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

(11) **EP 1 808 558 A2**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.07.2007 Bulletin 2007/29

(51) Int Cl.:
E05B 47/00 *(2006.01)* ***D06F 37/42*** *(2006.01)*
A47L 15/00 *(2006.01)*

(21) Application number: **07100555.7**

(22) Date of filing: **15.01.2007**

(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 LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **16.01.2006 IT TO20060026**

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(54) Electrical appliance with door provided with an electrically operated locking device

(57) The electrical appliance comprises
a chamber closed by a door (P),
a locking device (1) including an operating solenoid (26) connected in series with a PTC resistor (38) between two electrical connecting terminals (12a, 27a), which, as the result of a first energizing and at least one subsequent energizing of the solenoid (26), is capable of assuming, respectively, a locking condition in which it retains the door (P) in the position which closes the chamber, and an unlocking condition in which it allows the door (P) to be opened; and
a control unit (40) connected to these electrical terminals (12a, 37a) and capable of causing subsequent energizing of the said solenoid (26) by means of subsequent applications of voltage between the said terminals (12a, 37a).

The control unit (40) is designed to keep the energizing voltage (V) continuously applied to the said terminals (12a, 37a) after the first energizing or after each first energizing of the locking device (1) for a predetermined time (t_2-t_1) in such a way that the resistance (R) of the PTC resistor (38) reaches and is kept at a value such that the current (I) flowing through the solenoid (26) is reduced to a minimum value and thus preventing the energizing of the solenoid.

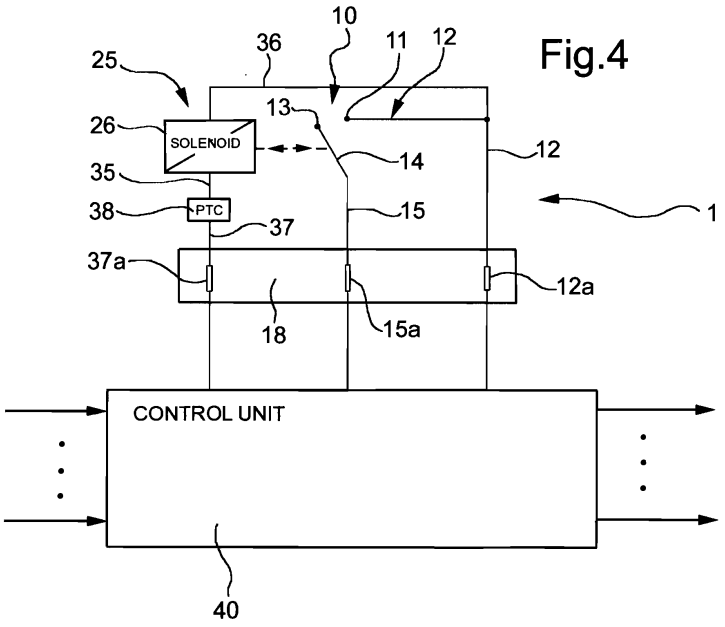

Fig.4

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Description

[0001] The present invention relates to an electrical appliance, such as a domestic electrical appliance, particularly a washing machine or a washer-dryer.

[0002] More specifically, the invention relates to an electrical appliance comprising:

a chamber closed by a door,
a locking device associated with the door, including an operating solenoid connected in series with a PTC resistor between two electrical terminals, which, as the result of a first energizing and at least one subsequent energizing of the solenoid, is capable of assuming, respectively, a locking condition in which it retains the door in the position which closes the chamber, and an unlocking condition in which it allows the said door to be opened; and
control means connected to the said electrical terminals and capable of causing subsequent energizing of the said solenoid by means of subsequent applications of voltage between the said terminals.

[0003] An example of an electrical appliance provided with a door locking device of the type defined above is described in US Patent 6 334 637 held by the present applicant.

[0004] One object of the present invention is to provide an electrical appliance of the type specified above, improved in particular in that it has greater immunity to electromagnetic interference and greater operating security.

[0005] This and other objects are achieved according to the invention with an electrical appliance of the type defined above, characterized in that the aforesaid control means are designed to keep the energizing voltage continuously applied to the said terminals for a predetermined period before the first energizing or each first energizing of the locking device, in such a way that the resistance of the PTC resistor reaches and remains at a value such that the current flowing through the solenoid is reduced to a minimum value, thus preventing the energizing of the solenoid.

[0006] Further characteristics and advantages of the invention will be made clear by the following detailed description, provided purely by way of example and without restrictive intent, with reference to the attached drawings, in which:

Figure 1 is a front view of a locking and unlocking device for an electrical appliance according to the invention,
Figure 2 is a side view of the device of Figure 1;
Figure 3 is a cross section, on an enlarged scale, taken along the line III-III of Figure 2,
Figure 4 is an electrical diagram, partially in block form, of part of an electrical appliance according to the present invention; and
Figure 5 is a set of diagrams which show in qualitative form, as a function of the time t shown on the axis, examples of the variation of some electrical magnitudes in the operation of an appliance according to the present invention.

[0007] In Figures 1 and 2, the number 1 indicates the whole of a locking and unlocking device for a door or hatch P for closing a chamber of an electrical appliance, such as a washing machine or a washer-dryer, or other domestic electrical appliance.

[0008] The locking device 1 comprises a supporting casing 2, made from electrically insulating material, designed to be fixed to the structure of the electrical appliance, in the proximity of the aperture for access to its aforesaid chamber, this aperture being associated with a door or hatch P (Figure 2) which is provided in a known way with a catch member A. In the embodiment shown by way of example, the supporting casing 2 is formed by two half-shells 3 and 4, joined together.

[0009] As shown in Figure 1, the casing 2 of the device 1 has an aperture 5 for the introduction of the catch member A carried by the door P.

[0010] A retaining member or slider 6, provided with a window-like aperture 7 through which the catch member A can pass, is mounted slidably in the supporting casing 2 of the device 1.

[0011] When the door P is open (Figure 2), the retaining member 6 is held (by an associated spring which is not shown) in a rest position (Figure 1) in which its window 7 faces the aperture 5 of the casing 2. In this condition, the catch member A of the door can be introduced into the aperture 5 and into the window 7 when the door is closed, and, conversely, can be disengaged from this window and from this aperture when the door is opened.

[0012] As shown in Figure 1, when the retaining member or slider 6 is in the rest position, it covers an aperture 8 formed in the upper half-shell 3 of the supporting casing 2, in which a locking member 9 extends in a translatable way.

[0013] In a known way, the arrangement is such that, when the door P is closed, the catch member A engages in the aperture or window 7 of the retaining member or slider 6, and causes the latter to be translated (towards the right according to Figure 1) in such a way as to uncover the aperture 8.

[0014] With reference to Figure 3, a switch indicated in a general way by 10 is positioned in the lower half-shell 4 of the casing 2. This switch comprises a fixed contact 11 carried by a shaped metallic element 12, one of whose ends 12a, in the form of a flat pin, extends, as a connecting terminal, into a recessed seat 18 of the supporting casing.

[0015] The switch 10 also comprises a moving contact 13 (not visible in Figure 3, but shown in Figure 4) carried by one end of a metallic strip 14, in a position facing the fixed contact 11. The other end of the strip 14 is fixed by being positioned above a shaped metallic member 15, and is stably secured with the latter to the supporting

casing, by means of a rivet 16 for example.

[0016] The end of the strip 14 which carries the moving contact 13 interacting with the fixed contact 11 extends under the latter.

[0017] A coil spring 17, shown in broken lines in Figure 3, is interposed between the base wall of the half-shell 4 of the supporting casing 2 and the strip 14. This spring tends to push a strip 14 upwards in closure against the fixed contact 11.

[0018] The end of the strip 14 which carries the moving contact 13 is connected to the locking member 9, in such a way that the spring 17 also tends to push the locking member 9 from a lowered or disengaged position, in which it does not project outside the supporting casing 2, to a raised or engaged position in which this locking member partially protrudes from the aperture 8 and is positioned in the path of the retaining member or slider 6, thus preventing its return towards the rest position in which it allows the door P to be opened. For further details of the construction of the locking device, reference may be made to the prior US patent cited above.

[0019] The metallic connecting member 15 forms an appendage or end 15a (Figure 3) shaped in the form of a flat pin, which extends into the seat 18 and acts as a connecting terminal.

[0020] The locking member 9 is also associated with an electromechanical control device, such as that shown by way of example in Figure 3. This device is of a known type, and is described in detail in the United States patent cited above.

[0021] With reference to Figure 3, the said electromechanical control device essentially comprises a toothed wheel 20 mounted rotatably in the half-shell 4 about a shaft 21, adjacent to the locking member 9. This toothed wheel has an upper portion provided with toothing in the form of sawteeth 22.

[0022] The number 25 indicates the whole of an electrically operated actuator which comprises a coil or solenoid 26, inside which a core 27 is mounted so as to be axially translatable, a rod 28 being connected to one end of this core. The end of the rod 28 opposite the core 27 pushes into a recessed seat of a shaped member indicated as a whole by 29. This member has in its median part a slotted aperture 30 in which there extends a fixed stud or pin 31 integral with the supporting casing of the device.

[0023] The end 29a of the member 29 which is opposite the actuator 25 is shaped in the form of a pawl and engages between a pair of consecutive sawteeth 22 of the toothed wheel 20.

[0024] The number 32 indicates a pawl which is mounted so that it can oscillate about a fixed shaft 33 and is also engaged between a pair of consecutive sawteeth of the toothed wheel 20, by the force of a coil spring 34 which is interposed between this pawl and the end of the shaped member 29 adjacent to the actuator 25.

[0025] The arrangement described above is such that, whenever the actuator 25, in other words the solenoid 26, is energized, the core 27 is translated (upwards according to Figure 3) and, by means of the rod 28, causes a movement of the shaped member 29, which in turn causes the toothed wheel 20 to rotate through one step, in other words through a distance corresponding to one sawtooth 22. Having completed this angular movement, the pawl 32 again stabilizes the angular position of the wheel 20.

[0026] In the embodiment shown in Figure 3, the winding or solenoid 26 of the electromagnetic actuator has one of its terminals connected to a shaped electrically conducting member 35, and the other terminal connected to the connecting member 12-12a by means of a conducting link 36.

[0027] A positive temperature coefficient (PTC) resistor 38 is connected between the connecting member 35 and a conducting member 37, having an end 37a which extends into the recessed seat 18 of the casing of the device and is shaped in the form of a flat pin to act as a connecting terminal.

[0028] In the electrical diagram of Figure 4, parts and elements described previously have been given the same reference numerals as those used previously. In Figure 4, the number 40 indicates a control circuit or unit of the electrical appliance. This circuit or unit has three terminals, connected in sequence to the connecting terminals 12, 15a and 37a of the door locking device 1.

[0029] The mode of operation of the equipment described above is as follows.

[0030] When the door P is open, the locking device 1 is in the condition shown in Figures 1 and 2: the locking member 9 is "covered" by the retaining member or slider 6 and is also retained in the retracted position of disengagement from the toothed wheel 20 (in the way described and illustrated in detail the prior US patent cited above).

[0031] When the door P is closed, the slider 6 is translated and "uncovers" the locking member 9. In this stage, however, the locking member is retained in the retracted position of disengagement from the toothed wheel 20, which remains in the position which it was in during the preceding stage.

[0032] When the user of the electrical appliance starts it up, the control unit 40 of this appliance causes a first energizing of the actuator 25 at an instant t_1 (Figure 5), by applying a voltage V between the terminals 12a and 37a of the locking device 1. As a result of this energizing, the member 29 of the locking device 1 causes the toothed wheel 20 to rotate through a distance equal to the angular extension of one tooth 22 of this wheel. The locking member 9 can therefore move to the protruding engagement position under the action of the spring 17 on the strip 14. At the same time, the moving contact 13 carried by the strip 14 is brought to bear on the fixed contact 11; in other words, the switch 10 is closed. With the locking member 9 in the protruding position, the return of the retaining member or slider 6 to the rest position, in which it allows the door P to be opened, is prevented.

[0033] In the appliance according to the invention, the control unit 40 is designed to keep the energizing voltage V continuously applied between the terminals 12a and 37a, after the first energizing or each first energizing of the locking device 1, for a specified time t_2-t_1 (Figure 5), in such a way that the resistance R of the PTC resistor 38 reaches and is kept at a value such that the current I flowing through this resistor and the solenoid 26 is reduced to a minimum level, which in itself is sufficient to prevent the energizing of the solenoid during substantially the whole of the time interval t_2-t_1.

[0034] Near the end of the operating cycle of the electrical appliance, in order to allow the door P to be opened, the control unit 40 interrupts the application of the voltage V to the terminals 12a, 37a at the instant t_2 (Figure 5). The resistance R of the PTC resistor 38 then decreases, at a rate which can conveniently be increased by the suitable location of this resistor 38 in the proximity of a portion of the outer wall of the supporting casing of the door locking device which, as shown in Figure 3, can be provided with a plurality of integral fins 39 to facilitate heat dissipation.

[0035] On completion of the operating cycle of the domestic electrical appliance, the control unit 40 causes the sending of one or two successive energizing pulses to the coil 26 of the electromagnetic actuator 25, to allow the door P to be opened. These pulses are indicated by V1 and V2 in the upper graph in Figure 5. As a result of this, the toothed wheel 20 is made to rotate through a distance such that it can return the locking member 9 to the retracted or disengaged position, in which it again allows the retaining member or slider 6 to return to the position in which the door can be opened.

[0036] The continuous maintenance of the energizing voltage V between the terminals 12a and 27a of the door locking device 1 after the first energizing or after each first energizing, for the time interval t_2-t_1, is in itself sufficient to disable the operation of the solenoid 26 throughout this time interval, thus making the device immune to any undesired energizing due to received electromagnetic interference. Clearly, the instant t_2, at which the application of the voltage V between the aforesaid terminals is interrupted, is set by the control unit 40 appropriately in advance of the instant at which the unlocking of the door is to be enabled, in order to allow the PTC resistor 38 to cool down sufficiently.

[0037] The prolonged and continuous application of the energizing voltage V for the time interval t_2-t_1, rather than for a brief pulse period t'_1-t_1 as in prior art devices, enables the operation to be substantially interference-free and therefore intrinsically more secure.

[0038] Clearly, provided that the principle of the invention is retained, the forms of application and the details of construction can be varied widely from what has been described and illustrated purely by way of example and without restrictive intent, without thereby departing from the scope of protection of the invention as defined by the attached claims.

Claims

1. Electrical appliance comprising:

   a chamber closed by a door (P),
   a locking device (1) associated with the door (P), including an operating solenoid (26) connected in series with a PTC resistor (38) between two electrical connecting terminals (12a, 27a), which, as the result of a first energizing and at least one subsequent energizing of the solenoid (26), is capable of assuming, respectively, a locking condition in which it retains the door (P) in the position which closes the chamber, and an unlocking condition in which it allows the door (P) to be opened; and
   control means (40) connected to the said electrical terminals (12a, 37a) and capable of causing subsequent energizing of the said solenoid (26) by means of subsequent applications of voltage between the said terminals (12a, 37a);
   the appliance being **characterized in that** the said control means (40) are designed to keep the energizing voltage (V) continuously applied to the said terminals (12a, 37a) after the first energizing or after each first energizing of the locking device (1) for a predetermined time (t_2-t_1) in such a way that the resistance (R) of the PTC resistor (38) reaches and is kept at a value such that the current (I) flowing through the solenoid (26) is reduced to a minimum value and thus prevents the energizing of the solenoid.

2. Appliance according to Claim 1, in which the said PTC resistor (38) is located in the proximity of a portion of a wall of a supporting casing (2, 4), this wall being provided with a plurality of formations (39), particularly fins, which can facilitate the dissipation of the thermal energy developed by the said resistor (38).

Fig.1

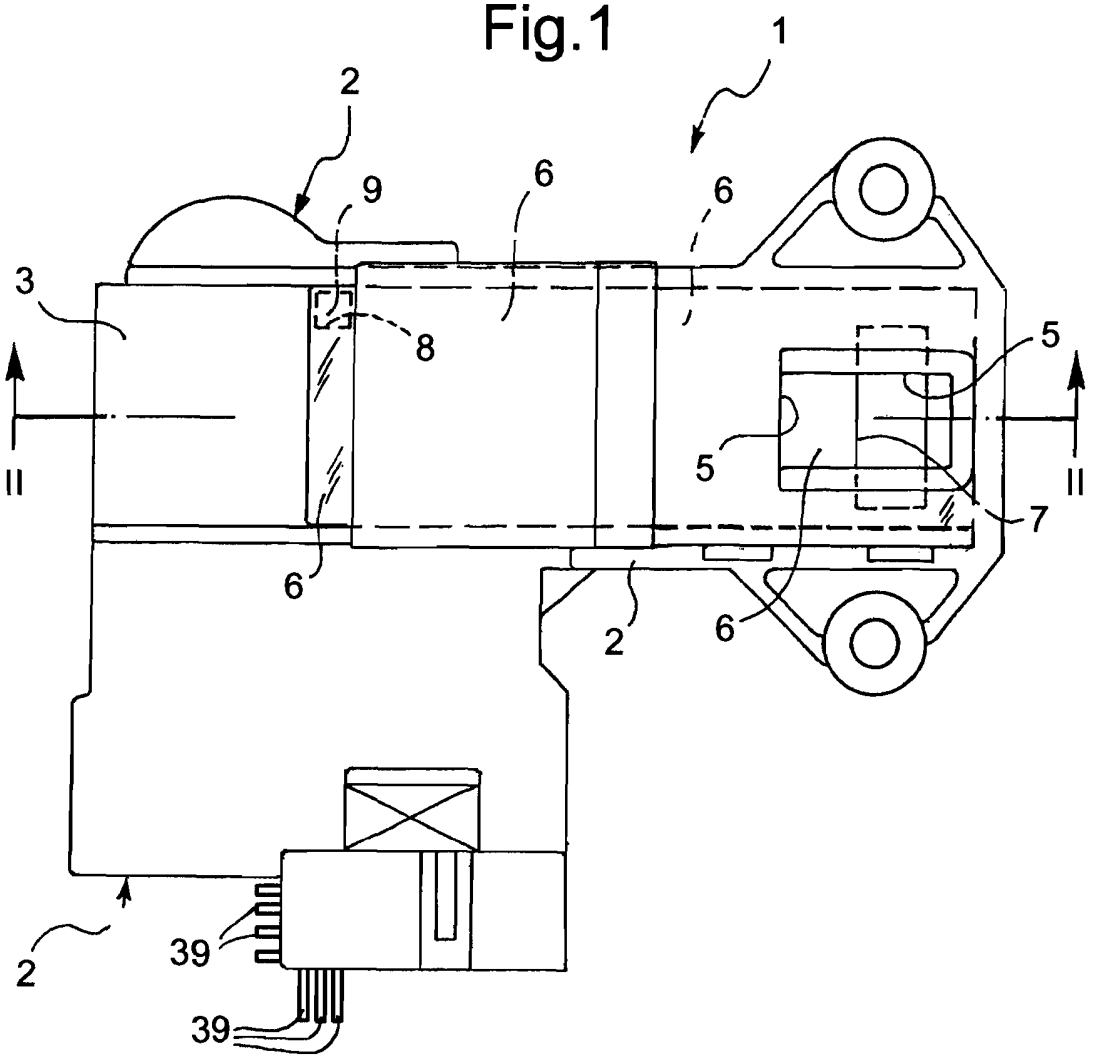


Fig.2

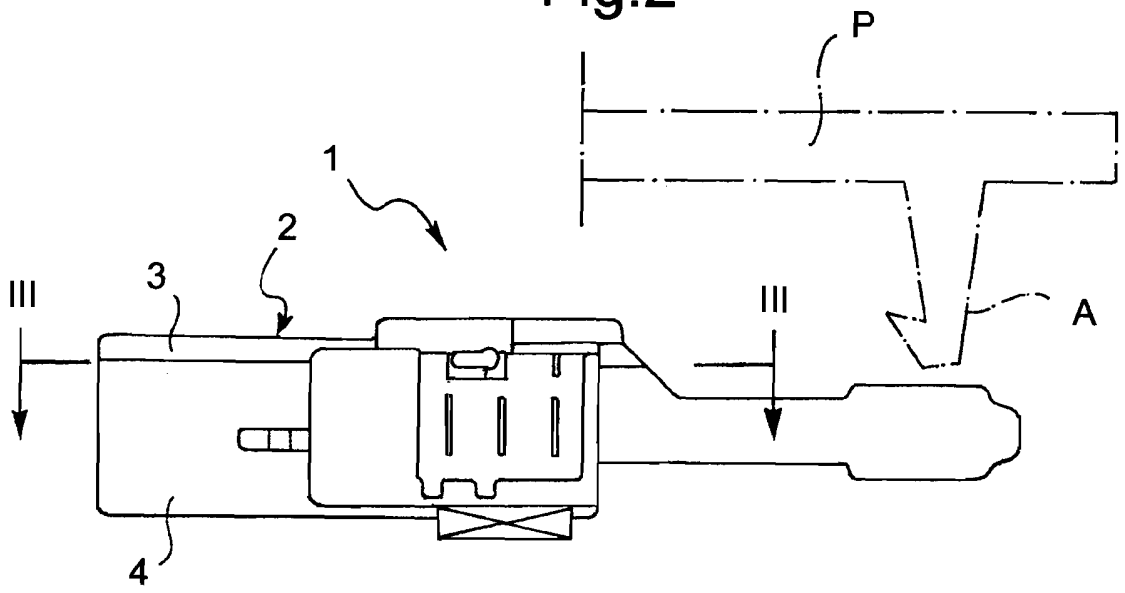
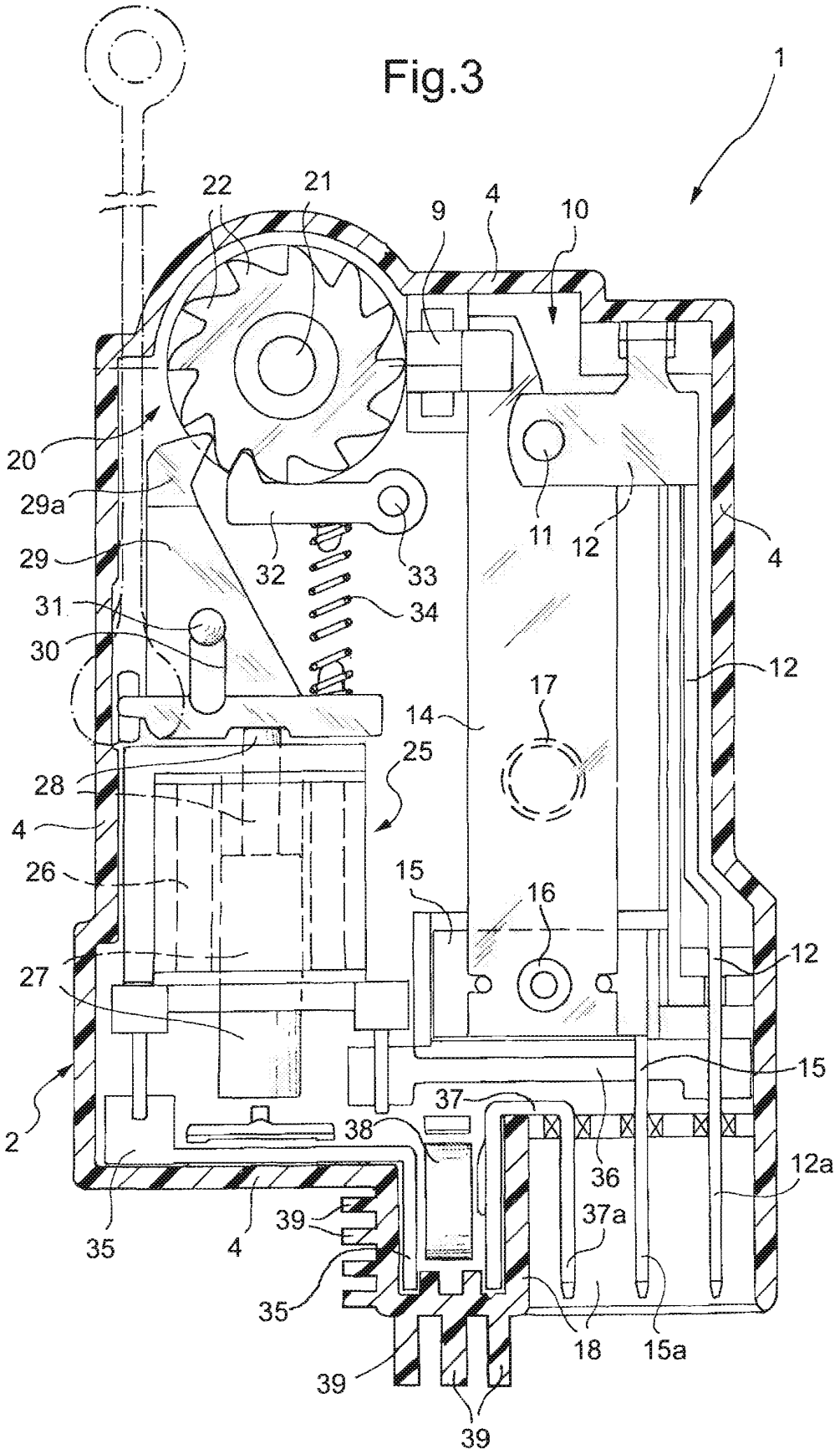


Fig.3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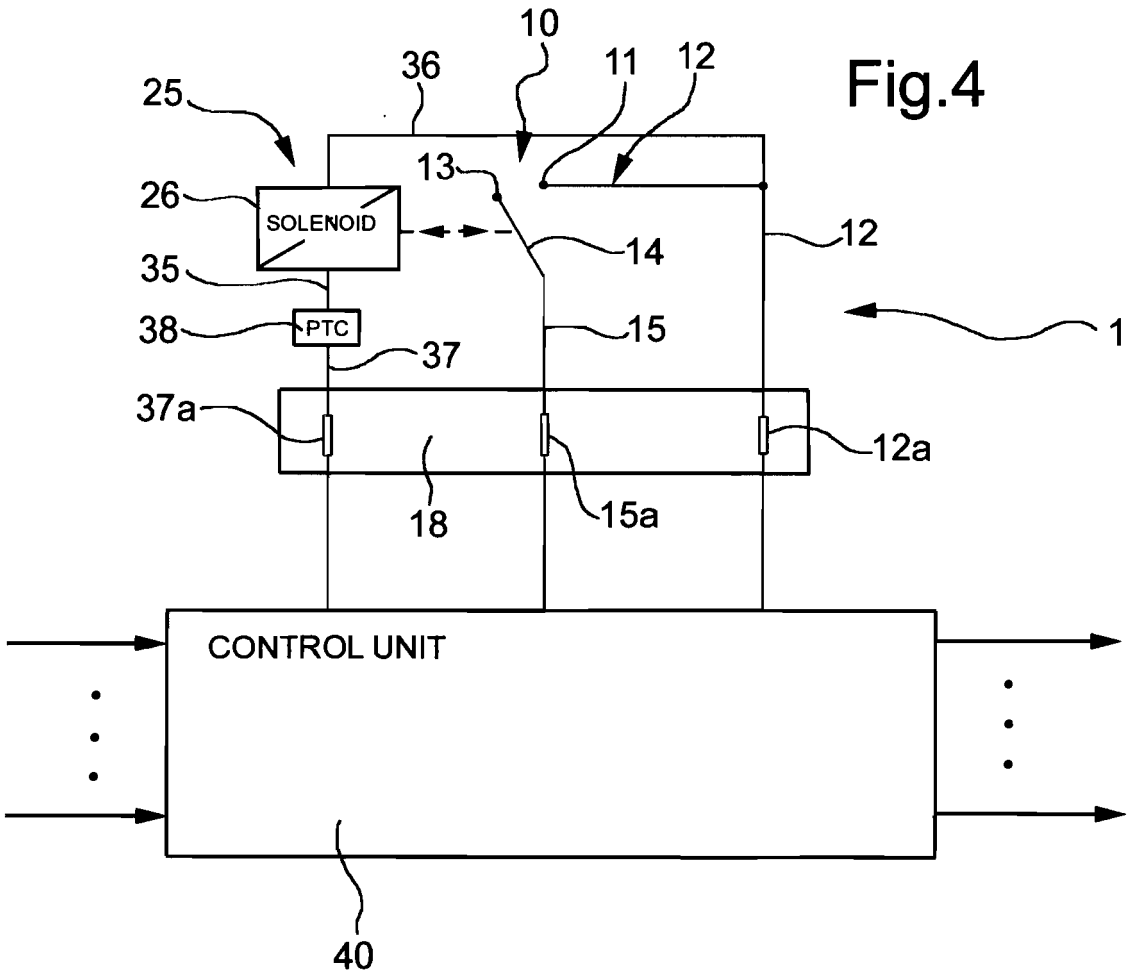
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36
11
12
25
13
26
SOLENOID
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12
35
38
PTC
15
1
37
37a
12a
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15a
CONTROL UNIT
40

Fig.4

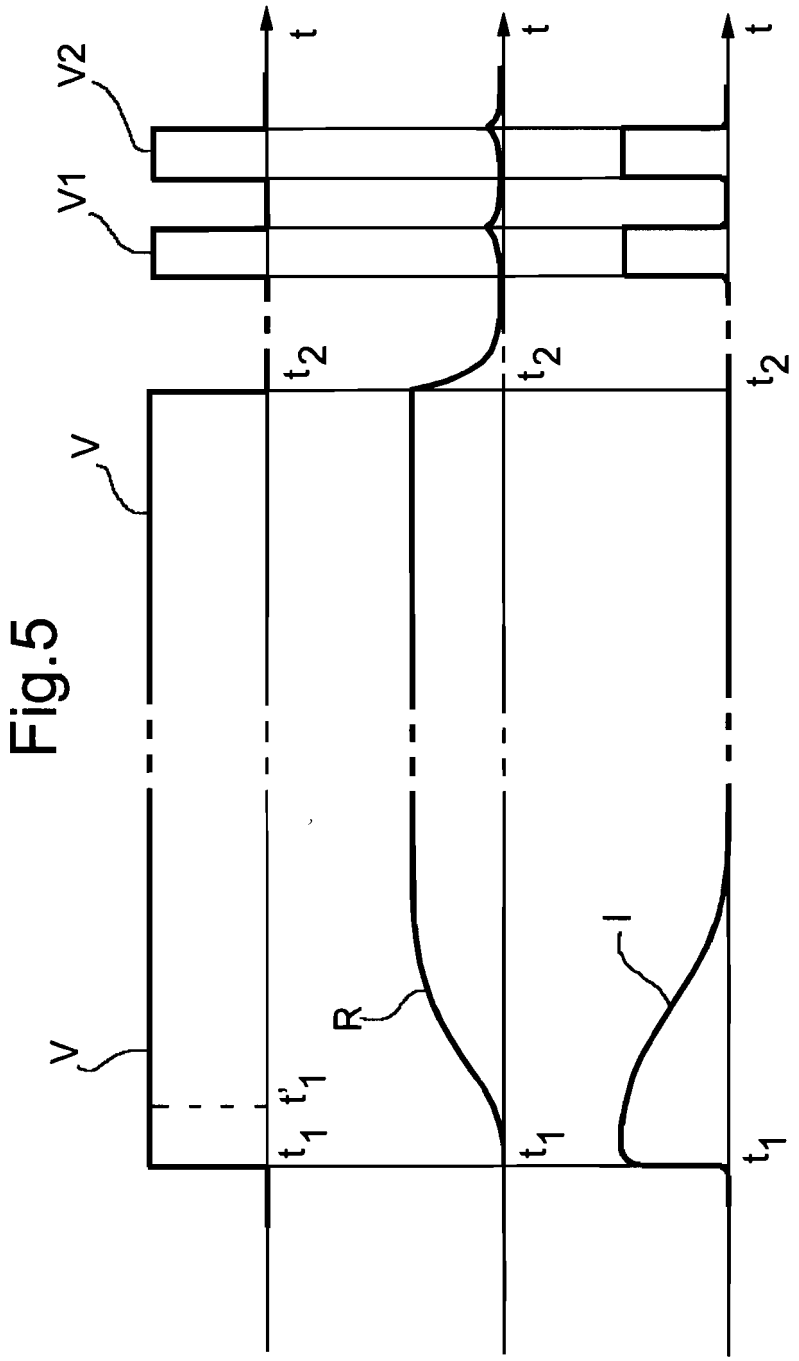

Fig.5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6334637 B **[0003]**