US 20030115913A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2003/0115913 A1

Lee et al. (43) Pub. Date: Jun. 26, 2003

(54) WASHING MACHINE WITH AN IMPROVED WATER TUB

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(21) Appl. No.: **10/172,010**

(22) Filed: **Jun. 17, 2002**

(30) **Foreign Application Priority Data**

Dec. 24, 2001 (KR) 2001-84402

Publication Classification

(51) **Int. Cl.**[7] **D06F 23/04**

(52) **U.S. Cl.** **68/23.3**; 68/23.7

(57) **ABSTRACT**

A washing machine includes a water tub improved in strength and configured to reduce an amount of washing water consumed by the washing machine. The water tub has a bottom part, and a body part upwardly extended from a periphery of the bottom part by a certain height. The body part includes at least one annular stepped portion to reduce a diameter of the body part. The water tub includes a first annular stepped portion formed at a middle of the water tub, and second and third annular stepped portions formed above and below the first annular stepped portion, respectively. The body part of the water tub is widened upwardly. Hence, the washing machine has a water tub that is strengthened and able to reduce vibration.

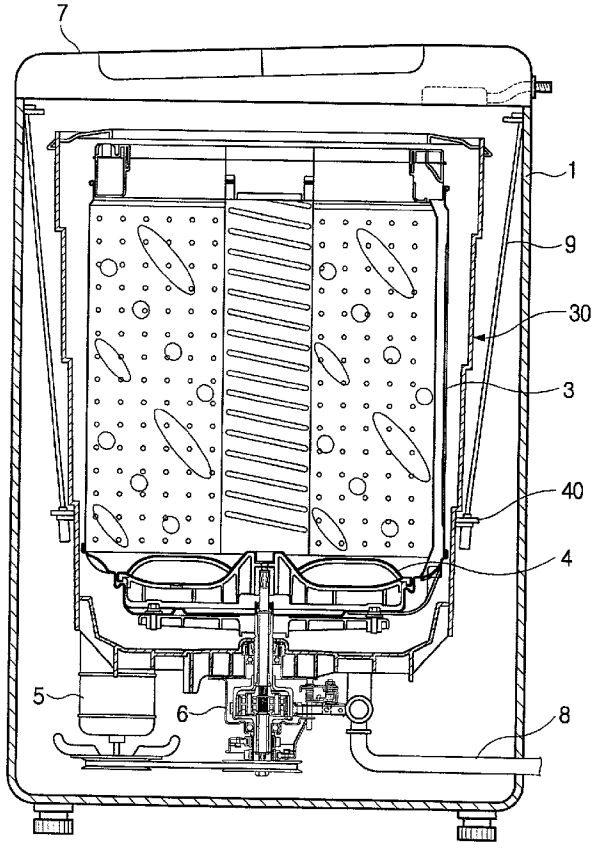


FIG. 1
(PRIOR ART)

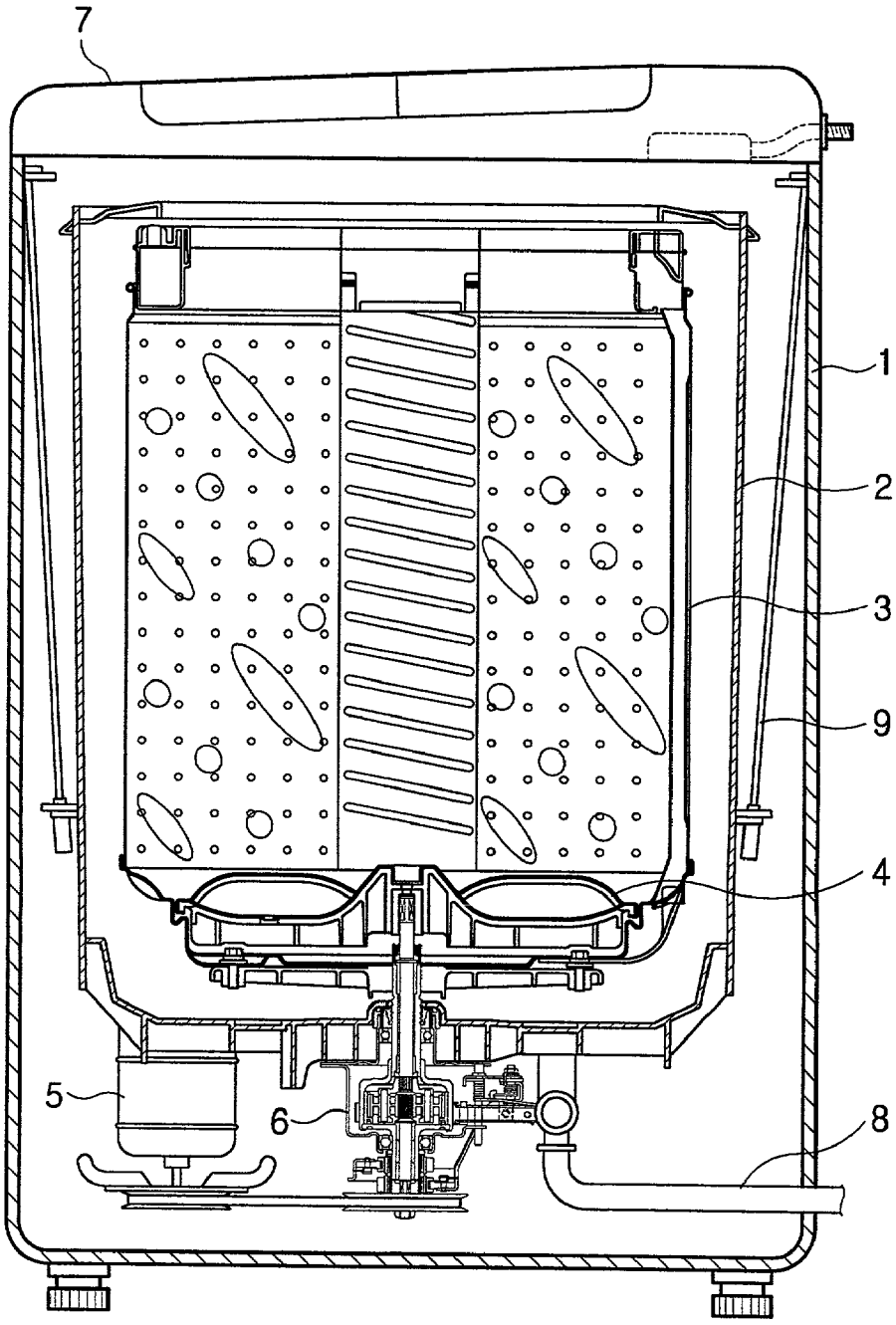


FIG. 2
(PRIOR ART)

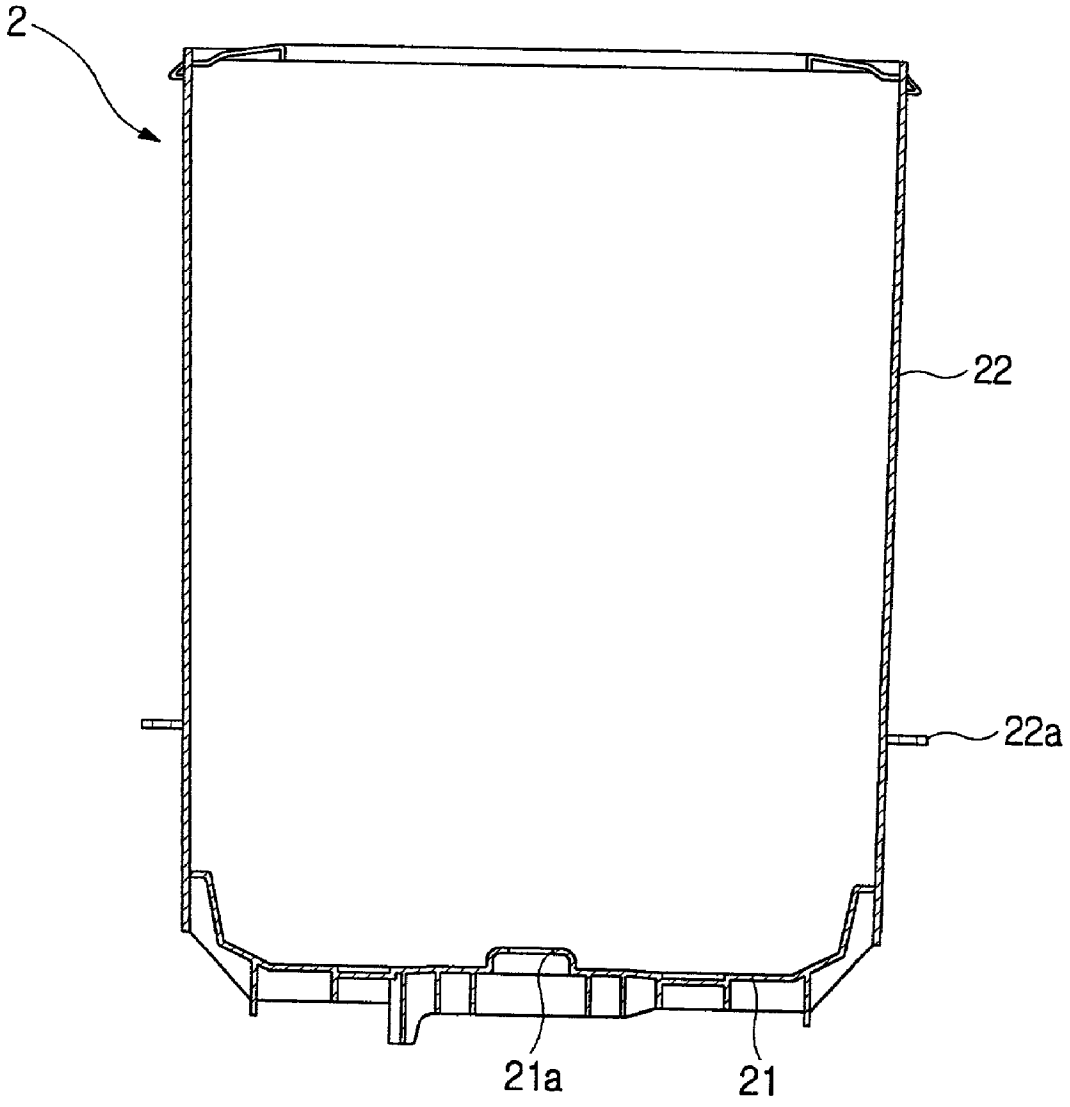


FIG. 3

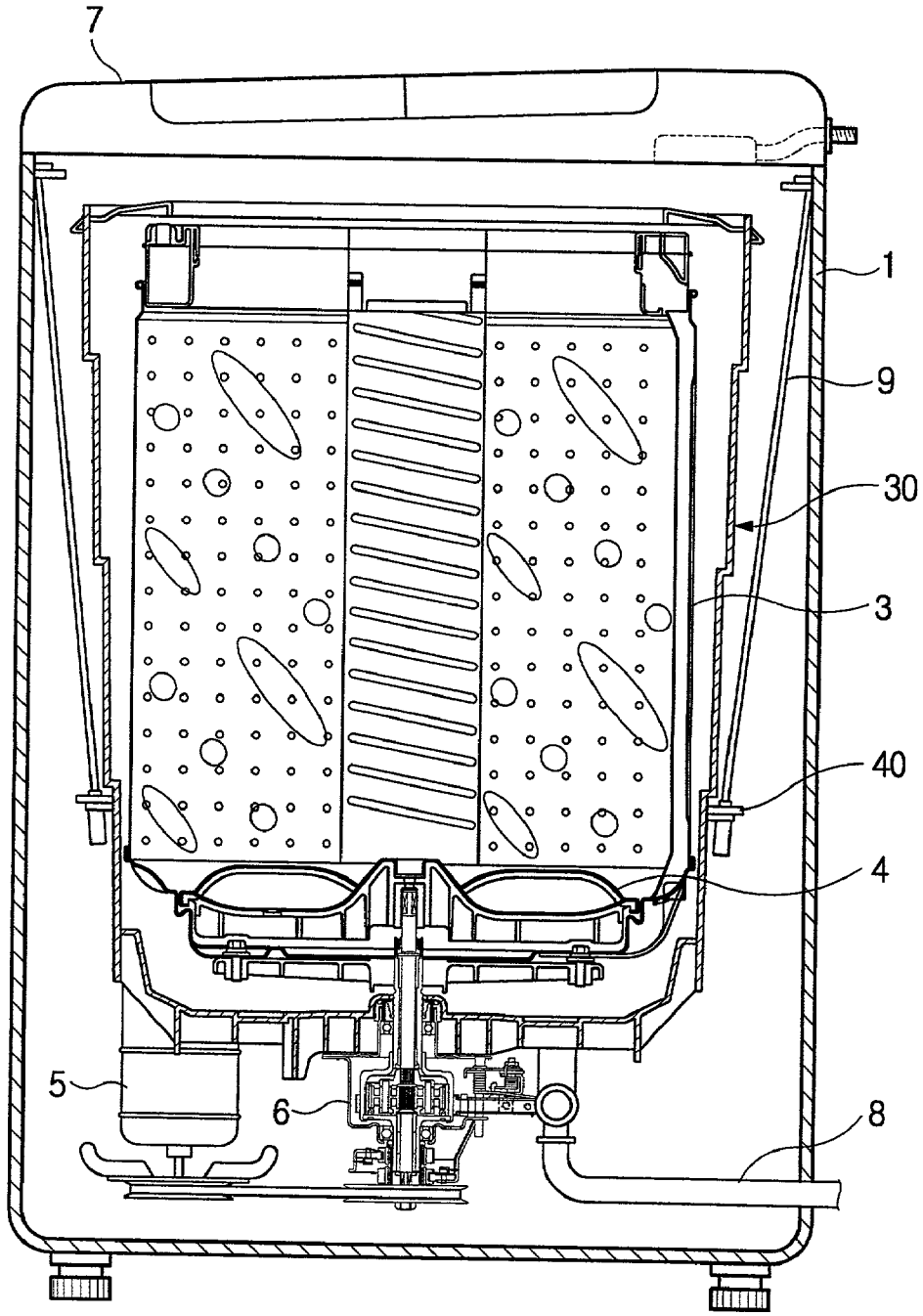
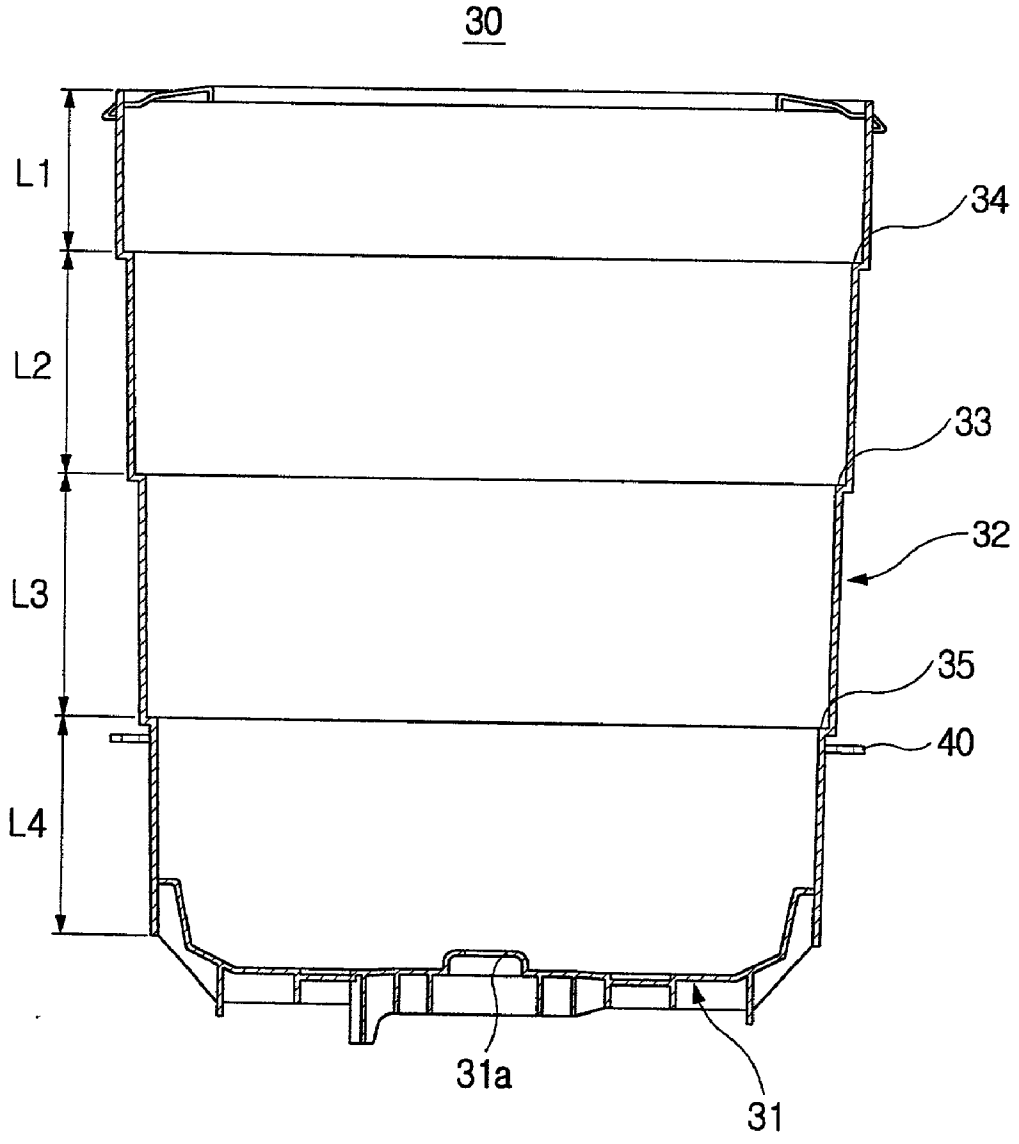


FIG. 4



WASHING MACHINE WITH AN IMPROVED WATER TUB

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Application No. 2001-84402, filed Dec. 24, 2001, in the Korean Industrial Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a washing machine, and more particularly, to a water tub for a washing machine having an improved structure to thereby increase a strength of the water tub and reduce an amount of washing water consumed by the washing machine.

[0004] 2. Description of the Prior Art

[0005] Generally, a washing machine is intended to wash laundry by rotating a cylindrical rotatable tub containing washing water. Such a washing machine is divided into a drum type and a vertical type washing machine. The drum type washing machine includes a rotatable tub horizontally positioned and rotated in the washing machine. The rotatable tub causes laundry to rise along a rotating inner surface of the rotatable tub, and to fall during forward and reverse rotations, thereby obtaining a washing effect. The vertical type washing machine includes a rotatable tub equipped with a pulsator, and is vertically positioned and rotated to wash laundry with water flow generated from the pulsator during forward and reverse rotations.

[0006] **FIG. 1** is a longitudinal cross-sectional view showing an internal structure of a vertical type washing machine having a conventional water tub. Referring now to **FIG. 1**, an internal structure of a conventional vertical type washing machine **10** equipped with a water tub is shown. The vertical type washing machine **10** includes a housing **1** which defines the external appearance of the washing machine **10**, a cylindrical water tub **2** vertically positioned in the housing **1** to contain washing water, and a cylindrical rotatable tub **3** rotatably positioned in the water tub **2** and having a plurality of drain holes at a cylindrical surface of the cylindrical rotatable tub **3**. The vertical type washing machine **10** also includes a pulsator **4** centrally mounted on an inner floor of the rotatable tub **3** to generate a turbulent current in the washing water, and a driving motor **5** and power transmission unit **6** positioned under the water tub **2** to rotate the pulsator **4** and the rotatable tub **3**.

[0007] The housing **1** is opened at a top portion thereof to allow laundry to be put into and drawn from the rotatable tub **3**. An opened portion of the housing **1** includes a door **7** hingedly connected thereto to permit opening and dosing of the rotatable tub **3**. Furthermore, a bottom of the water tub **2** includes a drainage hose **8** outwardly extended from the housing **1** to drain the washing water contained in the water tub **2** after completion of a washing operation.

[0008] **FIG. 2** shows the water tub **2** of **FIG. 1**, which is separated from the washing machine **10**. As shown in **FIG. 2**, the conventional water tub **2** includes a circular bottom part **21** and a body part **22** upwardly extended from a periphery of the bottom part **21** by a certain distance which defines a cylindrical surface for the water tub **2**. Thus, the body part **22** forms a cylindrical body opened at a top portion of the water tub **2** and has a certain thickness. The water tub **2** is centrally formed at the bottom part **21** with a hole **21** a through which a shaft of the power transmission unit **6** passes. The shaft of the power transmission unit **6** is connected to the rotatable tub **3** and the pulsator **4**. An outer surface of the water tub **2** includes brackets **22***a* to support lower ends of suspension rods **9**. The suspension rods **9** are hung at upper ends thereof on inner portions of the housing **1** to suspend the water tub **2** (see **FIG. 1**).

[0009] The vertical type washing machine **10** having the conventional water tub **2** is operated as follows. When the washing machine **10** is turned on after depositing laundry into the rotatable tub **3**, the water tub **2** is supplied with the washing water, and the pulsator **4** is rotated in the forward and reverse rotations by the driving motor **5** and the power transmission unit **6**. With the forward and reverse rotations of the pulsator **4**, the washing water becomes turbulent. Therefore, the laundry is subjected to a washing process by friction with the inner surface of the rotatable tub **3** while being rotated along with the turbulent current.

[0010] When the washing operation is completed after a certain time elapses, the washing water is drained through the drainage hose **8**, and then a rinsing procedure is carried out to extract washing detergent from the laundry. Thereafter, the rotatable tub **3** is again rotated at a high speed by the driving motor **5** and the power transmission unit **6** to fulfill spin-drying of the laundry. Having been subjected to the spin-dry operation, the washing process for the laundry is completed.

[0011] In the above-described vertical type washing machine **10**, since the water tub **2** includes the circular bottom part **21**, a body part **22** upwardly extended from the periphery of the bottom part **21**, and an upper opening, the water tub **2** inevitably has weak structural integrity. Hence, the water tub **2** may not efficiently cope with vibration caused by the operation of the washing machine **10**. In other words, for example, since the conventional water tub **2** has the body part **22** extended straight up from the periphery of the bottom part **21** by a substantial length to contain a certain amount of the washing water, and has a relatively thin wall to reduce a weight thereof, the body part **22** vibrates excessively. This is due to a turning force of the pulsator **4** and a centrifugal force of the washing water, when the pulsator **4** and the rotatable tub **3** are rotated together with the laundry and the washing water at a high speed in the spin-dry operation. Therefore, after being used for a long period, the body part **22** of the water tub **2** may not efficiently absorb the turning force of the pulsator **4** and the rotatable tub **3**, thereby generating intense vibrations and noise. As a result of such a generation of vibrations and noise, the water tub **2** is deformed and thus shortened in service life. Furthermore, since the body part **22** of the water tub **2** has a normal plain wall, the washing machine **10** having the water tub **2** consumes a large amount of washing water.

SUMMARY OF THE INVENTION

[0012] Accordingly, it is an object of the present invention to provide a washing machine in which a water tub to

contain washing water is modified in structure to improve a structural strength of the water tub and to reduce an amount of washing water consumed by the washing machine.

[0013] Additional objects and advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0014] The foregoing and other objects of the present invention are achieved by providing a washing machine including a housing defining an external appearance of the washing machine, a water tub positioned in the housing to contain washing water, and including a bottom part and a body part upwardly extended from a periphery of the bottom part by a certain height. The body part includes at least one annular stepped portion which reduces a diameter of the body part. The washing machine also includes a rotatable tub positioned in the water tub.

[0015] According to an aspect of the invention, the water tub includes a first annular stepped portion formed at a middle of the water tub and second and third annular stepped portions formed above and below the first annular stepped portion, respectively

[0016] According to an aspect of the invention, each of the annular stepped portions has a radial width in a range of 1 mm to 5 mm.

[0017] According to an aspect of the invention, the body part of the water tub is configured to be widened upwardly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The above and other objects and advantages of the invention will become apparent and more appreciated from the following description of the preferred embodiments, taken in conjunction with the accompanying drawings of which:

[0019] **FIG. 1** is a longitudinal cross-sectional view showing an internal structure of a vertical type washing machine having a conventional water tub;

[0020] **FIG. 2** is a longitudinal cross-sectional view showing the conventional water tub of **FIG. 1**;

[0021] **FIG. 3** is longitudinal cross-sectional view showing an internal structure of a vertical type washing machine having a water tub, according to an embodiment of the present invention; and

[0022] **FIG. 4** is a longitudinal cross-sectional view showing the water tub of **FIG. 3**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] Reference will now be made in detail to the present preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

[0024] **FIG. 3** is a longitudinal cross-sectional view showing an internal structure of a vertical type washing machine having a water tub, according to an embodiment of the present invention. As shown in **FIG. 3**, the vertical type washing machine **10** includes a housing **1** defining an external appearance of the washing machine **10**, a cylindrical water tub **30** vertically positioned in the housing **1** to contain washing water, and a cylindrical rotatable tub **3** rotatably positioned in the water tub **30** and having a plurality of drain holes at a cylindrical surface thereof. The vertical type washing machine **10** also includes a pulsator **4** centrally mounted on an inner floor of the rotatable tub **3** to generate a turbulent current in the washing water, and a driving motor **5** and a power transmission unit **6** positioned under the water tub **30** to rotate the pulsator **4** and the rotatable tub **3**.

[0025] The housing **1** is provided at a top portion of the housing **1** with a door **7** via a hinge to allow laundry to be put into and drawn from the rotatable tub **3**. A bottom of the housing **1** includes a drainage hose **8** outwardly extended from the housing **1** to drain the washing water contained in the water tub **30** after completion of a washing operation. The water tub **30** is suspended from the housing **1** by suspension rods **9**, which are connected between upper portions of the housing **1** and brackets **40** attached to lower portions of the water tub **30**.

[0026] **FIG. 4** is a longitudinal cross-sectional view showing the water tub of **FIG. 3**. As shown in **FIG. 4**, the water tub **30** includes a bottom part **31**, which is centrally formed with a central hole **31** a through which the power transmission unit **6** that rotates the rotatable tub **3** and the pulsator **4** passes at an upper portion of the bottom part **31**. The water tub **30** also includes a body part **32** upwardly extended from the periphery of the bottom part **31** to define a generally cylindrical wall surface of the water tub **30**.

[0027] The water tub **30** is widened upwardly such that the body part **32** of the water tub **30** is stepwise enlarged in diameter from bottom to top. Accordingly, an outer and inner surface of the body part **32** is formed with at least one annular stepped portion. Although the body part **32** is shown in **FIG. 4** to have three annular stepped portions, the body part **32** may have more or less annular stepped portions depending on a height or diameter of the body part **32**.

[0028] The water tub **30** is horizontally provided at approximately a middle height thereof with a first annular stepped portion **33** so that the body part **32** is reinforced by a first annular stepped portion **33**, thereby achieving a strength to endure vibration. Therefore, the body part **32** is able to efficiently suppress vibration caused by rotation of the rotatable tub **3** and the pulsator **4**.

[0029] In addition, the body part **32** is provided above and below the first annular stepped portion **33** with second and third annular stepped portions **34** and **35**, respectively. The second and third annular stepped portions **34** and **35**, respectively, are configured to be similar to the first stepped portion **33**, so that a wall of the body part **32** includes several annular stepped portions **33**, **34**, and **35** along a length of the wall. Therefore, the annular stepped portions **33**, **34**, and **35**, enable the body part **32** of the water tub **30** to be stronger. Consequently, the annular stepped portions **33**, **34**, and **35** allow vibration of the body part **32**, due to high-speed rotation of the rotatable tub **3** and the pulsator **4**, to be lessened.

[0030] Also, as shown in **FIG. 4**, the body part **32** is divided into four sections L1, L2, L3 and L4 along a vertical length of the body part **32** via the sequentially positioned

annular stepped portions **33**, **34** and **35**. Accordingly, the water tub **30** is strengthened and reduced in vibration, as compared with the conventional water tub **2** (see **FIG. 2**) which is configured to have a plain cylindrical wall.

[**0031**] With the annular stepped portions **33**, **34**, and **35** formed at the body part **32**, the water tub **30** has reduced internal volume, thereby decreasing an amount of the washing water required.

[**0032**] The annular stepped portions **33**, **34** and **35** are sized to have a radial width in a range of 1 mm to 5 mm (e.g., preferably having a radial width of 3 mm).

[**0033**] The operation of the vertical type washing machine **10** having a water tub **30** is described below.

[**0034**] When the washing machine **10** is turned on after depositing laundry into the rotatable tub **3**, the water tub **3** is supplied with the washing water, and the pulsator **4** is rotated in forward and reverse rotations via the driving motor **5** and the power transmission unit **6**. Due to the forward and reverse rotations of the pulsator **4**, the laundry is subjected to a washing process by friction with an inner surface of the rotatable tub **3** while being rotated along with the turbulent current of the washing water.

[**0035**] When the washing operation is completed after a certain time period elapses, the washing water is drained through the drainage hose **8**, and then a rinsing procedure is carried out to extract washing detergent from the laundry. Thereafter, the rotatable tub **3** is again rotated at a high speed via the driving motor **5** and the power transmission unit **6** to carry out a spin-dry operation of the laundry. After the spin-dry operation, the washing process for the laundry is completed.

[**0036**] In the spin-dry operation, a turning force of the rotatable tub **3** and the pulsator **4**, and a centrifugal force of the washing water, are transmitted to the water tub **30**. Therefore, since the water tub **30** includes the cylindrical body part **32** divided into the four sections L1 to L4 by the annular stepped portions **33**, **34** and **35**, the water tub **30** efficiently absorbs the turning force of the rotatable tub **3** and the pulsator **4**, and the centrifugal force of the washing water.

[**0037**] As described above, the present invention provides a washing machine with a water tub that is strengthened and able to reduce vibration. Therefore, noise caused by vibration of the water tub is reduced, and the water tub is only slightly deformed after usage for a long period of time. Hence, the washing machine is more reliable to a user and is equipped with a water tub that reduces the amount of washing water required to wash laundry.

[**0038**] Although a preferred embodiment of the present invention has been shown and described, it would be appreciated by those skilled in the art that changes may be made without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. A washing machine comprising:

a housing defining an external appearance of the washing machine;

a water tub located in the housing to contain washing water, and including a bottom part and a body part upwardly extended from a periphery of the bottom part by a certain height, said body part having at least one annular stepped portion to reduce a diameter of the body part; and

a rotatable tub located in the water tub.

2. The washing machine as set forth in claim 1, wherein said water tub comprises:

a first annular stepped portion formed at a middle of the water tub; and

second and third annular stepped portions formed above and below the first annular stepped portion, respectively, all of said annular stepped portions together, enabling the body part to be strengthened and reduced in vibration.

3. The washing machine as set forth in claim 2, wherein each of said annular stepped portions has a radial width in a range of 1 mm to 5 mm.

4. The washing machine as set forth in claim 2, wherein said body part of the water tub is widened upwardly so that the body part is stepwise enlarged in diameter from bottom to top via said annular stepped portions, thereby suppressing vibration of the body part.

5. The washing machine as set forth in claim 4, wherein said water tub is made of a plastic material.

6. A washing machine comprising:

a housing defining an external appearance of the washing machine;

a water tub located in the housing to contain washing water;

a rotatable tub located in the water tub and having a plurality of drain holes at a cylindrical surface of the water tub;

a pulsator centrally mounted on an inner floor of the rotatable tub to generate a turbulent current in the washing water; and

a drive motor and power transmission unit located under the water tub to rotate the pulsator and the rotatable tub, wherein,

said water tub includes a bottom part and a body part upwardly extended from a periphery of the bottom part by a certain height, and has at least one annular stepped portion to reduce a diameter of the body part.

7. The washing machine as set forth in claim 6, wherein said body part includes a plurality of annular stepped portions depending on a height of the body part.

8. The washing machine as set forth in claim 6, wherein a middle of the water tub includes one of said at least one annular stepped portion to reduce vibration in the body part caused by rotation of the rotatable tub and the pulsator.

9. The washing machine as set forth in claim 6, wherein the water tub has a reduced internal volume to decrease an amount of the washing water required in a washing operation.

10. The washing machine as set forth in claim 6, wherein said water tub comprises:

a first annular stepped portion formed at a middle of the water tub; and

second and third annular stepped portions formed above and below the first annular stepped portion, respec-

tively, all of said annular stepped portions, together, enabling the body part to be strengthened and reduced in vibration.

11. The washing machine as set forth in claim 10, wherein in a spin-dry operation of the washing machine, said annular stepped portions allows the water tub to efficiently absorb a turning force of the rotatable tub and the pulsator, and a centrifugal force of the washing water.

12. The washing machine as set forth in claim 10, wherein said body part of the water tub is widened upwardly so that the body part is stepwise enlarged in diameter from bottom to top via said annular stepped portions, thereby suppressing vibration of the body part.

13. The washing machine as set forth in claim 10, wherein each of said annular stepped portions has a radial width in a range of 1 mm to 5 mm.

14. A washing machine comprising:

a housing defining an external appearance of the washing machine; and

a water tub located in the housing to contain washing water, the water tub including a bottom part and a body part upwardly extended from a periphery of the bottom part by a certain height, and the body part being widened from bottom to top to suppress vibration of the body part.

* * * * *