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(72) Inventor: **HWANG, Ui Kun**
Bucheon-si
Gyeonggi-do 420-861 (KR)

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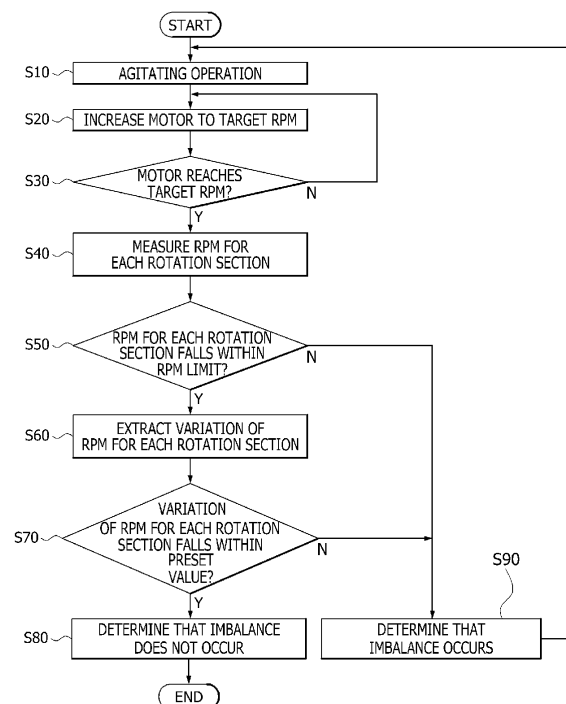
(74) Representative: **Michalski Hüttermann & Partner**
Patentanwälte
Speditionstraße 21
40221 Düsseldorf (DE)

(71) Applicant: **Daewoo Electronics Corporation**
Seoul 100-031 (KR)

(54) **METHOD FOR DETERMINING IMBALANCE IN DRUM WASHING MACHINE**

(57) A method for determining an imbalance in a drum washing machine includes increasing an RPM of a motor to a target RPM, and then measuring an RPM for each rotation section; comparing the RPM for each rotation section to an RPM limit; and determining whether an imbalance occurs according to the comparison result.

FIG.2



Description

[Technical Field]

[0001] The present invention relates to a drum washing machine, and more particularly, to an imbalance determination method for a drum washing machine, which determines whether an imbalance occurs or not, through an RPM for each rotation section and an RPM variation, during a spin-drying process.

[Background Art]

[0002] In general, washing machines may be classified as a pulsator washing machine and a drum washing machine.

[0003] The pulsator washing machine is a water tank-type washing machine which rotates a washing tub on a vertical axis, and rotates a pulsator to agitate and wash laundry items dipped in wash water of the washing tub.

[0004] The drum washing machine washes laundry items using a force that is caused when the laundry items fall downward after a horizontal drum housing the laundry items therein is rotated to move the laundry items upward, and a frictional force between the rotating drum and the laundry items.

[0005] In particular, when the drum washing machine is used, damage to laundry items may be reduced, the laundry items may not get tangled, and a washing effect of beating and rubbing the laundry items may be achieved. Recently, the drum washing machine is frequently used.

[0006] The above-described configuration is background for helping an understanding of the present invention, and does not necessarily mean that it is widely known in the technical field to which the present invention pertains.

[Disclosure]

[Technical Problem]

[0007] Conventional drum washing machines perform a balance spin-drying process such that laundry items adhere on an inner wall of the drum before the main spin-drying process is performed.

[0008] During the balance spin-drying process, whether an imbalance occurs or not is determined. When a balancer attached to the tub has a small weight, the tub supporting the drum is moved according to the rotation of the drum.

[0009] However, since the occurrence of the imbalance is determined based on only a variation in RPM for each rotation section, the increase and decrease in RPM caused by motion of the tub may not be sufficiently reflected. Thus, the imbalance determination may be erroneous or not performed in a normal manner.

[0010] The present invention can solve such problems,

and an aspect of the invention is to provide a method for determining an imbalance in a drum washing machine, which additionally determines an RPM for each rotation section, as well as a variation of an RPM for each rotation section, and determines whether or not an imbalance occurs during the spin-drying process.

[Technical Solution]

[0011] According to an aspect of the invention, a method for determining an imbalance in a drum washing machine includes: increasing an RPM of a motor to a target RPM, and then measuring an RPM for each rotation section; comparing the RPM for each rotation section to an RPM limit; and determining whether or not an imbalance occurs, according to the comparison result.

[0012] Determining whether or not the imbalance occurs may include determining that the imbalance occurs when the RPM for each rotation section deviates from the RPM limit.

[0013] Determining whether or not the imbalance occurs may further include determining whether the imbalance occurs according to a variation of the RPM for each rotation section, when the RPM for each rotation section falls within the RPM limit.

[0014] When the variation of the RPM for each rotation section falls within a preset value, it may be determined that the imbalance will not occur.

[0015] When the variation of the RPM for each rotation section exceeds a preset value, it may be determined that the imbalance occurs.

[Advantageous Effects]

[0016] According to one or more embodiments of the invention, both the RPM for each rotation section and the variation of the RPM for each rotation section are determined to improve the precision of the imbalance determination.

[Description of Drawings]

[0017] The above and other aspects, features and advantages of the invention will become apparent from the following detailed description in conjunction with the accompanying drawings, in which:

FIG. 1 is a block configuration diagram of a device for determining an imbalance of a drum washing machine in accordance with an embodiment of the present invention;

FIG. 2 is a flowchart for explaining an imbalance determination method for a drum washing machine in accordance with an embodiment of the present invention;

FIG. 3 is a graph illustrating the RPM of a motor during a balance spin-drying process in accordance with an embodiment of the present invention; and

FIG. 4 is a diagram illustrating rotation sections of a drum in accordance with an embodiment of the present invention.

[Detailed Description]

[0018] Embodiments of the invention will hereinafter be described in detail with reference to the accompanying drawings. It should be noted that the drawings may not be to precise scale and may be exaggerated in thickness of lines or sizes of components for descriptive convenience and clarity only. Furthermore, the terms as used herein are defined by taking functions of the invention into account and can be changed according to the custom or intention of users or operators. Therefore, definition of the terms should be made according to the overall disclosures set forth herein.

[0019] FIG. 1 is a block configuration diagram of a device for determining an imbalance of a drum washing machine in accordance with an embodiment of the present invention.

[0020] Referring to FIG. 1, the imbalance determination device in accordance with the embodiment of the present invention includes a control unit 10, a motor 20, and a load measurement unit 30.

[0021] The motor 20 serves to rotate a drum (not illustrated). The motor 20 may include a universal motor, for example.

[0022] The motor 20 may be directly installed on the center axis of the drum or installed at one side of the tub. When the motor 20 is installed at one side of the tub, torque generated by the motor 20 is transmitted through a power transmission device (not illustrated), for example, a belt, a belt pulley or gear.

[0023] The load measurement unit 30 serves to measure the load of the motor 20, which is caused by rotations of the drum.

[0024] When a spin-drying process is started, the control unit 10 performs a balance spin-drying process and a main spin-drying process while controlling the motor 20.

[0025] The main spin-drying process refers to a process of rotating the drum at high speed so as to remove wash water soaking into laundry items.

[0026] The balance spin-drying process refers to a process of measuring an imbalance value to determine whether or not an imbalance occurs, while laundry items adhere on the inner wall of the drum before the main spin-drying process is performed.

[0027] The balance spin-drying process includes an agitation operation, a laundry adherence operation, a water removal operation, and an imbalance determination operation. The agitation operation agitates laundry items within the drum so that the laundry items are not concentrated onto one side of the drum. The laundry adherence operation determines whether or not an imbalance occurs when the laundry items adhere to the inner wall of the drum. The water removal operation removes wash water or foam from the laundry items. The imbalance

determination operation determines whether or not an imbalance occurs after the water removal operation.

[0028] In particular, during the laundry adherence operation and the imbalance determination operation, the motor 20 is rotated at a target rotation speed so that the laundry items adhere on the inner wall of the drum. Then, the RPM of the motor 20 is measured on the basis of the load of the motor 20 as measured by the load measurement unit 30, and whether an imbalance occurs is determined on the basis of the RPM of the motor 20.

[0029] The control unit 10 measures the RPM of the motor 20 for each rotation section. The control unit 10 determines whether or not the RPM measured for each of the plurality of rotation sections falls within a RPM limit. When the RPM deviates from the RPM limit, the control unit 10 determines that an imbalance occurs.

[0030] In the conventional method, a variation of the RPM measured for each rotation section of the drum is compared to a preset value so as to determine whether or not an imbalance occurs. However, according to embodiment of the present invention, although the variation of the RPM for each rotation section falls within the preset value, the RPM for each rotation section can be used in addition to the variation of the RPM for each rotation section to determine whether or not an imbalance occurs. Thus, it is possible to improve the precision or accuracy of the imbalance determination.

[0031] On the other hand, when the RPM measured for each rotation sections falls within the RPM limit, a variation of the RPM for each rotation section may be extracted, and whether or not the variation falls within the preset value may be determined. Then, whether an imbalance occurs or not is determined according to the determination result.

[0032] The RPM limit may be within 10% of the target RPM.

[0033] Referring to FIGS. 2, 3 and 4, a method for determining an imbalance in a drum washing machine in accordance with an embodiment of the present invention will be described in detail.

[0034] FIG. 2 is a flowchart for explaining the method for determining an imbalance in a drum washing machine in accordance with an embodiment of the present invention. FIG. 3 is a graph illustrating the RPM of a motor during a balance spin-drying process in accordance with an embodiment of the present invention. FIG. 4 is a diagram illustrating rotation sections of a drum in accordance with an embodiment of the present invention.

[0035] Referring to FIG. 2, the control unit 10 controls the motor 20 to increase the RPM of the motor 20 to 45 RPM, thereby agitating the drum in the side-to-side direction, at step S10. Thus, laundry items within the drum are uniformly spread so as not to be concentrated on one side of the tub.

[0036] Then, the control unit 10 increases the RPM of the motor 20 to the target RPM and checks whether or not the RPM of the motor 20 reaches the target RPM, at steps S20 and S30.

[0037] The target RPM may be set to 95 RPM. The target RPM is not limited to 95 RPM, but may be set to a speed at which the laundry items adhere on the inner wall of the drum.

[0038] When the RPM of the motor 20 reaches the target RPM, the control unit 10 does not control the motor 20. The motor 20 and drum are allowed to freely rotate by inertia. At this time, the load measurement unit 30 measures the load of the motor 20 for each rotation section of the motor 20, and the control unit 10 measures an RPM for each rotation section based on the load of the motor 20, at step S40.

[0039] Referring to FIG. 4, the rotation of the motor 20 is divided into a plurality of rotation sections depending on the rotation angle of the motor 20, and the RPM of the motor 20 is measured for each rotation section.

[0040] In the present embodiment, the motor 20 includes 12 rotation sections A to L, obtained by dividing the rotational cycle of the motor 20 by 30 degrees.

[0041] In this way, the RPM for each rotation section may be measured and compared to the RPM limit so as to determine whether or not the RPM for each rotation section falls within the RPM limit, at step S50.

[0042] When the RPM for each rotation section deviates from the RPM limit, the control unit 10 determines that an imbalance occurs, at step S90.

[0043] As such, the control unit 10 may check whether or not the RPM for each rotation section falls within the RPM limit, and reflect an error caused by motion of the tub, thereby improving the precision or accuracy of the imbalance determination.

[0044] When the RPM for each rotation section falls within the RPM limit, a variation of the RPM for each rotation section is extracted at step S60.

[0045] The variation of the RPM for each rotation section is a difference in RPM between the respective rotation sections. For example, the variation may include a difference in RPM between the rotation sections A and B or a difference in RPM between the rotation sections B and C as illustrated in FIG. 4.

[0046] When the variation of the RPM for each rotation section is extracted, whether the variation of the RPM for each of the plurality of rotation sections falls within a preset value is determined at step S70.

[0047] The preset value is a reference value for determining whether an imbalance occurs. When the variation of the RPM for each rotation section deviates from the preset value, it may indicate that an RPM in a next rotation section is significantly different in comparison to an RPM in a current rotation section. In this case, the control unit 10 may determine that an imbalance occurs.

[0048] Thus, when the variation of the RPM for each rotation section falls within the preset value, the control unit 10 determines that an imbalance does not occur at step S80, and when the variation of the RPM for each rotation section exceeds the preset value, the control unit 10 determines that an imbalance occurs at step S90.

[0049] When it is determined that an imbalance does

not occur, the control unit 10 increases the RPM of the motor 20 to perform the water removal operation, and when it is determined that an imbalance occurs, the control unit 10 performs the balance spin-drying process again.

[0050] Although some embodiments have been provided to illustrate the invention in conjunction with the drawings, it will be apparent to those skilled in the art that the embodiments are given by way of illustration only, and that various modifications and equivalent embodiments can be made without departing from the spirit and scope of the invention. The scope of the invention should be limited only by the accompanying claims.

Claims

1. A method for determining an imbalance in a drum washing machine, comprising:

increasing an RPM of a motor to a target RPM, and then measuring an RPM for each rotation section of the motor;
comparing the RPM for each rotation section to an RPM limit; and
determining whether an imbalance occurs according to the comparison result.

2. The method of claim 1, wherein determining whether the imbalance occurs comprises determining that the imbalance occurs when the RPM for each rotation section deviates from the RPM limit.
3. The method of claim 1, wherein determining whether the imbalance occurs further comprises determining whether the imbalance occurs according to a variation of the RPM for each rotation section, when the RPM for each rotation section falls within the RPM limit.
4. The method of claim 3, wherein when the variation of the RPM for each rotation section falls within a preset value, it is determined that the imbalance will not occur.
5. The method of claim 3, wherein when the variation of the RPM for each rotation section exceeds a preset value, it is determined that the imbalance occurs.

FIG.1

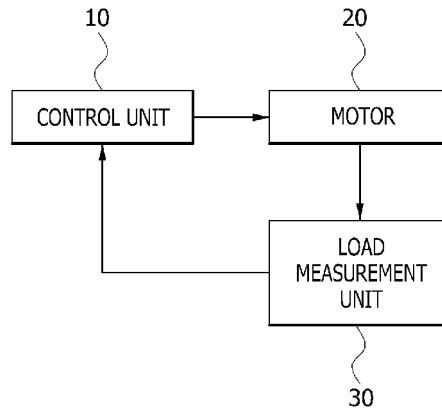


FIG.2

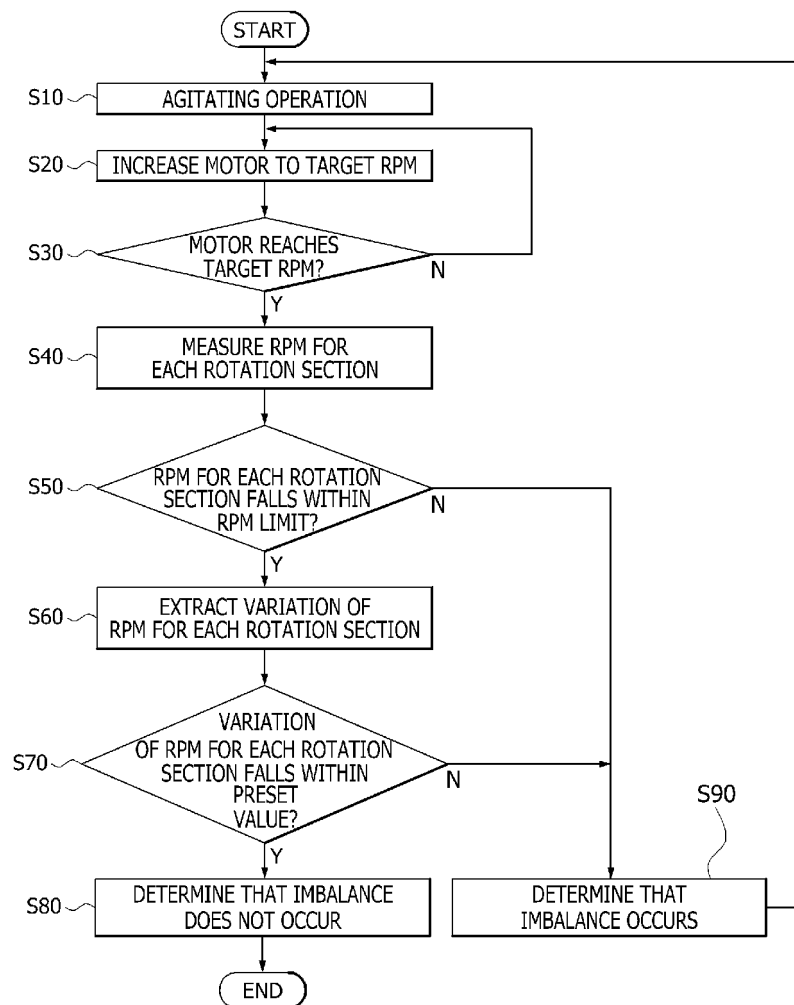


FIG.3

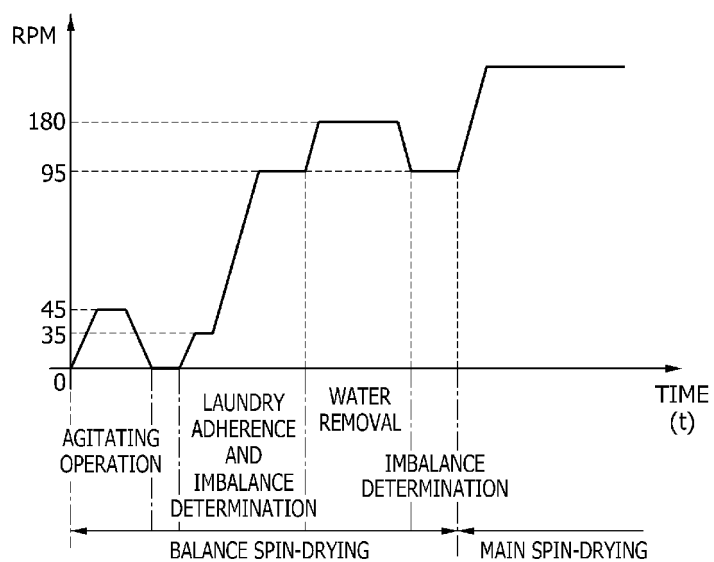


FIG.4

