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(72) Inventor: **Promutico, Fabrizio**,
Bitron S.p.A.
10122 Torino (IT)

(74) Representative: **Tiburzi, Andrea et al**
Barzanò & Zanardo Roma S.p.A.
Via Piemonte 26
00187 Roma (IT)

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

(54) **Improved door-locking device**

(57) The present invention relates to a door-locking device (10), comprising a frame (11) provided with an opening (12) wherein a hook (50), associated with a door of a washing machine or of an electric household appliance in general, can introduce and engage with said frame (11) when said door is closed, a locking pawl (60), that can take a first position, wherein it is withdrawn preventing supply of said household appliance, and a second position, wherein it is extracted, permitting supply of said household appliance; and a moving slider (20)

arranged within said frame (11), said slider (20) having a first slot (21) suitable to interact with said hook (50), a second slot (22) with which can be engaged said locking pawl (60) in said second position, when said slider (20) is in said locking position, to keep said hook (50) engaged with said frame (11) by said first slot (21) when said door is closed, said door-locking device (10) further comprises safety means (30) provided with control means (32,34) provided with control means (32,34), said safety means (30) being suitable to interact with said slider (20) to control its position.

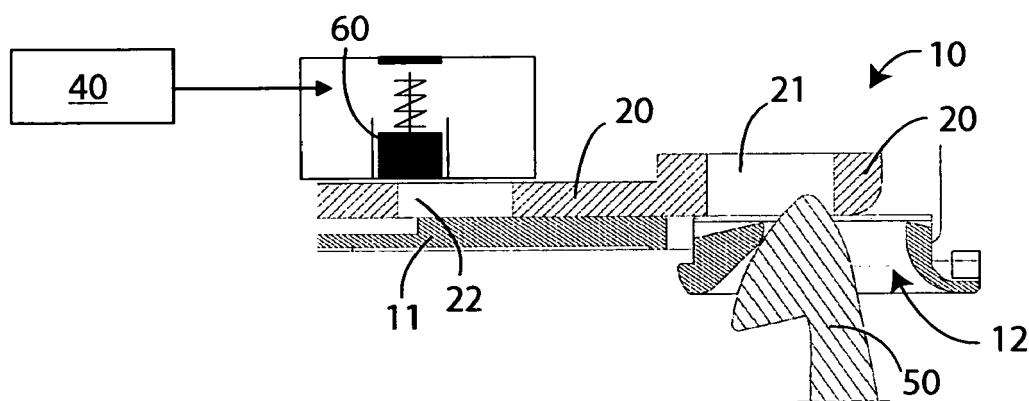


Fig. 2

Description

[0001] The present invention relates to an improved door-locking device.

[0002] More specifically, the invention concerns a door locking device for household appliances, such as washing machines and like, particularly studied and realised to make safer starting procedures of said household appliances.

[0003] Specification will be addressed in the following to the application of the device to a washing machine, but it is well evident that the same must not be considered as limited to this specific use.

[0004] As it is well known, known door-locking devices suitable to lock a closed door provided with a suitably shaped hook, comprise a frame having an opening, a movable slider, inserted within said frame, provided with a first slot for engaging the door hook when it is inserted within said opening of said frame, and a second slot or groove. Said door-locking device also comprises return means, such as a spring, suitable to keep said slider in a set position, and a locking pawl, that can take an operative position, wherein it is withdrawn from a seat and is engaged with said second slot of said slider, and a rest position, wherein it is withdrawn within said seat. Said locking pawl is controlled by an electro-mechanical device. When washing machine is not active, and door is closed and hook inserted within said opening, said hook interacts with said first slot of said slider, moving so as to permit locking pawl to engage with said second slot and keep said locked hook engaged with said frame opening. To open the door it is necessary acting on washing machine electronics to withdraw locking pawl from said second slot and free slider. Thus, opening the door, hook can be disengaged from said frame opening.

[0005] Generally speaking, to operate household appliance it should be necessary closing the door, engaging locking pawl with slider, and then activation of the same household appliance.

[0006] A problem of known household appliances, and particularly in washing machines, is that, in case door is open, it is possible activating washing machine by activation or control push button. Since door is open, washing machine does not start. Closing then the door, locking pawl is free and engages with slider and washing machine starts. Risk is that said procedure can be made by mistake, e.g. by a child, who, after having operated the washing machine, enters within the basket of the same, closing the door. Locking pawl locks slider and door cannot be open from inside.

[0007] In case, it could be possible overcoming said problems, providing suitable software for washing machine control logic, but it has been noted that the above does not ensure a suitable safety level, and complicates control logic of the whole machine, thus increasing the whole cost.

[0008] In view of the above, it is therefore object of the present invention that of suggesting an improved door-

locking device permitting avoiding the above risks.

[0009] These and other results are obtained according to the invention by a door-locking device permitting keeping slider in such a position to prevent closure of the door, or to permit its closure, but so as to permit an easy opening also from inside, and so as to free slider only by activation of a control, only in this case permitting engagement of locking pawl.

[0010] It is therefore specific object of the present invention a door-locking device, comprising a frame provided with an opening wherein a hook, associated with a door of a washing machine or of an electric household appliance in general, can introduce and engage with said frame when said door is closed, a locking pawl, that can take a first position, wherein it is withdrawn preventing supply of said household appliance, and a second position, wherein it is extracted, permitting supply of said household appliance; and a moving slider arranged within said frame, said slider having a first slot suitable to interact with said hook, a second slot with which can be engaged said locking pawl in said second position, when said slider is in said locking position, to keep said hook engaged with said frame by said first slot when said door is closed, characterized in that said door-locking device further comprises safety means provided with control means, said safety means being provided with control means, said safety means being suitable to interact with said slider to control its position, so as to maintain said slider in said release position; and free said slider following operation of said control means, thus permitting them passing from said release position to said locking position when said hook is inserted within said frame, so as to permit to said locking pawl passing from said first position to said second position to engage with said second slot.

[0011] Always according to the invention, said slider can comprise a groove and said safety means comprise a safety pin capable of taking a rest position, in which it is disengaged from said groove and an operating position, in which it is engaged with said groove, blocking said slider, said safety pin taking said rest position following the activation of said control means.

[0012] Still according to the invention, said safety means can be configured so that when they interact with said slider, when said hook is disengaged from said frame, said slider is arranged in such way that said second slot is not faced to said blocking pawl, maintaining the latter in said first position and preventing said washing machine or electric household appliance in general to start.

[0013] Furthermore, according to the invention, said control means comprise an actuator electrically connected with and controlled by a control unit suitable to control the movement of said safety pin from said rest position to said operating position, and a push button configured so as to: activating said actuator and driving said safety pin in said rest position, when said push button is kept pushed and/or when it is only pushed; and/or activating said actuator and driving and keeping said safety pin in

said rest position, when said push button is pushed according to a logic, controlled by said control unit.

[0014] Present invention will be now described for illustrative, but not limitative purposes according to its preferred embodiments, with particular reference to the figures of the enclosed drawings, wherein:

figure 1 is an operative block diagram of a door-locking device according to the present invention;
figure 2 shows a section view of door-locking device according to the present invention in a safety position;

figures 3a and 3b show operation of a known door-locking device; and

figures 4a and 4b show operation of a door-locking device according to the present invention.

Making reference to figures 1 and 2, it is shown the improved door-locking device according to the present invention.

[0015] Said door-locking device 10 comprises a frame 11 having an opening 12 with which can couple a hook 50 coupled with a door. Said door-locking device 10 comprises a slider 20 and safety means 30, that can keep said slider 20 in a set position when a washing machine or other machine is switched off and the door is open.

[0016] Said door-locking machine 10 further comprises an electronic control unit 40, to control said safety means 30, and a control push button 34 or any other kind of control.

[0017] Said safety means 30 comprise a safety pin 31, that can take a rest position, wherein it is withdrawn, and an operative position, wherein it is extracted, an actuator 32, electrically connected, controlled by said control unit and suitable to control movement of said safety pin 31 from said rest position to said operative position, and vice versa, and finally a spring 33 for returning said safety pin 31.

[0018] Said slider 20 has a first slot 21, with which said hook can interact, and a second slot 22, with which a locking pawl 60 can interact, said locking pawl 60 being connected to a micro switch preventing supply of machine when it is withdrawn. Anyway, operation and interaction of said locking pawl 60 will be better described in the following. Said slider 20 also has a groove 23, with which can engage said safety pin 31 when it is in an operative position. Said first slot 21 of said slider 20 is provided faced on said opening 12 when said slider 20 is in a safety position, i.e. with safety pin 31 engaged with said groove 23.

[0019] Operation of door-locking device 10 occurs as follows, making particular reference both to figure 2 and to figures 3a-3b, showing operation of a known door-locking device, and to figures 4a-4b, showing operation of a door-locking device according to the present invention. When safety pin 31 is in an operative position, i.e. extracted, it is engaged with said groove 23, locking said slider 20 in such a position preventing to said locking

pawl 60 engaging with relevant second slot 22, and to

- preventing closure of said door, not permitting to said hook 50 inserting within said opening 12 without interacting with said first slot 21 of said slider 20 and engaging with said frame 11 (figures 4a and 4b); or
- permitting closure of said door, thus permitting to said hook 50 entering within said opening 12 and at least partially interacting with said first slot 21, in such a way that said door can be opened by a very reduced force, e.g. sufficient to a child within the washing machine basket to open the door from inside.

[0020] Therefore, in case washing machine is activated before closing the door, said door cannot be closed, or, in case it is closed, it could not be blocked by locking pawl 60, thus permitting an easy re-opening of the same.

[0021] Instead, from figures 3a-3b showing a solution according to the prior art, it is observed that hook 50 enters within opening 12, interacts with slider 20, which is moved by the same hook 50, thus permitting to the locking pawl 60 to engage with the second slot 22 of said slider 20.

[0022] To operate washing machine and locking door during washing by door-locking device 10 according to the present invention, it will be necessary keeping push button 34 pressed 34. Thus, actuator 32 is activated by control unit 40, withdrawing safety pin 31 in the rest position, releasing slider 20; then, door can be closed, inserting hook 50 within said opening 12. Thus slider 20 interacts with first slot 21, engaging with said frame 11 on the edge of said opening 12. Said second slot 22 is faced to said locking pawl 60 that now, if activated, can interact with the same, locking slider 20, and hook 50, maintaining door closed. Now, even if free, safety pin 31 cannot engage with said groove 23, sliding on lateral surface of said slider 20.

[0023] When washing machine is activated, locking pawl 60, activated by said control unit 40, or by a further control unit, engages with said second slot 22, locking slider 20 so as to maintain door closed.

[0024] When washing machine is switched off, locking pawl 60 is disengaged from said second slot 22, always by the action of said control unit 40, or by another control unit, releasing slider 20. Opening now door, hook 50 moves slider 20, so that safety pin 31 can engage again with relevant groove 23, maintaining again said slider 20 in a safety position. Therefore, slider 20, when washing machine, or other household appliance, is switched off, is kept in a safety position, so as to prevent door can be closed or released only acting on a control, such as push button 34.

[0025] Safety pin 31 can be controlled electronically or mechanically by said push button 34, e.g. by a simple lever.

[0026] Therefore, on the basis of the above notes, door-locking device 10 can be in three different states:

- door open, safety pin in an operative position, thus extracted and engaged with said groove 23, locking pawl 60 withdrawn, and thus not engaged with said second slot 22: in this case, it is possible closing the door, taking also into consideration that hook is movable with respect to the door and subjected to the action of a spring, but position of the slider 20 within which said safety pin 31 is maintained, is such to permit an easy opening of the door even from inside;
- door closed, safety pin 31 in an operative position, thus extracted and engaged with said groove 23, locking pawl 60 withdrawn, and thus not engaged with said second slot 22: as already said, even if door is closed, it can be easily open (even by a child that would accidentally entered within the basket). In this condition, machine cannot be actuated, since locking pawl 60 is withdrawn, not permitting supplying the machine.
- door closed, safety pin 31 in a rest position, following pressure on push button 34, thus extracted and engaged with said slider 20 by said groove 23, locking pawl 60 extracted and engaged with said second slot 22: in this case, door remains locked, and machine can be activated.

[0027] Door-locking device 10 thus permits reducing risk that a child can activate washing machine, enter within the basket and closing and locking the door making it impossible opening the same. In fact, to fully close the door it is necessary the intervention of a user on actuator pushbutton or control. Activation can occur keeping pressed said push button, or by a single pulse that, by a suitable electronic circuit, keeps pin 31 disengaged from said groove 23 for a set time period, or by a stepped signal "t" or by any logic controlled by control unit 40 (it could be necessary pressing one or more times push button, or pressing the same for a set time interval, ecc.).

[0028] Present invention has been described for illustrative, but not limitative, purposes, according to its preferred embodiments, but it is to be understood that variations and/or modifications can be introduced by those skilled in the art without departing from the relevant scope, as defined in the enclosed claims.

Claims

1. Door-locking device (10), comprising a frame (11) provided with an opening (12) wherein an hook (50), associated with a door of a washing machine or of an electric household appliance in general, can introduce and engage with said frame (11) when said door is closed, a locking pawl, that can take a first position, wherein it is withdrawn preventing supply of said household appliance, and a second position, wherein its is extracted, permitting supply of said household appliance; and

a moving slider (20) arranged within said frame (11), said slider (20) having a first slot (21) suitable to interact with said hook (50), a second slot (22) with which can be engaged said locking pawl (60) in said second position, when said slider (20) is in said locking position, to keep said hook (50) engaged with said frame (11) by said first slot (21) when said door is closed,

characterized in that said door-locking device (10) further comprises safety means (30) provided with control means (32, 34), said safety means (30) being provided with control means (32, 34), said safety means (30) being suitable to interact with said slider (20) to control its position, so as to:

- maintain said slider (20) in said release position; and
- free said slider (20) following operation of said control means (32, 34), thus permitting them passing from said release position to said locking position when said hook (50) is inserted within said frame (11), so as to permit to said locking pawl (60) passing from said first position to said second position to engage with said second slot (22).

2. Door-locking device (10) according to claim 1, **characterized in that**

said slider (20) comprises a groove (23) and said safety means (30) comprise a safety pin (31) capable of taking a rest position, in which it is disengaged from said groove (23) and a operating position, in which it is engaged with said groove (23), blocking said slider (20), said safety pin (31) taking said rest position following the activation of said control means (32, 34).

3. Door-locking device (10) according to one of the preceding claims, **characterized in that** said safety means (30) are configured so that when they interact with said slider (20), when said hook (50) is disengaged from said frame (11), said slider (20) is arranged in such way that said second slot (22) is not faced to said blocking pawl (60), maintaining the latter in said first position and preventing said washing machine or electric household appliance in general to start.

4. Door-locking device (10) according to anyone of the preceding claims 2 or 3, **characterized in that** said control means comprise an actuator (32) electrically connected with and controlled by a control unit (40) suitable to control the movement of said safety pin (31) from said rest position to said operating position, and a push button (34) configured so as to:

- activating said actuator (32) and driving said

safety pin (31) in said rest position, when said push button (34) is kept pushed and/or when it is only pushed; and/or

- activating said actuator (32) and driving and keeping said safety pin (31) in said rest position, when said push button (34) is pushed according to a logic, controlled by said control unit (40).

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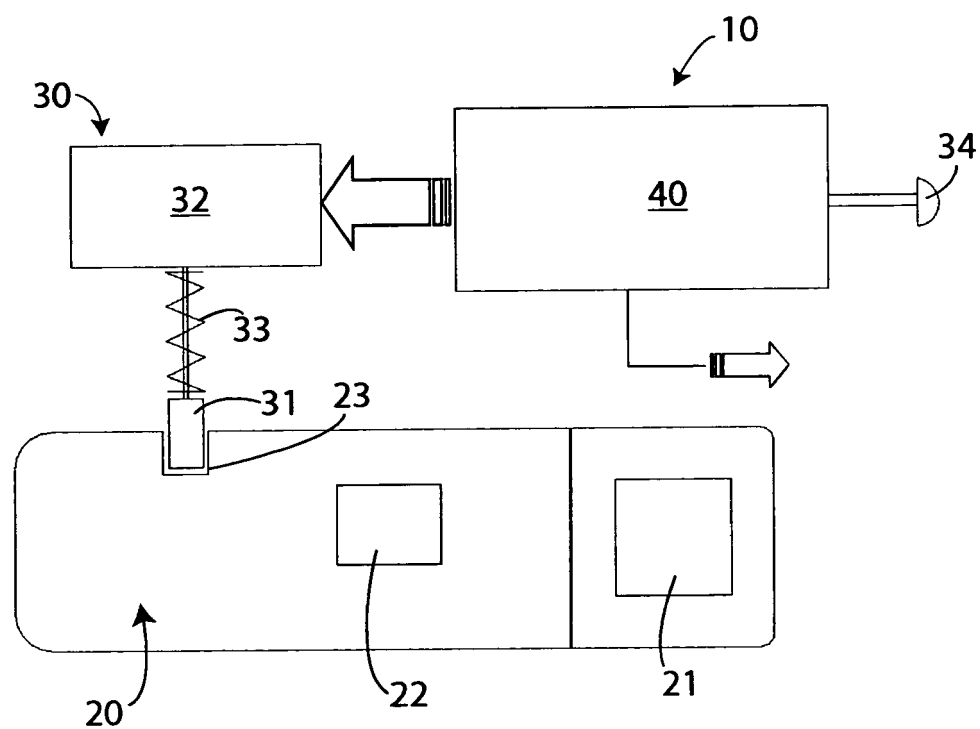


Fig. 1

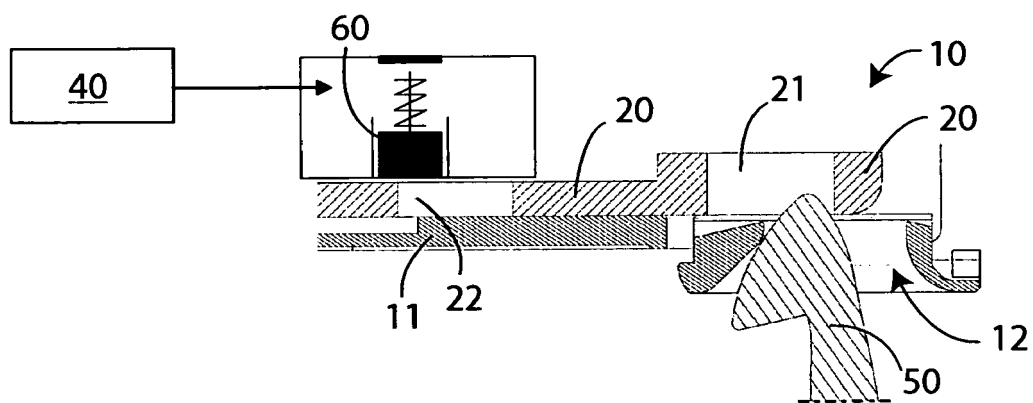


Fig. 2

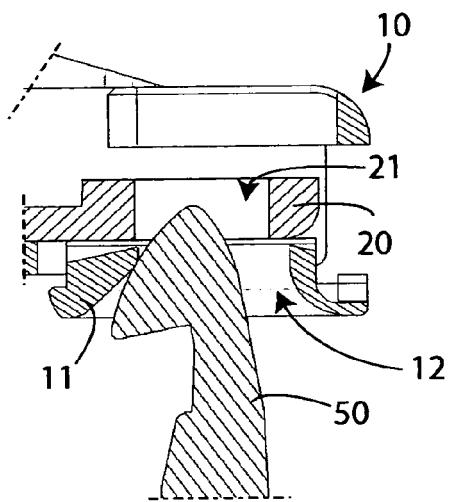


Fig. 3a
Prior Art

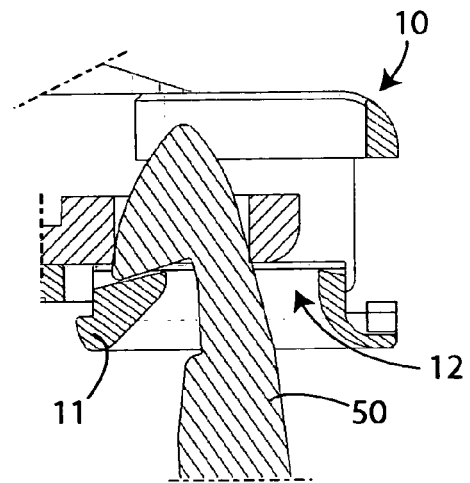


Fig. 3b
Prior Art

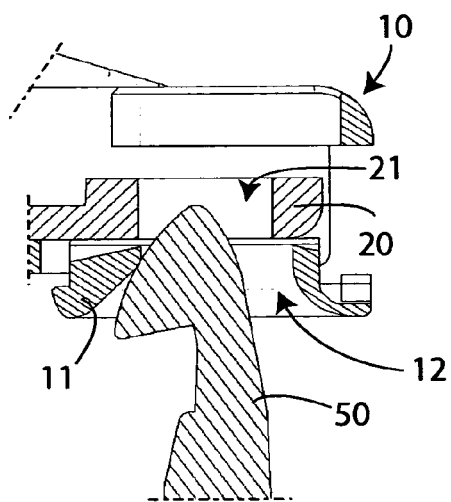


Fig. 4a

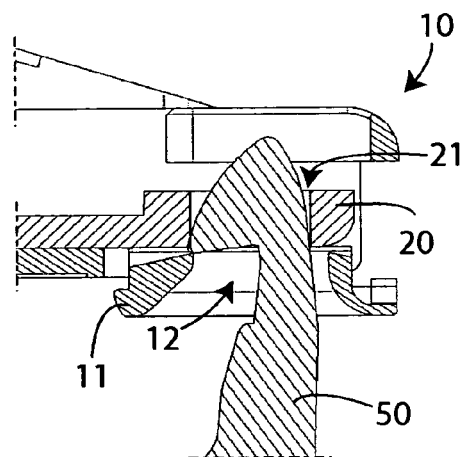


Fig. 4b