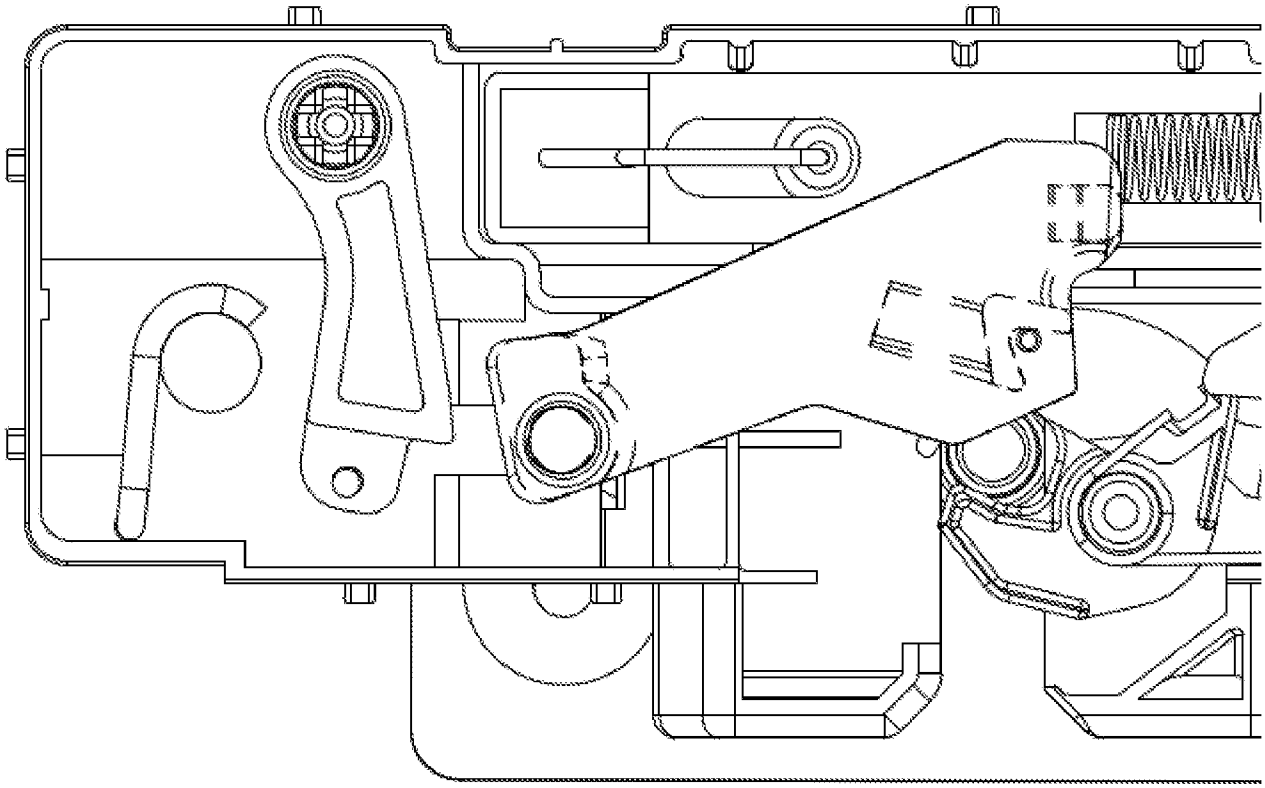


fig 6

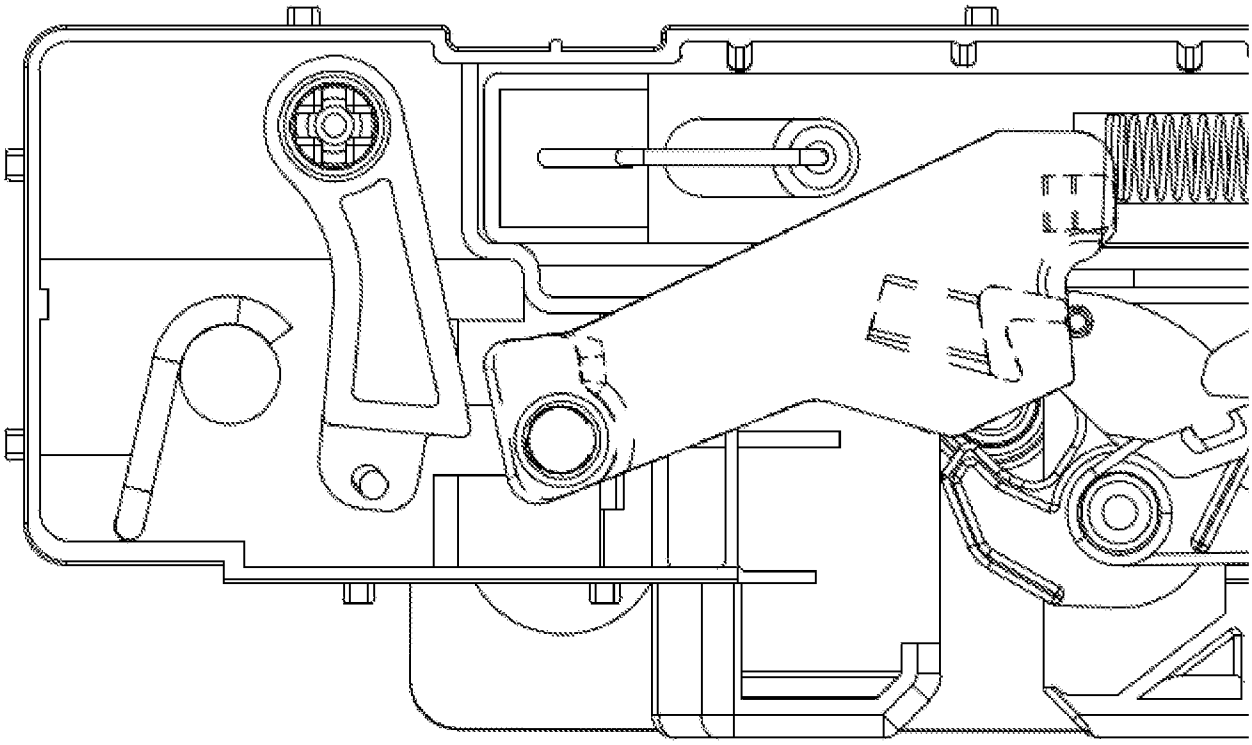


fig 7

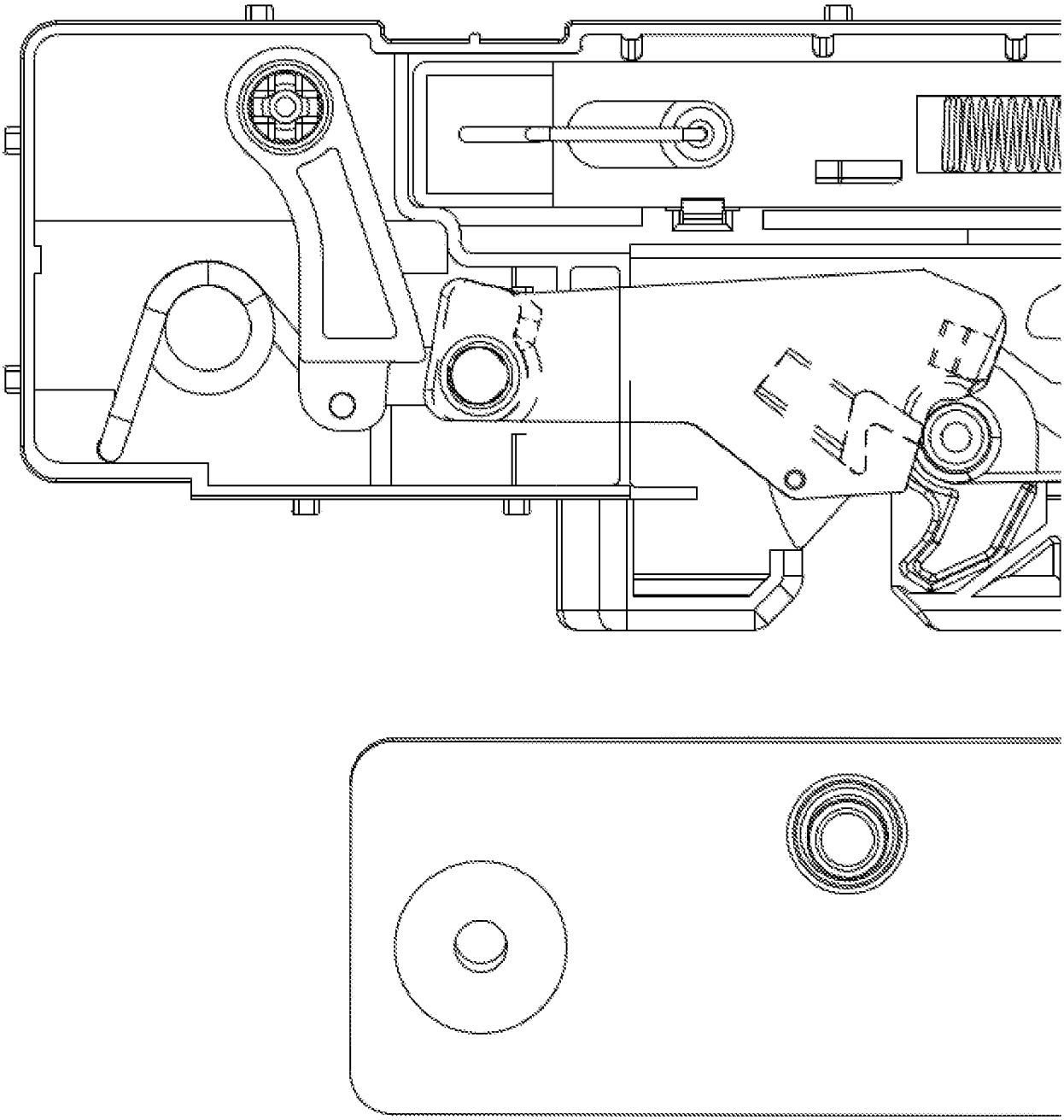


fig 8

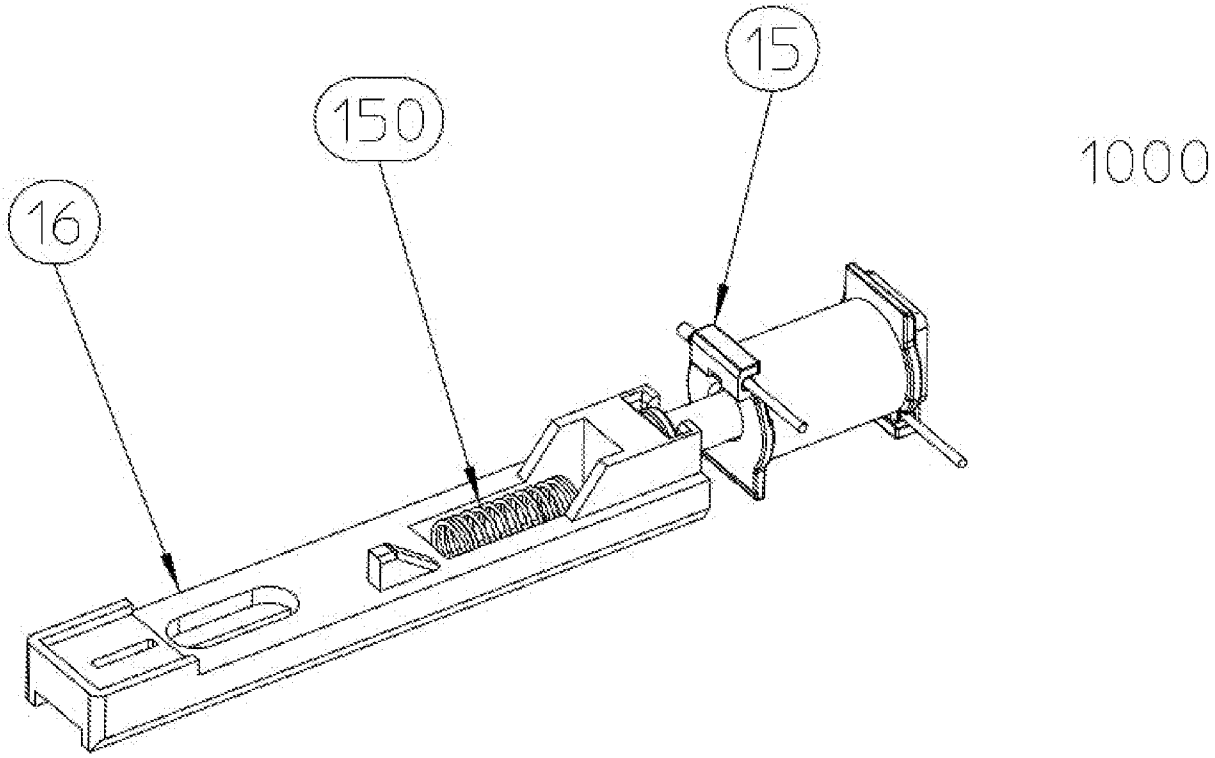


fig 9

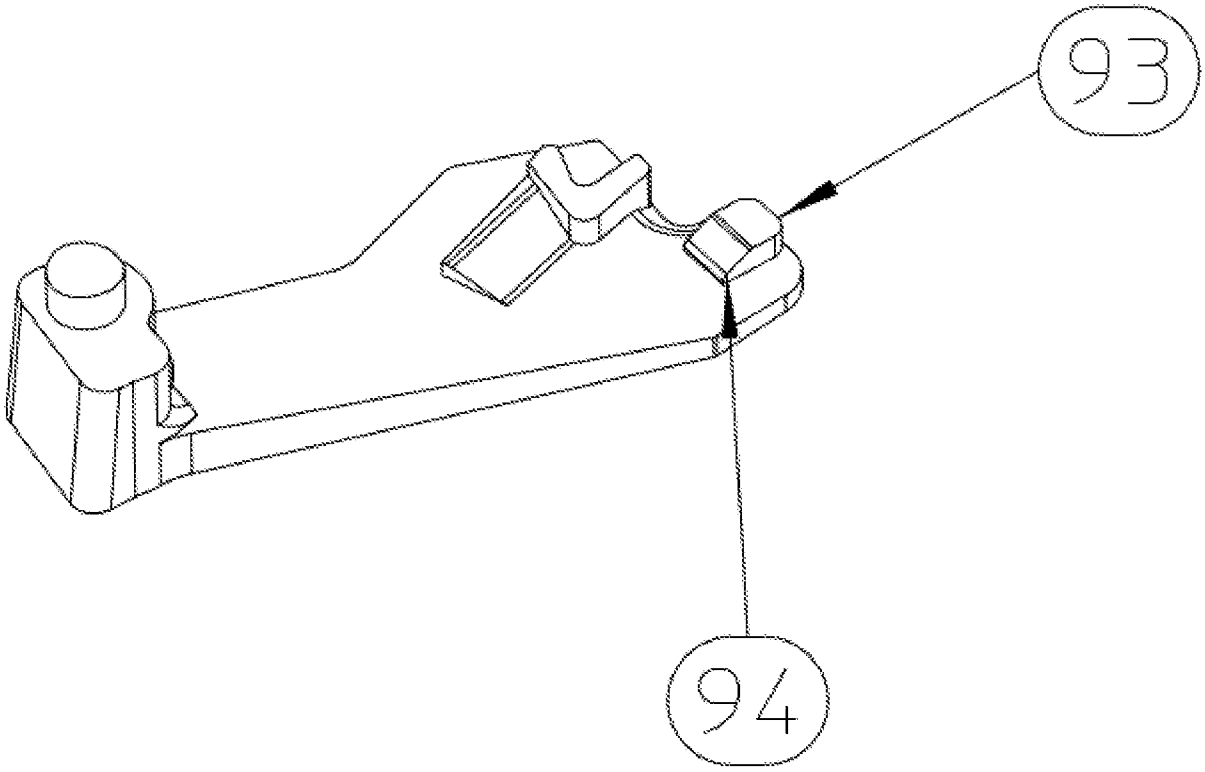


fig 10

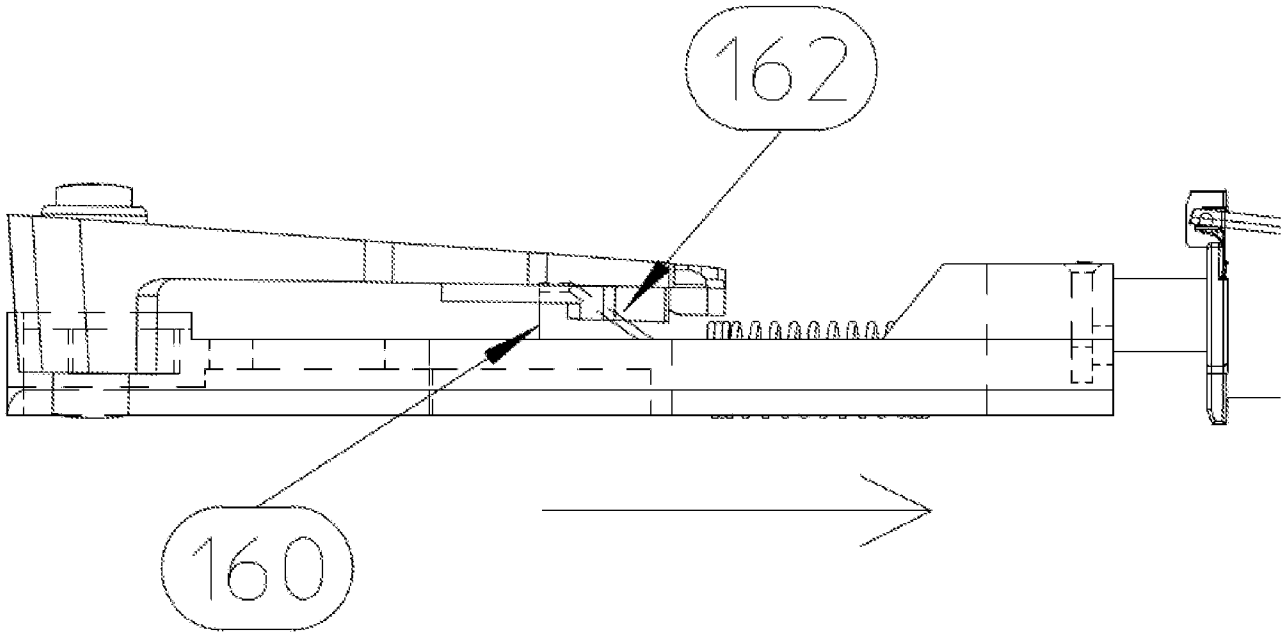


fig 11

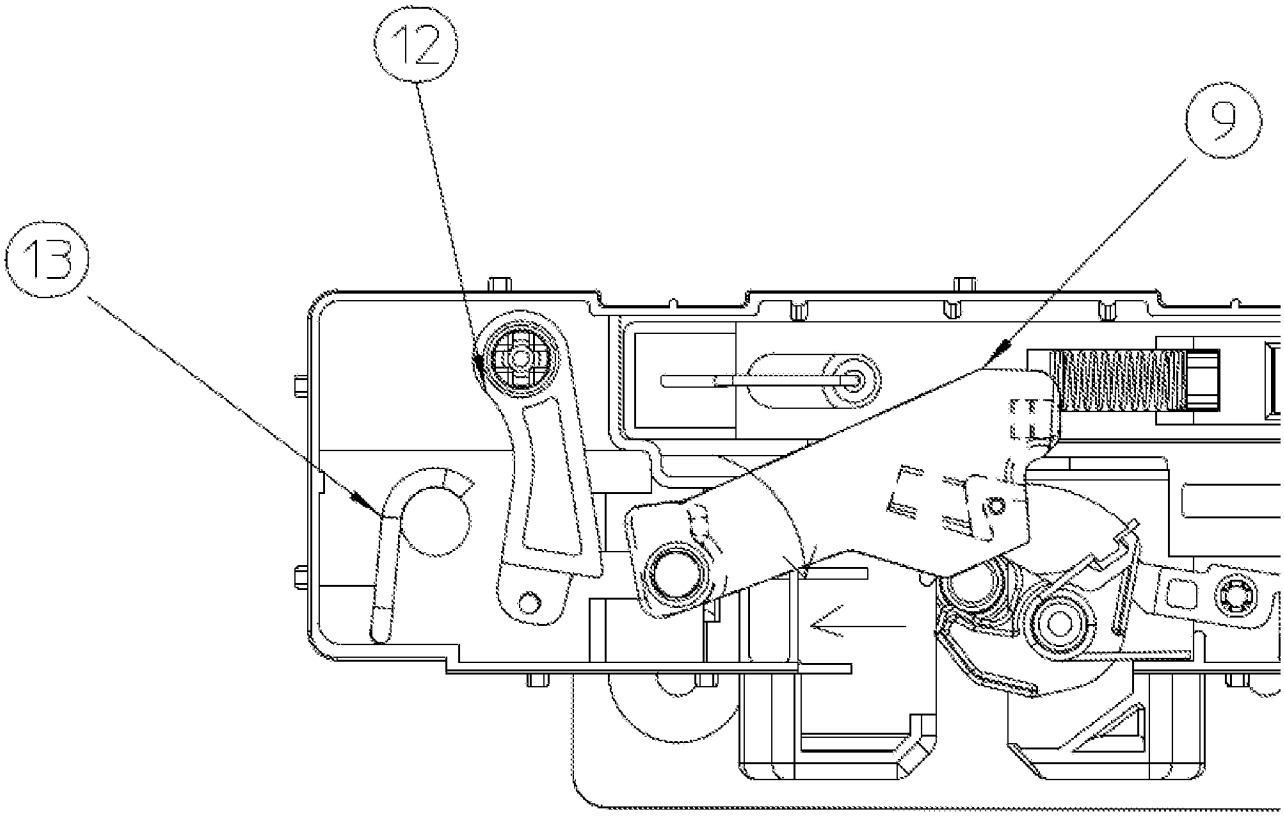


fig 12

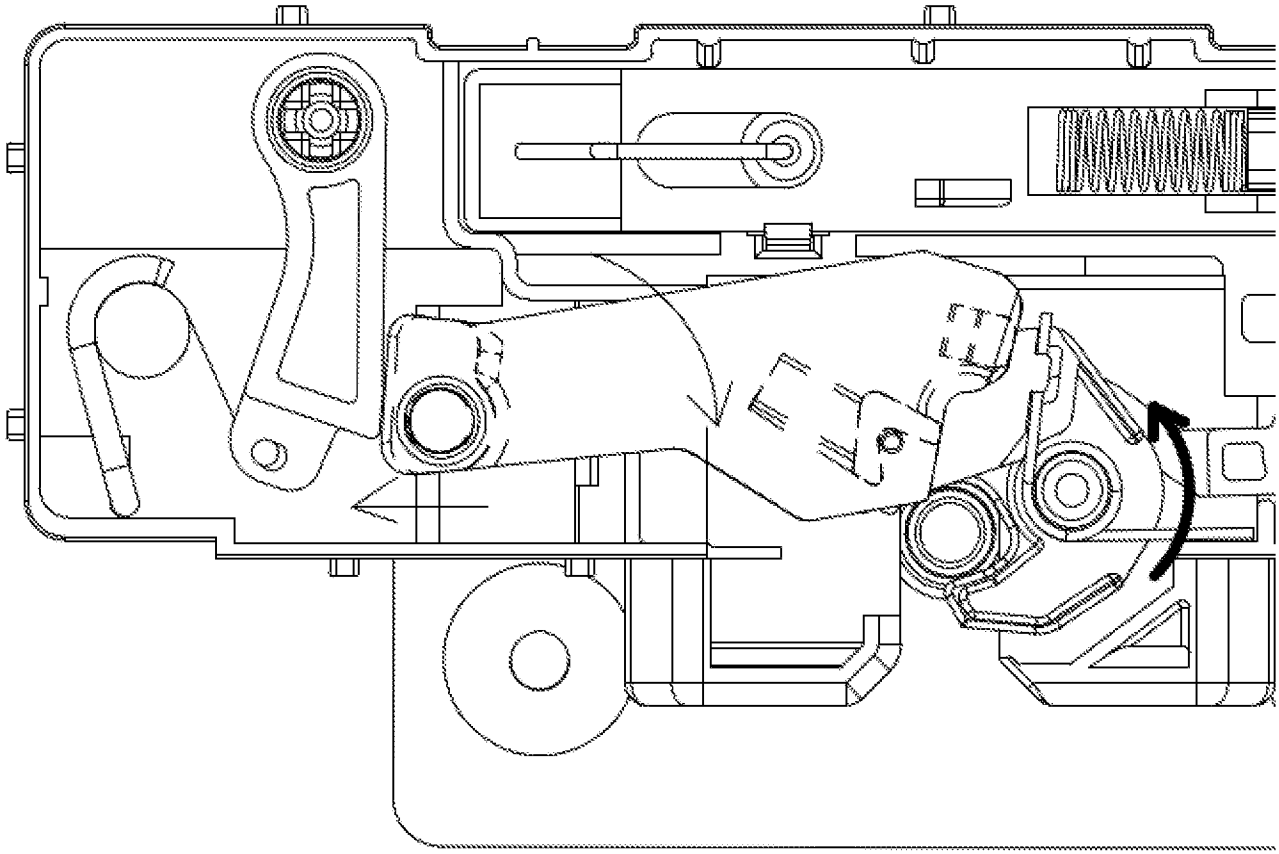


fig 13

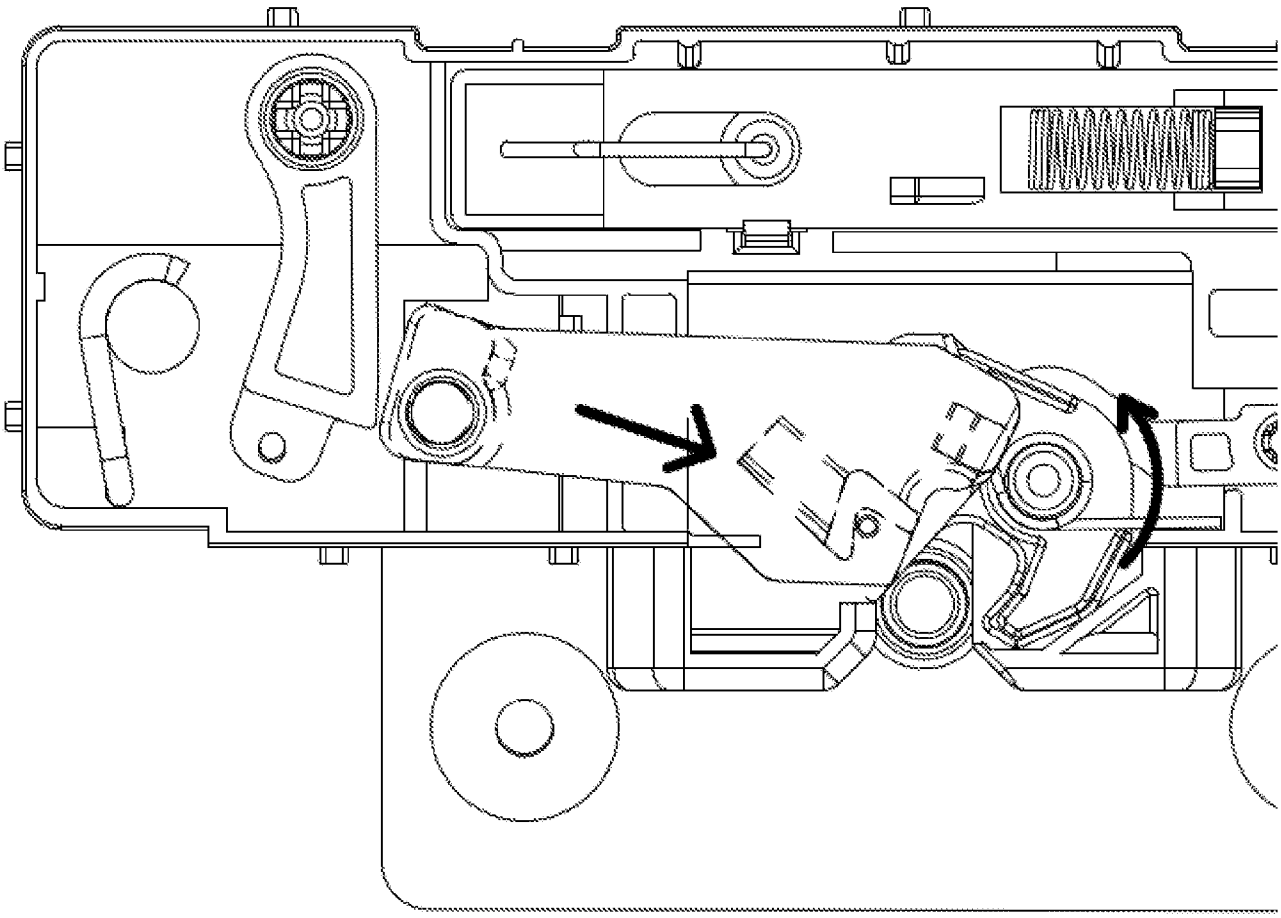


fig 14

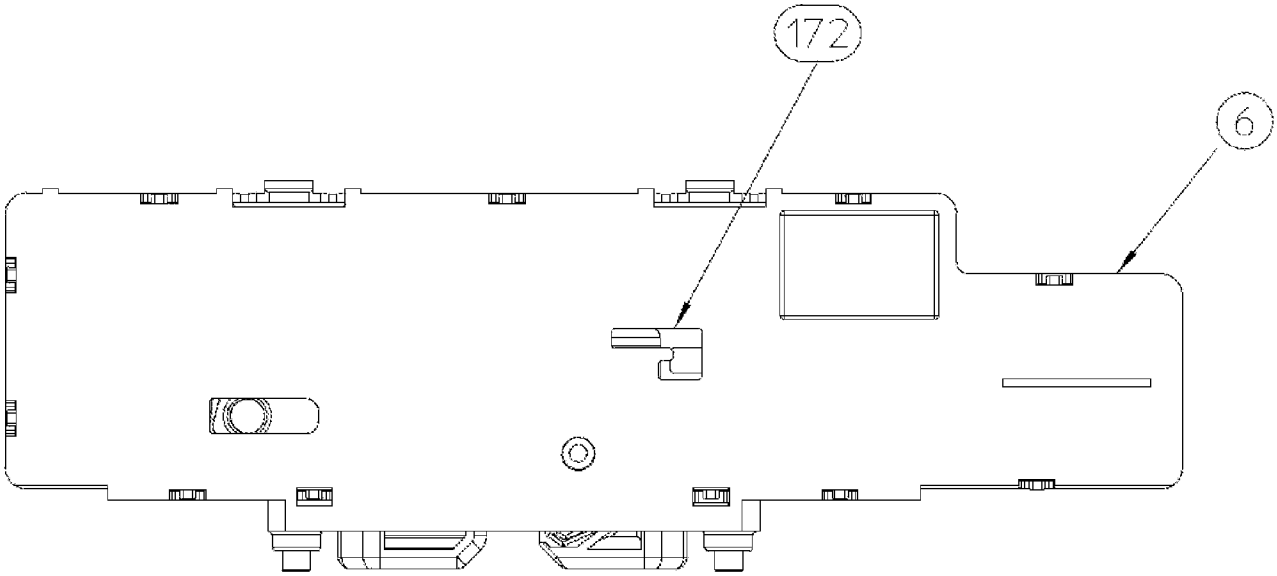


fig 15

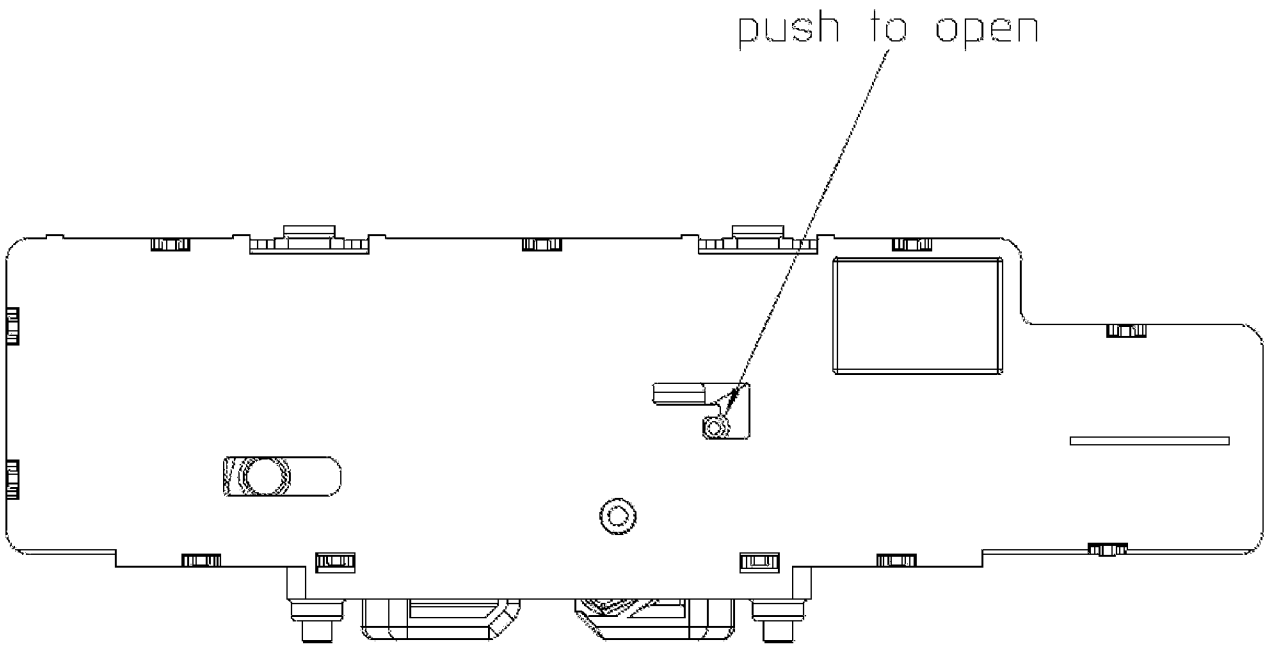


fig 16a

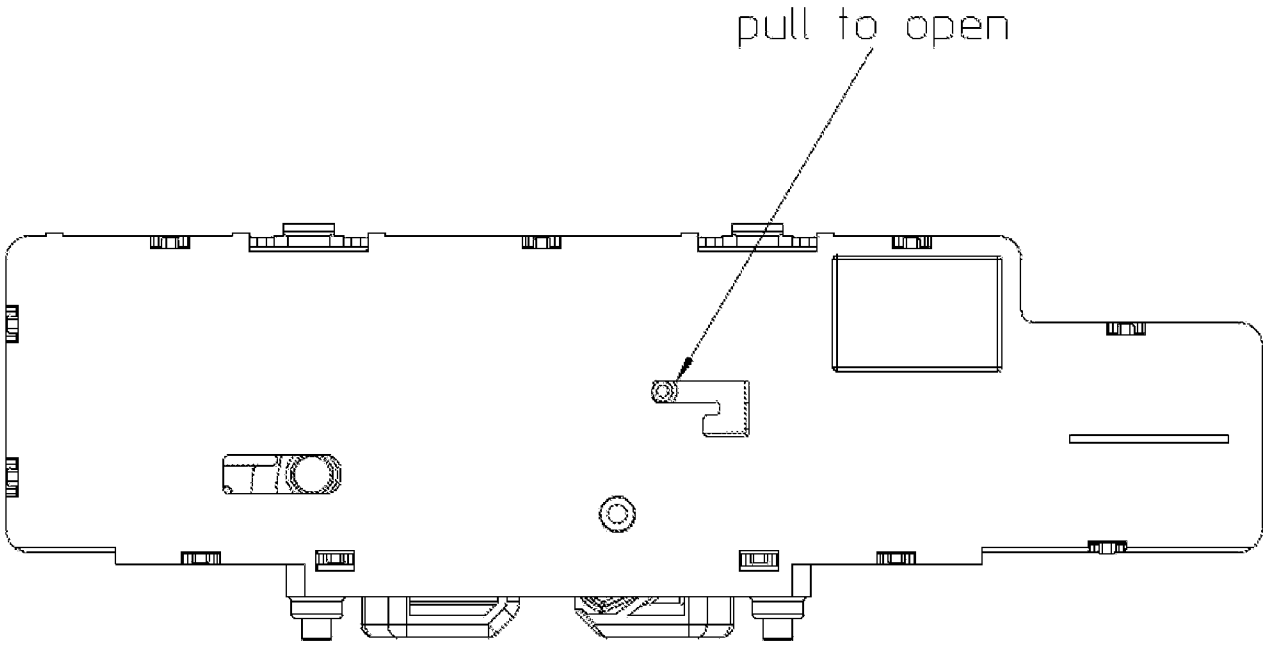
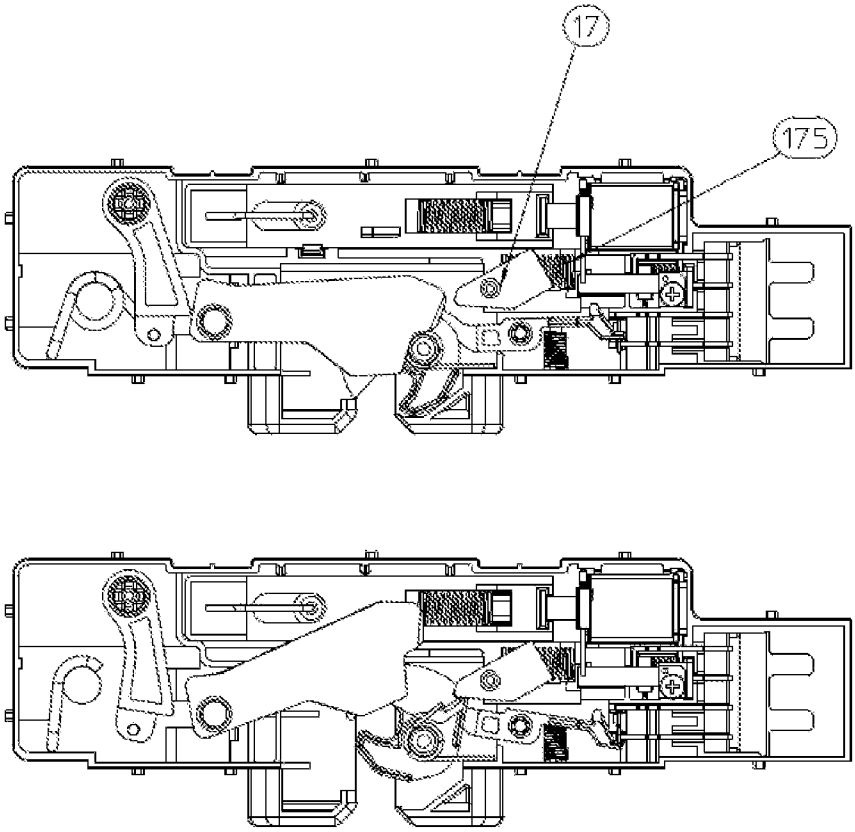


fig 16b



No interaction between lever (9),
wheel (8), and selector (17)

fig 17

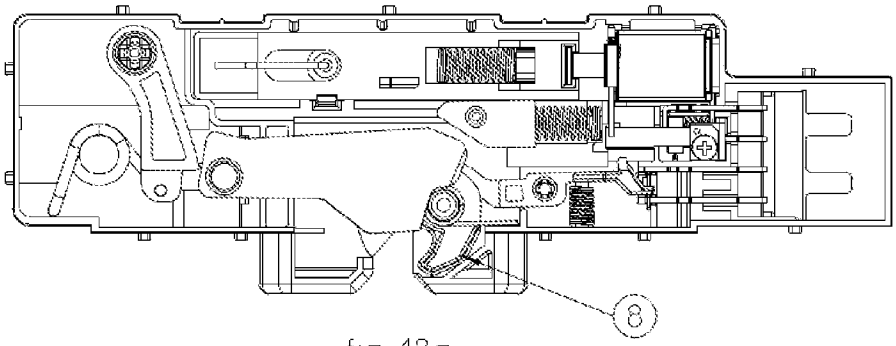
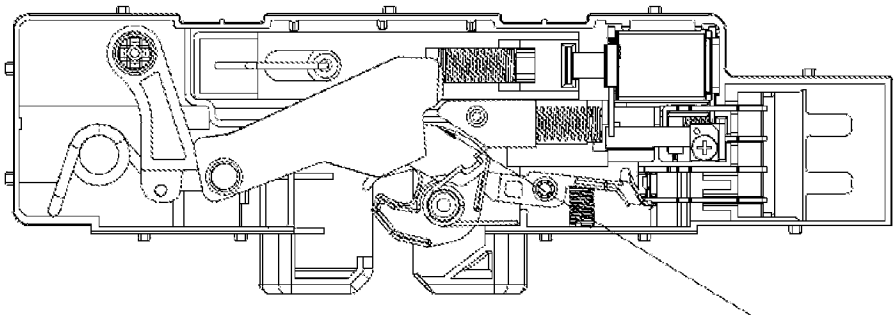
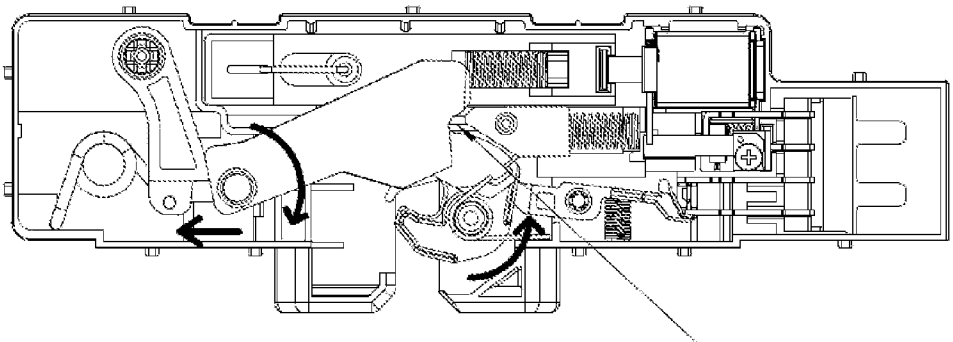


fig 18a



The clockwise rotation of the lever (9) is prevented by the elector (17)

fig 18b



The clockwise rotation of the lever (9) is prevented by the selector (17)

fig 19

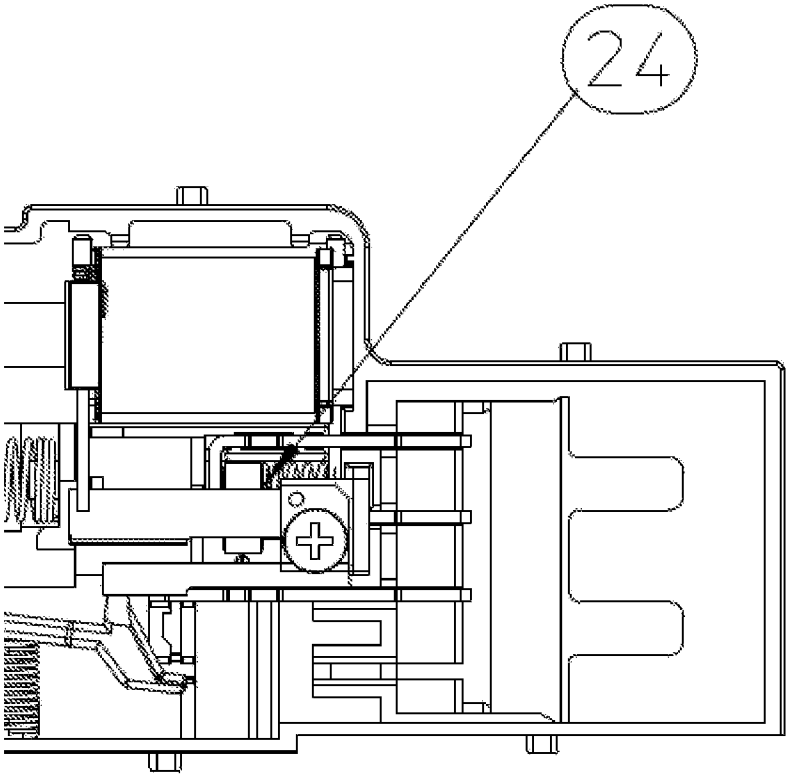


fig 20

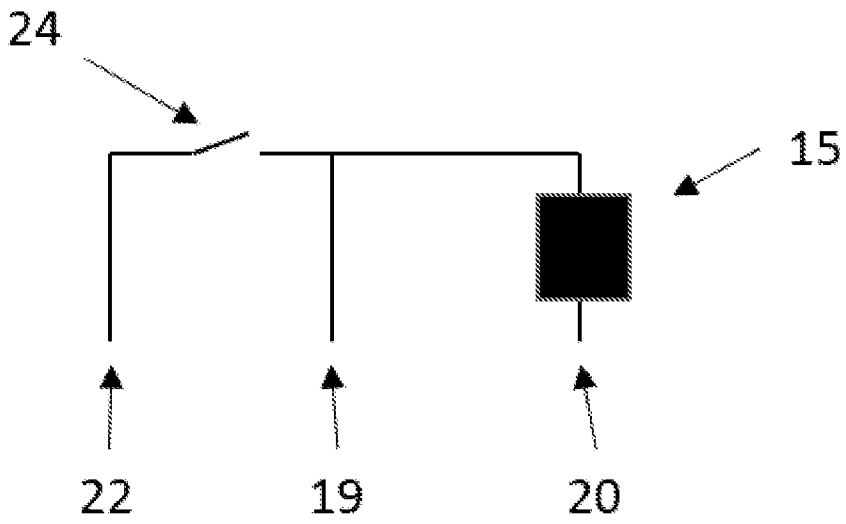


fig 21

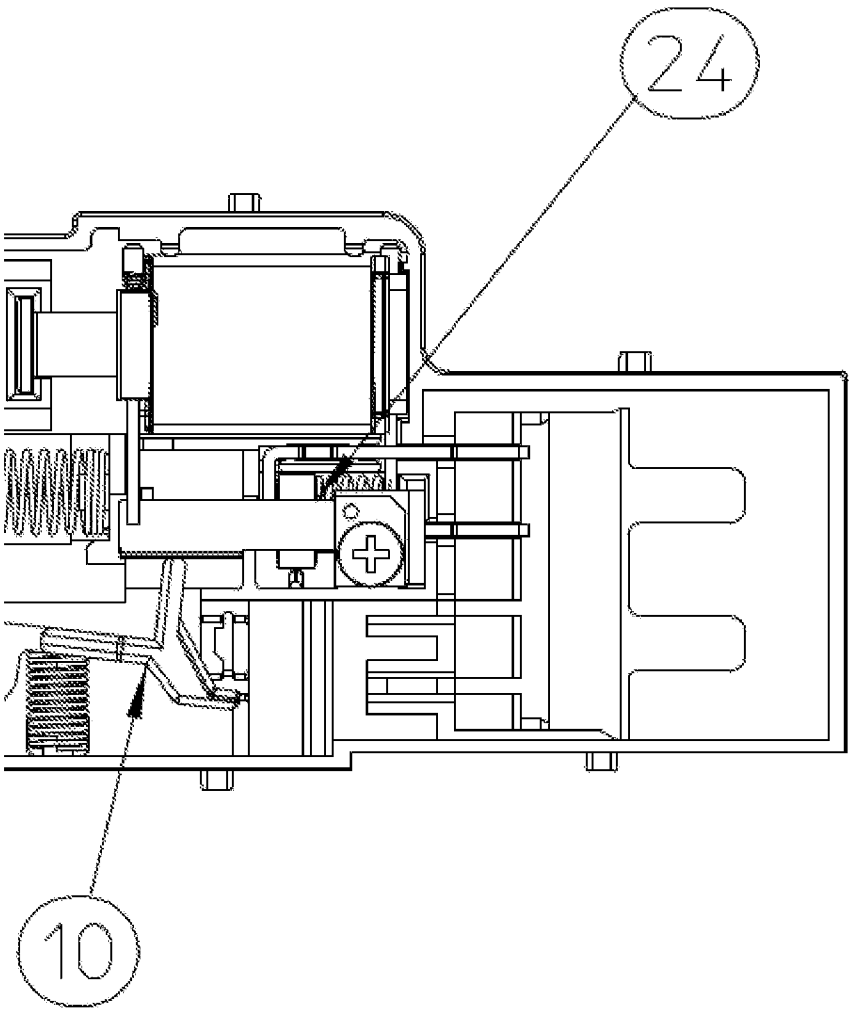


fig 22

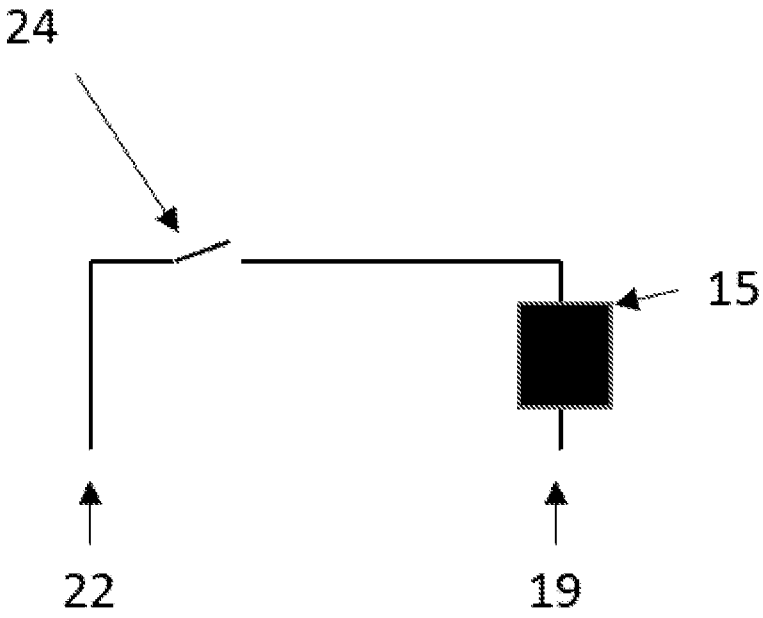


fig 23

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2021/060150

A. CLASSIFICATION OF SUBJECT MATTER
INV. E05C19/02 E05B63/00 E05B47/06 E05B47/00 D06F39/14
A47L15/42
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)
E05C E05B D06F A47L

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2013/124873 A2 (BITRON SPA [IT]) 29 August 2013 (2013-08-29) the whole document	1-16
A	EP 3 714 093 A1 (ELETTROTECNICA ROLD SRL [IT]) 30 September 2020 (2020-09-30) the whole document	1
A	US 2019/219269 A1 (DEYOUNG ROGER L [US]) 18 July 2019 (2019-07-18) the whole document	1
A	US 2019/017216 A1 (DIRNBERGER ALBERT [DE] ET AL) 17 January 2019 (2019-01-17) the whole document	1

☐ 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

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 January 2022	07/02/2022

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Ansel, Yannick

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2021/060150

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		DE 102017006642 A1	17-01-2019
		US 2019017216 A1	17-01-2019