



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
23.04.2003 Bulletin 2003/17

(51) Int Cl.7: **E05C 3/24**, E05C 5/00,
D06F 37/28, D06F 49/00

(21) Application number: **02023459.7**

(22) Date of filing: **21.10.2002**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
IE IT LI LU MC NL PT SE SK TR**
Designated Extension States:
AL LT LV MK RO SI

(72) Inventors:
• **Promutico, Fabrizio**
03010 Alatri, Frosinone (IT)
• **Scarsella, Gianni**
03010 Alatri, Frosinone (IT)

(30) Priority: **22.10.2001 IT TO20011003**

(74) Representative: **Quinterno, Giuseppe et al**
Jacobacci & Partners S.p.A.,
Corso Regio Parco, 27
10152 Torino (IT)

(71) Applicant: **BITRON S.p.A.**
10042 Nichelino (Torino) (IT)

(54) **A door-lock, particularly for household appliances**

(57) The device (1) comprises a support structure (2) with an opening (3) for the insertion of a hook (4) connected to a door (5), and a cam member (14) which is rotatable about a pin (13) translatable along an axis parallel to the direction of insertion of the hook (4), and which has a reaction profile (14a) disposed between a first recess or notch and a second recess or notch (14b, 14c). The cam member (14) is capable of:

adopting a rest position in which it is adjacent the opening (3) and its reaction profile (14a) bears against a stop member (25), and in which its first notch (14b) faces towards the opening (3) and can house an end portion (4a) of the hook (4) when the

latter (4) is inserted in the opening (3), and

performing, as a result of a further insertion of the hook (4), a reversible rotational/translational movement towards a working position in which it is adjacent the stop member (25), which engages in its second notch (14c), and in which position the hook-like member (4) is held in the first notch (14b).

A toggle mechanism (16) is connected to the cam member (14), and can adopt a first configuration and a second configuration in which it tends to keep the cam member (14) in the rest position and in the working position, respectively.

FIG. 2

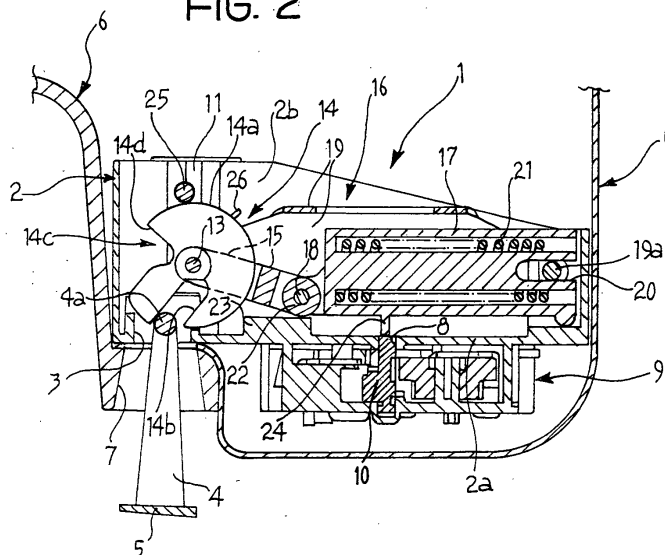
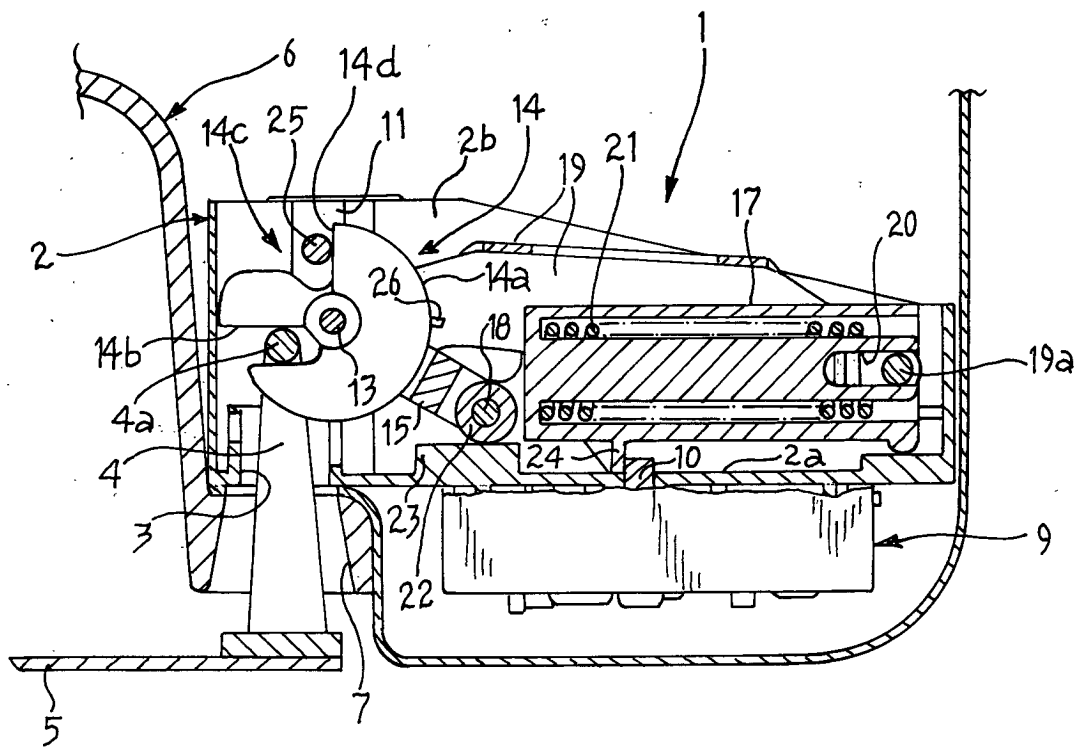


FIG. 6



Description

[0001] The present invention relates to a door-lock, particularly for household appliances, such as washing machines and/or tumble-driers.

[0002] The object of the present invention is to provide an improved door-lock which has a structure that is fairly simple and easy to produce and which is very reliable in operation.

[0003] This and other objects are achieved, according to the invention, by a door-lock the main characteristics of which are defined in appended Claim 1.

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

Figure 1 is a perspective view of a first door-lock according to the invention,

Figure 2 is a view of the first door-lock, sectioned on the line II-II of Figure 1 and shown in the fitted condition in a domestic appliance and in the rest condition,

Figure 3 is a view similar to that of Figure 2 and shows the first door-lock at the stage of its coupling with an associated hook-like member carried by the door,

Figure 4 is a view similar to that shown in Figure 3 and shows the first door-lock in the position for retaining the hook-like member connected to the door,

Figure 5 is a view similar to that of Figure 4 and shows a locking device associated with the first door-lock, in the condition in which it can prevent the release of the hook carried by the door,

Figure 6 shows the first door-lock in a condition in which the door is closed and in which a slide member of the lock is stopped against a stop member of the associated locking device,

Figure 7 is a perspective view of a second door-lock according to the invention,

Figure 8 is a view of the second door-lock, sectioned on the line VIII-VIII of Figure 7 and shown in the rest condition,

Figure 9 is a view similar to that of Figure 8 and shows the second door-lock at the stage of its coupling with an associated hook-like member of a door, and

Figure 10 is a view similar to those of Figures 8 and 9 and shows the second door-lock in the position

for retaining the hook-like member connected to the door.

[0005] In the drawings and in particular in Figure 1, a door-lock according to the invention is generally indicated 1.

[0006] The door-lock comprises a substantially box-shaped support structure 2 which is shown partially sectioned in Figure 1.

[0007] In the embodiment shown by way of example, the support structure 2 has a side wall 2a in which there is formed an opening 3 which, as will become clear from the following description with reference to Figures 2 to 6, is intended to allow a hook 4 connected to a door 5 (shown only partially in Figures 2 to 6) of a household appliance to be inserted in the structure.

[0008] As can be seen, for example, in Figure 2, the door-lock 1 is intended to be mounted in the structure 6 of a household appliance with the opening 3 facing and aligned with a corresponding opening 7 of the structure (Figures 2 *et seq.*).

[0009] A further opening, indicated 8, is formed in the wall 2a of the support structure 2 of the door-lock.

[0010] As can be seen in particular in Figures 2 *et seq.*, a locking device of a per se known type, generally indicated 9, is connected to the outer face of the wall 2a of the structure 2. This device comprises, in particular, a locking member 10 which is translatable (vertically as seen in Figures 2 *et seq.*) and is aligned with the opening 8 in the wall 2a. In operating conditions which will be described below, the member 10 can adopt a retracted, rest position (Figures 2 to 4) in which it does not project beyond the wall 2a, and an extended, working or locking position (Figures 5 and 6) in which it projects through and beyond the opening 8 in the wall 2a.

[0011] With further reference now to Figure 1, the support structure 2 comprises two further walls 2b, 2c, which face one another. A substantially straight channel 11 is formed in the wall 2b, substantially parallel to the axis of the opening 3. A further straight channel 12 is formed in the facing wall 2c, parallel to and facing the channel 11 (Figure 1).

[0012] A pin which is mounted so as to be translatable along the channels 11 and 12 is indicated 13. A cam member 14, as well as a first end of a lever 15 which forms part of a toggle mechanism generally indicated 16, are mounted rotatably on the pin. The mechanism also comprises a slide member 17, articulated to the other end of the lever 15 at 18. This slide member 17 is translatable in the support structure 2 along a direction (horizontal as seen in Figures 2 to 6) substantially perpendicular to the direction of sliding of the pin 13.

[0013] The toggle mechanism 16 further comprises a connecting element or tie 19 having one end articulated pivotably on the pin 13, its other end being provided with a transverse element 19a mounted so as to be translatable in a central longitudinal slot 20 of the slide member 17 (Figures 2 to 6).

[0014] The mechanism 16 also comprises a helical spring 21 housed in an outer shell portion of the slide member 17 and reacting, at one end, against the end of the slide member which is articulated to the lever 15 and, at the opposite end, against the transverse element 19a of the connecting member or tie 19.

[0015] The pin 18 of the articulation between the lever 15 and the connection element or tie 19 is surrounded by an idle wheel 22 (Figures 2 *et seq.*) which can run or roll on the flat end surface of an internal projection 23 of the wall 2a of the support structure 2.

[0016] With reference to Figures 2 to 6, the slide member 17 has an outer transverse projection 24 for cooperating with the movable member 10 of the locking device 9 in the manner which will be described below.

[0017] A fixed stop pin 25 extends in the support structure 2, between the walls 2b and 2c, adjacent the channels 11 and 12. The stop pin 25 is intended to cooperate with the cam member 14 in the manner which will be described below.

[0018] The cam member 14 has a curved peripheral reaction profile 14a which, in the embodiment shown, has an angular amplitude of approximately 240°. This reaction profile extends between two recesses or notches of the cam member, indicated 14b and 14c, respectively. The second notch 14c has a substantially radial wall, indicated 14d, adjacent the reaction profile 14a.

[0019] The notch 14b of the cam member 14 can house the distal portion 4a of the hook-shaped member 4 (Figures 3 *et seq.*).

[0020] The recess or notch 14c of the cam member 14, on the other hand, can house the stop pin 25, as can be seen, for example, in Figures 4 and 5.

[0021] A torsion spring 26, associated with the cam member 14, is arranged around the pin 13 and tends to keep the cam member 14 in the rest angular position shown in Figure 2.

[0022] Figure 2 shows the door-lock 1 in the rest condition. In this condition, the cam member 14 is adjacent the opening 3 and its reaction profile 14a bears against the stop pin 25. Moreover, the notch 14b of the cam member has its radially outermost portion facing the opening 3 so that the notch can receive the end portion 4a of the hook-like member 4. The lever 15 and the slide member 17 are arranged in an almost fully opened-out relative position.

[0023] The spring 21 helps to hold the cam member 14 against the stop pin 25.

[0024] When the door 5 of the domestic appliance is closed, the end portion 4a of its hook 4 penetrates the opening 3 of the door-lock and enters the notch 14b of the cam member 14. Further insertion of the hook-like member 4 brings about rotation of the cam member 14 (clockwise as seen in Figure 2) as indicated by the curved arrow of Figure 3. The rotation of the cam member 14 continues as far as the position shown in Figure 3, in which the reaction profile 14a of the member 14 is released from the stop pin 25. At this point, the thrust

exerted by the spring 21 on the slide member 17 is such that the pin 13 moves along the channels 11 and 12, away from the opening 3, so as to bring the cam member 14 into abutment with the pin 25 which is engaged in the notch 14c of the cam member (Figure 4). The door is closed, but not yet properly locked.

[0025] It is pointed out that when the hook member 4 reaches the position shown in Figure 3 during the closure movement of the door 5, the toggle mechanism 16 automatically triggers the above-described movement of the cam member 14, bringing about a type of automatic pull ("auto-pull") on the hook 4 and hence on the door 5.

[0026] When the door is closed (Figure 4), the stop pin 25 is engaged in the recess 14c of the cam member 14 and, in particular, is in abutment with the wall or side 14d of that recess.

[0027] In the closed but not yet locked condition (Figure 4), the door 5 of the domestic appliance can still optionally be opened either from outside or from inside the domestic appliance (child safety).

[0028] When the door is closed, if the locking device 9 is activated (for example, by setting the domestic appliance in operation) the movable member 10 of the device can be brought to the extended position shown in Figures 5 and 6 in which it projects beyond the wall 2a of the support structure 2 of the door-lock, so as to be arranged on the return path of the projection 24 of the slide member 17. In this condition, except for possibly taking up the distance indicated d in Figure 5, the slide member 17 is prevented from returning towards the position which it occupies at rest, and the release of the hook 4 from the cam member 14 is thus prevented.

[0029] The door can be reopened only when the locking device has been deactivated (for example, upon completion of the operation of the domestic appliance) and the locking member 10 is returned in known manner towards its retracted position in which it does not obstruct the translation of the slide member 17.

[0030] The door-lock described above and illustrated in Figures 1 - 6 has many merits and advantages.

[0031] In the first place, it can compensate for any play in the sealing gaskets (not shown) associated with the door 5. This compensation is possible by virtue of the "auto-pull" travel which is substantially equal to the difference between the distances indicated l_2 and l_1 in Figures 4 and 3, respectively. When the door 5 is closed, depending on the characteristics of the gaskets associated with the door, the cam member 14 does not necessarily reach the position shown in Figure 5 in which the stop pin 25 is housed in the base of the recess or notch 14c, but may stop in an intermediate position between those shown in Figures 5 and 6.

[0032] A further advantageous characteristic of the device lies in the fact that a small force is sufficient to close the door.

[0033] This is possible because the friction which is developed between the stop pin 25 and the reaction pro-

file 14a of the cam member 14 depends on the intensity of the force reacted, that is, on the force component which the spring 21 applies to the lever 15, this component being small when the door 5 is open and increasing in the course of the closure travel of the door, since it depends on the angle included between the lever 15 and the slide member 17.

[0034] A further advantage of the solution according to the invention lies in the fact that the intensity of the force necessary to open the door is substantially constant, that is, it varies very little in dependence on the opening travel. This characteristic is rendered possible by virtue of the toggle mechanism 16 and enables the force required to open the door from inside the domestic appliance to be kept at sufficiently low values, consistent with the values prescribed by the standards relating to so-called "child safety".

[0035] Figures 7 to 10 show a variant of the door-lock according to the invention.

[0036] In these drawings, parts and elements identical or substantially equivalent to parts and elements already described with reference to Figures 1 to 6 have again been attributed the same reference numerals as were used above.

[0037] In the variant according to Figures 7 to 10, the support structure 2 has a pair of twin arcuate walls which have their lower concave surfaces 125 facing towards the cam member 14. These walls are connected to the lower ends of the channels 11 and 12.

[0038] The cam member 14 has a follower pin 114a, preferably rotatable about its own axis (which is substantially parallel to that of the pin 13). The pin 114a cooperates with the arcuate surfaces 125 of the support structure 2. The cooperation between the pin 114a and the surfaces 125 is substantially equivalent, in its effects, to that between the arcuate profile 14a of the cam member 14 and the member 25 of the lock described above with reference to Figures 1-6.

[0039] In the variant according to Figures 7-10, the toggle mechanism 16 is considerably simplified in comparison with that of Figures 1-6. The lever 15 and the tie 19 are in fact eliminated and the cam member 14 bears with its convex arcuate surface 14d directly on a roller 22 mounted for rotating about a pin carried by an end of the slide member 17.

[0040] A tension spring 119, that is, a helical spring in the embodiment shown, is stretched between a pin 14e of the cam member 14 and a pin carried by the other end of the slide member 17. At rest (Figure 8), the pins between which the spring 119 is stretched are substantially coplanar with the pin 13 of the cam member. When the hook 4 is inserted in the opening 3, the cam member 14 initially rotates as a result of the interaction between its pin 114a and the surfaces 125. The pin 13 of the cam member is brought clearly above the plane defined by the pins which stretch the spring 119 (Figure 9).

[0041] As the movement continues towards the working position (Figure 10), the pin 114a engages the chan-

nels 11 and 12 and translates upwards, guided thereby. The pin 13 of the cam member 14 remains above the plane of the pins between which the spring 119 is stretched.

[0042] As the cam member 14 moves from the position of Figure 8 to that of Figure 10, it remains in contact with the roller 22 because of the pull exerted by the spring 119.

[0043] This spring enables the torsion spring 26 of the device of Figures 1-6 to be omitted.

[0044] The functional characteristics of the device according to Figures 7-10 remain the same as those of the device of Figures 1-6 but its structure is greatly simplified.

[0045] 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. The device (1) particularly for domestic appliances comprising:

a support structure (2) in which an opening (3) is defined for the insertion, in a predetermined direction, of a hook-like member (4) connected to a door (5), and

a cam member (14) which is provided with at least a first recess or notch (14b),

and which is mounted so as to be rotatable in the structure (2) about a pin (13) translatable in guided manner along an axis substantially parallel to the direction of insertion of the hook (4) in the opening (3),

the support structure (2) and the cam member (14) being provided, respectively, with a first element (25; 125) and with a second element (14a; 114a), cooperating with one another in a manner such that the cam member (14) is capable of:

adopting a rest position in which it is adjacent the opening (3) and its element (14a; 114a) bears against the corresponding element (25; 125) of the support structure (2), and in which its first notch (14b) faces towards the opening (3) and can house an end portion (4a) of the hook-like member (4) when the hook-like member (4) is inserted in the opening (3), and

performing, as a result of a further insertion of the hook-like member (4) into the structure (2), a reversible rotational/translational movement towards a working position in which it is adjacent the element (25; 125) of the support structure (2) and in which the hook-like member (4) is held in the first notch (14b),

the door-lock (1) further comprising a toggle mechanism (16) which is mounted in the structure (2), is connected to the cam member (14), and is capable of adopting a first configuration and a second configuration in which it tends to keep the cam member (14) in the rest position and in the working position, respectively.

2. A door-lock according to Claim 1 in which the above-mentioned element of the cam member (14) is a curved peripheral reaction profile (14a) of the member (14) and the cooperating element of the support structure (2) is a stop member (25) of the structure (2).

3. A door-lock according to Claim 2 in which the cam member (14) has a second recess or notch (14c) and the curved reaction profile (14a) extends between the first and second recesses or notches (14b, 14c) of the cam member (14), the second recess or notch (14c) being suitable for engaging the stop member (25) of the support structure (2) when the cam member (14) adopts the working position.

4. A door-lock according to any one of the preceding claims in which the toggle mechanism (16) comprises:

a lever (15) with a first end pivotable on the pin (13) of the cam member (14),

a slide member (17) which is mounted for sliding in the support structure (2) along an axis arranged at an angle to the direction of insertion of the hook-like member (4), and which is articulated to the other or second end of the lever (15),

a connecting element or tie (19) having a first end articulated to the pin (13) and its other or second end mounted for sliding in the structure (2) along an axis substantially parallel to the axis of translation of the slide member (17), and

resilient means interposed between the slide member (17) and the second end of the connecting element or tie (19) and tending to urge the slide member (17) and the second end of

the connecting element or tie (19) in opposite directions.

5. A door-lock according to Claim 4 in which the second end of the connecting element or tie (19) is mounted for sliding in a guide element (20) of the slide member (17).

6. A door-lock according to Claim 5 in which the resilient means comprise a helical spring (21).

7. A door-lock according to Claim 1 in which the said element of the cam member (14) is a follower appendage (114a) of the member and the cooperating element of the support structure (2) is an arcuate surface (125).

8. A door-lock according to Claim 7 in which the toggle mechanism (16) comprises:

a slide member (17) mounted for sliding in the support structure (2) along an axis arranged at an angle to the direction of insertion of the hook-like member (4),

a roller (22) carried by the slide member (17) and rotatable about an axis (18) substantially parallel to the axis of rotation of the cam member (14), and

a resilient element (119) having one end connected to the slide member (17) and the other end connected eccentrically to the cam member (14) in a manner such that a convex arcuate surface of the cam member (14) is kept in contact with the roller (22).

9. A door-lock according to Claim 8 in which the resilient element (119) is a tension spring.

10. A door-lock according to any one of the preceding claims, further comprising a locking device (9) including a movable locking member (10) which can adopt a retracted, rest position and an extended, working position in which it can interfere with the toggle mechanism (16) to keep the cam member (14) in the working position.

11. A door-lock according to Claim 2 or Claim 8 and according to Claim 10 in which the movable member (10) of the locking device (9) is arranged, in its extended position, to obstruct the return of the slide member (17) to the rest position.

12. A door-lock according to any one of the preceding claims in which the toggle mechanism (16) is arranged automatically to bring about a movement of the cam member (14) towards the working position

as soon as the cam member (14) passes beyond a predetermined angular position during the closure of the door (5).

5

10

15

20

25

30

35

40

45

50

55

FIG. 1

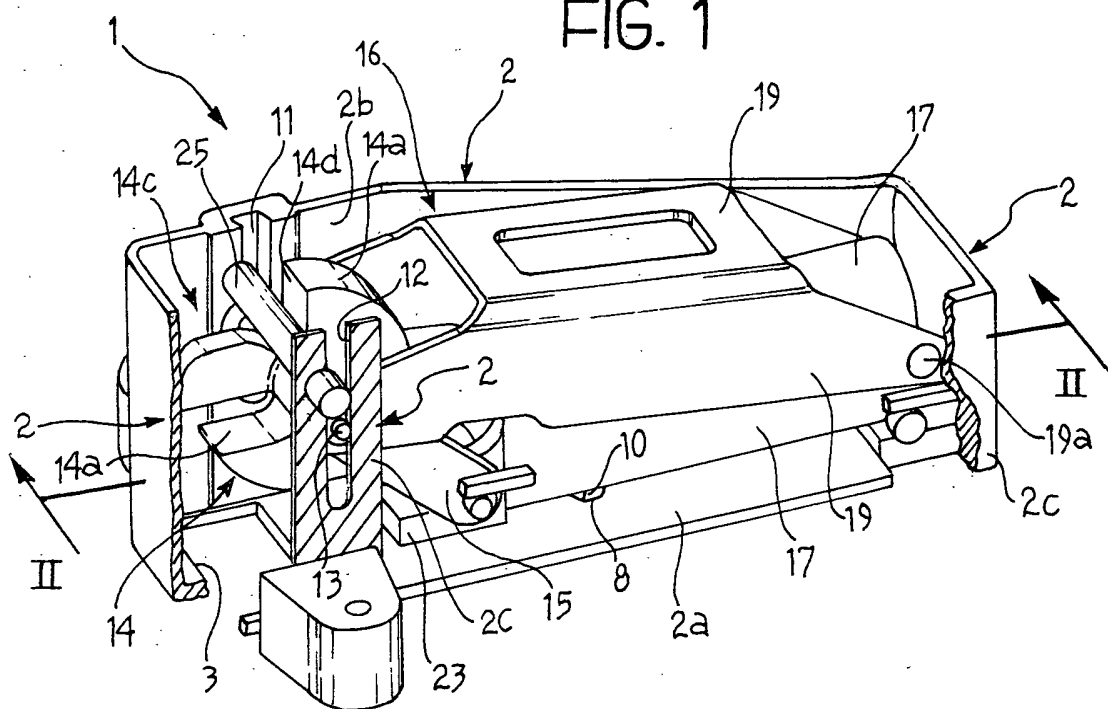


FIG. 2

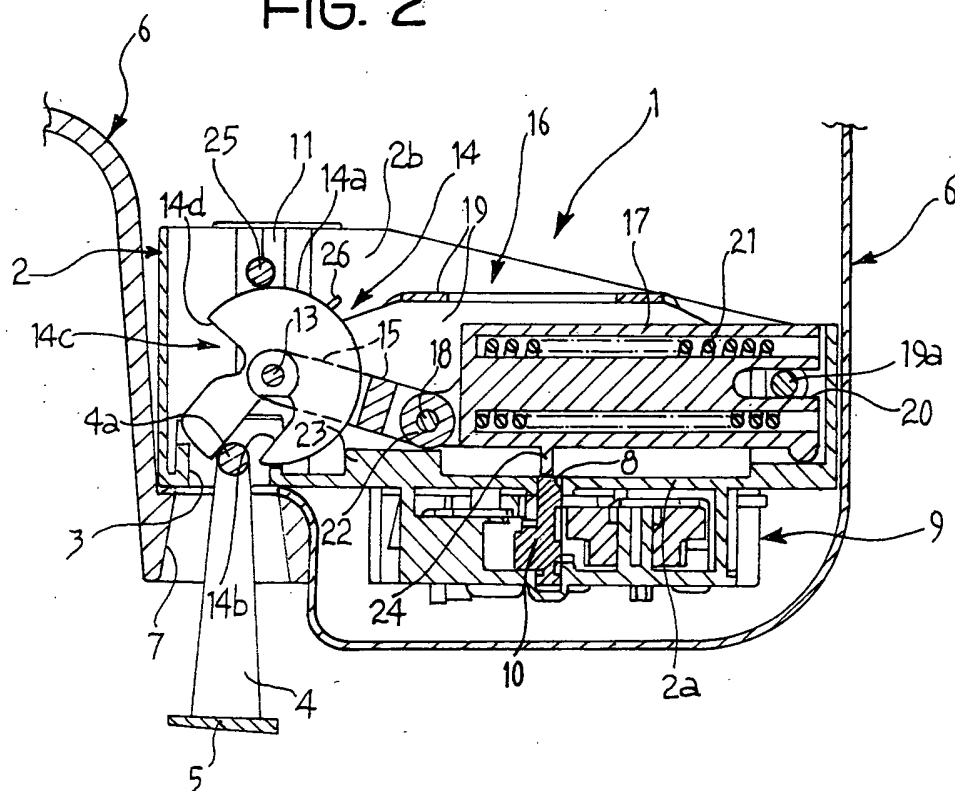


FIG. 3

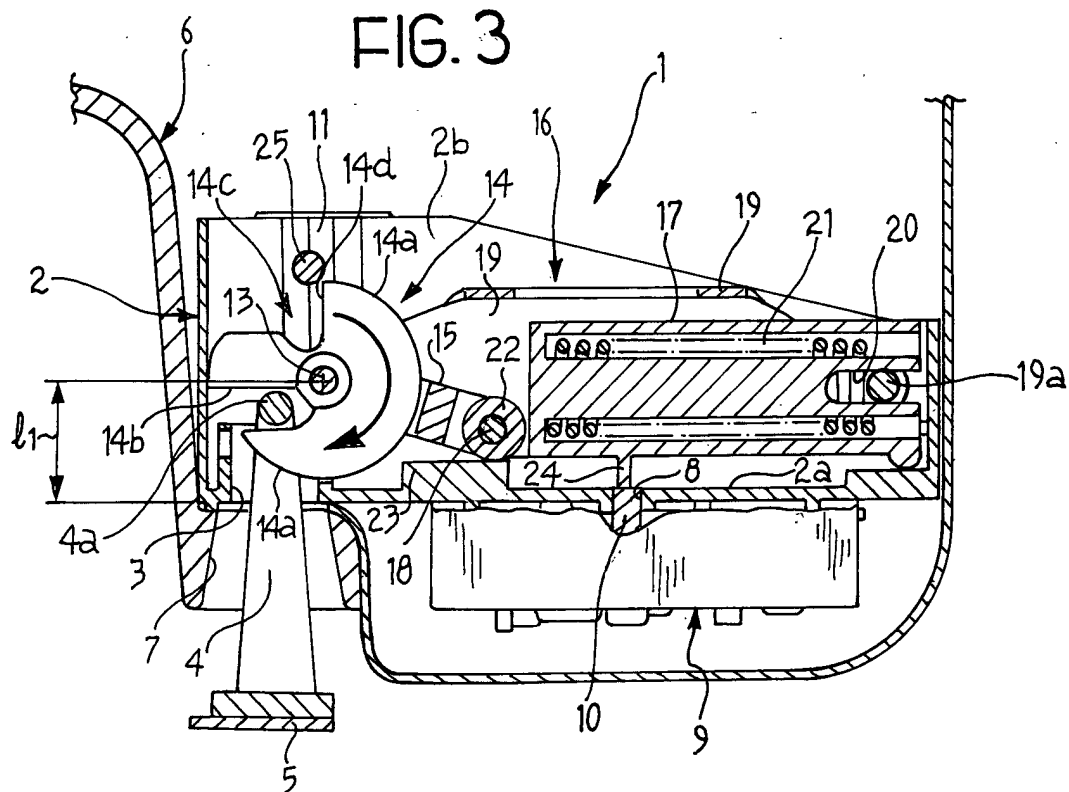


FIG. 4

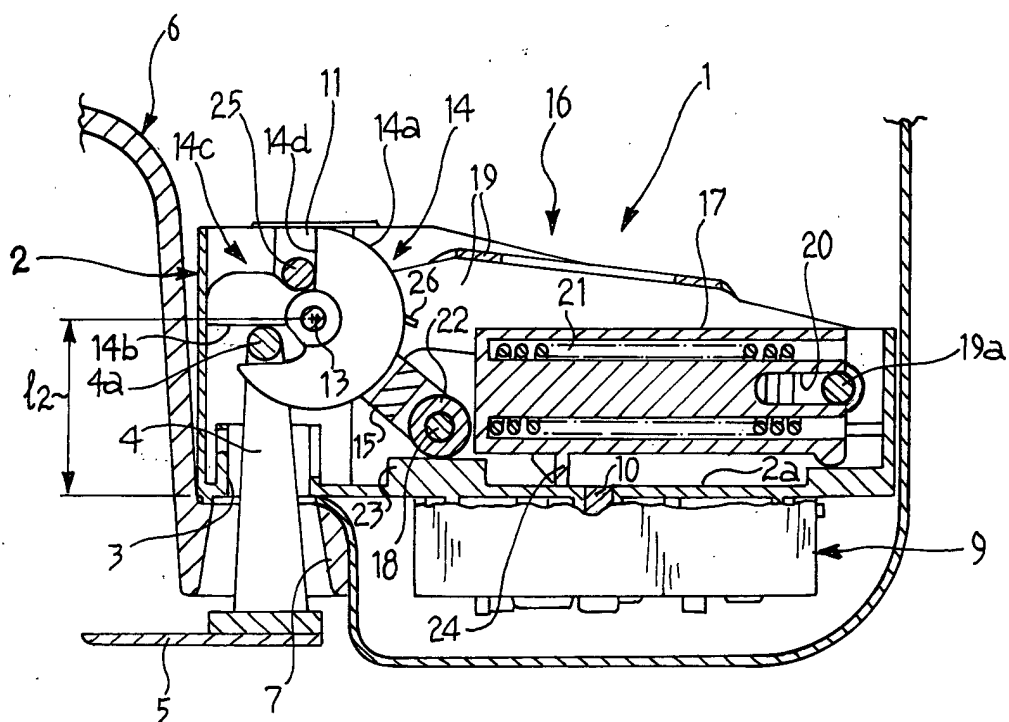


FIG 5

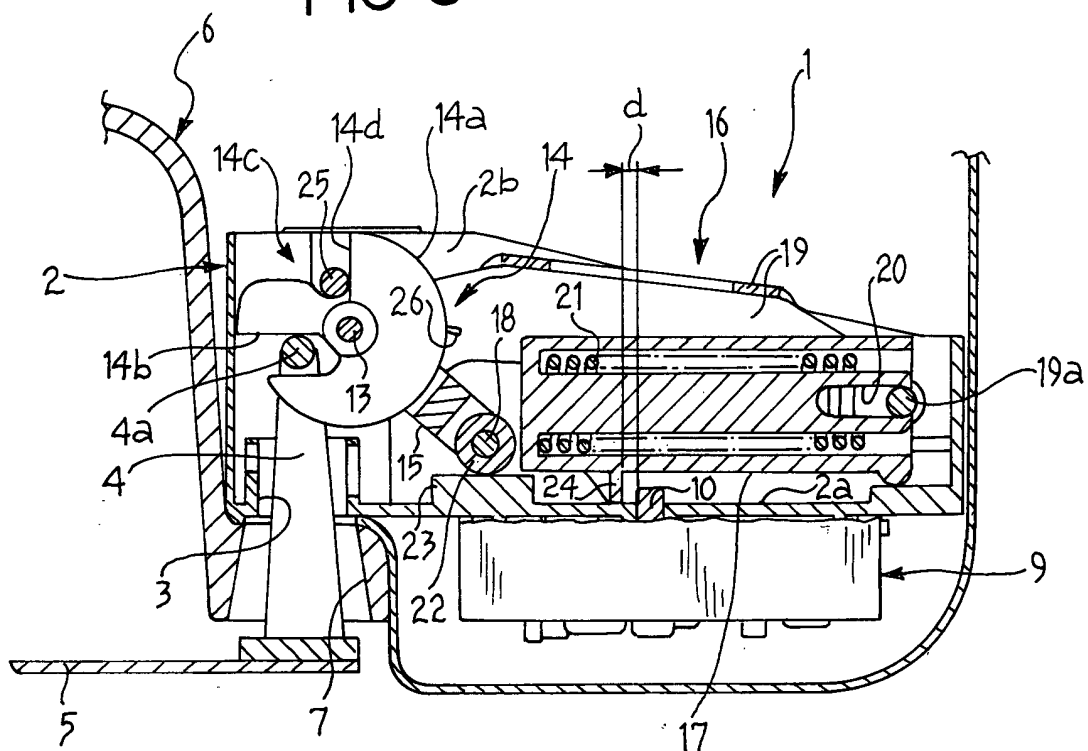


FIG. 6

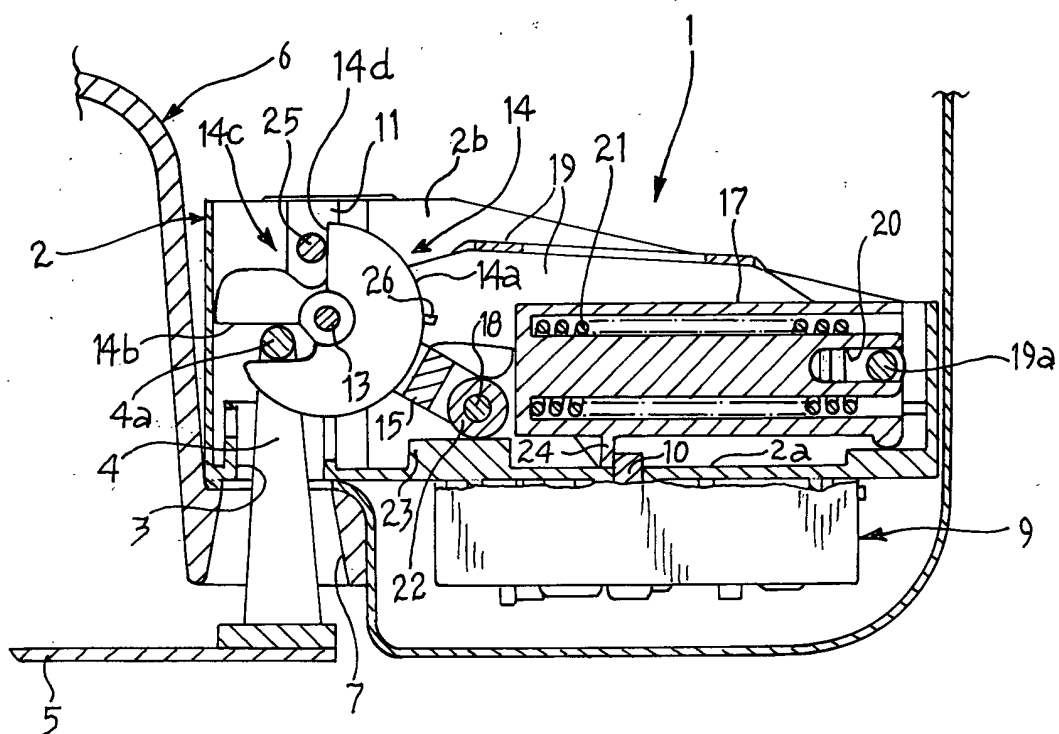


FIG. 7

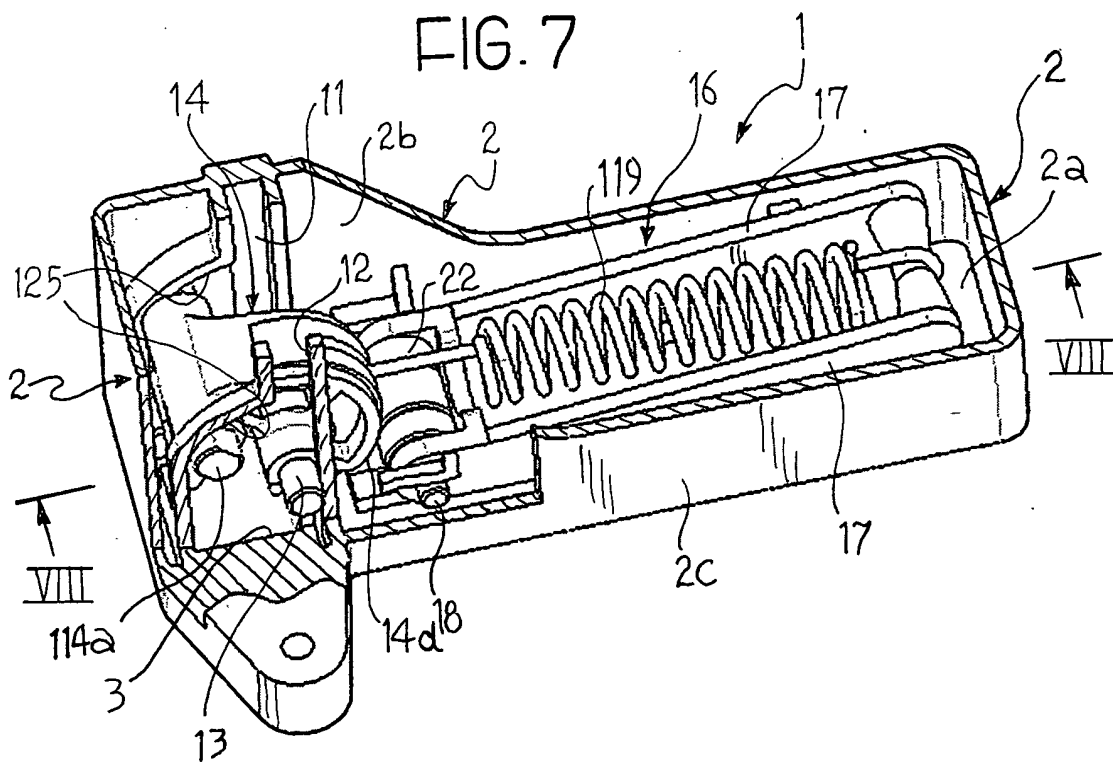


FIG. 8

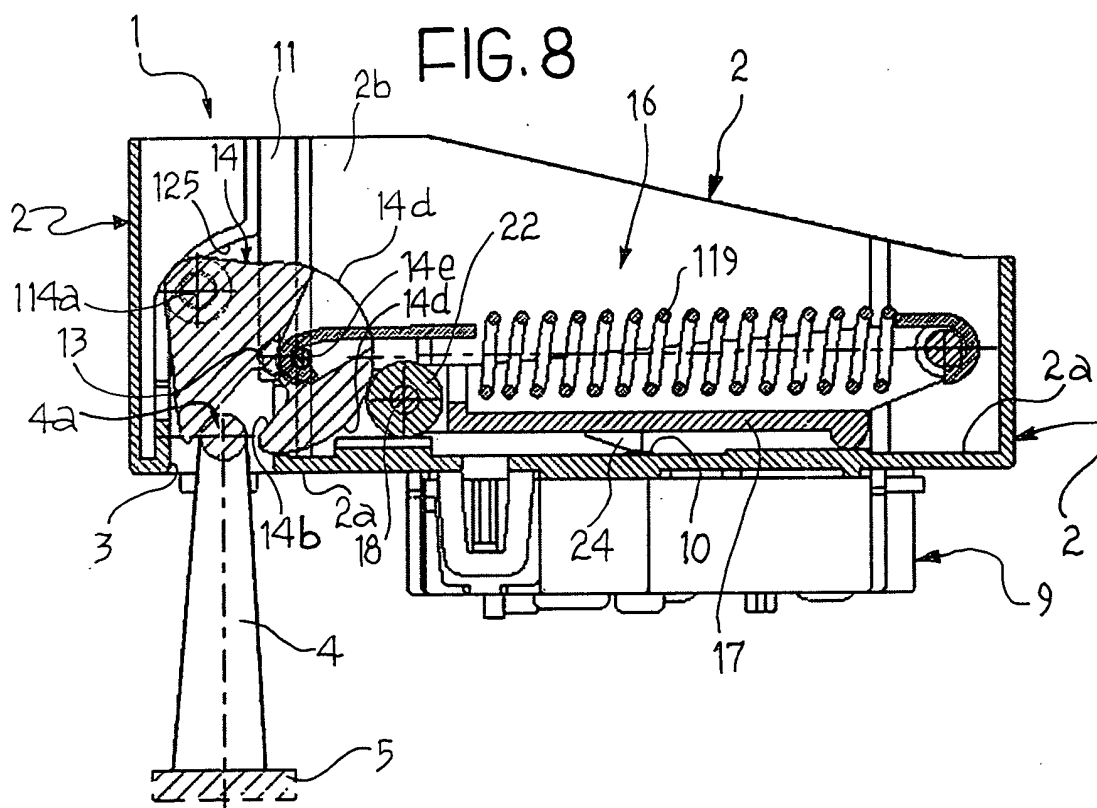


FIG 9

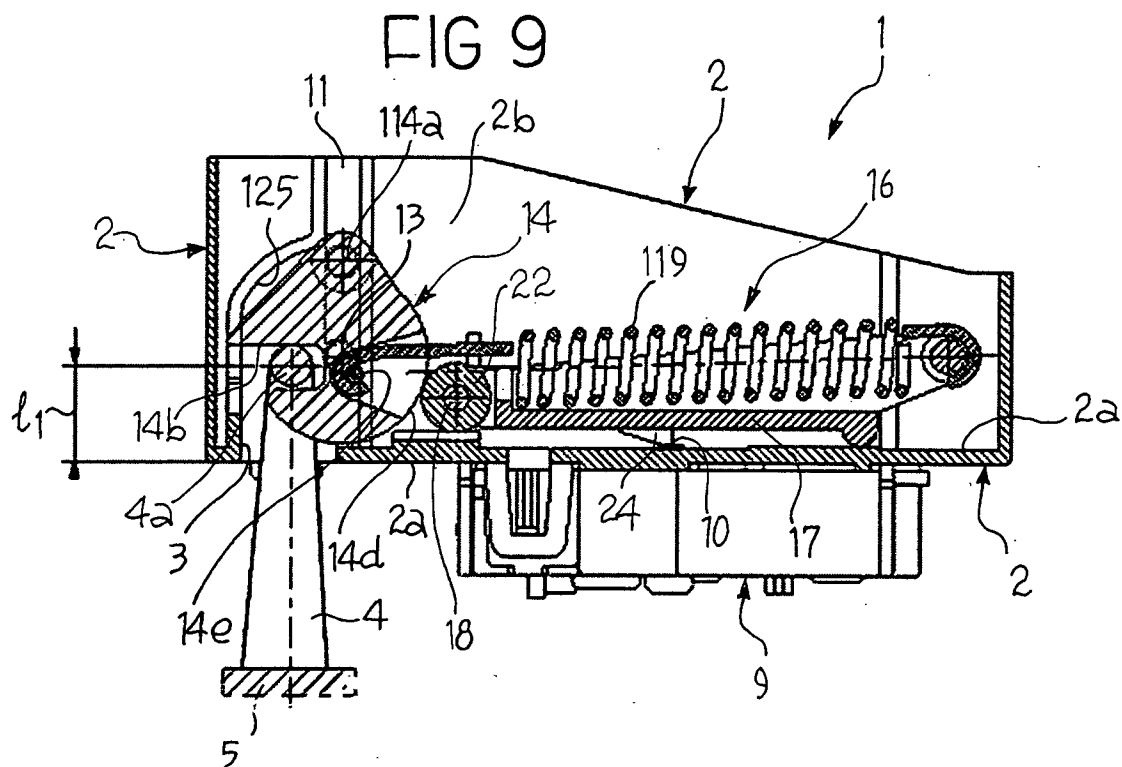


FIG. 10

