(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 544 387 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.06.2005 Bulletin 2005/25

(21) Application number: **04106630.9**

(22) Date of filing: **16.12.2004**

(51) Int Cl.[7]: **E05B 47/00**, E05B 63/24, E05B 17/22, E05C 19/10, D06F 37/42

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

(30) Priority: **18.12.2003 IT TO20031021**

(71) Applicant: **BITRON S.p.A.**
10122 Torino (IT)

(72) Inventors:
- **Promutico, Fabrizio**
  03010 Alatri (Frosinone) (IT)
- **Saccocci, Andrea**
  03020 Castro dei Volsci (Frosinone) (IT)

(74) Representative: **Quinterno, Giuseppe et al**
Jacobacci & Partners S.p.A.
Corso Emilia, 8
10152 Torino (IT)

(54) A door lock device of increased safety, particularly for domestic electrical appliances

(57) A door locking device comprising:

a support structure (2) with an aperture (3) into which a hook member (4) connected to this door (P) is introduced when the door (P) is closed,

a retainer slide (7) movable between a working position in which it is able to obstruct the aperture (3) partially and retain the hook member (4), and a rest position in which it is able to allow disengagement of the hook member (4); and

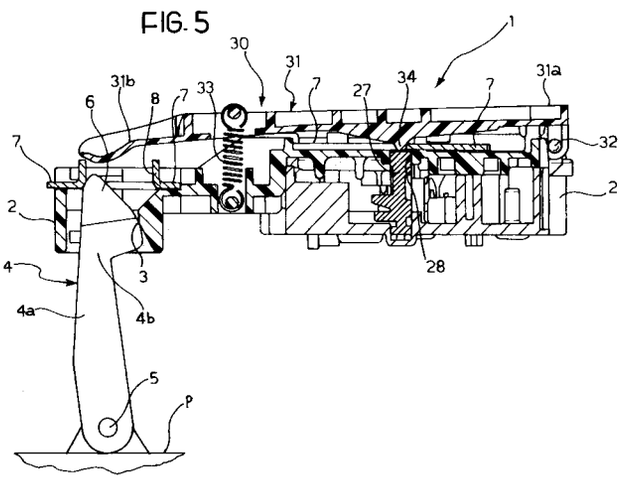
an electro-mechanical control device (27) including a movable lock member (27) displaceable from an inactive to a locking position, in which it is able respectively to allow and prevent the passage of the retainer slide (7) from the working position to the rest position. The device further includes a safety mechanism (30) including a feeler member (31b) sensitive to the position of the hook member (4) when the door (P) is closed and

an intervention member (34) associated with the feeler member (31b) and operable, when the hook member (4) is disengaged from the feeler member (31b) whilst the lock member (27) is in the locking position, to interact

with the lock member (27) causing it to return to the release position, and

with the retainer slide (7) locking it in the said working position.

FIG. 5



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Description

[0001] The present invention relates to a door lock, particularly for domestic electrical appliances such as, for example, washing machines or the like.

[0002] More specifically, the particular object of the invention is a device for locking a door or the like, particularly for a domestic electrical appliance, of the type comprising:

- a support structure in which is defined an aperture into which, when the door is closed, it introduced a hook member connected to this door;
- a retainer slide, movable with respect to this structure between a working position in which it is able partially to obstruct the said aperture and to retain the hook member introduced into this aperture, and a rest position in which it is able to allow disengagement of the said hook member from the aperture in the door; and
- an electro-mechanical control device including a movable lock member displaceable, upon activation of the apparatus, from an inactive or release position to locking position in which it is able respectively to allow and to prevent the passage of the retainer slide from the working position to the rest position; an electric switch being associated with the said lock member, capable of changing condition or state when this lock member passes from the release position to the locking position and vice versa.

[0003] Door lock devices of this type are well known. Such a device is described for example in Italian Patent Application TO2000A000658 in the name of the same applicant.

[0004] Door lock devices of this type made until now have in general a very reliable and safe operation.

[0005] One possible disadvantage of such devices, however, lies in the fact that if, during operation of the domestic electrical appliance, the closure door or hatch is subject to an opening force greater than a predetermined value (typically a value envisaged by the homologation rules for door lock devices) or if breakage of the hook member connected to the door takes place, this latter can open, whilst the domestic electrical appliance remains in operation, with the readily imaginable potential risks.

[0006] One object of the present invention is therefore to provide a door lock device of increased safety which makes it possible to overcome the above-indicated disadvantage of prior art devices.

[0007] This and other objects are achieved according to the invention with a door lock device of the type specified above, characterised in that it further includes a safety mechanism including:

- a feeler member, sensitive, when the door is closed, to the position of the hook member of the said door; and
- an intervention member associated with the said feeler member and operable, when the hook member is disengaged from the said feeler member whilst the said lock member is in the locked position, to interact
- with the said lock member by causing the return thereof of the release position; and
- with the retainer slide, locking it in its said working position.

[0008] Further characteristics and advantages of the invention will become apparent from the following detailed description, given purely by way of non-limitative example, with reference to the attached drawings, in which:

- Figure 1 is a perspective view of the door lock device according to the present invention;
- Figure 2 is a partially exploded perspective view of the door lock device according to Figure 1;
- Figure 3 is a sectioned view essentially along the line III-III of Figure 1, showing this door lock device in a rest condition; and
- Figures 4 and 5 are views similar to that shown in Figure 3, and show the door lock device in an operative working condition and in an operative emergency condition.

[0009] In the drawings, a door lock device according to the invention is generally indicated 1.

[0010] In the exemplary embodiment illustrated this device comprises a body 2 of moulded plastics material at one end of which is formed an aperture 3 (see in particular Figures from 3 to 5).

[0011] The aperture 3 is able to allow introduction of a hook member, such as that indicated 4 in Figures 4 and 5.

[0012] In a manner known per se, the door lock device 1 can be fixed close to an opening of a domestic electric appliance, and the hook member 4 is intended to be connected, for example in an articulated manner, to the movable door P associated with this aperture of the domestic electrical appliance.

[0013] In the embodiment illustrated the hook member 4 comprises a leg 4a having an end articulated at 5 to the door P and another end which, after a narrowed section or neck 4b, forms an enlarged head indicated 6.

[0014] The reference numeral 7 indicates a shaped slide, axially translatable with respect to the support body 2 along a direction approximately orthogonal to the direction of introduction of the hook member 4 into the apparatus 3.

[0015] The slide 7 has a main aperture 8 which in the various operative conditions or positions of the slide are at least partially facing and aligned with the aperture 3 of the support structure 2.

[0016] A coil spring 10 (Figures 2 and 3) is interposed

between the slide 7 and the support structure 2 and tends to maintain the slide 7 in the rest position shown in Figure 3 in which the aperture 8 of this slide is aligned with the aperture 3 of the body 2. When the slide 7 is in this position the hook member 4 of the door P can be introduced through the aperture 3 in such a way that its terminal head 6 projects beyond this aperture 3 and engages in the aperture 8 formed in the slide 7 as shown in Figure 4.

[0017] Within the support body or casing 2 is contained an electro-mechanical control device of type known per se. This device is, for example, of the type illustrated in detail and described in the earlier Italian Patent Application mentioned above. This electro-mechanical control device will therefore not be further described in all its detail, but rather solely in relation to the aspects relevant to the purpose of understanding of the present invention.

[0018] The electro-mechanical control device contained in the support casing 2 includes a movable lock member, indicated 27 in Figures from 3 to 5. This member is mounted so as to be axially translatable, in a vertical direction as seen in Figures from 3 to 5, through an aperture 28 formed in the wall of the support casing 2 (Figures 4 and 5).

[0019] The movable lock member 27 is displaceable, following activation of the apparatus with which the door lock device 1 is associated, from an inactive or release position shown in Figure 3, to a locked position shown in broken outline in Figure 4, in which it is able respectively to allow and to prevent passage of the retainer slide 7 from the working position to the rest position.

[0020] The lock member 27 is associated, in a manner known per se and not illustrated, with an electric switch capable of changing condition or state when this lock member 27 passes from the release position to the locked position, and vice versa. One way of associating an electric switch with the lock member is described in detail in the above-mentioned Italian Patent Application. The electric switch associated with the lock member 27 in particular makes it possible to signal to the control unit of the domestic electric appliance, that the door P is closed and locked.

[0021] In relation to what has been described so far, the door lock device according to the invention corresponds substantially to the prior art devices, and functions essentially in the following way.

[0022] When the door P of the domestic electrical appliance is open, the door lock device 1 assumes the rest configuration shown in Figure 3. In this condition the electro-mechanical control device contained in the support casing 2 has no current flowing through it. The lock member 27 is maintained in a retracted position shown in Figure 3, in which it does not project out of the support casing 2. The spring 10 maintains the slide 7 in the rest position, in which its aperture 8 faces the aperture 3 of the body 2.

[0023] If the user closes the door P of the domestic electric appliance the hook member 4 associated with this door passes through the aperture 3 of the body 2 and engages in the aperture 8 of the slide 7 as shown in Figure 4. The slide 7 is correspondingly translated towards the retention position as shown in Figure 4, against the action of the spring 10 which is compressed.

[0024] If the domestic electrical appliance is now activated an electric current flows in the electro-mechanical control device contained in the support casing 2. In a manner known per se, after a certain predetermined time period, this current causes the movable locking member 27 to move into the extended position in which it is able to interfere with a portion or wing 7a of the slide 7 (see also Figure 2) preventing return of this latter towards the rest position shown in Figure 3. In this condition the door P is effectively closed and locked, that is to say it cannot be opened. This condition is detectable by the control unit of the domestic electrical appliance in that the switch associated with the movable lock member 27 has changed its condition or state.

[0025] The door P can subsequently be reopened only if the current flowing in the electro-mechanical control device housed in the support member casing 2 is interrupted, for example, at the end of an operating cycle of the domestic electrical appliance, or following interruption of the electrical energy supply to this appliance.

[0026] When this happens, after a certain time, the movable lock member 27 is returned to the retracted position in which it does not obstruct the return of the slide 7 towards the rest position of Figure 3. The door of the domestic electrical appliance can now again be opened.

[0027] The door lock device 1 further includes a security mechanism generally indicated 30. This mechanism comprises a lever generally indicated 31, having one end 31a articulated to the support structure 2 about an axis defined by two aligned pegs or pins 32 (Figure 2 et seq).

[0028] The opposite end 31b of the lever 31 faces the aperture 8 of the slide 7 on the opposite side of the aperture 3 of the casing 2 from the said slide.

[0029] A coil spring indicated 33, has one end anchored to the lever 31, at an intermediate point between its ends 31a and 31b, and the other end anchored to the support structure or casing 2. The spring 33 tends to bias the lever 31 towards the support casing 2 of the door lock device.

[0030] In an intermediate position between the anchorage of the spring 33 and the end 31a the side lever 31 facing the support casing 2 has a projecting appendix indicated 34 in Figures from 3 to 5. This appendix is located substantially facing the movable lock member 27.

[0031] When the door lock device is in the rest position (Figure 3) the slide 7 lies between the movable lock member 27, which is in the retracted condition, and the projecting appendix 34 of the lever 31. The lever 31 rests on the slide 7 in correspondence with the said projecting appendix 34, under the force exerted by the spring 33.

[0032] When the door P of the domestic electric ap-

pliance is closed, the head 6 of the hook member 4 engages through and beyond the aperture 8 of the slide 7 as is shown in Figure 4, going on to engage the end 31b of the lever 31 and causing this lever to turn about the pins 32 in a clockwise sense as seen in Figure 3. The projecting appendix 34 of the lever 31 is now lifted from the slide 7.

[0033] The end 31b of the lever 31 acts, when the door is closed, as a feeler member 4 sensitive to the position of the hook member 4 of the door P.

[0034] The lever 31 remains in the position illustrated in Figure 4 even when, after the operation of the domestic electrical appliance has started, the lock member 27 moves into the extended position in which it prevents return of the retainer slide 7 to the rest condition of Figure 3. In this condition the slide 7 partially obstructs the opening of the aperture 3 in the casing 2, the aperture 8 of this slide being in part transversely offset with respect to the aperture 3.

[0035] If, whilst the domestic electric appliance is in operation a stress of exceptional magnitude is applied to the door P, this may cause breakage of the hook member 4 or may force disengagement of this hook member from the slide 8. The lever 31 of the safety mechanism 30, under the action of the spring 33, immediately turns in an anticlockwise sense as seen in Figure 4, bringing it into the position shown in Figure 5. In this condition the projecting appendix 34 of the lever 31 forces the movable lock member 27 into the retracted position, but at the same time prevents return of the slide 7 towards the rest position.

[0036] Consequently, by the effect of the rotation of the lever 31 of the safety mechanism, the switch associated with the movable lock member 27, which again changes condition or state, signals to the control unit of the machine that the door is no longer closed and locked, but rather is open. Moreover, the slide 7, which is held in the retention position in which it partially obstructs the aperture 3, prevents possible reintroduction of the head 6 of the hook member 4 of the door P.

[0037] To reinstate the door lock device to the rest condition of Figure 3, it will be necessary now to act on the security lever 31 causing it to be pulled away from the support casing 2 so as to disengage the slide 7 from the projecting appendix 34 of the safety lever.

[0038] Naturally, the principle of the invention remaining the same, the embodiments and details of construction can be widely varied with respect to what has been described and illustrated purely by way of non-limitative example, without by this departing from the ambit of the invention as defined in the annexed claims.

Claims

1. A locking device for a door (P) or the like, particularly for a domestic electrical appliance, comprising:

a support structure (2) in which is defined an aperture (3) into which a hook member (4) connected to this door (P) is introduced when the door (P) is closed;

a retainer slide (7) movable with respect to the said structure (2) between a working position in which it is able to partially obstruct the said aperture (3) and retain the hook member (4) introduced into the said aperture (3), and a rest position in which it is able to allow disengagement of the said hook member (4) in order to allow the door (P) to open; and

an electro-mechanical control device (27) including a movable lock member (27) displaceable, upon activation of the apparatus, from an inactive or release position to a locking position in which it is able respectively to allow and prevent the movement of the retainer slide (7) from the working position to the rest position; the said lock member (27) being associated with an electric switch capable of switching condition or state when this lock member (27) passes from the release position to the locking position and vice versa;

the door lock device being **characterised in that** it further includes a safety mechanism (30) including;

a feeler member (31b) for sensing the position of the hook member (4) of the said door (P) when the door (P) is closed; and

an intervention member (34) associated with the said feeler member (31b) and operable, when the hook member (4) is disengaged from the said feeler member (31b) whist the lock member (27) is in the locking position, to interact

with the said lock member (27) causing return thereof to the release position, and

with the retainer slide (7), locking it in the said working position.

2. A device according to Claim 1, in which the said safety mechanism (30) comprises:

a lever (31) pivoted to the said support structure (2) in a rotatable manner on the side thereof opposite that from which the hook member (4) of the door (P) is introduced through the said aperture (3); and

elastic means (33) tending to bias the said lever (31) towards the support structure (2);

the lever (31) having one end (31b) acting as a feeler member and capable of being maintained in contact with the hook member (4) of the door (P) when the door (P) is closed, by the effect of the action exerted by the said elastic means (33) on the lever (31);

the lever (31) further having a projecting appen-

dix (34) intermediate between the said end (31b) and the pivot axis (32) of the lever (31), the said projecting appendix (34) forming the said intervention member.

3. The device according to Claim 2, in which the said elastic means comprise a coil spring (33) anchored at one end to the said lever (31) and at the other end to the said support structure (2).

4. A device according to Claim 3, in which the said coil spring (33) is anchored to the lever (31) at a point intermediate between the said end (31b) of the lever (31) and the said projecting appendix (34).

FIG. 1

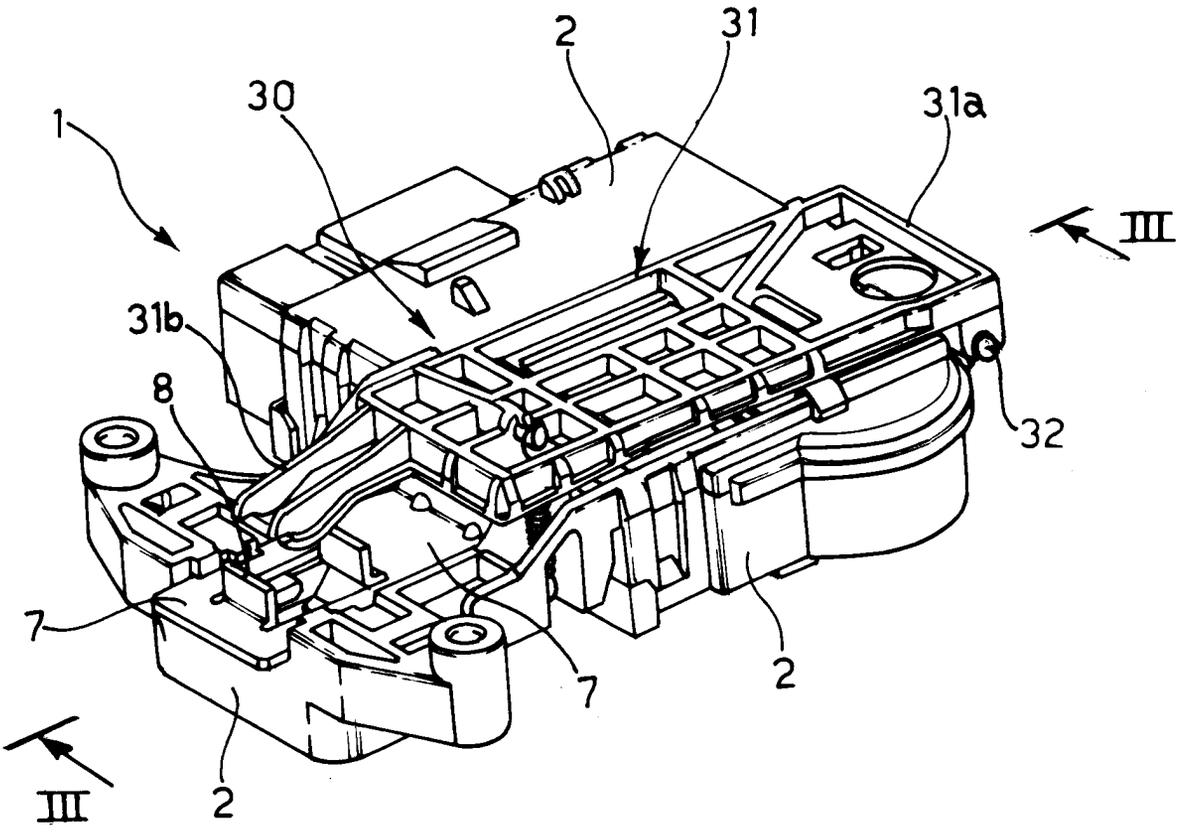

FIG. 2

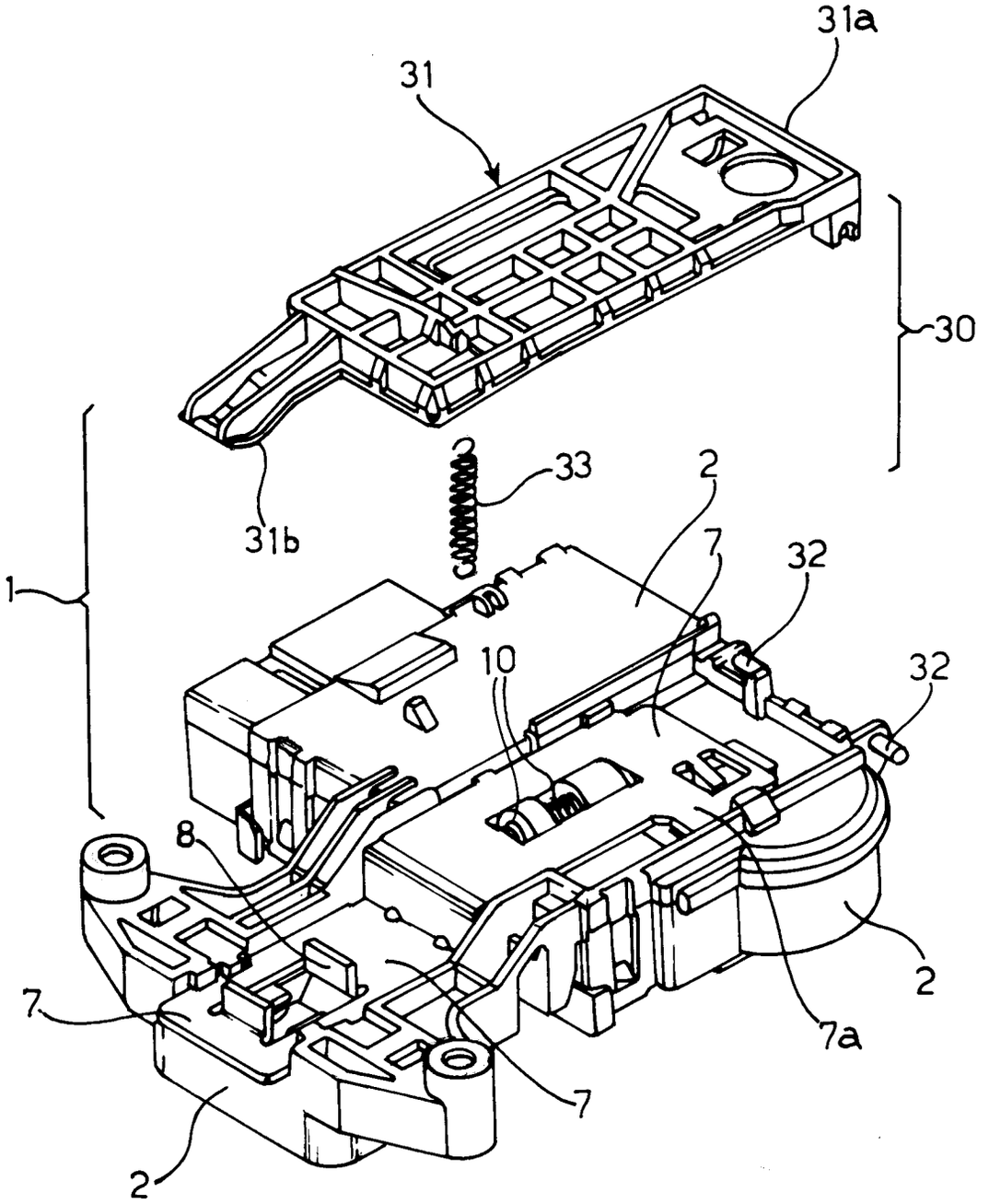

FIG. 3

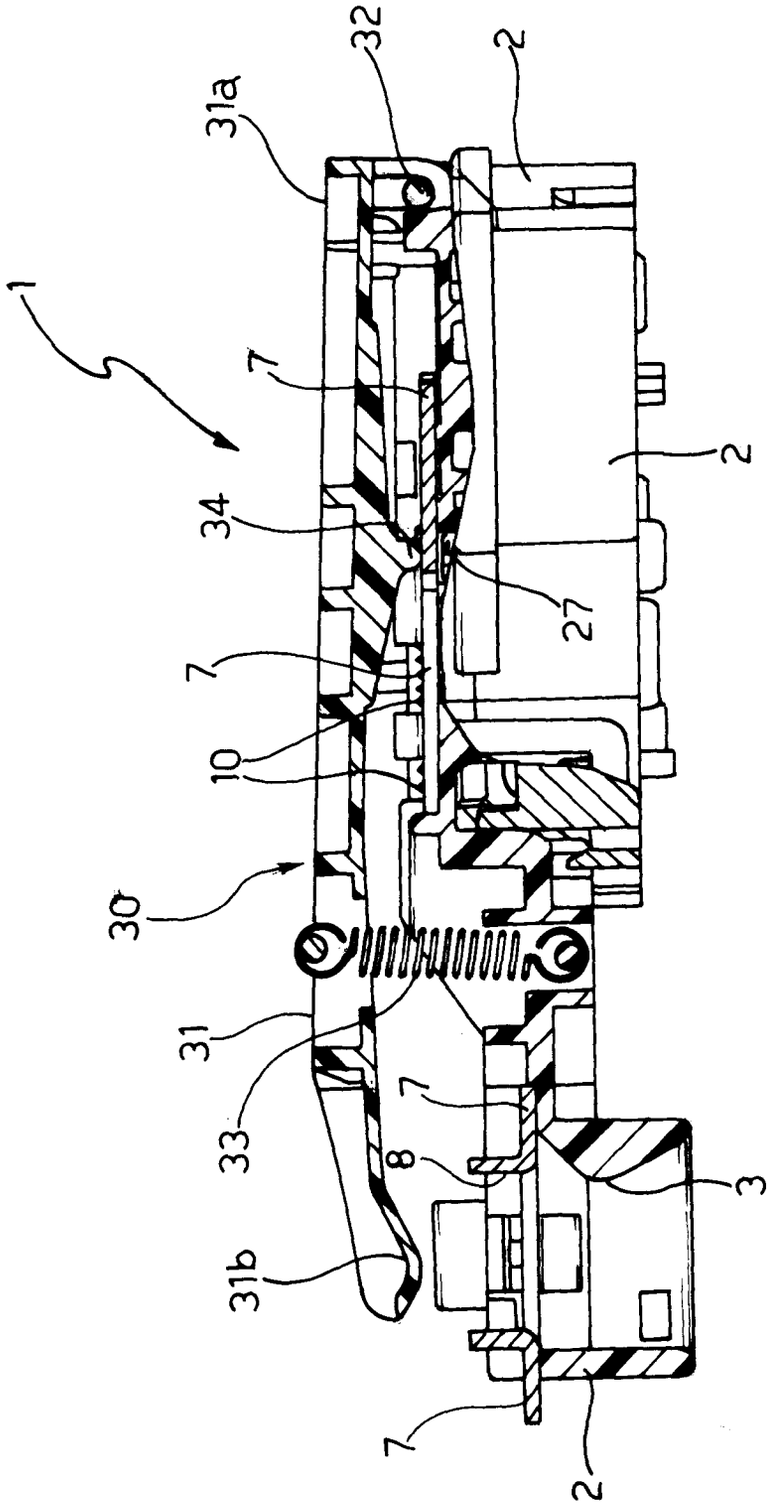

FIG. 4

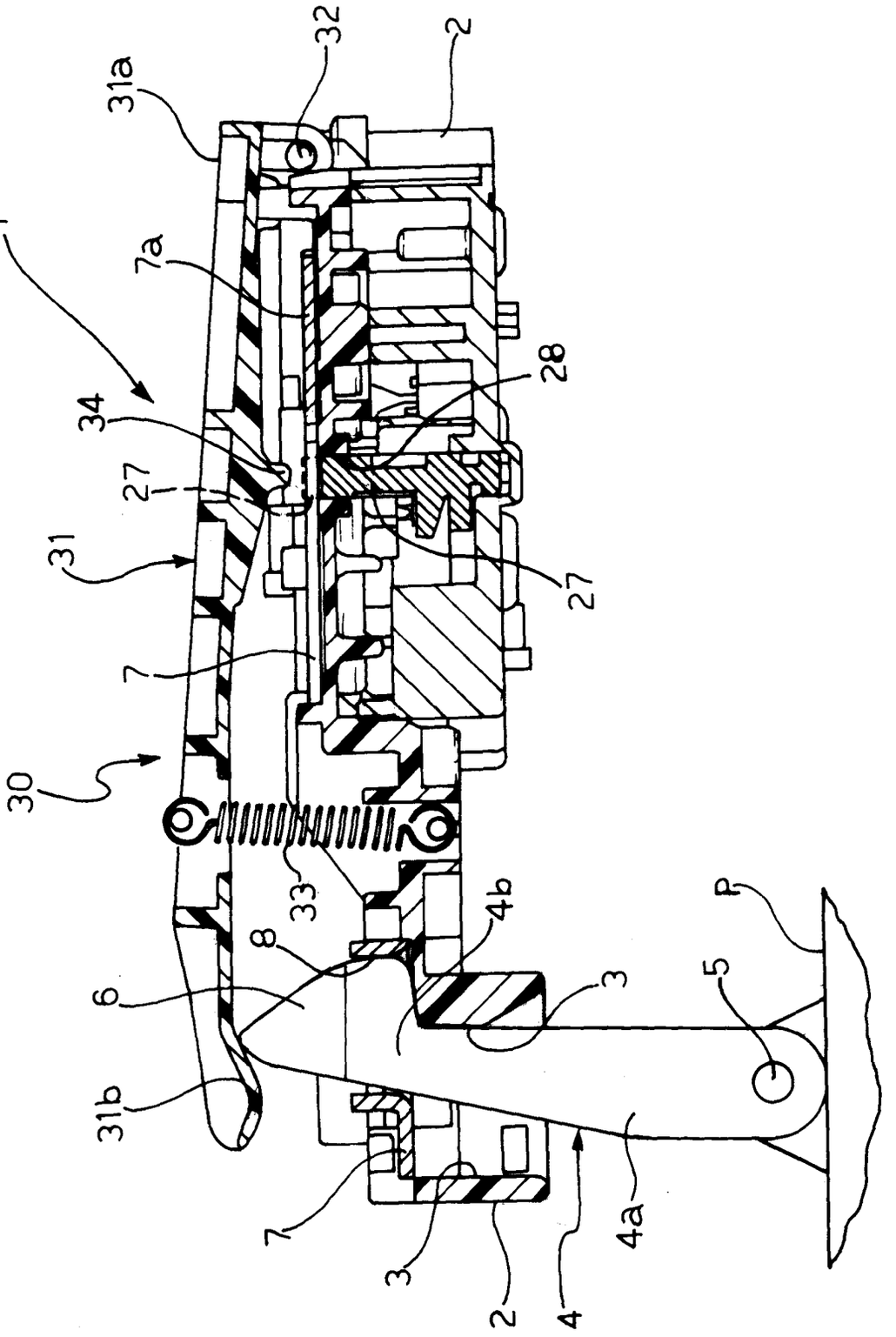

FIG. 5