

DEHYDRATING METHOD FOR A WASHING MACHINE

The present invention relates to operation control methods for washing machines, and more particularly to a dehydrating method (spin-cycle control method) for washing machines.

The basic construction of a washing machine of the type to which the invention pertains will be described with reference to Figure 1, which is a sectional side view of the washing machine. The washing machine shown is of the fully automatic, single-tub agitation type. In Figure 1, reference numeral 1 designates an agitator composed of a hollow cylinder in which are formed a number of through-holes 2 and which has several agitator blades 3 secured to the outer wall of the cylinder extending vertically and arranged radially, and reference numeral 4 designates a dehydrating (spin) tub having the agitator 1 at its centre. Through-holes 5 are formed in the side wall of the dehydrating tank 4. A balancer 6 including a hollow annular member is formed at the upper end opening of the dehydrating tub 4. The balancer 6 is used to prevent vibration of the dehydrating tub during dehydration. Further in Figure 1, reference numeral 7 designates a water receiving tank provided outside the dehydrating tub 4, the tank 7 having a water discharging outlet (not shown) to which a drain pipe (not shown) is connected.

In Figure 1, reference numeral 8 designates an electric motor which is coupled to a rotation transmitting section 12 through a speed reducing mechanism including a pulley 9, an endless V-belt 10, and a pulley 11. The rotation transmitting section has dual drive shafts 12a and 12b which are controlled by a spring clutch mechanism 13. The outer drive shaft 12a is coupled to

the dehydrating tub 4, and the inner drive shaft 12b to the agitator 1.

5 The above-described mechanisms are all installed through a vibration preventing buffer (not shown) in the outer casing (not shown). A control device using a microcomputer and an operating section including operating switches are provided on the upper part of the outer casing. The outputs of a water level detector and other detectors are applied to the control device. The outputs of the control device are applied to a drive circuit for the motor 8, a valve control circuit for a water supplying valve, a water discharging valve, and other circuits.

15 In washing, rinsing and dehydrating operations with the washing machine, the clothes to be washed (the load), water and detergent are put in the tub 4, and then the power switch is turned on. As a result, the motor 8 is rotated alternately in the forward direction and in the reverse direction, and accordingly the agitator is
20 rocked to effect washing. As controlled by a timer in the control device, the washing operation is continued for a predetermined period of time, whereupon the water is discharged. Thus, the washing cycle has been accomplished, and the dehydrating (spin) cycle is
25 carried out.

In the dehydrating cycle, the spring clutch mechanism 13 is operated to rotate the shaft 12b together with the shaft 12a. The motor 8 is rotated in one direction only so that the dehydrating tub 4 is rotated through
30 the pulley 9, the V-belt 10, the pulley 11, and the rotation transmitting section 12 by the motor 8. In this case, the speed of rotation of the dehydrating tub 4 is determined by the speed reduction ratio of the

pulleys 9 and 11, and the speed of rotation of the motor 8 is determined from the number of poles. In the case of an induction motor, the steady-state speed of rotation is 900 rpm. When the speed of rotation reaches this value, the dehydrating operation is started.

In the above-described conventional dehydrating method, the rotation of the dehydrating tub is such that immediately after the rotation of the dehydrating tub is started, the speed of rotation of the tub quickly reaches a high speed of rotation of 900 rpm. Therefore, a high centrifugal force is abruptly applied to the wet clothes in the tub 4, which tends to shift the latter to one side of the tub 4, as a result of which the dehydrating tub strongly vibrates and produce large amounts of noise. Such vibration cannot be completely absorbed by the balancer 6 provided at the upper end opening of the tank 4.

The dehydrating tub 4 may be intermittently rotated merely by controlling the period of energization of the motor 8. However, since the force of rotation due to inertia depends on the weight of the load (the wet clothes), it is impossible to achieve accurate speed control with this method.

On the other hand, the dehydrating tub of a fully automatic washing machine in which the dehydrating tub is used as the washing tub also is larger than that of a twin-tub type washing machine in which a washing tub is provided separately from the dehydrating tub.

Therefore, the noise output and vibration of the former are generally larger than of the latter. In order to minimize the amount of noise and vibration, a balancer for causing the dehydrating tub to rotate in a

horizontal plane is provided at the upper end opening of the dehydrating tub; however, a balancer cannot sufficiently eliminate the production of noise and vibration.

- 5 Recently, thin fabrics and delicate fibres such as wool are often washed in a home washing machine. In the conventional dehydrating operation, only one speed of rotation, which is considerably high (900 rpm), is provided. If woollen clothes are washed in such a
- 10 machine and dried in a dehydrating tub which is rotated at such a high speed, an excessively high centrifugal force tends to be applied. As a result, the clothes can be excessively dehydrated and damaged or creased. This difficulty cannot be eliminated even if the period
- 15 of dehydration is decreased or the dehydrating tub is intermittently rotated utilizing a timer.

SUMMARY OF THE INVENTION

An object of this invention is to provide a dehydrating method for a washing machine by which the above-described difficulty is eliminated, that is, with
5 which, during the dehydrating operation, the shifting of the load to one side of the dehydrating tub is prevented, and production of large amounts of noise and vibration is prevented.

Another object of the invention is to provide a
10 dehydrating method for a washing machine by which not only strong fabrics such as cottons, but also more delicate fabrics such as wollens can be dehydrated without damage or creasing.

In accordance with the invention there is provided a
15 method of dehydrating a load of clothes in a tub of a washing machine, which comprises the steps of:

(a) detecting the fact that the operation of said washing machine is in an initial stage of a dehydrating operation;

(b) in said initial stage of said dehydrating operation, rotating said tub at low speed for a predetermined period of time by

- (i) detecting a speed of rotation of said tank;
- 5 (ii) detecting whether or not the speed of rotation thus detected has reached a predetermined low speed of rotation; and

(iii) upon detection of the fact that said tub is in rotation at said low speed, maintaining said
10 predetermined condition of low speed rotation for a predetermined period of time; and

(c) rotating said tub at high speed when said predetermined period of time has passed, the speed being switched to high speed or low speed, as the case
15 may be, by means of a frequency converting means.

In the accompanying drawings:-

Figure 1 is a sectional side view showing a single-tank, agitation-type washing machine which practices the method of the invention;

20 Figure 2 is a characteristic curve diagram indicating rates of rotation of a dehydrating tank in a

dehydrating method of a washing machine according to the invention;

5 Figure 3 is a block diagram of a dehydrating operation control section forming an essential part of the washing machine;

Figure 4 is a waveform diagram showing the output waveform of a frequency converter in Figure 3;

Figure 5 is an explanatory diagram showing a washing procedure;

10 Figure 6 is an explanatory diagram showing a water-added dehydrating operation (spin-and-rinse cycle), which forms an essential part of the washing procedure;

Figure 7 is an explanatory diagram showing a dehydrating operation included in the washing procedure;

15 Figure 8 is a block diagram showing a control unit and a frequency converter in Figure 3;

Figure 9 is a flowchart showing the control operation of the control unit;

20 Figure 10 is an explanatory diagram for a description of a dehydrating method for a washing machine in accordance with a second embodiment of the invention;

Figure 11 is an explanatory diagram showing an ordinary washing procedure;

25 Figure 12 is a flow chart showing the control operation of the control unit in the second embodiment;

Figure 13 is a block diagram of an operation control mechanism employed in a dehydrating method for a washing machine in accordance with a third embodiment of the invention; and

- 5 Figure 14 is a flowchart showing the control operation of the control unit in the third embodiment.

Preferred embodiments of the invention will now be described with reference to the accompanying drawings.

- 10 Figure 2 is a characteristic diagram indicating the speed of a dehydrating tub operated according to a dehydrating method of the invention. Figure 1 is a sectional side view of the washing machine which practices the method of the invention. The construction of the washing machine is similar to that
15 described before.

- In the method of the invention, the motor 8 of the above-described washing machine is provided with a speed detector 14 for detecting the speed of rotation of the motor 8, and the output of the speed detector 14
20 is applied to the control device. The speed detector may be, for instance, a tachometer generator. The tachometer generator may be replaced by a device which includes a rotary plate having a detecting hole and which is secured to the shaft of the motor 8, and a
25 U-shaped angle detector with a light-emitting section and a light-detecting section.

- The washing machine further has a frequency converter 16, a control unit 15, and an AC clock circuit 17. The control unit 15 controls a drive circuit for the motor
30 8. The output signal of the control unit 15 is applied to the frequency converter 16. The output signal of

the AC clock circuit 17 is supplied to the control unit 15. The AC clock circuit 17 is made up of a transformer 17a, resistors 17b and 17e, a diode 17c, and a transistor 17d.

5 Washing, rinsing and dehydrating cycles are successively carried out according to a set washing procedure as shown in Figure 5. In the washing operation, after the clothes, water and detergent are loaded into the dehydrating tank, the power switch is turned on. As a
10 result, the motor 3 is rotated alternately in the forward direction and in the reverse direction. As controlled by the operation of a timer in the control device, the above-described washing operation is performed for a predetermined period of time, and then
15 the wash water is discharged. Thus, the washing operation has been accomplished.

Next, in the rinse cycle, a water-added dehydration operation (water is added during spinning) and an ordinary rinsing operation (ordinary spin) are
20 alternately carried out. The word "water-added dehydration" is intended to mean the discharging of detergent from the load while new water is being added from above.

In the water-added dehydration cycle, the spring clutch
25 mechanism 13 is operated to rotate the shafts 12a and 12b together, and the motor 3 is rotated continuously in one direction only. When the motor 3 is energized, the dehydrating tank 4 and the agitator 1 are rotated. However, in the initial stage of the water-added
30 dehydration cycle, the water adding operation is not yet carried out. The output of the speed detector 14 is supplied to the control unit 15. On the other hand, in the AC clock circuit 17 an input whose phase is the

same as that of the power frequency applied to the motor 8 is supplied to the transformer 17a where the voltage of the input thus applied is reduced. The transformer output is then subjected to half wave
5 rectification by the diode 17c. The current applied to the transistor 17d is limited by the resistor 17b, and the resultant sinusoidal half wave is shaped into a rectangular wave by the transistor 17d and the resistor 17e to make it suitable as an input to the control unit
10 15.

When the speed of rotation of the motor 8 reaches a value such that the speed of rotation of the dehydrating tub 4 is about 300 rpm (i.e., one-third of
15 of the dehydrating tank 4), the control unit 15 applies an output to the frequency converter 16 so that only the parts of the power waveform which are shown shaded in Figure 4 are applied to the motor 8. The frequency of the shaded parts is one-third of the fundamental
20 frequency (50/60Hz). Accordingly, the speed of rotation of the motor 8 is also reduced to one-third, and the speed of rotation of the dehydrating tub 4 is decreased to one-third of the ordinary high speed of rotation thereof.

25 Thus, the washing in the dehydrating tank is dehydrated for a predetermined period of time while the dehydrating tub 4 is being rotated at the low speed of 300 rpm.

The low speed should be selected to be lower than the
30 resonance point at which the dehydrating tank vibrates maximally, and therefore the low speed is not limited to 300 rpm. That is, the low speed may be set to a value in a range of about 300 rpm to 450 rpm. The

operation of the dehydrating tank at the low speed will be referred to as "balanced rotation" when applicable (see Figure 6).

5 During balanced rotation, the speed of rotation of the dehydrating tub is lower than the resonance point, and therefore the load has little tendency to shift to one side of the dehydrating tub. Even if the load is shifted to one side of the dehydrating tub, its position will be quickly corrected, and therefore
10 eccentric rotation, accompanied by large amounts of noise and vibration, is scarcely caused. During balanced rotation, about 60% of the water in the clothes is removed, and the weight of the load is decreased as much.

15 Thereafter, high speed rotation is effected. That is, the adding of water is started and the motor 8 is continuously operated. The speed of the motor 8 is increased until the speed of rotation of the dehydrating tank 4 reaches 900 rpm. During this high
20 speed rotation, noise and vibration due to eccentric rotation are scarcely produced because the percentage of content of the water in the load has been decreased by the previous balanced rotation. Balanced rotation is carried out also in the step of final hydration as
25 shown in Figure 7.

Balanced rotation will be described in more detail. The control unit 15 and the frequency converter 16 in Figure 3 include a CPU (central processing unit) 15A, a ROM (read-only memory) 15B, a RAM (random access memory)
30 15C, and an I/O port 15D for inputting and outputting signals, as shown in Figure 8.

A program as shown in Figure 9 is stored in the ROM 15B. During the dehydrating operation, the motor speed is controlled according to this program. When the motor 8 is energized, the CPU 15A receives the output signal of the tachometer generator 14 through the I/O port 15D and determines whether or not the speed of the motor 8 has reached the value at which the speed of rotation of the dehydrating tub is 300 rpm (S1 in Figure 9). This operation is repeatedly carried out until an output signal is obtained which indicates that the speed of the motor 8 has reached the value at which the dehydrating tub is rotating at 300 rpm (t_1 in Figure 2), and then the next step S2 is effected.

The instruction of rotation applied to the motor 8 until the step S2 is effected causes the motor to rotate at its fundamental frequency (50 or 60 Hz) as shown in Figure 4. In the step S2, an instruction of rotation of one-third the fundamental frequency, as shown shaded in Figure 4, is outputted. Therefore, the dehydrating tank is rotated at a low speed of 300 rpm, which is one-third the high speed of 900 rpm.

In the following step S3, it is determined whether or not the dehydrating tub has rotated at 300 rpm continuously for a predetermined period of time. When the predetermined period of time has passed (t_2 in Figure 2), the next step S4 is effected.

In the step S4, the instruction of rotation at one-third that of the fundamental frequency (50/60 Hz) is changed over to the instruction of rotation of 50/60 Hz. Therefore, the motor 8 is rotated at a high speed.

The high speed rotation is followed by a dehydrating operation which is carried out for a predetermined period of time. The dehydrating operation is accomplished at the end of the predetermined period of time (S5 in Figure 9).

The dehydrating operation including balanced rotation is carried out as described above.

In the above-described embodiment, the motor 8 is started in the ordinary manner, and the speed of rotation of the motor 8 detected so that, when the speed of rotation reaches about 300 to 450 rpm, the dehydrating tub 4 is rotated at the low speed. However, the following method may be employed instead.

At the start of the washing operation, the operating section applies an input signal to the control unit 15 so that the dehydrating tub 4 is rotated, for instance, at 300 rpm for a predetermined period of time in the initial stage of the water-added dehydration cycle, namely, a low speed rotation instruction is applied at the start of rotation of the dehydrating tub. That is similar to the above-described first embodiment, the washing operation is carried out, and thereafter water-added dehydration is effected. Thereupon, the control unit 15 provides an output so that the speed of rotation of the dehydrating tub 4 is set to 300 rpm (in response to the output of the frequency converter 16) from the start of rotation.

While an embodiment of the invention has been described with reference to a fully automatic, agitation-type washing machine, the technical concept thereof is applicable to all washing machines which have dehydrating tubs such as twin-tub type washing machines

and pulser-operated (vortex type) washing machines.

The operation of a second embodiment of the invention will be described.

Figure 2 shows a standard washing procedure for a
5 washing machine of the second embodiment. In the
washing operation, the clothes, water and detergent are
placed in the dehydrating tub 4 and then the power
switch is turned on. As a result, the motor 8 is
rotated alternately in the forward direction and in the
10 reverse direction, and accordingly the agitator 1 is
also rocked. Controlled by a timer in the control
device, the above-described operation is continued for
a predetermined period of time, and then the water is
discharged. Thus, the washing operation has been
15 accomplished, and the rinsing operation is effected.

In the rinsing operation, a water-added dehydration and
an ordinary rinsing operation are alternatively carried
out. In the water-added dehydration cycle, the spring
clutch mechanism 13 is operated to rotate the shaft 12b
20 together with the shaft 12a, and the motor 8 is rotated
in one direction only. When the motor 8 is energized,
the dehydrating tub 4 and the agitator 1 are rotated.
However, in the initial stage of the water-added
dehydration cycle, the water adding operation is not
25 carried out.

As shown in Figure 10, when the speed of the motor 3
increases to rotate the dehydrating tub 4 at 300 rpm,
the control device provides an output to stop the motor
3 for a short period of time. In succession, the motor
30 8 is started again, and the speed of the motor 8 is
increased until the speed of the dehydrating tub
reaches 300 rpm.

This operation is repeated about five times.

The speed of 300 rpm is the upper limit value because it is lower than the resonance point at which the dehydrating tub 4 vibrates maximally, as described
5 before. The intermittent operation of the dehydrating tank at the low speed of rotation is referred to as "balanced rotation" in the second embodiment also.

During balanced rotation, the speed of rotation of the dehydrating tub is lower than the resonance point, and
10 therefore the load does not have a strong tendency to shift to one side in the dehydrating tub. Even if the load does shift to one side of the dehydrating tub, the position is quickly corrected, and therefore eccentric rotation accompanied by large amounts of noise and
15 vibration is scarcely caused. During balanced rotation, about 30% of the water in the clothes is removed, and the load on the motor is decreased as much.

Thereafter, high speed rotation is effected. That is, the adding of water is started again, and the motor 8
20 is continuously operated until the speed of the dehydrating tub 4 reaches 900 rpm. During high speed rotation, noise and vibration due to eccentric rotation are scarcely produced because the quantity of water in the clothes has been partially decreased during
25 balanced rotation.

After the rinsing operation, the final operation namely, a dehydrating operation, is carried out. As in the above-described case, balanced rotation is carried out in the initial stage of the dehydrating operation.

30 Balanced rotation will be described in more detail. Balanced rotation is carried out by the same circuit as

that shown in Fig. 8; however, it should be noted that program as shown in Fig. 12 is stored in the ROM 15B.

As indicated in Fig. 12, upon energization of the motor 8, the CPU 15A receives the output signal of the tachometer generator 14 through the I/O port 15D and then determines whether or not the signal represents the fact that the speed of rotation of the dehydrating tub has reached 300 rpm (Step S11 in Fig. 12). If the speed of rotation represented by the signal is smaller than 300 rpm, the determination is carried out again. When it is detected that the signal indicates that the speed of rotation of the dehydrating tub has reached 300 rpm, the next step S12 is effected.

In the step S12, the energization of the motor 8 is stopped for a predetermined short period of time, as a result of which the speed of rotation of the motor 8 is temporarily decreased as shown in Fig. 10.

In the subsequent step S13, it is detected whether or not the deenergization of the motor 8 has been performed for the predetermined short period of time. When the predetermined short period of time has passed, the next step S14 is effected.

In the step S14, it is detected how many times the energization of the motor 8 has been interrupted. That is, the energization and deenergization of the motor is repeated a predetermined number of times, and then the next step S15 is carried out.

In the step S15, the motor 8 is rotated at a high speed so that the dehydrating tub is rotated at 900 rpm as shown in Fig. 10.

In the subsequent step S16, the period of time for which the dehydrating tub is rotated at the high speed is determined. When the period of time thus detected reaches a predetermined value, high speed rotation is stopped. Thus, the dehydrating operation has been accomplished.

According to the above-described program, the dehydrating operation including balanced operation is carried out.

The rotation of the dehydrating tub 4 may be controlled merely by controlling the period of energization of the motor 8. However, since the force of rotation due to inertia depends on the size of the washing load, in this energization period control method it is impossible to estimate ahead of time the time of application of the force of rotation. Therefore, when the motor 8 is stopped, the speed of rotation of the motor 8 is decreased temporarily; however, it increases gradually because the motor is started again. Accordingly, the speed of rotation of the dehydrating tub is increased as the on-off operation of the motor is repeated. Thus, it is difficult to maintain the speed of rotation of the dehydrating tub lower than the resonance point.

While the second embodiment has been described with reference to a fully automatic, agitation-type washing machine, the technical concept is applicable to all washing machines which have dehydrating tanks such as twin-tub type washing machines and pulsator-operated washing machines.

As is apparent from the above description, in the inventive dehydrating method for washing machines

described with reference to the second embodiment of the invention, it is unnecessary to add special mechanisms or electrical components to the washing machine, and the method ensures a low amount of vibration and low amount of noise. Furthermore, use of the method prevents the difficulty of the dehydrating tub being stopped during dehydration.

A third embodiment of the invention concerning a low speed dehydrating operation will now be described.

In Fig. 13, reference numeral 20 designates a control unit, which is an essential component of the operation control device and which uses a microcomputer or the like, 21, a frequency converter, 22, an AC clock circuit including a transformer 22a, resistors 22b and 22e, a diode 22c, and a transistor 22d, and 23, an operating section for setting the speed of rotation and a period of rotation for the dehydrating tub 4.

Output signals of the operating section 23 and the AC clock circuit 22 are supplied to the control unit 20, the output signal of which is applied through the frequency converter 21 to the motor 8.

A preferred method of controlling the dehydrating operation with the above-described operation control device will be described. Before the start of a washing operation, a speed of rotation and a period of rotation suitable for the material of the load are set, for instance, to 300 rpm (one-third of the ordinary high speed of rotation of 900 rpm) using the operating section 23, specifically, by depressing a "DELICATE" switch of the washing program section. Similar to the case of conventional washing machine, the timer of the control device is then operated to rotate the motor 8

alternately in the forward direction and in the reverse direction for a predetermined period of time, thereby to rock the agitator to perform the washing operation. Thereafter, the water is discharged, and then a
5 dehydrating operation is carried out.

In the dehydrating operation, the spring clutch mechanism 13 is operated to rotate the shafts 12a and 12b together so that the motor 8 is rotated in one direction only. The rotation of the motor 8 is
10 transmitted through the pulley 9, the V-belt 10, the pulley 11 and the rotation transmitting section 12 to the dehydrating tub 4. As a result, centrifugal force is applied to the load in the dehydrating tub, and the clothes are therefore dehydrated.

15 In the dehydrating operation, the speed of 300 rpm of the dehydrating tub set by the operating section 23 is instructed to the control unit 20, and, on the other hand, an input whose phase is the same as that of the power applied to the motor 8 is supplied to the
20 transformer 22a. The voltage of the input is reduced by the transformer 22a, and the transformer output is subjected to half-wave rectification by the diode 22c. The current applied to the transistor 22d is limited by the resistor 22b, and the transistor 22d and the
25 resistor 22e form a sinusoidal rectangular half-wave signal which is suitable as an input to the control unit 20. Thus, the control unit 20 receives the two inputs and applies outputs to the frequency converter 21. In this case, only the parts of the power signal
30 shown shaded in Fig. 4 are applied to the motor 8. The frequency of the shaded parts is one-third the fundamental frequency (50/60 Hz). Accordingly, the speed of rotation of the motor 8 (which is an induction motor) is also reduced to one-third, and the speed of

rotation of the dehydrating tub 4 is decreased to one-third of its ordinary high speed of rotation. Thus, the clothes in the dehydrating tub 4 are dehydrated in the dehydrating tub 4 which is rotated at the low speed.

This low-speed dehydration operation will be described in more detail. The dehydration operation is also controlled by the same circuit as that shown in Fig. 8; however, it should be noted that the program stored in the ROM 15A is different. That is, the program is the same as that shown in Fig. 9 up to the step S3 (or that shown in Fig. 12 up to the Step S14), and the following steps are as indicated in Fig. 14.

After the step S3 (or S14) of ending balanced rotation, the washing program selected by the operation section 23 is confirmed so as to determine whether or not high-speed dehydration is selected (Step S21). If high-speed dehydration has been selected, the motor is rotated at the high speed (Step S22). If high-speed dehydration has not been selected, then the motor is rotated at the low speed (Step S23). In both high-speed rotation and low-speed rotation, the period of rotation is confirmed and the rotation is continued for the predetermined period of time.

In the above-described embodiment, the speed of rotation of the dehydrating tub 4 is one-third of the ordinary high speed of rotation; however, the speed of rotation is not limited thereto or thereby. That is, any speed of rotation lower than the high speed of rotation, such as a speed half the high speed of rotation, can be used. It has been found through experiments that a speed of rotation which is on the order of one-third to one-half the high speed of

rotation is preferable for delicate fabrics such as wool.

5 As is apparent from the above description, in the
dehydrating method for washing machines of the third
embodiment of the invention, the dehydrating tub is
rotated not only at the high speed of rotation but also
at a low speed of rotation one-third to one-half the
high speed of rotation. Therefore, a speed of
rotation, and hence a centrifugal force, suitable for
10 the material of the clothes being washed is obtained.
Accordingly, even a garment made of a delicate fabric
such as wool will never be damaged, deformed or creased
during the dehydrating operation.

CLAIMS

1. A method for dehydrating a load of clothes in a tub of a washing machine, which comprises the steps of:

5 (a) detecting the fact that the operation of said washing machine is in an initial stage of a dehydrating operation;

(b) in said initial stage of said dehydrating operation, rotating said tub at low speed for a predetermined period of time by

10 (i) detecting a speed of rotation of said tank;

(ii) detecting whether or not the speed of rotation thus detected has reached a predetermined low speed of rotation; and

15 (iii) upon detection of the fact that said tub is in rotation at said low speed, maintaining said predetermined condition of low speed rotation for a predetermined period of time; and

20 (c) rotating said tub at high speed when said predetermined period of time has passed, the speed being switched to high speed or low speed, as the case may be, by means of a frequency converting means.

25 2. The method as claimed in claim 1, in which in said step of rotating said tub at low speed, the speed of rotation thereof is one-third to one-half that in said step of rotating said tub at said high speed.

30 3. The method as claimed in claim 2, in which, in said step of rotating said tub at low speed, said low speed of rotation is smaller than a range of speeds of rotation at which said tub resonates and strongly vibrates.



4. The method as claimed in claim 1, in which said frequency converting means includes means for generating a rectangular wave corresponding to half the alternating current wave, and means for receiving an
5 output from said rectangular wave generating means and selecting a predetermined part of the alternating current waveform.

5. The method as claimed in claim 4, which further comprises the steps of:

10 (d) determining whether a dehydrating operation being carried out is a first dehydrating operation in which the washing load is merely dehydrated or a second dehydrating operation in which the washing is dehydrated while water is being added; and

15 (e) in said second dehydrating operation, adding water to said load in said step of rotating said tub at high speed.

