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(54) A device for locking and unlocking the door of an electric household appliance

(57) The device comprises:

a housing (2, 13) with an opening (3) into which a retaining member (A) connected to the door can be introduced along a predetermined axis,

a slide (4) which is movable along the said axis and to which a hook member (5), pivotable about an axis (6) transverse the said axis, is articulated;

a resilient member (8) is interposed between the slide (4) and the housing (2) and can adopt two stable configurations in which it arranges the slide (4) in a first operative position and in a second operative position, respectively, and in which guide profiles (7) which are fixed relative to the housing (2) and cooperate with the hook member (5) arrange the hook member in a rest position in which it allows the retaining member (A) to be introduced into the opening (3) and in a working position in which the hook member (5) can restrain the retaining member (A) which has been introduced into the opening (3), respectively.

The arrangement is such that, when the retaining member (A) of the door is introduced into the opening (3), it can bring about a movement of the slide (4) from the first position towards the second position by a distance sufficient to bring about a snap-switching of the resilient member (8) from the first configuration to the second and the consequent movement of the slide (4) to the second operative position.

The device (1) further comprises a locking member (14) movable between a release position and an engagement position in which it can permit and prevent the movement of the slide (4) from the working position to the rest position, respectively.

FIG. 7

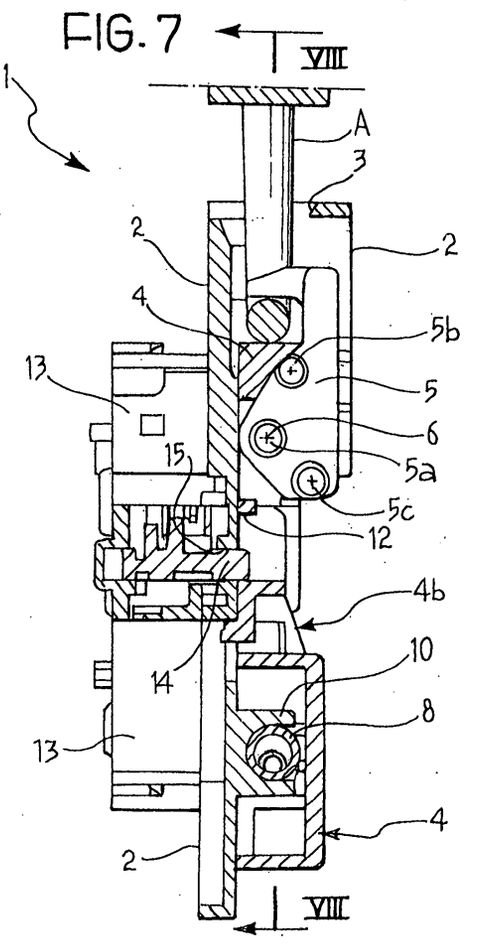

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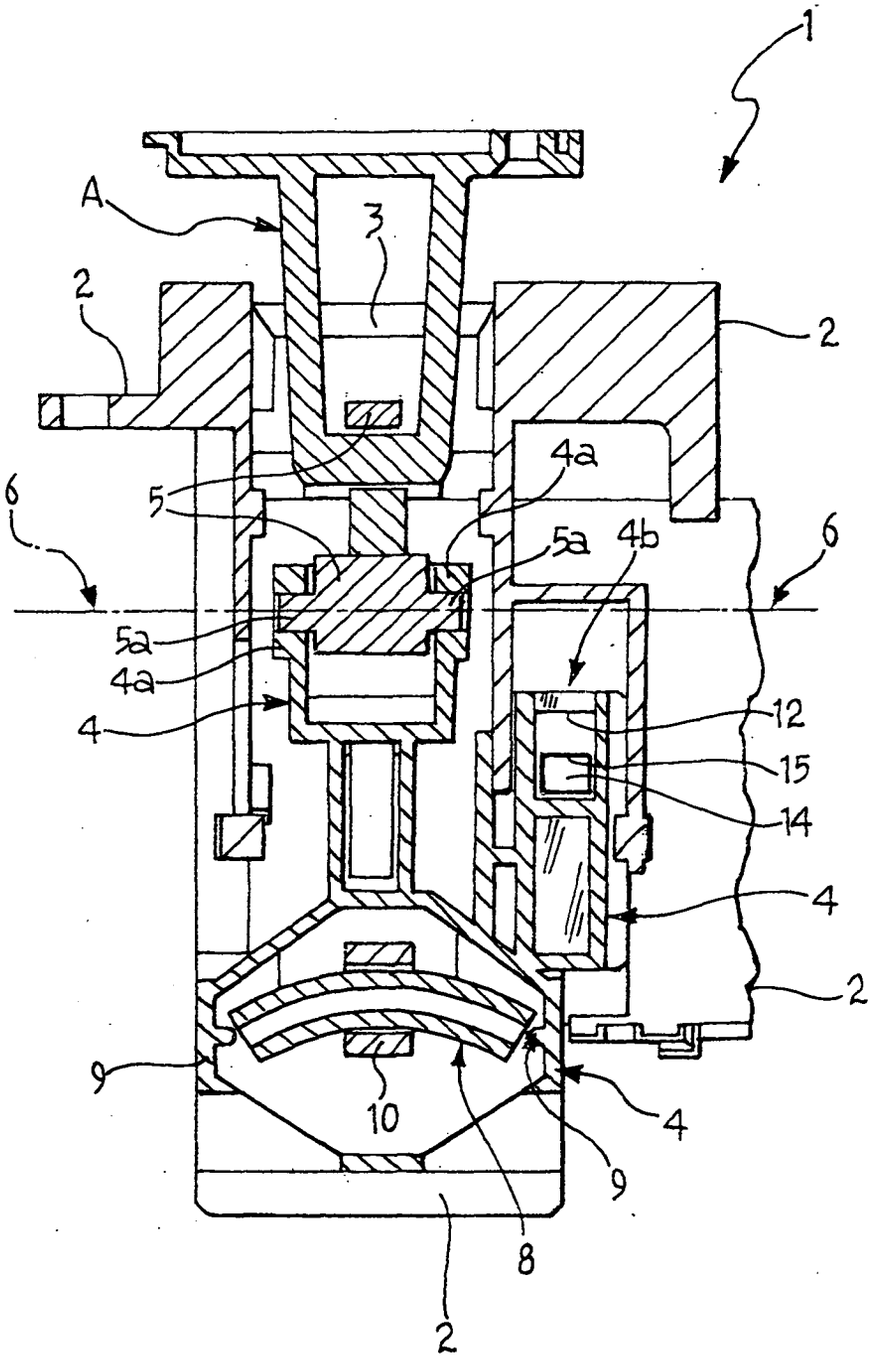
FIG. 8



Description

[0001] The present invention relates to a device for locking and unlocking the door of an electric household appliance.

[0002] An object of the present invention is to provide a locking and unlocking device which has a structure that can be produced easily and inexpensively and which is highly reliable in operation.

[0003] This and other objects are achieved, according to the invention, by a locking and unlocking device comprising:

a support housing in which an opening is defined for allowing a retaining member connected to the door to be introduced along a predetermined axis,

a slide which is movable in the housing along the said axis and to which a hook member, pivotable about an axis transverse the said axis, is articulated,

bistable resilient means being interposed between the slide and the housing and being able to adopt a first stable configuration and a second stable configuration in which they can arrange the slide, respectively, in a first operative position and in a second operative position that are spaced apart along the axis, and in which guide means which are fixed relative to the housing and cooperate with the hook member can arrange the hook member in a rest position in which it allows the retaining member to be introduced into the opening and in a working position in which the hook member can restrain the retaining member which has been introduced into the opening, respectively;

the arrangement being such that, when the retaining member of the door is introduced into the opening, it can bring about a movement of the slide from the first position towards the second position by a distance sufficient to bring about a snap-switching of the resilient means from the first configuration to the second configuration and the consequent movement of the slide to the second position;

the device further comprising:

a locking member movable in the housing between a release position and an engagement position in which it can permit and prevent the movement of the slide from the working position to the rest position, respectively, and

control means which can be activated electrically and which can control the position of the locking member.

[0004] Further characteristics and advantages of the invention will become clear from the following detailed description which is given purely by way of non-limiting example with reference to the appended drawings, in which:

Figure 1 is a perspective view of a device according to the invention, shown in the rest or door-open configuration;

Figure 2 is a perspective view of the device according to Figure 1, shown in the door-closed condition;

Figure 3 is a partially-exploded, perspective view of the device according to the preceding drawings;

Figure 4 is a partial view sectioned on the line IV-IV of Figure 1;

Figure 5 is a sectioned view similar to that of Figure 4 and shows the device according to the preceding drawings in a first condition;

Figures 6 and 7 are sectioned views similar to that of Figure 5 and show the device in further conditions;

Figure 8 is a view sectioned on the line VIII-VIII of Figure 7; and

Figure 9 is a partial perspective view of a variant.

[0005] In the drawings and in Figures 1 to 3 in particular, a device for locking and unlocking the door (not shown) of an electric household appliance is generally indicated 1.

[0006] The device 1 comprises a support housing, generally indicated 2, which is made, for example, of a moulded plastics material.

[0007] An opening 3 is defined in the housing 2 for the introduction of a retaining member A which is fixed in known manner to the door of an electric household appliance.

[0008] A slide, also made, for example, of a plastics material, is generally indicated 4 in the drawings. The slide 4 is mounted so as to be translatable in the housing 2 away from and towards the opening 3 along an axis which is substantially parallel to the axis of the opening.

[0009] A hook member 5 is articulated to the slide 4 and is pivotable about an axis 6 transverse the axis of translation of the slide.

[0010] The hook 5 has, in particular, a pair of opposed pins 5a, which are formed integrally therewith and are engaged in corresponding aligned openings formed in two facing lugs 4a of the slide 4 (see, for example, Figures 3 and 4).

[0011] The hook 5 also has two pairs of opposed transverse pins 5b, 5c cooperating with respective guide

profiles, generally indicated 7 in Figures 3 to 5, formed in two opposed walls of the housing 2, along the path of the slide 4.

[0012] As can be seen in Figures 4 and 5 in particular, each guide profile 7 has three adjacent surface portions 7a, 7b and 7c. The intermediate portion 7a of each guide profile 7 is substantially parallel to the axis of translation of the slide 4, whereas the end portions 7b and 7c are inclined, for example by about +45° and -45°, respectively.

[0013] The pins 5b and 5c of the hook member 5 can cooperate with the inclined surface portions 7b and 7c of the guide profiles 7 in a manner such that, when the slide 4 is in a first operative position shown in Figures 1 and 5, the hook member 5 is in an angular position in which it allows the retaining member A of the door to be introduced through the opening 3 of the housing 2 of the device.

[0014] However, the slide 4 can move from the first operative position, shown in Figures 1 and 5, to a second operative position shown in Figures 2, 7 and 8.

[0015] When the slide moves from the first operative position to the second operative position, the interaction of the pins 5b, 5c with the surface portions 7b, 7c of the guide profiles 7 is such that the hook member 5 is arranged in an angular position in which it can restrain the retaining member A that has been introduced through the opening 3 of the housing 2 of the device.

[0016] A helical spring mounted transversely in the slide 4 (Figure 8) is indicated 8 in Figures 3 and 5-8. The helical spring 8 has its opposite ends engaged on corresponding supports 9 of the slide 4 (Figures 6 and 8) in an axially compressed state.

[0017] The intermediate portion of the helical spring 8 extends and is held in a fork-shaped projection 10 integral with the support housing 2 (Figures 3, 5, 6-8).

[0018] By virtue of its state of axial compression, the helical spring 8 has bistable behaviour in the sense that it can adopt a first stable configuration and a second stable configuration in which it is curved relative to its own natural longitudinal axis to one side and to the other side, respectively, as shown in Figure 5 and in Figure 8, respectively.

[0019] A lateral portion of the slide 4, which is mounted for sliding relative to the main face of the housing 2 and in which an opening 12 is formed, is indicated 4b (see Figures 2, 3 and 5-9 in particular).

[0020] As can be seen in Figures 3 and 5-9 in particular, a shell 13 is connected to the housing 2 of the device; the shell 13 houses the components of an electromechanical control device 20, for example, of the type described in the Applicant's USA patent 6,334,637. This device comprises, in particular, a locking member 14 which can extend through an opening 15 formed in the support housing 2 (see Figures 3 and 5-9 in particular).

[0021] In particular, the locking member 14 can adopt a release position (Figures 5 and 6) in which it does not protrude from the container with the shell 13 through the opening 15 of the housing 2 and does not therefore obstruct the sliding of the slide 4 relative to that housing.

[0022] The locking member 14 can, however, adopt an engagement position (Figures 7 and 8) in which it projects beyond the opening 15 of the housing 2, engaging in the opening 12 of the slide 4, when the slide is in its second operative position, preventing the slide 4 from returning to the first operative position which is shown, for example, in Figure 5.

[0023] The locking and unlocking device described above operates substantially in the following manner.

[0024] At rest and with the door or hatch of the electric household appliance in the open condition, the device adopts the configuration shown in Figure 1: the spring 8 is curved upwards and keeps the slide 4 in the first operative position or raised position; the hook 5 does not obstruct the introduction of the retaining member A of the door into the opening 3 of the locking device 1. In this condition, the electromechanical control device 20 keeps the locking member 14 in the release position in which it does not obstruct any movement of the slide 4.

[0025] When the door of the electric household appliance is closed, the retaining member A is introduced into the opening 3 of the locking device 1, as can be seen in Figures 4 and 5. The member A engages the top portion of the slide 4 and thus causes it to move downwards, as can be seen in the sequence of Figures 4, 5 and 6.

[0026] As a result of the downward movement of the slide 4, the hook member 5 pivots about the axis 6, anticlockwise as seen in Figure 5, owing to the interaction between its pins 5b and 5c and the corresponding surfaces 7b and 7c of the guide profiles 7. The distal end of the hook member 5 grips the retaining member A as can be seen in Figure 6.

[0027] During the introduction of the retaining member A into the locking device 1, the slide 4 reaches the position shown in Figure 6 in which the spring 8 is substantially "straightened out". During its further downward movement, when it has passed the position of Figure 6, the spring 8 snaps almost instantaneously towards its second stable configuration causing a so-called "auto-pull" effect on the slide 4, as well as on the hook 5 and the retaining member A, towards the second operative position (Figure 8). In this condition, the free end of the locking member 14 faces the opening 12 of the slide 4.

[0028] If, after the closure of the door, the electric household appliance is switched on, a control unit thereof can activate the electromechanical control device 20, in known manner, so as to bring about the movement of the locking member 14 to the engagement position shown in Figure 7 in which it protrudes into the opening 12 of the slide 4, preventing the slide 4 from returning to the rest operative position and thus in fact preventing opening of the door.

[0029] Upon completion of the operating cycle of the electric household appliance, the control unit of the appliance controls the electromechanical device 20 in a

manner such that the locking member 14 is retracted to the release position. In this condition, the locking member 14 no longer obstructs the return of the slide 4 to the rest operative position and thus allows the door to the opened by a pull exerted thereon so as to cause the slide 4 to return upwards to the rest operative position, bringing about pivoting of the hook member 5 during the last stage of that upward movement so that the hook member 5 is released from the retaining member A of the door.

[0030] The final stage of the upward movement of the slide 4 is facilitated by the snap-switching of the spring 8 back towards the first configuration in which it is bent downwards.

[0031] In the variant of Figure 9, a microswitch, generally indicated 30, is fixed to the housing 2 of the device and comprises an operating member 31 which can cooperate with the slide 4 in a manner such that the switch switches, for example, from open to closed, when the slide 4 is in the lowered operative position, that is, when the door of the electric household appliance is closed. The switch 30 can indicate the door-closed condition to a control unit of the electric household appliance.

[0032] Naturally, the principle of the invention remaining the same, the forms of embodiment and details of construction may be varied widely with respect to those described and illustrated purely by way of non-limiting example, without thereby departing from the scope of the invention as defined in the appended claims.

Claims

1. A device for locking and unlocking the door of an electric household appliance, comprising:

a support housing (2, 13) in which an opening (3) is defined for allowing a retaining member (A) connected to the door to be introduced along a predetermined axis,

a slide (4) which is movable in the housing (2) along the said axis and to which a hook member (5), pivotable about an axis (6) transverse the said axis, is articulated;

bistable resilient means (8) being interposed between the slide (4) and the housing (2) and being able to adopt a first stable configuration and a second stable configuration in which they can arrange the slide (4), respectively, in a first operative position and in a second operative position that are spaced apart along the axis, and in which guide means (7) which are fixed relative to the housing (2) and cooperate with the hook member (5) can arrange the hook member in a rest position in which it allows the retaining member (A) to be introduced into the opening (3) and in a working position in which the hook member (5) can restrain the retaining member (A) which has been introduced into the opening, respectively;

the arrangement being such that, when the retaining member (A) of the door is introduced into the opening (3), it can bring about a movement of the slide (4) from the first position towards the second position by a distance sufficient to bring about a snap-switching of the resilient means (8) from the first configuration to the second configuration and the consequent movement of the slide (4) to the second operative position; the device (1) further comprising:

a locking member (14) movable in the housing (2) between a release position and an engagement position in which it can permit and prevent the movement of the slide (4) from the working position to the rest position, respectively, and

control means (20) which can be activated electrically and which can control the position of the locking member (14).

2. A device according to Claim 1 in which the resilient means comprise an elongate resilient member (8) which is disposed in an axially compressed condition between two supports (9) of the slide (4) which are arranged opposite one another transverse the said axis, an intermediate portion of the resilient member (8) extending in a retaining projection (10) of the support housing (2).

3. A device according to Claim 2 in which the resilient member is a helical spring (8).

4. A device according to any one of the preceding claims, further comprising an electric switch (30) fixed to the housing (2) and comprising a movable control member (31) which can cooperate with the slide (4) in a manner such that the switch (30) can adopt a first condition and a second condition when the slide (4) is in the first operative position and in the second operative position, respectively.

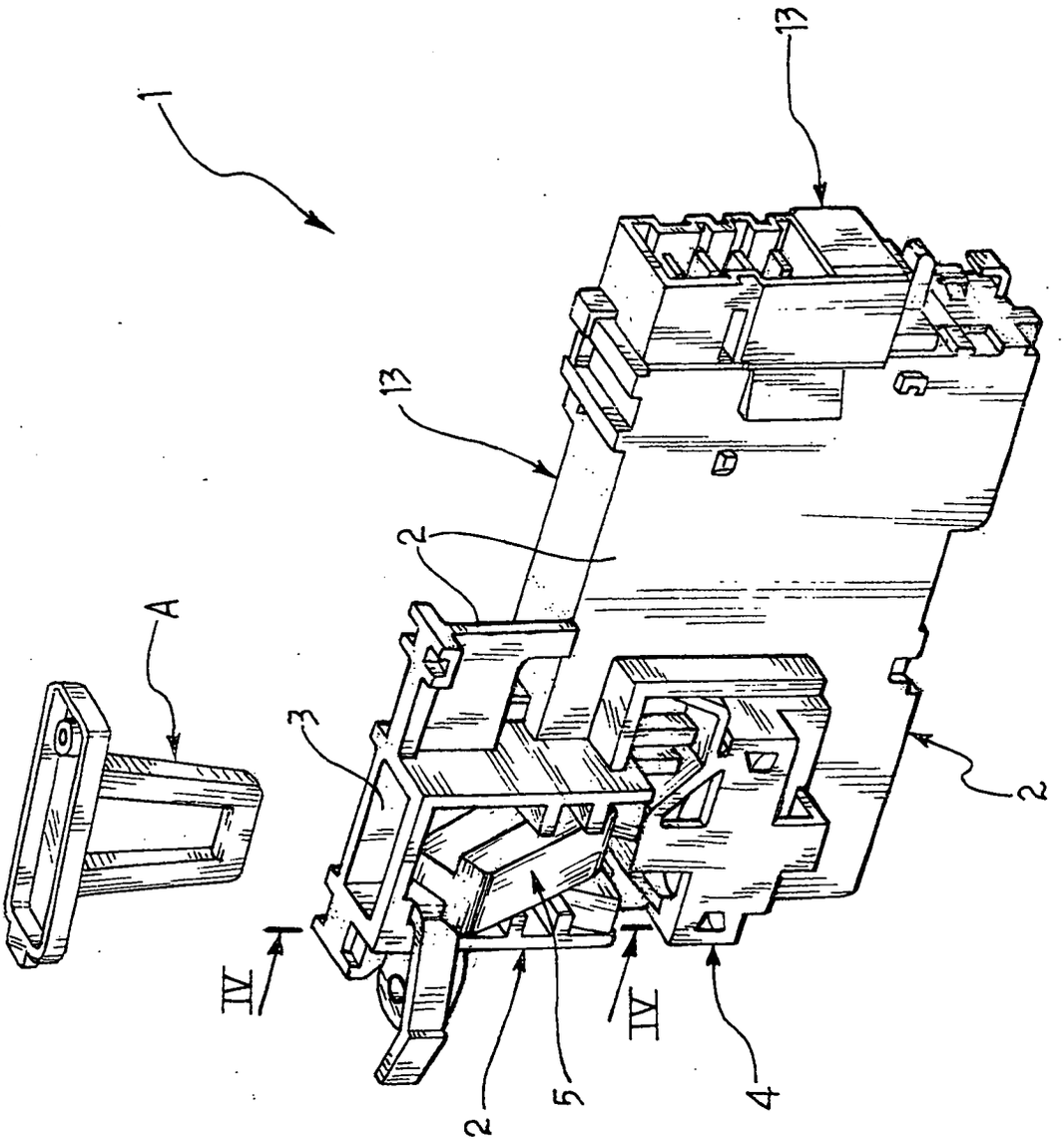


FIG. 1

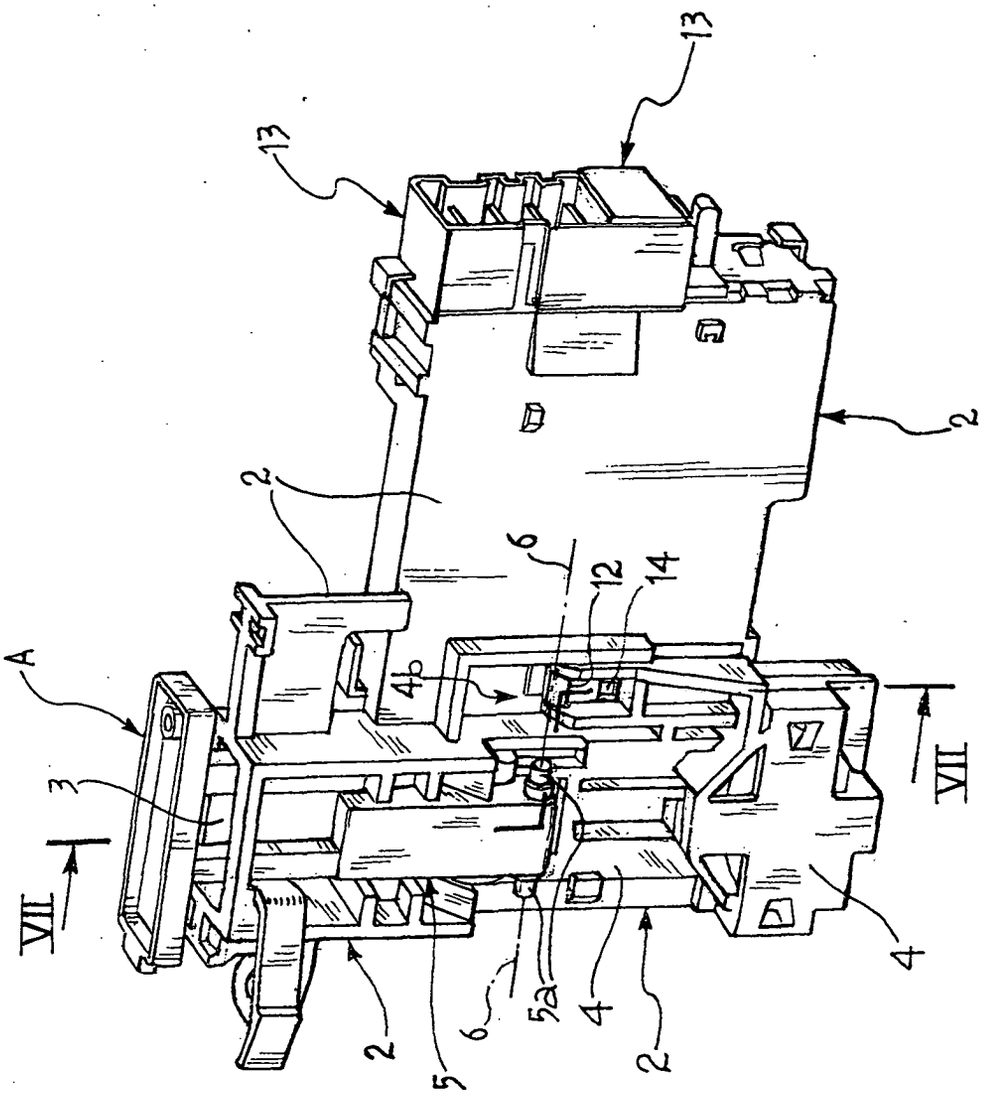


FIG. 2

FIG. 3

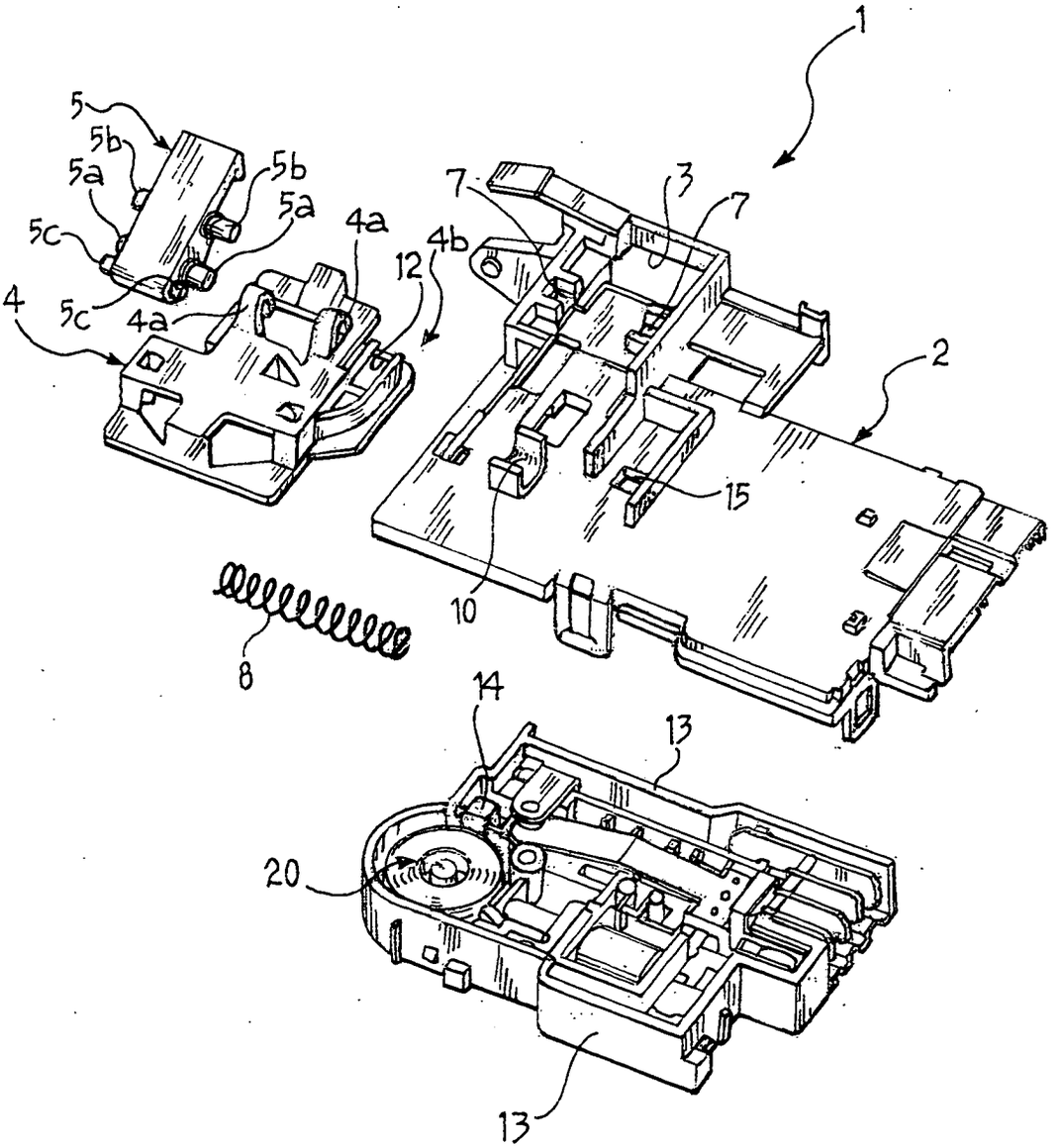


FIG. 5

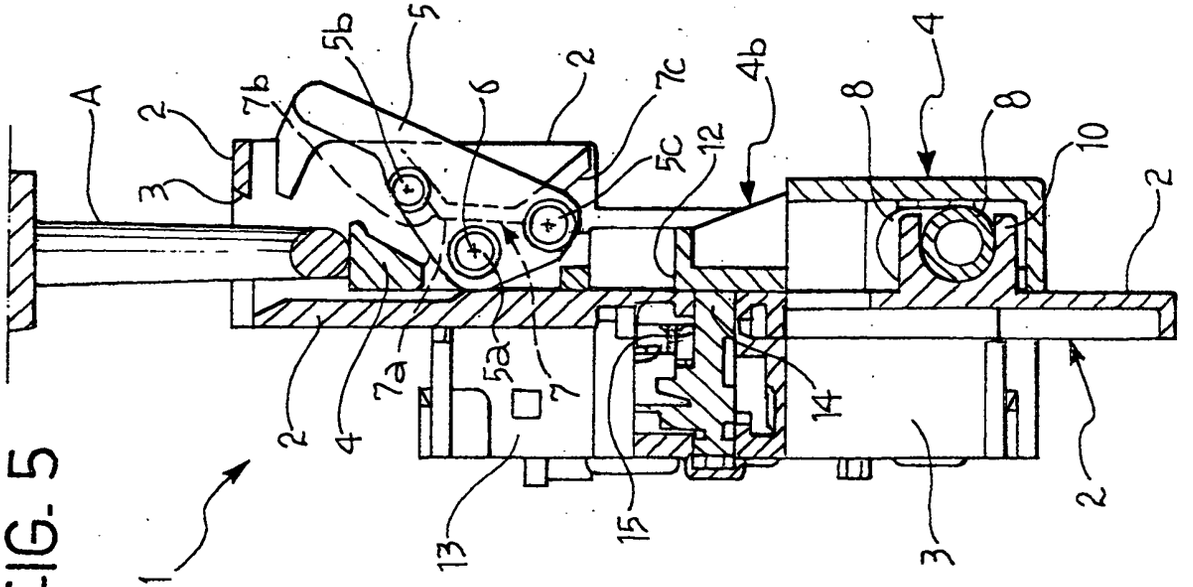

A
2
3
7b
5b
5
6
2
7c
4b
5c
12
8
4
8
10
2
7a
5a
7
4
2
13
15
14
3
2
1

FIG. 4

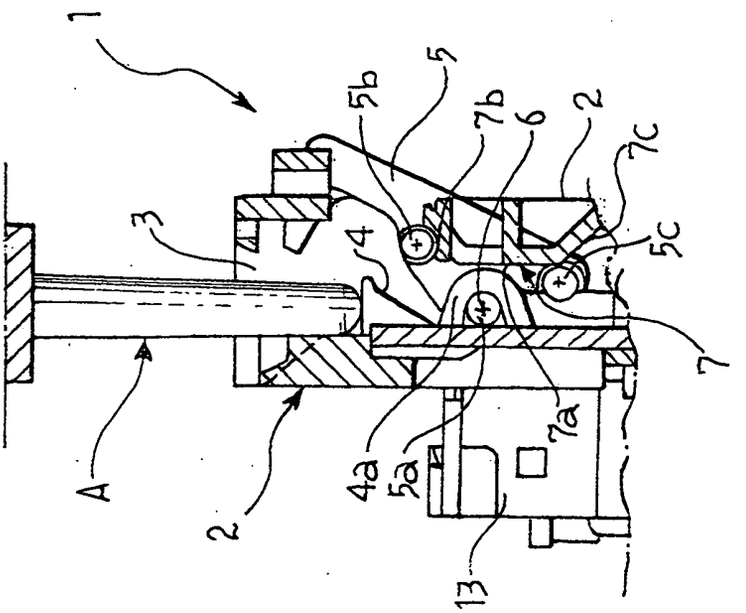

1
5b
5
7b
6
2
7c
3
4
5c
7
A
2
4a
5a
7a
13

FIG. 7

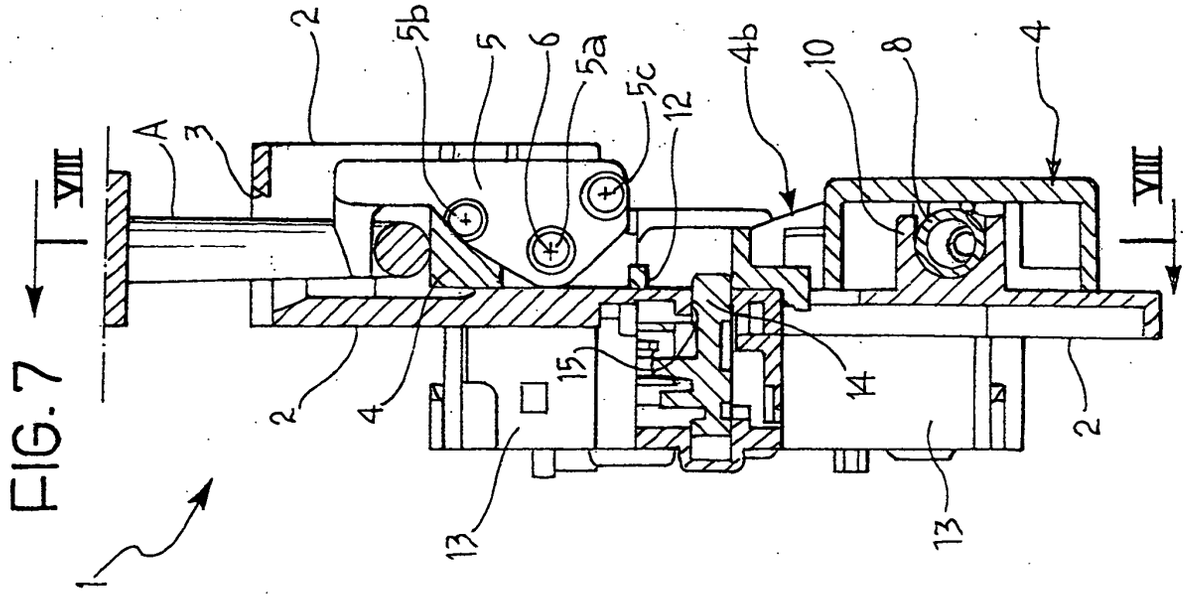

VIII
VIII
A
1
2
3
4
5
5a
5b
5c
6
8
10
12
13
14
15

FIG. 6

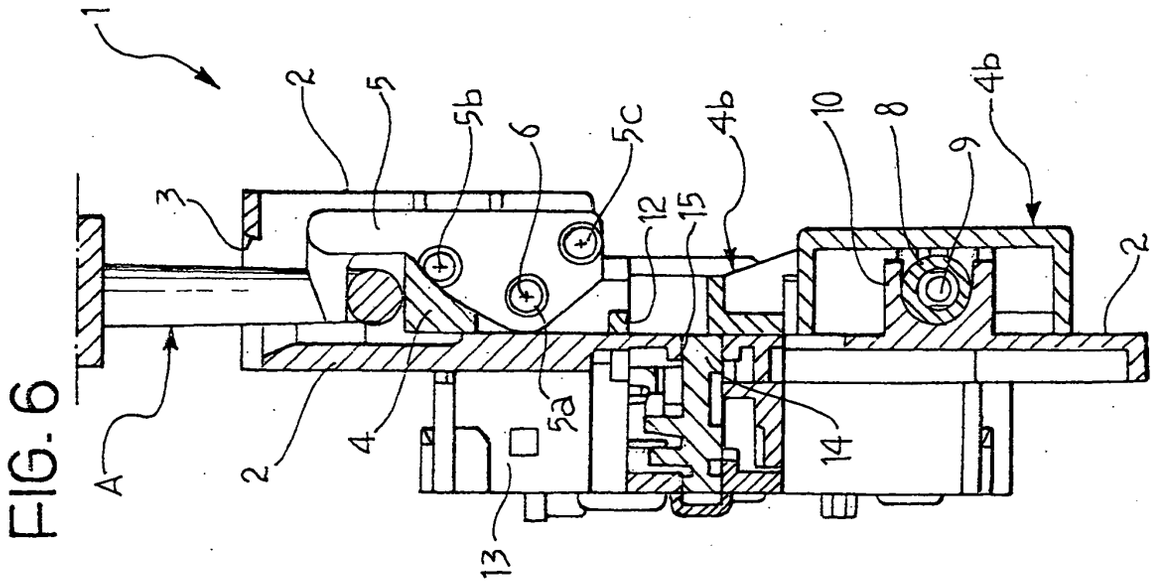

1
A
2
3
4
4b
5
5a
5b
5c
6
8
9
10
12
13
14
15

FIG. 8

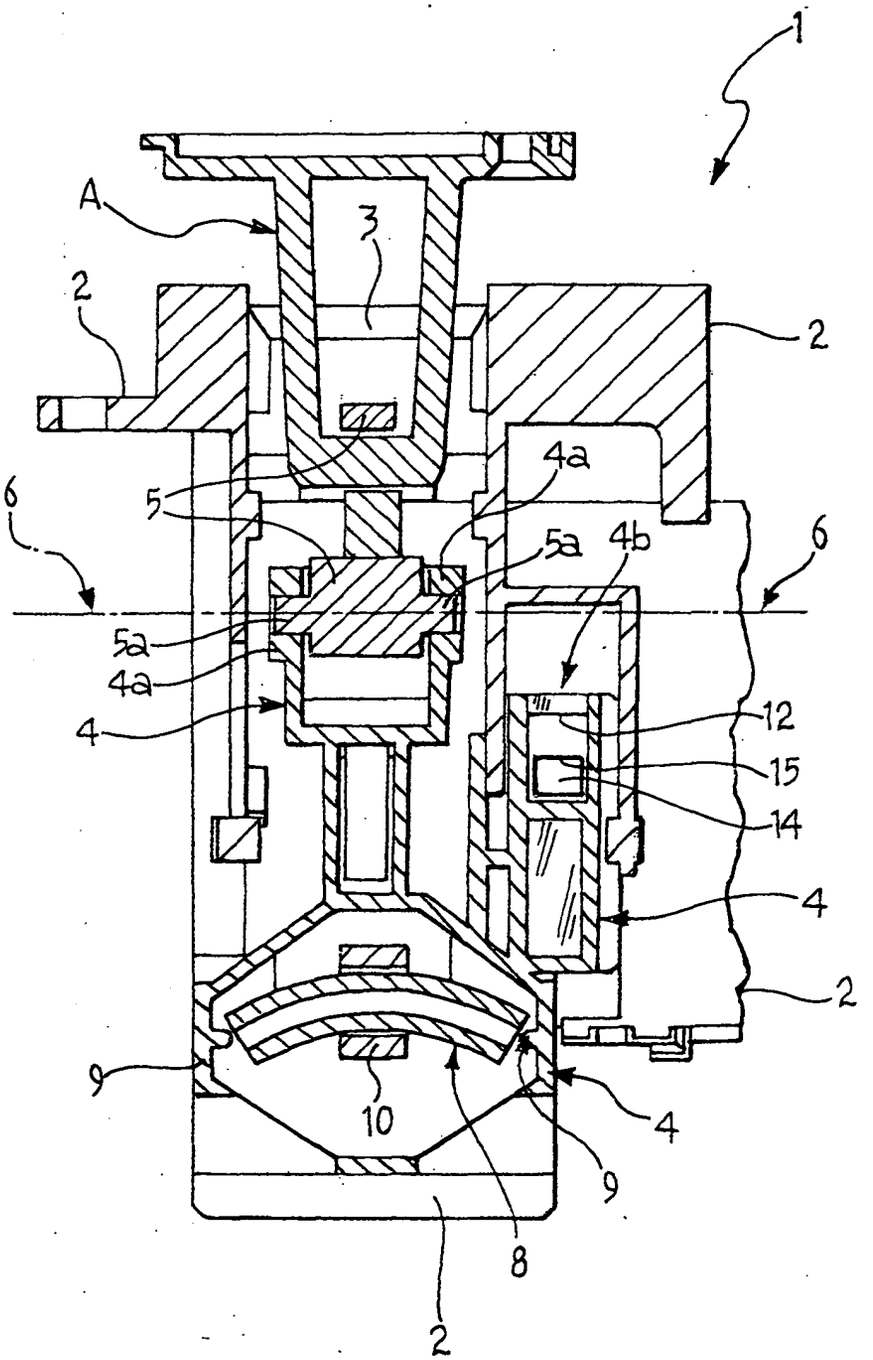


FIG. 9