PATENTS ACT 1990

PATENT REQUEST : STANDARD PATENT

I/We being the person(s) identified below as the Applicant(s), request the grant of a patent to the person(s) identified below as the Nominated Person(s), for an invention described in the accompanying standard complete specification.

Full application details follow:

[71/70] Applicant(s)/Nominated Person(s):

LG Electronics Inc.

of

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[54] Invention Title:

Drying method of drum-type washing machine

[72] Name(s) of actual inventor(s):

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Basic Convention Application(s) Details:


DATED this TWENTY THIRD day of AUGUST 1996

[Signature]

a member of the firm of DAVIES COLLISON CAVE for and on behalf of the applicant(s)
An object of the invention is to ameliorate the problems of prior art. Methods according to the invention may prevent the drum from generating a flushing noise when proceeding with a drying step, and may also prevent laundry from attaching to the drum and thus becoming crumpled.

CLAIM

1. A drying method of a drum-type washing machine comprising the steps of:
   (a) draining water contained in laundry in a drum of the washing machine by maintaining a predetermined drying speed for a predetermined time in an initial drying step when executing a drying cycle of the washing machine; and
   b) sensing drum eccentricity after a predetermined time in said step (a), and then, if said eccentricity is not sensed, accelerating the drying speed to proceed with the drying operation.

2. The method as claimed in claim 1, wherein, in said step (b), said eccentricity is sensed by comparing, with a reference value, the difference between the slowest spinning speed of the drum and the fastest spinning speed of the drum.
NAME OF APPLICANT(S):
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INVENTION TITLE:
Drying method of drum-type washing machine

The following statement is a full description of this invention, including the best method of performing it known to me/us:-
Background of the Invention

The present invention relates to a method of drying laundry in a drum-type washing machine.

A general drum-type washing machine, as in FIG. 1, includes an oscillation part 7 for generating a predetermined clock signal, a micro computer 1 for controlling the washing machine in response to the clock signal generated by the oscillation part 7; a reset part 4 for initializing the micro computer 1; a key input part 3 for allowing a user to selectively input the washing cycles; a display part 2 for displaying a washing condition under the control of the micro computer 1; a speed detecting part 5 for detecting the speed of a motor 12; a buzzer driving part 6 for driving a buzzer when an error or alarm is generated from the washing machine; a static voltage part 9 for applying a predetermined voltage to the micro computer 1; a water level sensing part 8 for sensing the amount of water fed to a drum; and a load driving part 10 made up with triacs 10a, 10b, 10c and for driving motor 12, heater 13, and drainage pump 14 under the control of micro computer 10.

The thus-structured general drum-type washing machine performs a drying operation as illustrated in FIG. 2 which is a flowchart showing a method of controlling a drying cycle by sensing eccentricity of a conventional drum-type washing machine, and FIG. 3, which is a graph illustrating the drying cycle.

If a user finishes washing or rinsing, or selects a drying cycle in step 21S, the drain pump 14 is operated for drainage. When water-level sensing part 8 senses that there is no water in the washing tub, a washing/drying motor 12 is driven. When the motor 12 speeds up to a predetermined speed R1, in steps 22S and 23S, the time tb until the predetermined speed R1 is reached is measured.

When the measured time tb is compared with a predetermined time ta in step 24S, and then time tb is determined to be larger than time ta, it is sensed that the eccentricity is great due to unbalanced laundry, so that the motor 12 is stopped to re-drive the drying motor in step 25S. In the above step 24S, if time tb is smaller than time ta, the eccentricity of the laundry is sensed as being small, so that the motor is accelerated to the drying speed in steps 26S, 27S and maintains a predetermined period of time in step 28S. Then, the drying step is completed.
When the drying step is completed, as illustrated in FIG. 4, the whole laundry attaches to the inner surface of the drum.

As described above, according to the drying method of a conventional drum-type washing machine, the time required for accelerating the spinning speed to a predetermined speed at which the unbalance of the laundry is sensed, is not constant. Thus, if the eccentricity is not sensed just after reaching the predetermined speed, the spinning speed is accelerated to the drying speed. As a result, a large amount of water contained in the laundry drains at one time and thus causes a flushing noise.

Moreover, the conventional drying method has another disadvantage that the laundry attaches to the drum after the drying step ends, and thus the laundry gets tangled and crumpled.

**Summary of the Invention**

An object of the invention is to ameliorate the problems of prior art. Methods according to the invention may prevent the drum from generating a flushing noise when proceeding with a drying step, and may also prevent laundry from attaching to the drum and thus becoming crumpled.

According to the invention there is provided a drying method of a drum-type washing machine comprising the steps of:

(a) draining water contained in laundry in a drum of the washing machine by maintaining a predetermined drying speed for a predetermined time in an initial drying step when executing a drying cycle of the washing machine; and

(b) sensing drum eccentricity after a predetermined time in said step (a), and then, if said eccentricity is not sensed, accelerating the drying speed to proceed with the drying operation

**Brief Description of the Attached Drawings**

FIG. 1 is a block diagram showing the structure of a general drum-type washing machine;

FIG. 2 is a flowchart showing a drying cycle involving sensing eccentricity of a conventional drum-type washing machine;

FIG. 3 is a graph showing the drying cycle of FIG.2;

FIG. 4 is a cross sectional view of the inner washing tub after the drying cycle of FIG.
Detailed Description of Preferred Embodiment

With reference to the attached drawings, a drying method of a drum-type washing machine of the invention will be described in detail.

The structure of the present invention is the same as the conventional typical washing machine of FIG. 1. The drying cycle of the drum-type washing machine of the invention will be described with reference to FIGs. 5 and 6.

During washing, after a washing and rinsing step is completed, and if a user randomly selects a drying cycle in steps 50S and 51S to proceed with the drying cycle, the drain pump 14 for executing the drain step is operated. And then, if the water-level sensing part 8 senses that there is no water in the washing machine, a washing/drying motor 12 is driven to accelerate the spinning speed of the washing tub to a predetermined speed R2 where the laundry can float in the air and spin with the drum in step 52S.

After that step, the predetermined speed R2 in steps 53S and 54S is maintained in steps 53S and 54S for a predetermined time Tc, in order to discharge water contained in the laundry, thereby preventing eccentricity from being generated due to the water contained in the laundry.

When the washing tub finishes spinning at the predetermined speed R2 and for time Tc, the washing machine starts to sense unbalance of the laundry.

The unbalance sensing operation is performed by comparing, with a reference value in step 55S, calculated results of the speed X2 at which the drum spins fastest so that the laundry is placed on the bottom of the drum as in FIG. 7A, and the speed X1 at which the drum spins slowest so that the laundry is placed in the upper part of the drum as in FIG. 7B.

After the determining step, if the difference between X2 and X1 is larger than the...
reference value, the laundry is determined to be in the unbalanced state, so that the motor 12 is stopped in step 56S and re-processed from the starting step of the drying operation in step 52S.

If the difference between X2 and X1 is smaller than the reference value in the above step 55S, the laundry is determined to be in a balanced state, so that the speed of the motor 12 is accelerated to the drying speed in steps 57S and 58S and the drying speed is maintained for a predetermined time in step 60S. Thus, the drying step is completed.

When the drying cycle is executed through those steps of the invention, the dried laundry does not adhere to the inner surface of the drum as in FIG. 8 and also does not get tangled and crumpled by being placed on the bottom of the drum.

The thus-structured drying method of the invention prevents flushing noise in the drum, generated when the washing machine reaches the drying speed, by discharging the water contained in the laundry at the initial drying stage, and also prevents the laundry from getting crumpled or tangled, by placing the laundry on the bottom of the drum without sticking to the drum.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A drying method of a drum-type washing machine comprising the steps of:
   (a) draining water contained in laundry in a drum of the washing machine by
   5 maintaining a predetermined drying speed for a predetermined time in an initial drying step when
   executing a drying cycle of the washing machine; and
   b) sensing drum eccentricity after a predetermined time in said step (a), and then,
   10 if said eccentricity is not sensed, accelerating the drying speed to proceed with the drying
   operation.

2. The method as claimed in claim 1, wherein, in said step (b), said eccentricity is sensed by
   comparing, with a reference value, the difference between the slowest spinning speed of the drum
   and the fastest spinning speed of the drum.

3. A drying method of a drum-type washing machine
   substantially as hereinbefore described with reference to
   the drawings.

4. The steps, features, compositions and compounds
   disclosed herein or referred to or indicated in the
   specification and/or claims of this application,
   individually or collectively, and any and all combinations
   of any two or more of said steps or features.

DATED this TWENTY THIRD day of AUGUST 1996

LG Electronics Inc.

by DAVIES COLLISON CAVE
Patent Attorneys for the applicant(s)
ABSTRACT OF THE DISCLOSURE

A drying method of a drum-type washing machine including the steps of: (a) draining water contained in laundry in the washing machine drum by maintaining a predetermined drying speed for a predetermined time in an initial drying step when executing a drying cycle of the washing machine; and (b) sensing drum eccentricity after a predetermined time in the step (a), and then, if the eccentricity is not sensed, accelerating the drying speed to proceed with the drying operation, thereby preventing the drum from generating a flushing noise if there is an unbalance during drying, and also preventing the laundry from getting crumpled because of attachment to the drum on ending of the drying step.
FIG. 1
prior art

FIG. 2
prior art
FIG. 3
prior art

![Graph showing drying speed and unbalance sensing point of time.]

FIG. 4
prior art

![Diagram of a drum with laundry inside.]
FIG. 5

start

drying cycle

50S

N

Y

increase to a predetermined speed?

52S

N

proceed with other stroke

51S

Y

predetermined time (tc)?

53S

N

maintaining predetermined speed

54S

Y

X2 - X1 > reference value

55S

N

motor stop

56S

Y

accelerating to the drying speed?

57S

N

proceeding drying

59S

Y

predetermined time?

60S

end