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METHOD FOR CLEANING A WASHING MACHINE

Field of the Invention

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The present invention relates to a method for cleaning a washing machine by way of removing foreign substances such as black mold grown therein.

10 Background of the Invention

Referring to Fig. 6, there is illustrated a conventional washing machine.

As shown in Fig. 6, outer tub 1 contains therein
15 washer tub 3 which has pulsator 2 rotatably disposed on the bottom part thereof, and is suspended via suspension rods 4 from outer frame 5 of the washing machine. Motor 6 drives pulsator 2 and washer tub 3 via V-belt 7 and clutch 8 which also functions as a speed reduction mechanism. Water supply
20 valve 9 is for supplying water into washer tub 3; water drain valve 10, for draining washing fluid from washer tub 3; and water level detector 11, for detecting the water level inside outer tub 1.

Pump chamber 13 is provided in proximity to the
25 periphery of inner blades 12 of pulsator 2. The washing fluid in washer tub 3 is sent to lint filter 15 from pump



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chamber 13 via water circulation passage 14. Covering member 16 is provided at the upper part of outer tub 1. Controller 17 controls motor 6, water supply valve 9, water drain valve 10 and the like to control washing, rinsing and dewatering cycles sequentially.

In such a washing machine described above, parts of dirt removed from the laundry articles and certain components of detergent may, in combination with metallic ions contained in the tap water, form metallic soap, which may then be attached to, e.g., outer tub 1, washer tub 3 and pulsator 2. Moreover, with repetition of the washing cycles, microorganisms contained in the laundry articles may act on the attached metallic soap, thereby creating foreign substances such as biofilms and black mold at certain hidden parts of the outer wall of washer tub 3, the inner wall of outer tub 1, the lower part of pulsator 2 and the like. As is often the case, parts of such deleterious deposits may be detached therefrom by the water flow during the washing cycle to contaminate the laundry articles.

Such foreign substances can be removed by way of using a washer tub detergent containing therein a bleaching component as the major part thereof. When using it, water supply valve 9 and water level detector 11 are operated to supply water as high as possible inside washer tub 3. Then, the detergent is added and pulsator 2 is rotated to dissolve the detergent. And then by soaking in the water for several

hours, the detergent acts on and removes the foreign substances. Thereafter, water drain valve 10 is operated to drain the water. Subsequently, in order to rinse out washer tub 3, water is supplied up to a preset level inside washer tub 3 and pulsator 2 is rotated to execute rinsing; and then
5 the water is drained.

However, such tub cleaning method described above suffers from certain drawbacks. That is, it is burdensome to manually execute the soaking or the tub washing operation
10 for an extended period of time and then automatically execute the tub rinsing operation. Further, only the foreign substances residing below the water level during the tub washing operation can be removed. In other words, only the portion of the foreign substances soaked in the tub washing
15 fluid during the hours of the soaking operation can be removed, and the foreign substances disposed above the increased water level created by the rotation of pulsator 2 cannot be removed. Still further, the foreign substances so removed may not be completely drained out of the washing
20 machine by the tub rinsing operation; and, therefore, certain parts thereof may remain inside the washing machine and then stick to and contaminate the laundry articles during a next laundry washing cycle.

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Summary of the Invention

It is, therefore, an object of the present invention to provide a tub cleaning method capable of executing both a tub washing process and a tub rinsing process in an automated manner, to thereby effectively remove foreign substances generated inside a washing machine.

In accordance with a preferred embodiment of the present invention, there is provided a method for cleaning a washing machine having a washer tub and an outer tub, including the steps of: washing the washer tub, a pulsator rotatably disposed on a bottom part of the washer tub, and an inner surface of the outer tub by using a tub washing fluid containing a detergent; and rinsing the washed tubs and pulsator, wherein the washing step includes the steps of: providing the tub washing fluid containing the detergent inside the washer tub and the outer tub; performing a soaking process accompanied by intermittent forward and reverse rotations of the pulsator; and draining the tub washing fluid out of the washer tub after the soaking process.

Brief Description of the Drawings

The above and other objects and features of the present invention will become apparent from the following description of preferred embodiments given in conjunction

with the accompanying drawings, in which:

Fig. 1 is a vertical cross sectional view of a washing machine which executes a tub washing process in accordance with a first preferred embodiment of the present invention;

5 Fig. 2 presents a flow chart of the tub washing process of the first embodiment of the present invention;

Fig. 3 illustrates a vertical cross sectional view of the washing machine which executes a tub rinsing process in accordance with a second preferred embodiment of the present invention;

10 Fig. 4 provides a flow chart of the tub rinsing process of the second embodiment of the present invention;

Fig. 5 shows a vertical cross sectional view of the washing machine which executes a tub cleaning cycle in accordance with a third preferred embodiment of the present invention; and

Fig. 6 depicts a vertical cross sectional view of a conventional washing machine.

20 Detailed Description of the Preferred Embodiments

Preferred embodiments of the present invention will now be described in detail with reference to Figs 1 to 5, in which like parts to those of the prior art washing machine depicted in Fig. 6 are denoted by like reference numerals.

First preferred embodiment

As shown in Fig. 1, controller 18 controls the operations of motor 6, water supply valve 9, water drain valve 10 and the like to control one or more laundry washing cycles. In each cycle washing, rinsing and/or dewatering processes are controlled sequentially or selectively. Controller 18 also executes a tub washing process by using a tub washing fluid containing a detergent and a tub rinsing process thereafter in order to clean washer tub 3, pulsator 2 rotatably disposed on a bottom part thereof, and the inner surface of outer tub 1.

The tub washing process is executed by supplying a tub washing fluid wherein the tub washing fluid of a certain concentration is provided into washer tub 3 and outer tub 1; a soaking process during which intermittent forward and reverse rotation of pulsator 2 is carried out; and then a draining process which drains the tub washing fluid from the washer tub 3.

During the soaking process, the water level is set to be level P1, which is preferably higher than a maximum water level which can be reached during the laundry washing cycles; and the forward and reverse rotation and rotation stops of pulsator 2 are executed alternately. Moreover, after the soaking process, an agitation process is executed, wherein the tub washing fluid in washer tub 3 is agitated by pulsator 2.

The operation of the washing machine will now be described with reference to Figs. 1 and 2. Upon pushing a start switch(not shown) at step 20, the tub washing fluid supply process of the tub washing process is initiated. At
5 step 21, water is supplied to washer tub 3 up to preset water level P1, which is higher than the maximum water level during the laundry washing cycles, by means of water supply valve 9 and water level detector 11, and then water supply valve 9 is closed. At step 22, detergent is added. And at
10 step 23, motor 6 rotates pulsator 2 to execute the forward and reverse rotation for a preset time period to thereby dissolve the detergent and to provide the tub washing fluid with a uniform concentration of detergent.

Subsequently, entering into the soaking process
15 accompanied by the intermittent forward and reverse rotation of pulsator 2, motor 6 makes pulsator 2 execute the forward and reverse rotation under the on/off control of the controller 18 at step 24. By the forward and reverse rotation of pulsator 2, the agitating force of the tub
20 washing fluid in washer tub 3 is increased and when pulsator 2 is on, the central part of the fluid surface inside washer tub 3 goes down, while the outer part thereof, i.e. the fluid level between washer tub 3 and outer tub 1, rises.

Therefore, the fluid level between washer tub 3 and
25 outer tub 1 rises above preset water level P1, whereby the detergent can reach up to a higher level in the outer wall

of washer tub 3 and in the inner wall of outer tub 1. Inversely, in the off state, the fluid level in washer tub 3 increases back, and that between washer tub 3 and outer tub 1 goes down.

5 Thereafter, at step 25, soaking is executed for a predetermined time period, during which the forward and reverse rotation of pulsator 2 is not performed, thereby allowing the tub washing fluid to act on the foreign substances sufficiently. At step 26, operations at steps 24
10 and 25 are repeated for a preset number of times so that the detergent can reach the foreign substances efficiently and the water stream developed by the forward and reverse rotation of pulsator 2 can remove the foreign substances.

 Next, in a subsequent agitation process at step 27, by
15 forward and reverse rotation of pulsator 2, the tub washing fluid in washing and dewatering tub 3 is sent to lint filter 15 from pump chamber 13 via water circulation passage 14 and thus the foreign substances included in the tub washing fluid are collected in lint filter 15. At the same time,
20 the foreign substances deposited in the backside of pulsator 2, pump chamber 13, water circulation passage 14 and the like can also be removed and collected in lint filter 15.

 Subsequently, entering into the draining process, water drain valve 10 is operated at step 28 to drain the tub
25 washing fluid from washer tub 3, and then the procedure proceeds to the rinsing process at step 29.

In this manner, a water stream can be created by the intermittent forward and reverse rotation of pulsator 2 so that more foreign substances formed on the outer wall of washer tub 3 and the inner wall of outer tub 1 can be removed; and by the automation, the burdensome process can be readily executed in an automated manner and the foreign substances formed in the washing machine can be removed.

Further, in the soaking process, the preset water level is set to be higher than the maximum water level during the laundry washing cycles and the tub washing fluid is agitated by the alternate execution of the forward and reverse rotation and rotation stop of pulsator 2; and moreover, the central part of the fluid level inside washer tub 3 goes down while the fluid level between washer tub 3 and outer tub 1 rises. Consequently, the tub washing fluid can reach and remove the foreign substances formed on the outer wall of washer tub 3 and the inner wall of outer tub 1 above the maximum water level of the laundry washing cycles.

Yet further, by executing, after the soaking process, the agitation process in which tub washing fluid in washer tub 3 is agitated by pulsator 2, the foreign substances removed by the soaking process can be collected in lint filter 15.

In the present embodiment, the water level is maintained to be identical during both the tub washing fluid supply process and the soaking process. However, the water

level in the tub washing fluid supply process may be set to be equal to, e.g., the maximum water level of the laundry washing cycles and water may be supplied more in the subsequent soaking process to a level higher than the maximum water level. In this case, the detergent can be dissolved faster by the tub washing fluid supply process.

Second preferred embodiment

As shown in Fig. 3, controller 29 controls the operations of motor 6, water supply valve 9, water drain valve 10 and the like to control the laundry washing, rinsing and dewatering processes sequentially or selectively, and also executes a tub washing process by using the tub washing fluid containing therein detergent and a tub rinsing process thereafter in order to clean washer tub 3 and the inner surface of outer tub 1 which contains therein washer tub 3. The rinsing process executes, at least once, the following processes sequentially: a tub rotating rinsing process wherein water supply valve 9 and water drain valve 10 are opened at the same time while washer tub 3 is rotated at a low speed; a first agitating rinsing process wherein pulsator 2 is rotated with a smaller amount of water than that of the soaking process while water drain valve 10 is closed; a second agitating rinsing process wherein pulsator 2 is rotated with the same amount of water as in the soaking process; and a draining process being executed with water

drain valve 10 open.

Further, a water supplying rinsing process is preferably executed prior to the draining process of the rinsing process. Other parts are identical to those of the
5 above-described first preferred embodiment; and, therefore, they are represented by the identical reference numerals and the description thereof will be omitted.

The operation of the above washing machine will now be described with reference to Figs. 3 and 4. After finishing
10 the tub washing process, the procedure goes into the tub rinsing process as follows: first at step 31, the tub rotating rinsing process is executed, wherein water supply valve 9 and water drain valve 10 are opened or operated at the same time while washer tub 3 is rotated at a low speed ,
15 so that the foreign substances remaining, e.g., on pulsator 2, at the bottom part of the outer wall of washer tub 3 and at the bottom part of the inner wall of outer tub 1 after finishing the tub washing process are discharged with the drain water. Herein, instead of the tub rotating rinsing
20 process, a water supplying and draining process can be executed, in which washer tub 3 is not rotated while water is supplied and drained almost at the same time by operating water supply valve 9 and water drain valve 10.

Next, water is supplied up to low water level P2 by
25 water supply valve 9 and water level detector 11 at step 32 during which water drain valve 10 is closed. Next, the

first agitating rinsing process is executed at step 33, wherein motor 6 is driven to enable pulsator 2 to make forward and reverse rotation for a predetermined time period, causing foreign substances remaining between washer tub 3 and outer tub 1 to be caught in the tub washing fluid. At this time, since pulsator 2 makes the forward and reverse rotation with a small amount of water, a powerful water stream can be made, shattering or breaking the removed foreign substances into small pieces.

Next at step 34, water is supplied by water supply valve 9 and water level detector 11 while water drain valve 10 is being closed, up to water level P1 of the soaking process of the tub washing process, which is higher than water level P2 in the first agitating rinsing process; and at step 35, the second agitating rinsing process is executed, wherein the forward and reverse rotation of pulsator 2 is made by motor 6 for a certain time period, washing off the foreign substances remaining above low water level P2 between washer tub 3 and outer tub 1 and catching them in the tub washing fluid.

Since pulsator 2 is rotated for a certain time period at step 35, the tub washing fluid in washing and dewatering tub 3 is forced to be sent to lint filter 15 from pump chamber 13 via water circulation passage 14. Since the foreign substances are broken into small pieces at step 33, they are sent to lint filter 15 with the circulating tub

washing fluid, thereby being collected therein. Furthermore, since pulsator 2 is driven to make the forward and reverse rotation at step 35 with high water level P1, the amount of water that passes through lint filter 15 is large so that
5 the foreign substances can be removed easily.

Subsequently, at step 36, the water supplying rinsing process is executed by rotating pulsator 2 while operating water supply valve 9 and water drain valve 10. The foreign substances that remain without being discharged or collected
10 by the preceding steps can be discharged with the drain water. At step 37, the water remaining inside outer tub 1 is drained out by operating water drain valve 10 while closing water supply valve 9. In the water supplying rinsing process, the operation of water supply valve 9 and
15 water drain valve 10 can be made continuously or intermittently.

As described above, between the tub washing process and the first agitating rinsing process, the tub rotating rinsing process is executed, wherein water supply valve 9
20 and water drain valve 10 are operated at the same time while washer tub 3 is rotated at the low speed. Consequently, foreign substances remaining on pulsator 2, at the bottom part of the outer wall of washer tub 3 and at the bottom part of the inner wall of outer tub 1 can be discharged out
25 of outer tub 1 by way of simultaneously performing the water supplying and draining, enabling the following rinsing

processes to be carried out effectively.

Herein, the water supplying and draining process can be executed in lieu of the tub rotating rinsing process to produce substantially identical effects, wherein washer tub
5 3 is not rotated and water is supplied and drained almost at the same time by way of operating water supply valve 9 and water drain valve 10.

Further, since in the first agitating rinsing process, pulsator 2 is made to produce the forward and reverse
10 rotation with a small amount of water, a powerful water stream is generated, shattering the removed foreign substances into small pieces and spreading them over the tub washing fluid so that they can be removed out of outer tub 1 easily. Further, since water is subsequently supplied up to
15 water level P1 of the soaking process and pulsator 2 is rotated to make the forward and reverse rotation for the certain time period, the foreign substances remaining above low water level P2 between washer tub 3 and outer tub 1 can be washed off to be caught in the tub washing fluid and at
20 the same time the amount of water that passes through lint filter 15 becomes increased, so that the foreign substances can be collected and removed in lint filter 15.

Furthermore, by executing the water supplying rinsing process, the foreign substances that could not be discharged
25 or collected by the tub washing process and the previous rinsing processes can be discharged and thus prevented from

remaining in the washing machine.

In the present embodiment, either one of the tub rotating rinsing process and the water supplying and draining process, which is executed instead of the tub rotating rinsing process, has been described as being executed prior to the first agitating rinsing process. Since, however, the primary object of either one of the processes is to achieve the efficient discharge of the foreign substances out of outer tub 1, it can be executed before or after the second agitating rinsing process to produce the substantially identical effects.

Yet further, in the present embodiment, the water supplying rinsing process has been described as being executed after the second agitating rinsing process. However it can be executed instead of the second agitating rinsing process, producing substantially identical effects.

Still further, in the present embodiment, the water supplying rinsing process has been described as being executed by simultaneously supplying and draining water by way of operating water supply valve 9 and water drain valve 10. However, the process can be performed by operating only water supply valve 9, producing substantially identical effects, by way of executing the water draining through an overflow outlet(not shown).

Third preferred embodiment

As shown in Fig. 5, controller 38 controls the

operations of motor 6, water supply valve 9, water drain valve 10 and the like to control the laundry washing, rinsing and dewatering processes sequentially or selectively, and also executes a tub washing process by using the tub washing fluid containing therein detergent and a tub rinsing process thereafter in order to clean washer tub 3 and the inner surface of outer tub 1 which contains therein washer tub 3. The tub rinsing process executes the following processes sequentially: a first agitating rinsing process wherein pulsator 2 is rotated with a smaller amount of water than that of the soaking process; a second agitating rinsing process wherein pulsator 2 is rotated with water having a water level equal to or higher than fluid level p1 of the soaking process; and a draining process. Other parts are identical to those of the above-described second preferred embodiment; and, therefore, they are represented by the identical reference numerals and the description thereof will be omitted.

The operation of the above washing machine will be described in detail. In the first agitating rinsing process, since pulsator 2 makes the forward and reverse rotation with the small amount of water, a powerful water stream can be generated, shattering or breaking the removed foreign substances into small pieces and dispersing them in the tub washing fluid so that they can be removed out of outer tub 1 easily.

Next, water is supplied up to water level P3 which is higher than water level P1 of the soaking process while pulsator 2 makes the forward and reverse rotation for a preset time, washing off the foreign substances remaining
5 above low water level P2 between washer tub 3 and outer tub 1 and catching them in the tub washing fluid. And the amount of water that passes through lint filter 15 can be larger than that of the soaking process so that more foreign substances can be collected and removed in lint filter 15.

10 Further, since the water level is higher than water level P1 of the soaking process, the upper part of washer tub 3 and outer tub 1 which the tub washing fluid has reached due to the force of the water stream in the soaking process may be rinsed clean.

15 The tub cleaning cycle described above, i.e., the combined operation of the tub washing process and the tub rinsing process, is programmed in the storage region of controller 18; and, therefore, the whole tub cleaning cycle can be performed automatically under the control of
20 controller 18.

As described above, the present invention includes the steps of: washing the washer tub, the pulsator rotatably disposed on the bottom part thereof, and the inner surface of the outer tub by using a tub washing fluid containing a
25 detergent; and rinsing the washed tubs and pulsator, the washing step including the steps of: supplying the tub

washing fluid containing the detergent into the washer tub and the outer tub; performing a soaking process accompanied by intermittent forward and reverse rotation of the pulsator; and draining the tub washing fluid out of the washer tub after the soaking process. By using this method, compared with the prior manual soaking, a water stream can be generated by the forward and reverse rotation of the pulsator during the soaking process so that more of the foreign substances formed on the outer wall of the washer tub and the inner wall of the outer tub can be removed; and by the automation, the laborious process can be readily executed in an automated manner and the foreign substances formed in the washing machine can be effectively removed.

While the invention has been shown and described with respect to the preferred embodiments, it will be understood by those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the following claims.

CLAIMS:

1. A method for cleaning a washing machine having a washer tub and an outer tub, comprising the steps of:
- 5 washing the washer tub, a pulsator rotatably disposed on a bottom part of the washer tub, and an inner surface of the outer tub by using a tub washing fluid containing a detergent; and
- rinsing the washed tubs and pulsator,
- 10 wherein the washing step includes the step of:
- supplying the tub washing fluid containing the detergent into the washer tub and the outer tub;
- performing a soaking process accompanied by intermittent forward and reverse rotation of the pulsator;
- 15 and, thereafter,
- draining the tub washing fluid out of the washer tub,
- wherein the rinsing step includes the step of:
- performing a tub rotating rinsing process, wherein supplying and draining of water is carried out almost
- 20 simultaneously while the washer tub is rotated;
- performing a first agitating rinsing process, wherein the pulsator is rotated with a smaller amount of water than that of the soaking process;
- performing a second agitating rinsing process, wherein
- 25 the pulsator is rotated with water having a water level equal to or higher than a fluid level of the soaking process; and
- performing a water draining process,
- wherein each of the steps included in the rinsing step
- 30 is carried out at least once.

2. The method for cleaning a washing machine of claim 1, wherein the water level of the second agitating rinsing process is higher than the fluid level of the soaking process.

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3. The method for cleaning a washing machine of claim 1, wherein the tub rotating rising process is executed at least once before or after the second agitating rinsing process.

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4. The method for cleaning a washing machine of claim 3, wherein the water level of the second agitating rinsing process is higher than the fluid level of the soaking process.

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5. A method for cleaning a washing machine having a washer tub and an outer tub, comprising the steps of:

washing the washer tub, a pulsator rotatably disposed on a bottom part of the washer tub, and an inner surface of the outer tub by using a tub washing fluid containing a detergent; and

rinsing the washed tubs and pulsator,
wherein the washing step includes the steps of:
supplying the tub washing fluid containing the detergent into the washer tub and the outer tub;
performing a soaking process accompanied by intermittent forward and reverse rotation of the pulsator;
and, thereafter,

draining the tub washing fluid out of the washer tub,
wherein the rinsing step includes the steps of:

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performing a water supplying and draining process,
wherein water supplying and draining is executed almost at
the same time;

performing a first agitating rinsing process, wherein
5 the pulsator is rotated with a smaller amount of water than
that of the soaking process;

performing a second agitating rinsing process, wherein
the pulsator is rotated with water having a water level
equal to or higher than a fluid level of the soaking
10 process; and

performing a water draining process,
wherein each of the steps included in the rinsing step is
carried out at least once.

15 6. The method for cleaning a washing machine of any one
of claims 1 to 5, wherein the rinsing step further
includes, before the water draining process, the step of
performing a water supplying rinsing process in which water
supplying and draining is carried out while the pulsator is
20 rotated.

7. A method for cleaning a washing machine having a
washer tub and an outer tub, comprising the steps of:

washing the washer tub, a pulsator rotatably disposed
25 on a bottom part of the washer tub, and an inner surface of
the outer tub by using a tub washing fluid containing a
detergent; and

rinsing the washed tubs and pulsator,

wherein the washing step includes the steps of:

30 supplying the tub washing fluid containing the
detergent into the washer tub and the outer tub;

performing a soaking process accompanied by
intermittent forward and reverse rotation of the pulsator;
and, thereafter,

draining the tub washing fluid out of the washer tub,
5 wherein the rinsing step includes the steps of:

performing a tub rotating rinsing process, wherein
supplying and draining of water is carried out almost at
the same time while the washer tub is rotated;

performing an agitating rinsing process, wherein the
10 pulsator is rotated with a smaller amount of water than
that of the soaking process;

performing a water supplying rinsing process in which
water supplying and draining is carried out while the
pulsator is rotated; and

15 performing a water draining process,
wherein each of the steps included in the rinsing steps is
carried out at least once.

8. A method for cleaning a washing machine having a
20 washer tub and an outer tub, comprising the steps of:

washing the washer tub, a pulsator rotatably disposed
on a bottom part of the washer tub, and an inner surface of
the outer tub by using a tub washing fluid containing a
detergent; and

25 rinsing the washed tubs and pulsator,
wherein the washing step includes the steps of:

supplying the tub washing fluid containing the
detergent into the washer tub and the outer tub;

performing a soaking process accompanied by
30 intermittent forward and reverse rotation of the
pulsator;

and, thereafter,

draining the tub washing fluid out of the washer tub,
wherein the rinsing step includes the steps of:

performing a water supplying and draining process,
wherein water supplying and draining is executed almost at
5 the same time;

performing an agitating rinsing process, wherein the
pulsator is rotated with a smaller amount of water than
that of the soaking process;

performing a water supplying rinsing process in which
10 water supplying and draining is carried out while the
pulsator is rotated; and

performing a water draining process,
wherein each of the steps included in the rinsing step is
carried out at least once.

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9. The method for cleaning a washing machine of any one
of claims 1, 5, 7, or 8, wherein the washing machine is
made to perform one or more laundry washing cycles for
washing laundry articles and wherein, during the soaking
20 process, a fluid level is set to be higher than a maximum
water level during the laundry washing cycle and the
pulsator is rotated to make the forward and reverse
rotation and stopped alternately.

25 10. The method for cleaning a washing machine of any one
of claims 1, 5, 7, or 8, wherein the tub washing step
further includes, after the step of performing the soaking
process, the step of agitating the tub washing fluid in the
washer tub by the pulsator.