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(54) Title: DRUM-TYPE WASHING MACHINE AND METHOD FOR CONTROLLING WATER INFLOW THEREOF

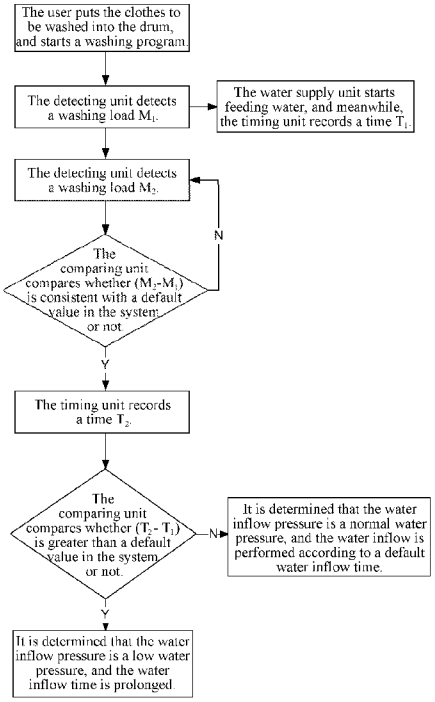


FIG. 2

(57) Abstract: A drum-type washing machine and a method for controlling a water inflow thereof are provided. The drum-type washing machine includes a control system for controlling operations of the washing machine, a detecting unit for detecting a washing load, a timing unit for recording an operating time of the washing machine, a comparing unit for performing a comparison operation between parameters, and a water supply unit for feeding a washing solution into the washing machine. The control system controls a water inflow of the washing machine according to a signal of the comparing unit, so as to ensure a cleaning degree of washed clothes.

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DRUM-TYPE WASHING MACHINE AND METHOD FOR CONTROLLING WATER INFLOW THEREOF

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a drum-type washing machine and a method for controlling a water inflow thereof, and more particularly to a drum-type washing machine applicable to a low water pressure situation and a method for controlling a water inflow thereof.

Related Art

A drum-type washing machine or a drum-type washing and drying machine (also called a washer dryer) is increasingly popular among consumers, as it rarely damages or wrinkles the clothes, and saves water.

When the clothes are washed by using the drum-type washing machine, the clothes are partially soaked in a washing solution mixed by water and a washing agent. Upon being driven by a motor, a drum of the drum-type washing machine drives the clothes and the washing solution within the drum to rotate together at a high speed, and the clothes to be washed are raised to a certain height under a function of raising ribs disposed on an inner wall of the drum, and then fall down, so as to produce a falling-type washing effect in the drum. Thus, the objective of washing the clothes is achieved by utilizing a squeezing effect when the clothes fall down and a chemical effect of the washing solution, such that a cleaning ratio or a cleaning degree of the clothes is better than that of other types of washing machines (for example, a pulsator washing machine or an agitator washing machine).

Definitely, a working principle of the drum-type washing machine is one of the reasons for causing the good cleaning ratio. A cleaning ratio is defined by the washing performance

divided by the washing performance of a reference washing machine. A good cleaning ratio is a cleaning degree better than the reference washing machine. In addition, the amount of the washing solution or a water inflow during washing and rinsing significantly influences the cleaning ratio. Therefore, an accurate control of the water inflow of the washing machine becomes a key point for improving the cleaning ratio.

In a conventional method, the water inflow is controlled by controlling a water inflow time, but such a control method is apparently inaccurate, especially in regions with a low water pressure, for example, in some of the cities and regions with a low water pressure in China, or during peak hour of water usage, or in some high-rise residence buildings where the low water pressure phenomenon is quite common. Therefore, if the water inflow is controlled only by controlling the water inflow time, the cleaning ratio cannot be ensured.

In order to solve the above problem about the low water pressure, as for a known method, a flow valve or a flow sensor is installed to directly detect the water inflow to control the water inflow of the washing machine. However, in this method, the flow valve or the flow sensor is additionally installed, such that a production cost is increased, which is not an economic solution.

In PRC Invention Patent Application No. CN200610040753.0 applied by the applicant(s) of the present invention on May 31, 2006, a method for detecting a water pressure through a change of a water level in a certain time period without additionally installing a sensing device is provided. Although the above method satisfies the economic requirements, many influencing factors exist, for example, mechanical assemblies, different types of clothes to be washed, and different weights of the clothes to be washed. As a result, an accuracy achieved by the method for detecting the low water pressure provided in the above patent application is not desirable.

SUMMARY OF THE INVENTION

In view of the above problems, the present invention is directed to a drum-type washing machine and a method for controlling a water inflow thereof, so as to more

accurately control a water inflow of the washing machine, thereby ensuring a cleaning degree of washed clothes.

In order to achieve the above objectives, in an embodiment, the present invention provides a drum-type washing machine, which includes a control system for controlling operations of the washing machine, a detecting unit for detecting a washing load, a timing unit for recording an operating time of the washing machine, a comparing unit for performing a comparison operation between parameters, and a water supply unit for feeding a washing solution into the washing machine. The control system controls a water inflow of the washing machine according to a signal of the comparing unit.

According to a preferred embodiment of the present invention, the detecting unit for detecting the washing load is a three-dimensional (3D) sensor.

According to another preferred embodiment of the present invention, the water supply unit is a water valve.

In an embodiment, the present invention further provides a method for controlling a water inflow of a drum-type washing machine, which includes the following steps. First, a detecting unit detects a washing load, and delivers a detected signal to a control system. Next, the control system controls a timing unit to record an operating time of the washing machine. Then, a comparing unit compares signals delivered by the detecting unit and the timing unit with a default time reference in the control system. Finally, the control system controls a water inflow of a water supply unit according to a signal from the comparing unit.

In the method for controlling a water inflow of a drum-type washing machine according to a preferred embodiment of the present invention, the step of detecting the washing load and delivering the detected signal to the control system by the detecting unit is at least executed for twice.

In the method for controlling a water inflow of a drum-type washing machine

according to another preferred embodiment of the present invention, before the timing unit starts counting time, the step of detecting the washing load is executed by the detecting unit for once, and after the timing unit starts counting time, the step of detecting the washing load is executed by the detecting unit once again.

In the method for controlling a water inflow of a drum-type washing machine according to another preferred embodiment of the present invention, a time interval between the two steps of detecting the washing load executed by the detecting unit is controlled according to a variance of a detected washing load.

In the method for controlling a water inflow of a drum-type washing machine according to another preferred embodiment of the present invention, when the variance of the washing loads detected by the detecting unit after detecting the washing load twice is consistent with the default load reference in the control system, the timing unit stops counting the time, and delivers a recorded time to the comparing unit.

In an embodiment, the method for controlling a water inflow further provides different default load references in the control system. According to the first washing load detection the appropriate default load reference value is chosen by the control system. That means that the load reference value depends on the dry wash load which is determined by the first washing load detection.

In the method for controlling a water inflow of a drum-type washing machine according to another preferred embodiment of the present invention, the comparing unit calculates the time interval between the two steps of detecting the washing load executed by the detecting unit according to a signal delivered by the timing unit, compares the calculated time interval with the default time reference in the control system, and then delivers a comparison result to the control system. Additionally, a set of default time references may be stored in the control system. The set of default time references is dedicated to the set of default load references, i.e. for each default load reference is dedicated one default time reference.

In the method for controlling a water inflow of a drum-type washing machine according to another preferred embodiment of the present invention, when the comparison result is positive, the control system controls the water supply unit to prolong a water supply time, and when the comparison result is zero or negative, the control system controls the water supplying unit to reduce time of water supply.

The present invention has an efficacy of detecting a water inflow pressure by fully utilizing the detecting unit that is further used for other purposes, without installing an additional sensing device, and the detecting unit is less affected by external environmental factors, so that the water inflow of the washing machine can be accurately controlled, thereby ensuring the cleaning degree of washed clothes.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a system block diagram of a drum-type washing machine according to an embodiment of the present invention; and

FIG. 2 is a schematic flow chart of a method for controlling a water inflow of a drum-type washing machine according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 is a system block diagram of a drum-type washing machine 1 according to an embodiment of the present invention. Referring to FIG. 1, the drum-type washing machine 1 includes a control system 2 for controlling operations of the washing machine, a detecting unit 3 for detecting a washing load, a timing unit 4 for recording an operating time of the washing machine, a comparing unit 5 for performing a comparison operation between parameters, and a water supply unit 6 for feeding a washing solution into the washing machine. Similar to a structure of a conventional drum-type washing machine, the drum-type washing machine further includes an outer barrel and a drum disposed in the outer barrel and capable of rotating at a high speed upon being driven by a motor. A washing barrel assembly formed by the outer barrel and the drum is disposed in a cabinet of

the drum-type washing machine through a suspension spring disposed above the outer barrel and a supporting structure disposed under the outer barrel respectively. An opening provided for a user to put in the clothes to be washed or take out the washed clothes is disposed on a front end of the washing barrel assembly and the cabinet. An operation panel provided for the user to operate the washing machine is disposed above the opening, and different washing programs are set on the operation panel for the user to select. The control system 2 is disposed in the operation panel, and controls the washing machine to selectively execute a corresponding washing program according to an instruction input by the user. As a preferred embodiment of the present invention, the detecting unit 3 is a 3D sensor applied to the existing drum-type washing machine and used to determine the movement of the washing barrel assembly in three different directions of three-dimensional space and to measure and/or control vibrating and twisting amplitudes of the washing barrel assembly suspended in the washing machine when the washing machine executes a dehydrating program, and the detecting unit 3 is disposed under the washing barrel assembly. One end of the water supply unit 6 is connected to a washing agent distribution case disposed behind the operation panel and a user water supply system (for example, a water tap externally connected to a municipal water supply system), and the other end thereof is connected to the washing barrel assembly, so as to feed the water or the washing solution mixed by the water and the washing agent into the washing barrel assembly. In addition, the timing unit 4 and the comparing unit 5 connected to the control system 2 are further disposed behind the operation panel.

FIG. 2 is a schematic flow chart of a method for controlling a water inflow of a drum-type washing machine according to an embodiment of the present invention. Referring to FIG. 2, when using the washing machine, the user puts the clothes to be washed into the drum, and then inputs a corresponding instruction via the operation panel. The control system 2 determines a washing program selected by the user according to the instruction input by the user, so as to execute the corresponding washing program. After the user selects the corresponding washing program, the washing machine enters an operating stage. At this time, the control system 2 controls the detecting unit 3 to perform

a first detection on the clothes to be washed, and obtains a weight M_1 of the corresponding clothes to be washed according to a detection result. Then, the control system 2 controls to turn on the water supply unit 6 to start feeding the water into the washing barrel assembly, and the washing machine starts entering a normal washing program. Meanwhile, the control system 2 controls the timing unit 4 to record a time T_1 when the water supply unit 6 is turned on. After a certain time period elapsed, the control system 2 controls the detecting unit 3 to perform a second detection. At this time, not only the clothes to be washed are placed in the washing barrel assembly, but also the washing solution fed through the water supply unit 6 is also contained in the washing barrel assembly. For ease of description, the clothes to be washed or a mixture of the clothes to be washed and the washing solution is called a washing load herein, such that the weight M_1 of the clothes to be washed corresponding to the result of the first detection performed by the detecting unit 3 turns to become a washing load M_1, and it is determined that the washing load here is M_2 according to the result of the second detection performed by the detecting unit 3. When a difference of the washing loads determined according to the results of the two detections performed by the detecting unit 3 is a constant value, that is, when the comparing unit 5 determines that the difference (M_2-M_1) of the washing loads is consistent with a specific default load reference value $M_{default}$ in the control system 2, the control system 2 controls the timing unit 4 to stop counting the time, and to record a time T_2 at this time. Apparently, a difference (T_2-T_1) between the two times recorded by the timing unit 4 is a time period when the water supply unit 6 maintains an ON state. Then, the comparing unit 5 compares the difference (T_2-T_1) between the two times recorded by the timing unit 4 with another specific default time reference value $T_{default}$ in the control system 2. When the difference (T_2-T_1) between the two times recorded by the timing unit 4 is greater than the specific default time reference value $T_{default}$, that is, a comparison result of the comparing unit 5 is positive, the control system 2 considers that the current water inflow pressure is a low water pressure, so as to ensure the sufficient water inflow by prolonging the water inflow time through the water supply unit 6, thereby ensuring a cleaning degree of the washed clothes. On the contrary, when the difference between the

two times recorded by the timing unit 4 is smaller than the specific default time reference value $T_{default}$, that is, the comparison result of the comparing unit 5 is negative or zero, the control system 2 considers that the current water inflow pressure is a normal water pressure, such that the water inflow time does not need to be prolonged.

According to the present invention, by using the 3D sensor disposed in the conventional drum-type washing machine, the washing load of the washing machine is detected, and then it is determined whether the water inflow pressure is a low water pressure or not according to the comparison result between the time required when the detected washing load is increased by a certain amount and the default time in the system. Since the 3D sensor is used in the existing washing machine for controlling the vibrating and twisting amplitudes of the washing barrel assembly in the washing machine when the washing machine executes the dehydrating program, the drum-type washing machine and the method for controlling the water inflow thereof according to the present invention do not need to additionally install any sensing device, and meanwhile, the method is not affected by mechanical assemblies, different types of clothes to be washed, and different weights of the clothes to be washed, such that the method is more accurate, thereby ensuring the cleaning degree of the washed clothes.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

CLAIMS

What is claimed is:

1. A drum-type washing machine, comprising a control system for controlling operations of the washing machine, a detecting unit for detecting a washing load, a timing unit for recording an operating time of the washing machine, a comparing unit for performing a comparison operation between parameters, and a water supply unit for feeding a washing solution into the washing machine, wherein the control system controls a water inflow of the washing machine according to a signal of the comparing unit.

2. The drum-type washing machine according to claim 1, wherein the detecting unit for detecting the washing load is a three-dimensional (3D) sensor.

3. The drum-type washing machine according to claim 1, wherein the water supply unit is a water valve.

4. A method for controlling a water inflow of the drum-type washing machine according to any one of claims 1 to 3, comprising:

detecting a washing load and delivering a detected signal to the control system by the detecting unit;

controlling the timing unit to record an operating time of the washing machine by the control system;

comparing signals delivered by the detecting unit and the timing unit with a default time reference in the control system by the comparing unit; and

controlling a water inflow of the water supply unit according to a signal from the comparing unit by the control system.

5. The method for controlling a water inflow of the drum-type washing machine

according to claim 4, wherein the step of detecting the washing load and delivering the detected signal to the control system by the detecting unit is at least executed for twice.

6. The method for controlling a water inflow of the drum-type washing machine according to claim 5, wherein before the timing unit starts counting time, the step of detecting the washing load is executed by the detecting unit for once, and after the timing unit starts counting time, the step of detecting the washing load is executed by the detecting unit once again.

7. The method for controlling a water inflow of the drum-type washing machine according to claim 6, wherein a time interval between the two steps of detecting the washing load executed by the detecting unit is controlled according to a variance of a detected washing load.

8. The method for controlling a water inflow of the drum-type washing machine according to claim 7, wherein when the variance of washing loads detected by the detecting unit after detecting the washing load twice is consistent with a default load reference in the control system, the timing unit stops counting the time, and delivers a recorded time to the comparing unit.

9. The method for controlling a water inflow of the drum-type washing machine according to claim 8, wherein the default load reference is one value out of a set of reference values stored in the control system and wherein the default reference is preselected by the control system depending on the first wash load detection.

10. The method for controlling a water inflow of the drum-type washing machine according to claim 8 or 9, wherein the comparing unit calculates the time interval between the two steps of detecting the washing load executed by the detecting unit according to a signal delivered by the timing unit, compares the calculated time interval with a default time reference in the control system, and then delivers a comparison result to the control system.

11. The method for controlling a water inflow of the drum-type washing machine according to claim 10, wherein when the comparison result is positive, the control system controls the water supply unit to prolong a water supply time, and when the comparison result is zero or negative, the control system controls the water supplying unit to reduce time of water supply.

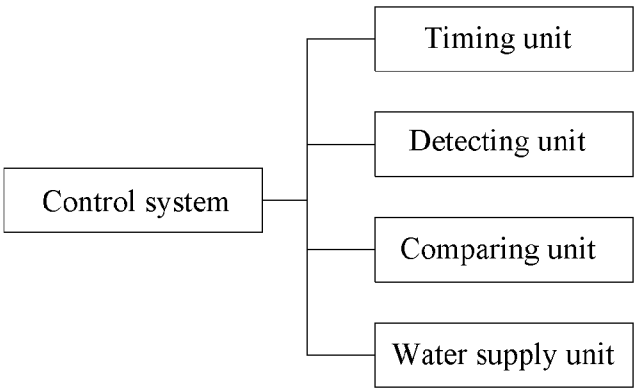

Timing unit
Detecting unit
Control system
Comparing unit
Water supply unit

FIG. 1

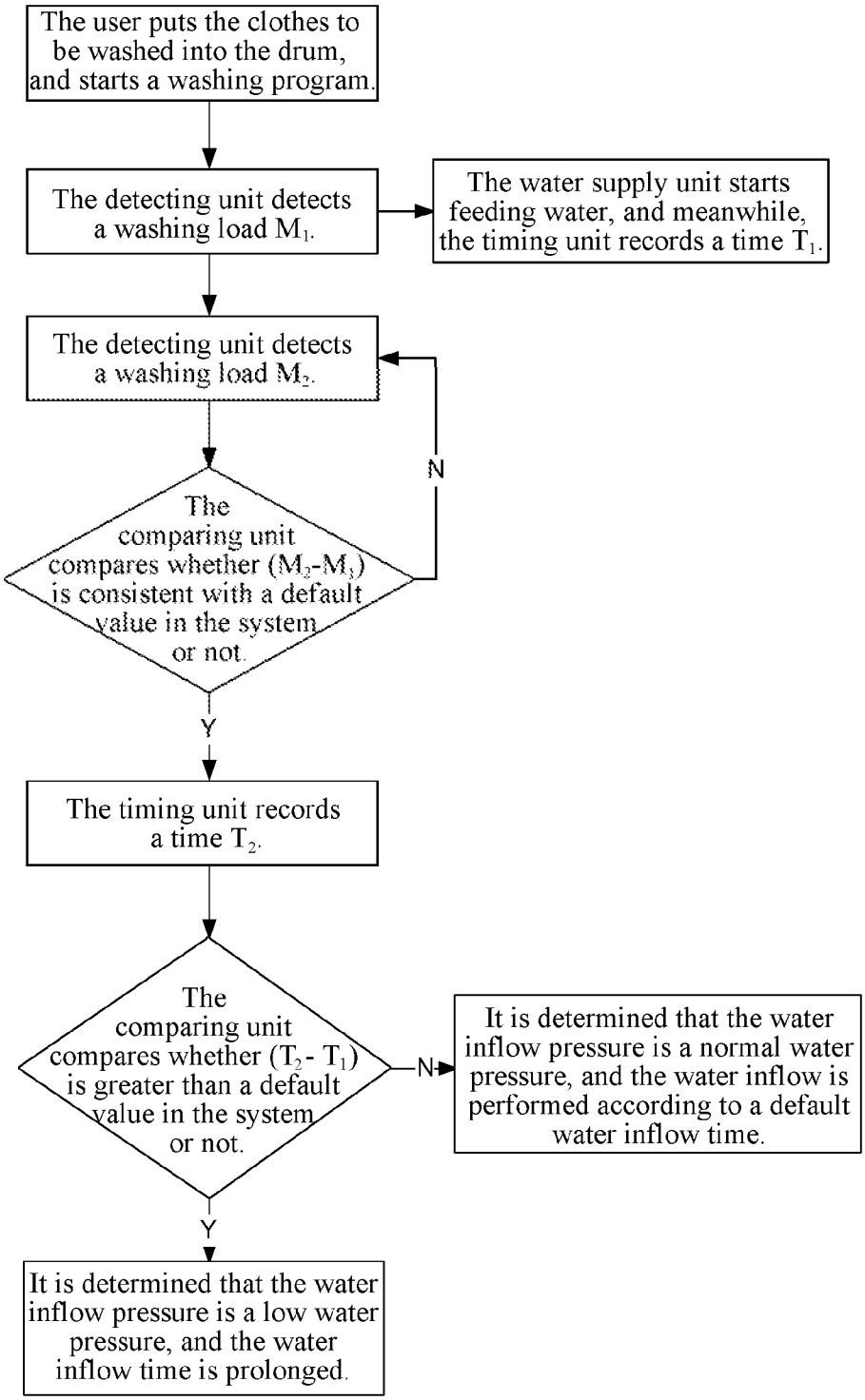

The user puts the clothes to be washed into the drum, and starts a washing program.
The detecting unit detects a washing load M_1.
The water supply unit starts feeding water, and meanwhile, the timing unit records a time T_1.
The detecting unit detects a washing load M_2.
The comparing unit compares whether (M_2-M_1) is consistent with a default value in the system or not.
N
Y
The timing unit records a time T_2.
The comparing unit compares whether (T_2- T_1) is greater than a default value in the system or not.
N
It is determined that the water inflow pressure is a normal water pressure, and the water inflow is performed according to a default water inflow time.
Y
It is determined that the water inflow pressure is a low water pressure, and the water inflow time is prolonged.

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/060458

A. CLASSIFICATION OF SUBJECT MATTER
INV. D06F39/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D06F A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 29 21 911 A1 (LICENTIA GMBH) 11 December 1980 (1980-12-11) page 14, line 6 - line 12; claim 4	1,3-4
A	JP 60 192224 A (OOYA MICHIO) 30 September 1985 (1985-09-30) abstract	1,4
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A	DE 44 39 680 C1 (HENKEL ECOLAB GMBH & CO OHG [DE]) 5 June 1996 (1996-06-05) abstract; claim 4	1-11

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search	Date of mailing of the international search report
20 October 2009	26/10/2009

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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