US 20200248355A1

(19) **United States**

(12) **Patent Application Publication**

**JANG et al.**

(10) **Pub. No.: US 2020/0248355 A1**

(43) **Pub. Date: Aug. 6, 2020**

(54) **LAUNDRY TREATING MACHINE AND CONTROL METHOD FOR THE SAME**

(71) Applicant: **LG Electronics Inc.**, Seoul (KR)

(72) Inventors: **Taegyu JANG**, Seoul (KR); **Minsoo SEO**, Seoul (KR); **Hyeonsik LEE**, Seoul (KR)

(21) Appl. No.: **16/775,938**

(22) Filed: **Jan. 29, 2020**

(30) **Foreign Application Priority Data**

Feb. 1, 2019 (KR) ..... 10-2019-0013825
Apr. 19, 2019 (KR) ..... 10-2019-0046099

**Publication Classification**

(51) **Int. Cl.**

| | |
|---|---|
| ***D06F 33/42*** | (2006.01) |
| ***D06F 39/08*** | (2006.01) |
| ***D06F 33/48*** | (2006.01) |

(52) **U.S. Cl.**

CPC ..... ***D06F 33/42*** (2020.02); *D06F 2105/48* (2020.02); ***D06F 33/48*** (2020.02); ***D06F 39/085*** (2013.01)

(57) **ABSTRACT**

Embodiments of the present disclosure relate to a control method for a laundry treating machine comprising a first drum rotating step that is configured to rotate the drum at a preset reference RPM; a first water discharging step that is configured to rotate the impeller at a preset first water discharge RPM during the first drum rotating step; a second drum rotating step that is configured to rotate the drum at a first drum RPM lower than the reference RPM; a second water discharging step that is configured to rotate the impeller at a second water discharge RPM lower than the first water discharge RPM during the second drum rotating step, wherein a water level inside the first discharge pipe is kept on being higher than the highest water level inside the housing, while the first water discharging step and the second water discharging steps are performed.

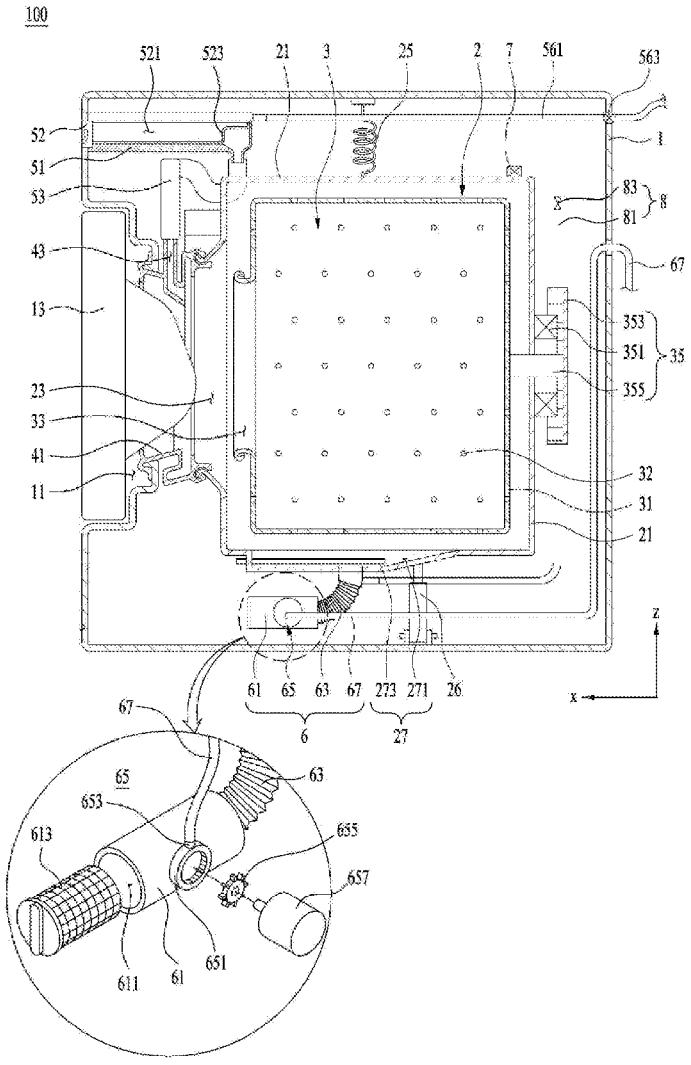


FIG. 1

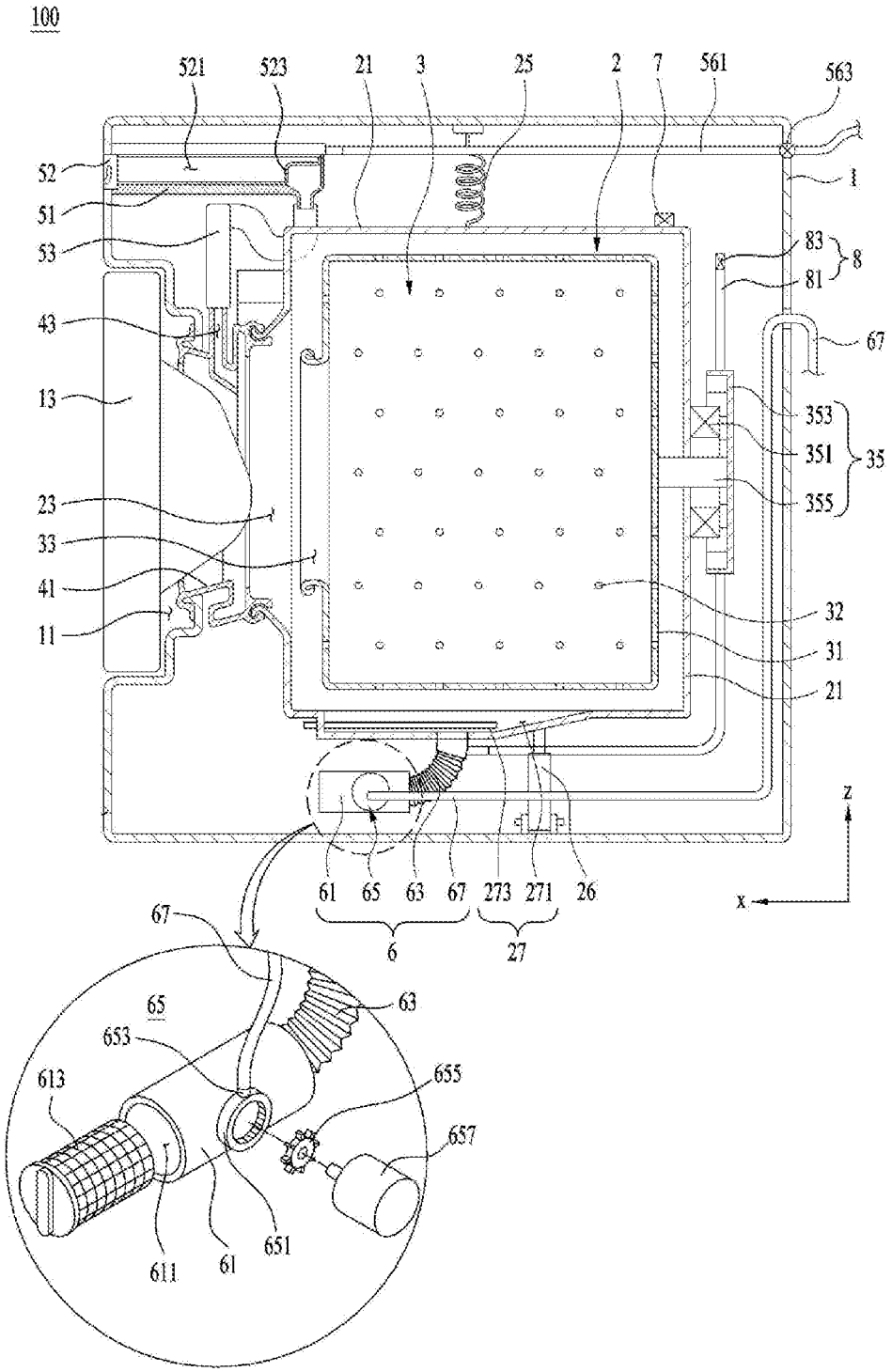

100
521
523
21
3
25
2
7
561
563
52
51
53
43
13
23
33
41
11
1
83
81
8
67
353
351
355
35
32
31
21
z
x
61
65
63
67
273
271
26
6
27
65
653
613
655
657
611
61
651

FIG. 2A

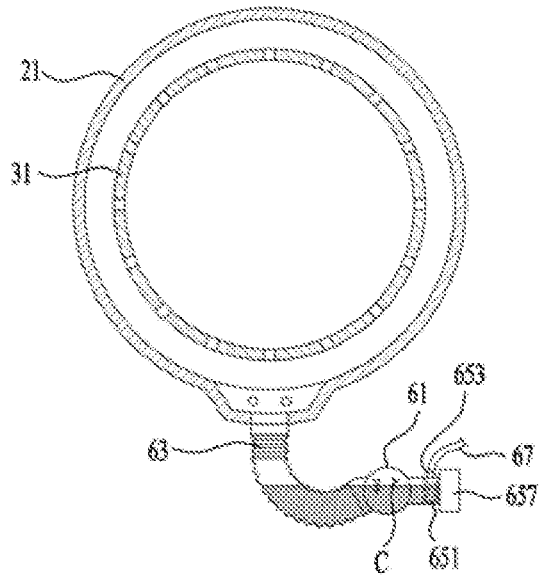



FIG. 2B

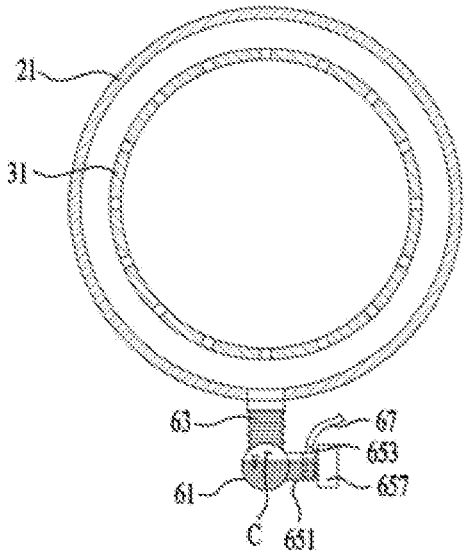
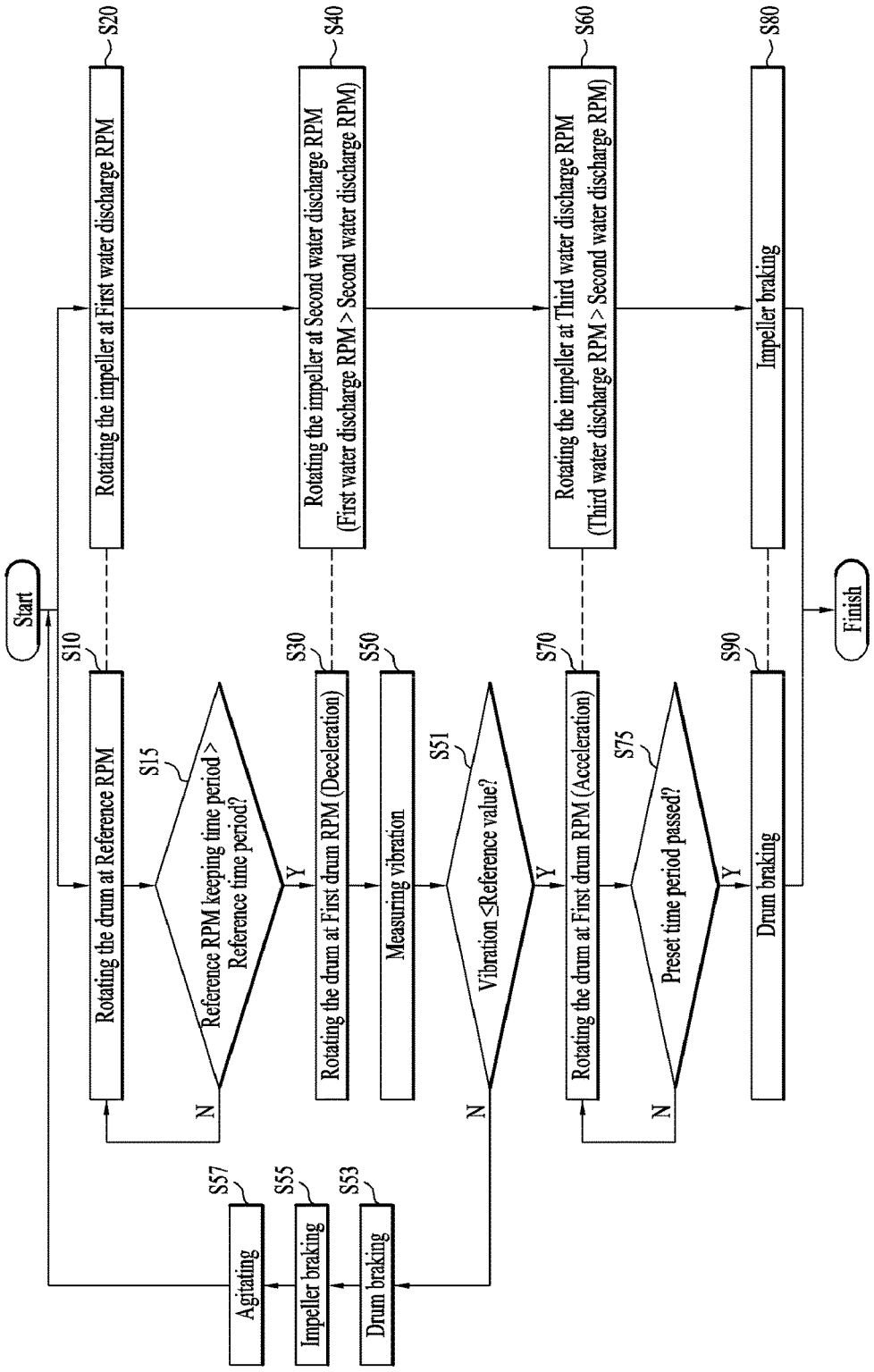


FIG. 3


Start
S10
Rotating the drum at Reference RPM
S15
Reference RPM keeping time period> Reference time period?
N
Y
S20
Rotating the impeller at First water discharge RPM
S30
Rotating the drum at First drum RPM (Deceleration)
S40
Rotating the impeller at Second water discharge RPM (First water discharge RPM > Second water discharge RPM)
S50
Measuring vibration
S51
Vibration ≤Reference value?
N
Y
S53
Drum braking
S55
Impeller braking
S57
Agitating
S60
Rotating the impeller at Third water discharge RPM (Third water discharge RPM > Second water discharge RPM)
S70
Rotating the drum at First drum RPM (Acceleration)
S75
Preset time period passed?
N
Y
S80
Impeller braking
S90
Drum braking
Finish

# LAUNDRY TREATING MACHINE AND CONTROL METHOD FOR THE SAME

## CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** This application claims priority to Korean Patent Application No. 10-2019-0013825, filed on Feb. 1, 2019, and Korean Patent Application No. 10-2019-0046099, filed on Apr. 19, 2019, the entire contents of which are hereby incorporated by reference in their entirety.

## BACKGROUND OF THE DISCLOSURE

### Technical Field of the Disclosure

**[0002]** Embodiments of the present disclosure relate to a laundry treating machine and a control method for the same.

### Background of the Disclosure

**[0003]** A laundry treating machine means an apparatus configured to wash clothes. Among conventional laundry treating machines, a laundry treating machine includes a cabinet; a tub that is mounted in the cabinet and configured to hold wash water; and a drum that is rotatably mounted in the tub and configured to hold clothes (hereinafter, laundry); a first discharge pipe configured to discharge the water held in the tub to a water discharge pump; and a second discharge pipe configured to guide the water discharged from the water discharge pump outside the cabinet. The water discharge pump provided in such a conventional laundry treating machine is typically provided to flow the water drawn into the first discharge pipe to the second discharge pipe by means of an impeller.

**[0004]** The conventional laundry treating machine having the above-noted structure may be operated to perform a cycle of separating contaminants from the laundry by rotating the drum after water is supplied to the tub; a cycle of discharging the water held in the tub; and a cycle of removing water or water elements from the laundry by rotating the drum (a spinning cycle).

**[0005]** The water discharge pump has to be actuated in the spinning cycle, because noise and vibration are likely to occur if the water held in the tub after separated from the laundry collides against the drum rotating at a high rotation number.

**[0006]** However, the amount of the water separated from the laundry during the spinning cycle gets decreased as time passes. Thus, unless controlling the rotation number of the impeller provided in the water discharge pump, noise and vibration might occur in the water discharge pump disadvantageously.

## SUMMARY OF THE DISCLOSURE

**[0007]** Accordingly, an object of the present disclosure is to address the above-noted and other problems.

**[0008]** Another object of the present disclosure is to provide a laundry treating machine that may minimize noise and vibration of a water discharge pump configured to be actuated during a spinning cycle for removing water from clothes, and a control method for the same.

**[0009]** Particular embodiments described herein include a method for controlling a laundry treating machine. The laundry treating machine may include a cabinet; a tub mounted in a cabinet and configured to receive water; a drum rotatably mounted in the tub and configured to hold laundry; a housing configured to receive water; an impeller rotatably supported in the housing; and a discharge pipe configured to guide the water in the tub toward the housing. The method includes rotating the drum at a preset reference revolutions per minute (RPM); while rotating the drum at the reference RPM, rotating the impeller at a preset first water discharge RPM such that a level of water inside the discharge pipe is higher than a highest water level inside the housing; rotating the drum at a first drum RPM lower than the reference RPM; and while rotating the drum at the first drum RPM, rotating the impeller at a second water discharge RPM lower than the first water discharge RPM such that the level of water inside the discharge pipe remains higher than the highest water level inside the housing.

**[0010]** In some implementations, the method can optionally include one or more of the following features. The first water discharge RPM may be set to be a predetermined RPM that maintains a first amount of the water discharged from the housing while rotating the impeller at the first water discharge RPM. The first amount of the water may be smaller than a second amount of the water supplied to the discharge pipe while rotating the drum at the reference RPM. The second water discharge RPM may be set to be a predetermined RPM that maintains a third amount of the water discharged from the housing while rotating the impeller at the second water discharge RPM. The third amount of the water may be smaller than a fourth amount of the water supplied to the discharge pipe while rotating the drum at the first drum RPM. The first water discharge RPM may be configured to be a variable RPM that increases based on a fifth amount of the water supplied to the housing increasing and decreases based on the fifth amount of the water decreasing. The method may include controlling a vibration sensor to measure vibration of the drum while rotating the drum at the first drum RPM; rotating the drum at a second drum RPM; and rotating the impeller at a third water discharging RPM while rotating the drum at the second drum RPM. The third water discharge RPM may be configured to maintain a sixth amount of the water supplied to the housing while rotating the drum at the second drum RPM, the sixth amount of the water being larger than a seventh amount of the water discharged from the housing while rotating the impeller at the third water discharge RPM. The third water discharge RPM may be configured to be a variable RPM that increases based on an eighth amount of the water supplied to the housing increasing and decreases based on the eighth amount of the water decreasing. The method may include pausing the rotation of the drum based on the measured vibration being greater than a reference value; and pausing the rotation of the impeller based on the measured vibration being greater than the reference value. The method may include, based on completion of pausing the rotation of the drum and pausing the rotation of the impeller, alternately repeating clockwise and counter-clockwise rotations of the drum; and based on completion of alternately repeating the clockwise and counter-clockwise rotations of the drum, performing: rotating the drum at the reference RPM; while rotating the drum at the reference RPM, rotating the impeller at the first water discharge RPM; rotating the drum at the first drum RPM; and while rotating the drum at the first drum RPM, rotating the impeller at the second water discharge RPM. The method may include, based on completion of pausing the rotation of the drum and

pausing the rotation of the impeller, alternately repeating clockwise and counter-clockwise rotations of the drum; and based on completion of alternately repeating the clockwise and counter-clockwise rotations of the drum, performing: rotating the drum at the first drum RPM; and while rotating the drum at the first drum RPM, rotating the impeller at the second water discharge RPM. The laundry treating machine may include an impeller driver configured to rotate the impeller. The discharge pipe may be a first discharge pipe. The laundry treating machine may include a second discharge pipe configured to guide the water discharged from the housing out of the cabinet. The laundry treating machine may include a water discharge pump, wherein the water discharge pump includes the housing and the impeller.

**[0011]** Embodiments of the present disclosure may provide a control method for a laundry treating machine comprising a tub that is mounted in a cabinet and holds water; a drum that is rotatably mounted in the tub and holds laundry; a drum drive part that is configured to rotate the drum; a housing that defines a predetermined space for storing water; an impeller that is rotatably provided in the housing; an impeller drive part that is configured to rotate the impeller; a first discharge pipe that is configured to guide the water held in the tub to the housing and a second discharge pipe that is configured to guide the water discharged from the housing to the outside of the cabinet, the control method comprising: a first drum rotating step that is configured to rotate the drum at a preset reference RPM; a first water discharging step that is configured to rotate the impeller at a preset first water discharge RPM during the first drum rotating step; a second drum rotating step that is configured to rotate the drum at a first drum RPM lower than the reference RPM; a second water discharging step that is configured to rotate the impeller at a second water discharge RPM lower than the first water discharge RPM during the second drum rotating step, wherein a water level inside the first discharge pipe may be kept on being higher than the highest water level inside the housing, while the first water discharging step and the second water discharging steps are performed.

**[0012]** The first water discharge RPM may be set to be a predetermined RPM that keeps the amount of the water discharged from the housing during the first water discharging step on being smaller than the amount of the water supplied to the first discharge pipe during the first drum rotating step.

**[0013]** The water discharge RPM may be set to be a predetermined RPM that keeps the amount of the water discharged from the housing during the second water discharging step on being smaller than the amount of the water supplied to the first discharge pipe during the second drum rotating step.

**[0014]** The first water discharge RPM may be set to be a variable RPM that increases when the amount of the water supplied to the housing increases and decreases when the amount of the water decreases.

**[0015]** The control method for the laundry treating machine may further comprising a vibration measuring step that is configured to control a vibration sensing part to measure vibration of the drum during the second drum rotating step; and a third water discharging step that is configured to rotate the impeller at a third water discharging RPM during the third drum rotating step.

**[0016]** The third water discharge RPM may be set to be a predetermined RPM that keeps the amount of the water supplied to the housing during the third drum rotating step on being bigger than the amount of the water discharged from the housing during the third water discharging step.

**[0017]** The third water discharge RPM may be set to be a variable RPM that increases when the amount of the water supplied to the housing increases and decreases when the amount of the water decreases.

**[0018]** The control method for the laundry treating machine may further comprise a drum braking step that is configured to pause the rotation of the drum and an impeller braking step that is configured to pause the rotation of the impeller, that are performed when the measured vibration is bigger than the reference value.

**[0019]** The control method for the laundry treating machine may further comprise an agitating step that is configured to alternately repeating a clockwise direction drum rotation and a counter-clockwise direction drum rotation, after the drum braking step and the impeller braking step are completed, wherein the first drum rotating step, the first water discharging step, the second drum rotating step and the second water discharging step may be re-performed after the agitating step is completed.

**[0020]** The control method for the laundry treating machine may further comprise an agitating step that is configured to alternately repeating a clockwise direction drum rotation and a counter-clockwise direction drum rotation, after the drum braking step and the impeller braking step are completed, wherein the second drum rotating step and the second water discharging step may be re-performed after the agitating step is completed.

**[0021]** The present disclosure has the effect of providing a laundry treating machine that may minimize noise and vibration of a water discharge pump configured to be actuated during a spinning cycle for removing water from clothes, and a control method for the same.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0022]** The present disclosure will become more fully understood from the detailed description given herein below and the accompanying drawings, which are given by illustration only, and thus are not limitative of the present disclosure, and wherein:

**[0023]** FIGS. **1** to **2**B are diagrams illustrating one embodiment of a laundry treating machine; and

**[0024]** FIG. **3** is a diagram illustrating one embodiment of a control method for the laundry treating machine.

## DESCRIPTION OF SPECIFIC EMBODIMENTS

**[0025]** Hereinafter, referring to the accompanying drawings, exemplary embodiments of the present disclosure will be described. Regardless of numeral references, the same or equivalent components may be provided with the same reference numbers and description thereof will not be repeated.

**[0026]** A laundry treating machine **100** according to one embodiment may include a cabinet **1**; a tub **2** that is provided in the cabinet and configured to hold water; and a drum **3** that is rotatably mounted in the tub **2** and holds laundry (e.g., clothes); a water supply part **561** and **563** configured to

supply water to the tub; and a water discharge part **6** configured to discharge the water held in the tub outside the cabinet.

**[0027]** The cabinet **1** may have a cabinet opening **11** that is provided to facilitate communication between the inside and outside of the cabinet. The cabinet opening **11** may be open and closed by a door **13** that is rotatably coupled to the cabinet **1**.

**[0028]** The tub **2** may include a cylinder-shaped tub body **21** having an inner empty space and a tub opening **23** that is provided in a front surface of the tub body. The tub opening **23** may be connected with the cabinet opening **13** through an insulation portion. The insulation portion for connecting the cabinet opening **11** and the tub opening **23** with each other may be configured to block the water held in the tub body **21** from being discharged to the cabinet **1** through the tub opening **23** and also dampen the vibration of the tub body **21** from being transferred to the cabinet **1**.

**[0029]** The insulation portion may have an insulating body **41** that is formed of a flexible material (e.g., rubber) to connect the cabinet opening **11** and the tub opening **23** with each other. The insulating body **41** may be formed of a cylinder-shaped flexible body with one body fixed to the cabinet opening **11** and the other end fixed to the tub opening **23**.

**[0030]** The tub body **21** may be mounted in the cabinet **1** by means of a tub support part. The tub support part may include a spring **25** provided to an upper area of a circumferential surface of the tub body **21** to the cabinet **1**; and a damper **26** provided to fix a lower area of the circumferential surface to the cabinet.

**[0031]** A heater **273** configured to heat the water held in the tub may be provided in the tub body **21**. The heater may be provided in a heating chamber **271** that is formed in the lower area of the circumferential surface of the tub body **21** (which is the area located lower than a rotation center of the drum). The heating chamber **271** may be provided as a predetermined space that projects from a bottom of the tub body towards a bottom of the cabinet, so as to collect the water stored in the tub body **21**.

**[0032]** The drum **3** may include a drum body **31** that is rotatable in the tub body **21**. The drum body **31** may be formed of a cylinder-shaped body having an inner empty space. Drum-through holes **32** may be formed in circumferential, front and rear surfaces of the drum body **31**, respectively, to facilitate communication between the drum body inside and the tub body inside. A drum opening **33** may be formed in a surface that is directed towards the cabinet opening **11** (e.g., a front surface of the drum) in the space defined by the drum body **31**.

**[0033]** The drum body **31** may be rotatable by a drum drive part **35**. The drum drive part may include a stator **351** that is fixed to a rear surface of the tub body **21** and configured to generate a rotating field; a rotor **353** that is provided outside the tub body **21** and configured to be rotated by the rotating field; and a shaft **355** that penetrates a rear surface of the tub body **21** and connects the rotor **353** with the drum body **31**.

**[0034]** The laundry treating machine **100** may further include a detergent supply part **5** that is configured to supply a washing detergent to the tub body **21**. The detergent supply part **5** may include a case **51** that is provided in the cabinet **1**; and a drawer **52** that is withdrawable from the case **41**.

**[0035]** The drawer **52** mounted in the case **51** may be withdrawn out of the cabinet **1** through a drawer introduction hole that is formed through a front surface of the cabinet. The drawer **52** may be formed in a polyhedron shape (e.g., a hexahedron) with an open top. The drawer may include a storage **521** that defines a predetermined space for storing a washing detergent; and a detergent outlet hole **523** that is in communication with the storage **521** and the case **51**. The detergent outlet hole **523** may be a through-hole that penetrates a rear surface or a bottom surface of the storage **521** or it may be a bell trap that is provided in the bottom of the storage **521**.

**[0036]** In this instance, the water supply part may include a water supply pipe **561** configured to supply water to the storage **521** from an external water supply; and a water supply valve **563** configured to open or close the water supply pipe **561** based on a control signal of a controller (not shown). Accordingly, when water is supplied to the storage **521** that stores the washing detergent therein through the water supply pipe **561**, the washing detergent may flow to the case **51** through the detergent outlet hole **523**, together with the washing detergent stored in the storage **521**.

**[0037]** The water and washing detergent that are discharged to the case **51** may be supplied to the tub body **21** through the insulating body **41**. For that, an inlet pipe **43** may be provide in the insulating body **41** to lead in the water and washing detergent and a supply pipe **53** may be provided in the detergent supply part **5** to guide the detergent and water towards the inlet pipe **43**. The inlet pipe **42** and the supply pipe **53** may be formed of a flexible material (e.g., rubber). That is to minimize the vibration of the tub that is transferred to the case **51** and the front panel **15** via the inlet pipe **42** and the supply pipe **53**.

**[0038]** The water held in the tub body **21** may be discharged outside the cabinet **1** through the water discharge part **6**.

**[0039]** The water discharge part **6** may include a chamber **61** that defines a predetermined space for storing water; a first discharge pipe **63** that is configured to guide the water from the tub body **21** to the chamber **61**; and a water discharge pump **65** configured to flow the water held in the chamber **61** towards a second discharge pipe **67**. The second water discharge pipe **67** may be provided as means for guiding the water discharged from the water discharge pump **65** towards the outside of the cabinet **1**. The highest point of the second discharge pipe **67** may pass a preset point that is higher than the lowest point of the tub opening **23**. The first discharge pipe **63** may connect the heating chamber **271** and the chamber **61** with each other.

**[0040]** The chamber **61** may include a filter **613** configured to filter the water discharged from the tub. The chamber **61** may be provided in a cylinder shape having a communication hole **611** that is formed in a front surface thereof. The communication hole **611** may be in communication with a filter coupling hole (not shown) that is formed through the front surface of the cabinet. In this instance, a user is able to insert the filter **613** through the filter coupling hole.

**[0041]** The water discharge pump **65** may include a first housing **651** provided to communicate with the chamber **61** and define a predetermined space for storing water; a first impeller **655** that is rotatable in the first housing; a first impeller motor **657** configured to rotate the first impeller;

and an outlet hole **653** penetrating a circumferential surface of the first housing and connected with the second water discharge pipe **67**.

**[0042]** The laundry treating machine **100** may further include vibration sensing part **7** that is configured to measure presence of vibration in the tub body **21** and the size of the vibration generated in the tub body. The drum body **31** may be connected to the rotor **353** by means of the shaft **355** penetrating the rear surface of the tub body **21**. Accordingly, the laundry treating machine **100** may sense the vibration in the drum body **31** by means of the vibration sensing part **7**.

**[0043]** In addition, the laundry treating machine **100** may further include a water level sensing part **8** that is configured to sense a water level inside the tub body **21**. The water level sensing part **8** may include a communication pipe **81** having water level scales that are equal to the water level scales inside the tub body **31**; and a sensor **83** configured to sense pressure variation inside the communication pipe **81**.

**[0044]** The communication pipe **81** may have one end connected to the first discharge pipe **382** and the other end located higher than the rotation center (e.g., along an axis of the shaft **355**) of the drum body **31**. Accordingly, once all of the water flows into the first discharge pipe **63** from the tub body, the water level sensing part **8** may also sense a water level of the first discharge pipe **63**.

**[0045]** When actuating the water discharge pump **65** during a spinning cycle for removing water or water element from the laundry, noise and vibration are likely to occur in the laundry treating machine **100** having the above-noted structure. A large amount of water is supplied to the water discharge pump **65** in an early stage of the spinning cycle. As the spinning cycle progresses, the amount of the water supplied to the water discharge pump **65** may decrease such that the water level inside the housing **651** may become lower than an upper end of the impeller **655**. When the impeller **655** is rotated in a state where the water level inside the housing **651** is lower than the upper end of the impeller **655**, the friction between the impeller **655** and the water might cause noise and vibration.

**[0046]** FIGS. **2**A and **2**B illustrate a state where the water level inside the housing **651** becomes lower than the upper end of the impeller **655**, when the spinning cycle and the water discharge process are performed simultaneously. FIG. **2**A illustrates a state where a much amount of laundry is loaded into the drum body **31** enough to lower the tub body **21** towards the bottom of the cabinet. FIG. **2**B illustrates a state where the lowering of the tub body **21** does not happen.

**[0047]** When the tub body **21** is not lowered (see FIG. **2**A), even one end of the first discharge pipe **63** connected to the heating chamber **271** may be lowered towards the bottom of the cabinet **1** and a water trap would be formed in the first discharge pipe **63**. If such a water trap is formed in the first discharge pipe **63**, noise and vibration might be caused by the water discharge pump more often.

**[0048]** FIG. **3** illustrates a control method for the laundry treating machine which may minimize the noise and vibration caused by the water discharge pump, when the spinning and the water discharging are performed simultaneously.

**[0049]** The control method shown in FIG. **3** may be applied to a spinning process and a water discharging that are performed in a washing cycle, or a water discharging process that is performed in a spinning cycle. The washing cycle may be configured to rotate the drum and separate foreign substances or contaminants from the laundry after water and a washing detergent are supplied to the tub. The rinsing cycle may be configured to rotate the drum after supplying water to the tub and separate the foreign substances from the laundry. The spinning cycle may be configured to rotate the drum and separate water from the laundry.

**[0050]** The control method for the laundry treating machine may include a first drum rotating step S**10** configured to rotate the drum **3** at a preset reference RPM (Revolution Per Minute) and remove water from the laundry; a first water discharging step S**20** configured to rotate the impeller **655** at a preset first water discharge RPM during the first drum rotating step S**10**; a second drum rotating step S**30** configured to rotate the drum **3** at a first drum RPM that is lower than the reference RPM; and a second water discharging step S**40** configured to rotate the impeller **655** at a second water discharge RPM that is lower than the first water discharge RPM.

**[0051]** The control method for the laundry treating machine is characterized in that water levels inside the first discharge pipe **63** is kept being higher than the highest water level inside the housing **651** during the first and second water discharging steps S**20** and S**40**.

**[0052]** In other words, the first water discharge RPM may be set to be a predetermined RPM that may keep the amount of the water discharged to the second discharge pipe **67** from the housing **651** during the first water discharging step S**20** to be smaller than the amount of the water supplied to the first discharge pipe **63** during the first drum rotating step S**10**.

**[0053]** Similarly, the second water discharge RPM may be set to be a predetermined RPM that may keep the amount of the water discharged to the second discharge pipe **67** from the housing **651** during the second water discharging step S**40** to be smaller than the amount of the water supplied to the first discharge pipe **63** during the second drum rotating step S**30**.

**[0054]** When the first and second water discharge RPMs are controlled as mentioned above, the water level inside the housing **651** may be prevented from getting lower than the upper end of the impeller **655**. Accordingly, the control method may minimize the noise and vibration caused in the water discharge pump during the spinning by means of the above-noted steps.

**[0055]** Meanwhile, the first water discharge RPM and the second water discharge RPM may not be fixed RPMs but set to be variable (as a variable RPM) based on the amount of the water supplied to the housing **651**. In other words, the first and second water discharge RPMs may be set to be variable based on the water levels inside the first discharge pipe **63** that are measured by the water level sensing part **8**.

**[0056]** In this instance, the first and second water discharge RPMs may be controlled to increase, when the amount of the water supplied to the housing **651** increases, and decrease, when the amount of the water decreases. Here, the RPM increase has to be controlled to keep the water level in the first discharge pipe **63** on being higher than the highest water level inside the housing **651**.

**[0057]** During the second drum rotating step S**30**, the control method for the laundry treating machine may implement a vibration measuring step S**50** configured to control the vibration sensing part **7** to measure vibration in the drum body **31**; and a vibration determining step S**51** configured to

determine whether the vibration measured in the vibration measuring step **S50** is a preset reference value or less.

**[0058]** When the measured vibration is the preset reference value or less, the control method may implement a first drum rotating step **S70** configured to rotate the drum body **31** at a second drum RPM that is higher than the reference RPM and separate water from the laundry. The reason why the vibration measuring step **S50** is performed before the third drum rotating step **S70** is to prevent a big vibration from occurring when rotating the drum body **31** at a high RPM.

**[0059]** When rotating the drum body **31** in a state where the laundry is in close contact with some area of the drum body **31**, the rotation center of the drum body **31** may be eccentric not to be equal to the rotation center of the drum drive part. The drum body **31** rotating in the eccentric state is likely to cause vibration and the vibration may become bigger as the eccentricity becomes bigger (it means that it may become bigger as the distance between the shaft and the rotation center of the drum body becomes farther). Accordingly, the control method may implement the first drum rotating step **S70** only when the vibration of the tub body **31** is the reference value or less and then minimize the vibration of the tub body **21** that might be generated during the third drum rotating step **S70**.

**[0060]** During the third drum rotating step **S70**, the control method may implement a third water discharging step **S60** that is configured to rotate the impeller **655** at a third water discharge RPM. In the third water discharging step **S60**, a water level inside the first discharge pipe **63** has to be kept being higher than the highest level inside the housing **651** so as to minimize the noise and vibration caused by the water discharge pump. Accordingly, the first water discharging RPM has to be set to be a predetermined RPM that may keep the amount of the water supplied to the housing **651** from the first discharge pipe **63** during the third drum rotating step **S70** on being higher than the amount of the water discharged to the second discharge pipe **67** from the housing **651**.

**[0061]** In addition, the third water discharge RPM may be set to be a variable RPM that may increase, when the amount of the water supplied to the housing **651** increases, and decrease, when the amount decreases.

**[0062]** The third drum rotating step **S70** may be performed for a predetermined time period that is set in the third drum rotating step. Once the time period passes, the control method may perform a drum braking step **S90** configured to end the rotation of the drum body; and an impeller braking step **S80** configured to end the rotation of the impeller.

**[0063]** Meanwhile, when the vibration measured in the vibration measuring step **S50** is larger than the reference value, the control method perform an eccentricity relieving step that is configured to reduce the vibration of the drum body **31**.

**[0064]** The eccentricity relieving step may include a drum braking step **S53** configured to pause the rotation of the drum body **31**; an impeller braking step **S55** configured to pause the rotation of the impeller **655**; and an agitating step **S57** configured to alternately agitating clockwise and counter-clockwise direction rotations of the drum body **31**. The agitating step **S57** may start once the drum braking step **S53** and the impeller braking step **S55** are completed.

**[0065]** After the completion of the agitating step **S57**, the control method may re-start the first drum rotating step **S10**, the first water discharging step **S20**, the second drum rotating step **S30** and the second water discharging step **S40**.

**[0066]** To reduce the time taken by the spinning, the control method may re-perform the second drum rotating step **S30** and the second water discharging step **S40** after completing the agitating step **S57**.

**[0067]** The control method applied to a front loading type laundry treating machine is described above, which includes the cabinet opening **11** provided in the front surface of the cabinet. However, the control method may be applied even to a top loading type laundry treating machine which includes the cabinet opening provided in the top surface of the cabinet. The tub opening is provided in the top surface of the tub body and the drum opening is provided in the top surface of the drum body. The shaft of the drum body is provided through the bottom surface of the tub body. That type having the above structure is one example of the top loading type laundry treating machine.

**[0068]** As the present features may be embodied in several forms without departing from the characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be considered broadly within its scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds, are therefore intended to be embraced by the appended claims.

What is claimed is:

**1**. A method for controlling a laundry treating machine, wherein the laundry treating machine comprises:

a cabinet;

a tub mounted in a cabinet and configured to receive water;

a drum rotatably mounted in the tub and configured to hold laundry;

a housing configured to receive water;

an impeller rotatably supported in the housing; and

a discharge pipe configured to guide the water in the tub toward the housing, the method comprising:

rotating the drum at a preset reference revolutions per minute (RPM);

while rotating the drum at the reference RPM, rotating the impeller at a preset first water discharge RPM such that a level of water inside the discharge pipe is higher than a highest water level inside the housing;

rotating the drum at a first drum RPM lower than the reference RPM; and

while rotating the drum at the first drum RPM, rotating the impeller at a second water discharge RPM lower than the first water discharge RPM such that the level of water inside the discharge pipe remains higher than the highest water level inside the housing.

**2**. The method of claim **1**, wherein the first water discharge RPM is set to be a predetermined RPM that maintains a first amount of the water discharged from the housing while rotating the impeller at the first water discharge RPM, the first amount of the water being smaller than a second amount of the water supplied to the discharge pipe while rotating the drum at the reference RPM.

**3**. The method of claim **2**, wherein the second water discharge RPM is set to be a predetermined RPM that maintains a third amount of the water discharged from the housing while rotating the impeller at the second water

discharge RPM, the third amount of the water being smaller than a fourth amount of the water supplied to the discharge pipe while rotating the drum at the first drum RPM.

**4**. The method of claim **2**, wherein the first water discharge RPM is configured to be a variable RPM that increases based on a fifth amount of the water supplied to the housing increasing and decreases based on the fifth amount of the water decreasing.

**5**. The method of claim **1**, further comprising:

controlling a vibration sensor to measure vibration of the drum while rotating the drum at the first drum RPM;

rotating the drum at a second drum RPM; and

rotating the impeller at a third water discharging RPM while rotating the drum at the second drum RPM.

**6**. The method of claim **5**, wherein the third water discharge RPM is configured to maintain a sixth amount of the water supplied to the housing while rotating the drum at the second drum RPM, the sixth amount of the water being larger than a seventh amount of the water discharged from the housing while rotating the impeller at the third water discharge RPM.

**7**. The method of claim **5**, wherein the third water discharge RPM is configured to be a variable RPM that increases based on an eighth amount of the water supplied to the housing increasing and decreases based on the eighth amount of the water decreasing.

**8**. The method of claim **5**, further comprising:

pausing the rotation of the drum based on the measured vibration being greater than a reference value; and

pausing the rotation of the impeller based on the measured vibration being greater than the reference value.

**9**. The method of claim **8**, further comprising:

based on completion of pausing the rotation of the drum and pausing the rotation of the impeller, alternately repeating clockwise and counter-clockwise rotations of the drum; and

based on completion of alternately repeating the clockwise and counter-clockwise rotations of the drum, performing:

rotating the drum at the reference RPM;

while rotating the drum at the reference RPM, rotating the impeller at the first water discharge RPM;

rotating the drum at the first drum RPM; and

while rotating the drum at the first drum RPM, rotating the impeller at the second water discharge RPM.

**10**. The method of claim **8**, further comprising:

based on completion of pausing the rotation of the drum and pausing the rotation of the impeller, alternately repeating clockwise and counter-clockwise rotations of the drum; and

based on completion of alternately repeating the clockwise and counter-clockwise rotations of the drum, performing:

rotating the drum at the first drum RPM; and

while rotating the drum at the first drum RPM, rotating the impeller at the second water discharge RPM.

**11**. The method of claim **1**, wherein the laundry treating machine includes an impeller driver configured to rotate the impeller.

**12**. The method of claim **1**, wherein the discharge pipe is a first discharge pipe, and wherein the laundry treating machine includes a second discharge pipe configured to guide the water discharged from the housing out of the cabinet.

**13**. The method of claim **1**, wherein the laundry treating machine includes a water discharge pump, wherein the water discharge pump includes the housing and the impeller.

* * * * *