METHOD OF CONTROLLING OPENING AND CLOSING OF A DOOR IN DRUM-TYPE WASHING MACHINE

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(54) METHOD OF CONTROLLING OPENING AND CLOSING OF A DOOR IN DRUM-TYPE WASHING MACHINE

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ABSTRACT

The present invention provides a method of controlling opening and closing of a door in a drum-type washing machine. When the drum-type washing machine suddenly stops in operation, e.g. in case of a mistake by a user or a switch-off, a water level of a tub is sensed, which shows lower than predetermined height, thereafter a door-lock system is converted that the door can be opened. To this function, the present invention has an effect on protecting against an outflow of water of the tub in case the user wrongly opens the door.

start

operating drum-type washing machine

locking door

door-closing-lamp : on

S10

stop

yes

no

S20

S30

S40

S50

S42

sensing water level

releasing door-lock

door-closing-lamp : off

door-opening-lamp : on

end

water level < predetermined height

no

yes
FIG. 2

start

S10 operating drum-type washing machine

S20 locking door
  door-closing-lamp : on

S30 stop

S40 sensing water level

water level < predetermined height

S42 yes

S50 releasing door-lock
  door-closing-lamp : off
  door-opening-lamp : on

end
FIG. 3

start

S101 child-lock : on

S110 operating drum-type washing machine

S120 locking door
door-closing-lamp : on

S130 stop

no

yes

S140 sensing water level

S142 water level < predetermined height

no

yes

S150 releasing child-lock

no

yes

S160 releasing door-lock
door-closing-lamp : off
door-opening-lamp : on

end
FIG. 4

start

S101 child-lock: on

S110 operating drum-type washing machine

S120 locking door

S130 door-closing-lamp: on

S130 stop

S140 sensing water level

S130 water level < predetermined height

S142 yes

S200 child-lock: off

S201 releasing door-lock

door-closing-lamp: off

door-opening-lamp: on

end
FIG. 5

start

S300 child-lock: off

S110 operating drum-type washing machine

S120 locking door
   door-closing-lamp: on

S301 child-lock: on

S130 stop
   no

S140 sensing water level

S142 water level < predetermined height
   no

S150 releasing child-lock
   no

S160 releasing door-lock

S161 door-closing-lamp: off
   door-opening-lamp: on

end
FIG. 6

S300
child-lock: off

S110
operating drum-type washing machine

S120
locking door
door-closing-lamp: on

S301
child-lock: on

S130
stop

S140
sensing water level

S142
water level < predetermined height

S302
child-lock: off

S160
releasing door-lock

S161
door-closing-lamp: off
door-opening-lamp: on

end
METHOD OF CONTROLLING OPENING AND CLOSING OF A DOOR IN DRUM-TYPE WASHING MACHINE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a method of controlling opening and closing of a door in a drum-type washing machine, to put it concretely, that opening and closing of the door in the drum-type washing machine is controlled depending on a water level of a tub when the drum-type washing machine comes to a stop in operation.

[0003] 2. Description of the Related Art

[0004] A washing machine is to decontaminate dirt on clothes or bedding through washing, rinsing and dehydrating.

[0005] A drum-type washing machine has a door in front to put laundry in it. A cabinet in the drum-type washing machine has a door-lock-switch which prevents the door from opening while the drum-type washing machine is on.

[0006] The door-lock-switch is affected by a controller of the drum-type washing machine. When the drum-type washing machine is operating, the controller makes the door unopened. When the drum-type washing machine finishes operating, the controller makes it possible to open the door.

[0007] However, when the drum-type washing machine stops by a pause, a mistake by a user, a switch-off, the drum-type washing machine up to the present releases the door-lock-switch and the door can be opened even though water is contained in a tub.

[0008] Consequently, the conventional drum-type washing machine causes inconvenience that water of the tub flows out of the drum-type washing machine as the user opens the door.

SUMMARY OF THE INVENTION

[0009] The present invention is designed to cope with the above-mentioned problem, its main purpose places in providing a method of controlling opening and closing a door in a drum-type washing machine, which prevents water from running out of the machine which unexpectedly becomes stopped while its operation. It is feasible that a water level of a tub is considered before deciding whether to allow the door to open or not.

[0010] The method of controlling opening and closing of the door in the drum-type washing machine comprises the steps of: operating the drum-type washing machine; locking the door not to open; sensing the water level of the tub when the drum-type washing machine stops operating; and releasing a door-lock so that the door becomes ready to open if the water level of the tub is sensed lower than predetermined height.

[0011] When the door-lock is released, a door-opening-lamp is turned on while a door-closing-lamp is turned off.

[0012] If the water level of the tub is sensed higher than predetermined height, the door-lock is maintained and it is returned to the step of sensing the water level of the tub.

[0013] The method of controlling opening and closing of the door in the drum-type washing machine further comprises that a child-lock is turned on before the drum-type washing machine stops. The child-lock is on by a user or automatically after the drum-type washing machine is operating.

[0014] The method of controlling opening and closing of the door in the drum-type washing machine further comprises that the door-lock is released following by turning off the child-lock if the drum-type washing machine stops operating and the water level in the drum-type washing machine is lower than predetermined height. The child-lock becomes off by the user or automatically.

[0015] Therefore, the method of controlling opening and closing of the door in the drum-type washing machine prevents water from flowing out of the door when the drum-type washing machine which has been operating stops or pauses. The reason is that the door holds its condition as can-be-opened or should-be-locked, reading the water level of the tub.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] A more complete appreciation of the invention, and many of the attendant advantages thereof, will be readily apparent as the same becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings in which like reference symbols indicate the same or similar components, wherein:

[0017] FIG. 1 is an illustration of a drum-type washing machine adapted for the present invention.

[0018] FIG. 2 is a flow chart of a method of controlling opening and closing of a door in the drum-type washing machine in accordance with the 1st embodiment of the present invention.

[0019] FIG. 3 is the flow chart of the method of controlling opening and closing of the door in the drum-type washing machine in accordance with the 2nd embodiment of the present invention.

[0020] FIG. 4 is the flow chart of the method of controlling opening and closing of the door in the drum-type washing machine in accordance with the 3rd embodiment of the present invention.

[0021] FIG. 5 is the flow chart of the method of controlling opening and closing of the door in the drum-type washing machine in accordance with the 4th embodiment of the present invention.

[0022] FIG. 6 is the flow chart of the method of controlling opening and closing of the door in the drum-type washing machine in accordance with the 5th embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0023] Reference now should be made to the drawings, in which the same reference numerals are used throughout the different drawings to designate the same or similar components.
Now, preferred embodiment of the present invention will be hereinafter described in detail with reference to the accompanying drawings.

FIG. 1 is an illustration of a drum-type washing machine adapted for the present invention.

As seen in FIG. 1, the drum-type washing machine includes: a door 1; a cabinet assembly 2 that shapes a body of the drum-type washing machine; a tub (not shown) in the cabinet assembly 2 that contains water; a drum 3 that rotates inside of the tub; and a motor (not shown) connected to the drum 3 that makes the drum 3 rotate.

A detergent box 4 with cleaning or softening materials and a control panel unit 5 with a controller of the drum-type washing machine are installed in the cabinet assembly 2.

A cabinet cover 6 which is the front of the cabinet assembly 2 has a hole 7 for holding the door 1. One side of the door 1 is connected to the cabinet cover 6 with a hinge and the other side of the door 1 hangs a hook 8.

The hook 8 fixes the door 1 by meeting a latch assembly 9 in the cabinet cover 6.

The latch assembly 9 is regulated by the controller in the control panel unit 5. The controller impresses or interrupts an electric current to a door-lock-switch (not shown) and commands its function. The latch assembly 9 accordingly runs and controls opening and closing of the door.

A child-lock-button 10 is on the control panel unit 5. As a user pushes the child-lock-button 10, a signal is delivered to the controller. After receiving the signal, the controller orders the latch assembly 9 to work and the door 1 is laid in a locking condition.

A child-lock is required to keep a child from entering the drum 3 after opening the door 1.

The control panel unit 5 has a door-opening-lamp 11 and a door-closing-lamp 12, which inform the user whether the door 1 can be opened or not.

Referring to FIG. 2, a method of controlling opening and closing of the door in the drum-type washing machine according to the 1st embodiment comprises the steps of: operating the drum-type washing machine at step S10 with manipulation by the user after laundry is loaded in the drum 3; locking the door 1 at step S20 by impressing the electric current to the door-lock-switch before or after or simultaneously with step S10 and by working the latch assembly 9; sensing whether the drum-type washing machine stops in operation at step S30; sensing the water level of the tub at step S40 when the drum-type washing machine stops operating; and releasing the door-lock at step S50 once that the door 1 becomes ready to open by the latch assembly 9 if the water level of the tub is sensed lower than predetermined height.

The step S20 of locking the door impresses the electric current to the door-lock-switch and converts the door into locking. In addition, it turns on the door-closing-lamp 12.

The step S30 of sensing the stop implies both the cases that the user puts a stop to the operation of the drum-type washing machine and the drum-type washing machine unexpectedly stops without manipulation by the user.

The former is, for example, the user turns off a power to put more laundry into the drum 3 before water is drained. The latter is that the drum-type washing machine becomes stopped due to a cut-off of the power, a mistake by the user or the incapacity of motor.

The step of S40 sensing the water level reads the water level contained in the tub and decides whether the door-lock is released.

The step of S50 releasing the door-lock interrupts the electric current to the door-lock-switch and makes the latch assembly 9 remove the door-lock when the water level of the tub is lower than predetermined height.

As the controller turns on the door-opening-lamp 11 and turns off the door-closing-lamp 12 at a time, the user can notice the door 1 is available to open at step S50.

The drum-type washing machine is turned out to be in normal operation at step S30, it is returned to step S10 and continues operating.

If the water level of the tub is higher than predetermined height at step S40, the door is locked as it used to be. It is returned to step S40 and waits till the water level of the tub gets lowered.

As soon as the water level of the tub is under predetermined height, the step S50 is activated and the door-lock is released.

FIG. 3 is the flow chart of the method of controlling opening and closing of the door in the drum-type washing machine in accordance with the 2nd embodiment of the present invention. The 2nd embodiment is developed from the 1st one by adding a function of the child-lock.

The method of controlling opening and closing of the door in the drum-type washing machine according to 2nd embodiment comprises the steps of: operating the drum-type washing machine at step S10 after the child-lock-button 10 is on and the child-lock is set up at step S101; locking the door at step S120; sensing whether the drum-type washing machine stops in operation at step S130; sensing the water level of the tub at step S140 when the drum-type washing machine stops operating; checking the child-lock to be released by manipulation of the child-lock-button at step S150 when the water level of the tub is lower than predetermined height; releasing the door-lock to be opened at step S160 when the child-lock-button is released; and turning off the door-closing-lamp and turning on the door-opening-lamp at step S161 after the door-lock comes to released.

As the user puts into operation of the child-lock, the door has been already locked at step S110. In addition to that, the door is automatically locked depending on the operation of the drum-type washing machine, a double-lock-system is executed at step S120.

Since the child-lock has priority over any other control, the door maintains the locking condition in any cases if the child-lock is on, regardless of the door-lock-switch-off.
The latch assembly functions the child-lock by the controller in the embodiment, though the latch assembly and a separate locking device can be installed in the drum-type washing machine in order to implement the child-lock.

Releasing the child-lock by the user is confirmed at step S150. Only if the child-lock-releasing-signal is received through the child-lock-button, the door becomes ready to open at step S160. If not, it waits till the signal is received.

If the water level of the tub is higher than predetermined height at step S140, the door is locked as it used to be. It is returned to step S140 and waits till the water level of the tub is lowered at step S142.

FIG. 4 is the flow chart of the method of controlling opening and closing of the door in the drum-type washing machine in accordance with the 3rd embodiment of the present invention.

From steps S101 to S140 in the 3rd embodiment is the same as the process in the 2nd one. When the water level of the tub is lower than predetermined height at step S140, contrary to the 2nd embodiment, the child-lock is automatically turned off at step S200 and allows the door to open by releasing the door-lock at step S201. It is possible even though there is no child-lock-releasing-signal.

When the door-lock is released at step S201, the door-closing-lamp is turned off and the door-opening-lamp is turned on.

The further explanation is excluded since the rests are identical with the 2nd embodiment.

FIG. 5 is the flow chart of the method of controlling opening and closing of the door in the drum-type washing machine in accordance with the 4th embodiment of the present invention.

The 4th embodiment includes, contrary to the 2nd one, the child-lock is off before the drum-type washing machine is in operation at step S300 and the child-lock is on after its operation at step S301.

The method of controlling opening and closing the door in the drum-type washing machine according to the 3rd embodiment comprises the steps of: operating the drum-type washing machine at step S110 while the child-lock-button is off at step S300; locking the door and turning on the door-closing-lamp at step S120; automatically turning on the child-lock at step S301; sensing whether the drum-type washing machine stops in operation at step S130, sensing the water level of the tub at step S140 when the drum-type washing machine stops operating; checking the child-lock to be released by manipulation of the child-lock-button at step S150 when the water level of the tub is lower than predetermined height; releasing the door-lock to be opened at step 160 when the child-lock is released; and turning off the door-closing-lamp and turning on the door-opening-lamp at step S161 after the door-lock comes to released.

The further explanation is excluded since the rests are identical with the 2nd embodiment.

FIG. 6 is the flow chart of the method of controlling opening and closing of the door in the drum-type washing machine in accordance with the 5th embodiment of the present invention.

The 5th embodiment is the same as the 4th one except that the child-lock is automatically turned off without the child-lock-releasing-signal at step S302 when the water level of the tub is under predetermined height.

The further explanation is excluded since the rests are identical with the 4th embodiment.

The method of controlling opening and closing of the door in the drum-type washing machine has the practical strength:

When the drum-type washing machine becomes stopped without finishing washing, the water level of the tub is sensed. Then, the door is opened only if the water level of the tub is lower than predetermined height. It can be prevented that water flows out caused by accidentally opening the door.

The user can clearly understand the condition of the drum-type washing machine since a lamp indicates that the door can be opened or should be locked depending on the water level of the tub.

When the drum-type washing machine stops in operation with the child-lock-on, the door-lock is released after the child-lock is released, even though the water level of the tub is under predetermined height. It can be prevented that the child opens the door when the drum-type washing machine is not operating.

It can be more definitely prevented that the door is accidentally opened with water contained in the drum-type washing machine on the ground that opening and closing of the door is decided by the double-lock-system including the child-lock.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

What is claimed is:

1. A method of controlling opening and closing of a door in a drum-type washing machine, comprising the steps of:
   - operating the drum-type washing machine;
   - locking the door not to open;
   - sensing a water level of a tub when the drum-type washing machine stops operating; and
   - releasing a door-lock so that the door becomes ready to open if the water level of the tub is sensed lower than predetermined height.

2. The method as set forth in claim 1, wherein the door-lock is maintained when the water level of the tub is sensed higher than predetermined height.

3. The method as set forth in claim 2, further comprising:
   - returning to the step of sensing the water level of the tub when the water level of the tub is sensed higher than predetermined height.

4. The method as set forth in claim 1, wherein a door-opening-lamp is turned on when the door-lock is released.

5. The method as set forth in claim 1, wherein a door-closing-lamp is turned off when the door-lock is released.
6. The method as set forth in claim 1, wherein a child-lock is turned on before the drum-type washing machine stops.
7. The method as set forth in claim 6, wherein the child-lock is turned on with manipulation by a user.
8. The method as set forth in claim 6, wherein the child-lock is automatically turned on after the drum-type washing machine is operating.
9. The method as set forth in claim 6, wherein the door-lock is released after the child-lock is released when the drum-type washing machine comes to a stop and the water level of the tub is lower than predetermined height.
10. The method as set forth in claim 9, wherein the child-lock is turned off by the user.
11. The method as set forth in claim 9, wherein the child-lock is automatically turned off.
12. The method as set forth in claim 9, wherein the door-lock is maintained when the water level of the tub is sensed higher than predetermined height.
13. The method as set forth in claim 11, further comprising: returning to the step of sensing the water level of the tub when the water level of the tub is sensed higher than predetermined height.
14. The method as set forth in claim 9, wherein the door-opening-lamp is turned on and the door-closing-lamp is turned off when the door-lock is released.