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(54) INTEGRATED STRUCTURE OF INTERNAL BARREL AND IMPELLER, WASHING MACHINE AND WASHING METHOD

(57) Disclosed are an integrated structure of an internal barrel and an impeller, a washing machine and a washing method. The structure comprises an internal barrel (1) which is used vertically, and at least two water stirring blades (2) at the internal barrel bottom (11), wherein the water stirring blades (2) and the internal barrel bottom (11) are arranged integrally; and the water stirring blades (2) are of a protrusion structure arranged at the internal barrel bottom (11), each water stirring blade (2) extends to an internal barrel wall (12) from the center of the internal barrel bottom (11), and each water stirring blade (2) raises up and extends in an outward radial direction of the internal barrel bottom (11) to the highest point, then is connected to the internal barrel wall (12), and raises up and extends in the shape of a gentle slope in a circumferential direction from one side to the highest point, and then descends in the shape of a steep slope to the internal barrel bottom (11), so as to control the positive and negative rotation of a washing machine at intervals, so that clothes roll in the internal barrel to complete washing. Since every time the angles of the positive and negative rotation are different, clothes are always in a continuous rolling state in the internal barrel, thereby reducing the possibility of twisting, so as to avoid non-uniform washing caused by the continuous washing friction of clothes in the same location. The lifting beating, centrifugal force turnover, impact striking, and friction rubbing act together during the washing, so that clothes are uniformly washed omnidirectionally.

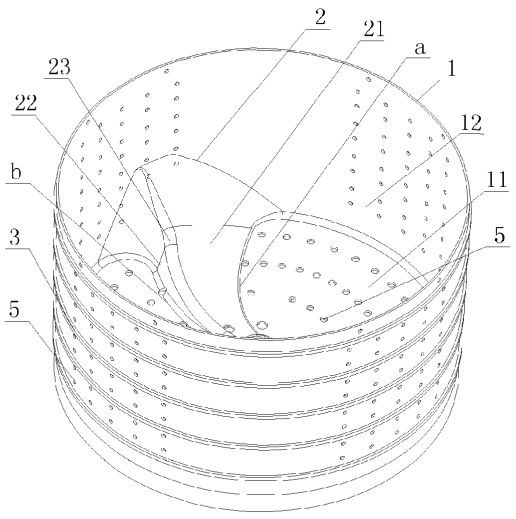

FIG. 1

EP 2 987 901 A1

Description

BACKGROUND

Technical Field

[0001] The present invention relates to the field of washing machines, and particularly, to an integrated structure of an internal barrel and an impeller, a washing machine using the structure, and a washing method of a washing machine.

Related Art

[0002] In the prior art, it is common to divide washing machines into drum washing machines, impeller washing machines and agitator washing machines. In principle, the impeller washing machines and the agitator washing machines are very similar. The impeller washing machines rely on an impeller to stir water currents, and water currents moving irregularly stir the clothing, so as to complete washing and rinsing processes of the clothing; the agitator washing machines rely on a stirring pole, to drag the clothing to move in water directly or by means of water power, so as to complete washing of the clothing. The drum washing machines rely on a plurality of ribs fixed to inner walls of the inner drum to lift the clothing, and the clothing is repeatedly lifted and falls in the drum to complete washing and rinsing processes.

[0003] In the prior art, it is considered that the drum washing machines use less water, have a low clothing wear rate, do not intertwine the clothing, can be provided with a water heating device, and achieve automation easily, but have weak detergency, a long washing time, a complicated structure and huge volume, consume many raw metal materials, and have a higher cost, which are relatively difficult to control during high speed dewatering. The agitator washing machines have good washing uniformity, strong detergency, a small clothing wear rate and large washing capacity, but have a long washing time, great noise, a complicated swing mechanism of a stirring wing, difficult machining, a higher cost, and large volume. The impeller washing machines have a simple structure, strong detergency, a short washing time, a low cost, and are lightweight, but have higher clothing wear rate and intertwine rate, poor washing uniformity and more water consumption.

[0004] At present, washing machines have been widely used in families, but existing washing machines are mostly dual power or double-drum machines, have a relatively complicated structure and a greater size, and occupy larger family space. An internal barrel of a general impeller washing machine is provided with an impeller, the structure is relatively complicated, the installation process is cumbersome, and the cost is high; if the internal barrel and the impeller can be designed into an integrated structure, the complexity, the installation process and the cost will be reduced greatly. How to integrate the advantages of the various washing machines is a facing major problem.

[0005] The Chinese Patent with Patent No. CN200510094191.3 discloses a clothing washing manner with a good washing effect, a low cost and no environmental pollution, which mainly includes the following steps: (i) adding an appropriate amount of washing water and defoaming agent to a washing machine that contains clothing to be washed; (ii) controlling a rotation speed of a tank of the washing machine to be 3-12 rpm through a control device, wherein, during operation of the tank, forward rotation and reverse rotation are carried out at intervals, the number of turns of the forward rotation each time is 0.3-1.5 turns, and the number of turns of the reverse rotation each time is 0.3-1.5 turns; after the tank operates continuously in this way for 0.4-1.5 minutes, the tank stops operating for 0.3-1.5 minutes; (iii) repeating the procedure in step (ii) 3-20 times; (iv) then making the tank rotate unidirectionally, carrying out a procedure of uniform distribution, and after the uniform distribution ends, carrying out quick dewatering for 0.3-3.5 minutes in a rotating drum; and (v) repeating the procedures in steps (i) to (iv) 2-12 times, so as to complete a washing process. However, the drum form still has a problem that balancing is relatively difficult to control during high speed dewatering.

[0006] The Chinese Patent with Patent No. CN03276136.8 discloses a washing machine with good dirt removal, and low twisting and wear. The screw-type washing machine increases a cleaning ratio and washing uniformity, and reduces the twisting rate and the wear rate. However, the structure of the washing machine is simple, the impeller (the internal barrel bottom) and the internal barrel wall are connected into one piece, there is no clutch, and the internal barrel is full of rifling threads thereon. During forward rotation, stop and reverse rotation of the internal barrel, the clothing is cleaned through combined actions such as pressured and multi-direction rubbing, centrifugal force washing without side effects, cavatition and high-speed start up inertia. However, the washing machine involved in the patent merely increases a screw structure for the internal barrel wall, no definition is given to the internal barrel bottom structure, and the space of the internal barrel bottom is wasted, which cannot have a washing effect on the clothing.

[0007] The Chinese Patent with Patent No. CN00215731.4 discloses an automatic washing machine without an impeller, including an internal barrel, an outer barrel, an internal barrel bottom water repellent rib and a motor, characterized in that the internal barrel and the internal barrel bottom water repellent rib are integrated, and the internal barrel bottom water repellent rib replaces the impeller of the existing impeller washing machine. A motor rotor is fixed onto a main shaft of the internal barrel, and the motor rotor and the internal barrel share the main shaft of the internal barrel. As the internal barrel and the internal barrel bottom water repellent rib are integrated, when the motor drives the internal barrel to make forward

and reverse intermittent operation, the internal barrel bottom water repellent rib drives water currents to move, to play a role of impeller. The patent discloses a non-impeller structure, which does not specifically describe the internal barrel bottom and a side structure thereof, the internal barrel bottom structure illustrated does not have a strengthening effect on turning of the clothing, and the side face does not have a corresponding water stirring blade to stir the internal washing water.

[0008] In view of this, the present invention is put forward.

SUMMARY

[0009] An objective of the present invention is to provide an integrated structure of an internal barrel and an impeller and add a water stirring blade structure to the internal barrel bottom, so as to overcome the shortcomings of the prior art; the structure extends from the internal barrel bottom to the internal barrel wall, enables the clothing to be lifted, fall and be hit in the circumferential direction, and also enables the clothing to be turned in a radial direction, to uniformly wash the clothing in all directions, which has a good washing effect, can complete washing, rinsing and dewatering processes by making the clothing only pass through one washing barrel, makes the washing machine have a simple structure, simplifies the installation process and reduces the cost.

[0010] Another objective of the present invention is to provide a washing machine having the integrated structure of an internal barrel and an impeller.

[0011] Another objective of the present invention is to provide a washing method of the washing machine; the method includes forward and reverse rotation at intervals to reduce twisting. Since every time the angles of the positive and negative rotation are different, non-uniform washing caused by the continuous washing friction of clothes in the same location is prevented. The lifting beating, centrifugal force turnover, impact striking, and friction rubbing act together during the washing by the integrated structure of an internal barrel and an impeller, so that clothes are uniformly washed omnidirectionally.

[0012] To achieve the objective, the present invention adopts the following technical solution:

An integrated structure of an internal barrel and an impeller, the structure comprises an internal barrel which is used vertically, and water stirring blades at the internal barrel bottom, wherein the water stirring blades and the internal barrel bottom are arranged integrally; and the water stirring blades are of a protrusion structure arranged at the internal barrel bottom, the number of the water stirring blades is at least two, each water stirring blade extends to an internal barrel wall from the center of the internal barrel bottom , and each water stirring blade raises up and extends in an outward radial direction of the internal barrel bottom to the highest point, then is connected to the internal barrel wall, and raises up and extends in the shape of a gentle slope in a circumferential direction from one side to the highest point, and then descends in the shape of a steep slope to the internal barrel bottom.

[0013] The number of the water stirring blades is 2-4, and the water stirring blades are evenly distributed around an axis of the internal barrel radially along the circumference of the internal barrel bottom clockwise or counterclockwise, and rise and extend along the circumference of the internal barrel bottom clockwise or counterclockwise in the same direction.

[0014] A gentle slope rising side of the water stirring blade smoothly rises, a steep slope falling side of the water stirring blade smoothly falls, the internal barrel bottom transits smoothly with the gentle slope rising side and the steep slope falling side, the water stirring blade smoothly rises outwardly along a radial direction of the internal barrel bottom, and the internal barrel wall transits smoothly with the water stirring blade.

[0015] Highest points of the water stirring blade form a ridge of the water stirring blade in different radial positions of the internal barrel bottom, the ridge is made up of two arcs, circle centers of the two arcs are distributed on different sides of the ridge, the circle center of the arc near the center of the internal barrel is on the gentle slope rising side, and the circle center of the arc near the internal barrel wall is on the steep slope falling side.

[0016] The water stirring blade tilts on two sides of any point on the ridge in different degrees, and a tilt degree of the gentle slope rising side is less than that of the steep slope falling side.

[0017] An intersecting line between the water stirring blade and the internal barrel bottom is an arc, bending directions of an intersecting line between the gentle slope rising side and the internal barrel bottom and an intersecting line between the steep slope falling side and the internal barrel bottom are the same, and each intersecting line smoothly transits with the outermost circumference of the internal barrel bottom.

[0018] A ratio range of the height of the internal barrel to the diameter of the internal barrel is 0.4-2, preferably the height of the internal barrel is less than or equal to the diameter of the internal barrel.

[0019] A ratio of the height of the internal barrel to the diameter of the internal barrel is 0.6.

[0020] The central position of the internal barrel bottom is provided with an axle hole that allows a power shaft to penetrate, and multiple water leakage holes are distributed on the internal barrel wall and/or the internal barrel bottom of the internal barrel.

[0021] A washing machine having the integrated structure of an internal barrel and an impeller, wherein inside an outer barrel of the washing machine is coaxially provided with the integrated structure of an internal barrel and an impeller, and a power shaft of the washing machine extends into the axle hole in the central position of

the internal barrel bottom in the integrated structure of an internal barrel and an impeller.

[0022] A washing method, wherein the method turns clothing in an internal barrel by controlling a washing machine to rotate forward and reversely at intervals, to complete washing, in the method, the washing machine rotates forward and reversely at different angles each time, the forward rotation angle each time is not equal to the reverse rotation angle each time, by means of an integrated structure of an internal barrel and an impeller, in the event of forward rotation in a circumferential direction, the clothing is pulled up and then falls subvertically, in the event of reverse rotation, the clothing is impacted by a subvertical plane in the circumferential direction, and in forward and reverse rotation processes, under the guide of centrifugal force produced by radial rotation and an internal barrel bottom structure, the clothing is turned outwardly and upwardly, and is turned inwardly and downwardly after arriving at an internal barrel wall.

[0023] Falling and beating of the clothing after pull-up when rotating forward in the circumferential direction or striking when rotating reversely and turning in the radial direction are carried out at the same time, to make the clothing always in a continuous rolling state in the internal barrel and collide with and rub the internal barrel bottom and the internal barrel wall, to be evenly washed.

[0024] Motions of the clothing in the circumferential direction and in the radial direction are guided by a projection structure of the internal barrel bottom.

[0025] The number of the projection structure is at least two, preferably 2-4, the projection structures are evenly distributed around an axis of the internal barrel radially along the circumference of the internal barrel bottom clockwise or counterclockwise, and rise and extend along the circumference of the internal barrel bottom clockwise or counterclockwise in the same direction, and the projection structures rise and extend along a radial outward direction of the internal barrel bottom, after extending to the highest point, are connected with the internal barrel wall, and after rising and extending to the highest point along the circumferential direction from one side in a shape of a gentle slope, drop back to the internal barrel bottom in a shape of a steep slope.

[0026] In the washing process, in the circumferential direction, during forward rotation, the clothing, after rising to the highest point along a smooth rising and extending plane of the projection structure, falls and beats along a subvertical steep slope plane, and during reverse rotation, the clothing hits the subvertical steep slope plane.

[0027] In the washing process, in a barrel diameter direction, centrifugal force produced by rotation makes the clothing turned outwardly and upwardly along the projection structure, and turned inwardly and downwardly after going to the internal barrel wall.

[0028] In the washing method, in a washing or rinsing process, the internal barrel increases to a forward rotation speed X at a certain acceleration, rotates forward for a certain time T1, pauses for a period of time, then increases to a reverse rotation speed Y at a certain acceleration, and rotates reversely for a certain time T2, a forward rotation angle each time is not equal to a reverse rotation angle, and the process is repeated 5-500 times for each washing or rinsing.

[0029] The forward rotation speed X and the reverse rotation speed Y are 20-100 rpm respectively, the forward rotation time T1 and the reverse rotation time T2 are 1-5 s respectively, and $X \times T1 \neq Y \times T2$.

[0030] The washing method includes the following steps:

1) placing a detergent along with the clothing into a washing internal barrel, and starting the washing machine;

2) controlling the washing internal barrel to increase to the forward rotation speed X at a certain acceleration, rotate forward for a certain time T1, pause for a period of time, then increase to a reverse rotation speed Y at a certain acceleration, and rotate reversely for a certain time T2, a forward rotation angle each time being not equal to a reverse rotation angle, and the process being repeated 5-500 times;

3) proceeding to a dewatering stage: controlling the washing internal barrel to rotate forward and reversely, and after even distribution of the clothing, the internal barrel rotating at a high speed for dewatering;

4) if the clothing needs to be washed multiple times, adding the detergent again to repeat steps 2) and 3); and

5) controlling water injection of the washing machine, and repeating steps 2) and 3) 1-8 times.

[0031] After the technical solution of the present invention is adopted, the following beneficial effects are brought about:

1. The integrated structure of an internal barrel and an impeller in the present invention can complete washing, rinsing and dewatering processes only through one washing barrel, makes the structure of the washing machine simple, simplifies the installation process and reduces the cost.

2. In the present invention, a water stirring blade structure is added to the internal barrel bottom, and the structure extends from the internal barrel bottom to the internal barrel wall, enables the clothing to be lifted, fall and be hit in the circumferential direction, and also enables the clothing to be turned in a radial direction, to uniformly wash the clothing in all directions, which has a good washing effect.

3. In the present invention, gradual rising and rapid

falling of the water stirring blade of the internal barrel bottom in the circumferential direction have an effect of lifting and then beating the clothing during forward rotation, and have an effect of impacting the clothing during reverse rotation; the internal barrel gradually rises in a direction from the center to the internal barrel wall, and the highest point is connected with the internal barrel wall, to have an effect of turning the clothing upwardly and outwardly in the radial direction and turning the clothing downwardly and inwardly after going to the internal barrel wall.

4. The height of the internal barrel is small, which saves installation space.

5. In the washing method according to the present invention, forward rotation and reverse rotation are set at intervals, reducing twisting of the clothing.

6. In the washing method according to the present invention, the forward rotation angle each time is not equal to the reverse rotation angle, to avoid that the clothing is repeatedly washed and rubbed in the same position to cause nonuniform washing.

7. In the washing method according to the present invention, trajectories of the clothing are varied, and the clothing is uniformly washed omnidirectionally through combined actions of lifting beating, centrifugal force turnover, impact striking, and friction rubbing.

8. In the washing method according to the present invention, turning of the clothing in the circumferential direction and turning in the radial direction are carried out at the same time, to wash the clothing uniformly and increase the washing rate.

[0032] Specific implementations of the present invention are further described below in detail in combination with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033]

FIG. 1 is a structural view of an integrated structure of an internal barrel and an impeller according to the present invention;

FIG. 2 is a top view of a structure of two water stirring blades of the integrated structure of an internal barrel and an impeller according to the present invention;

FIG. 3 is a top view of four water stirring blades of the integrated structure of an internal barrel and an impeller according to the present invention;

FIG. 4 is an installation view of the integrated structure of an internal barrel and an impeller according to the present invention;

FIG. 5 is a structural view of three water stirring blades of the integrated structure of an internal barrel and an impeller according to the present invention;

FIG. 6 is a structural view of four water stirring blades of the integrated structure of an internal barrel and an impeller according to the present invention;

FIG. 7 is a flowchart of the washing method according to the present invention;

FIG. 8 is a view of a radial trajectory of the clothing in the washing method according to the present invention;

FIG. 9 is a view of a trajectory of the clothing in the circumferential direction during forward rotation in the washing method according to the present invention; and

FIG. 10 is a view of a trajectory of the clothing in the circumferential direction during reverse rotation in the washing method according to the present invention.

[0034] In which: 1. internal barrel, 11. internal barrel bottom, 12. internal barrel wall, 2. water stirring blade, 21. gentle slope rising side, 22. steep slope falling side, 23. ridge, 3. reinforcing rib, 4. axle hole, 5. water leakage hole, 6. outer barrel, 7. power shaft.

DETAILED DESCRIPTION

[0035] As shown in FIG. 1, the present invention discloses an integrated structure of an internal barrel and an impeller, the structure including an internal barrel 1 vertically used and a water stirring blade 2 of an internal barrel bottom 11, wherein the water stirring blade 2 is integrated with the internal barrel 1, the water stirring blade 2 is a projection structure disposed at the internal barrel bottom 11, the number of the water stirring blade 2 is at least two, each water stirring blade 2 extends from the center of the internal barrel bottom 11 to an internal barrel wall 12, and each water stirring blade 2 rises and extends along a circumferential direction of the internal barrel bottom 11 and a barrel diameter outward direction respectively, after extending to the highest point along a radial outward direction of the internal barrel bottom 11, is connected with the internal barrel wall 12, and after rising and extending to the highest point along the circumferential direction from one side in a shape of a gentle slope, drops back to the internal barrel bottom 11 in a shape of a steep slope.

[0036] That is, the water stirring blade 2 extends from

the center of the internal barrel bottom 11 to the internal barrel wall 12, the water stirring blade 2 of the internal barrel bottom 11 slowly rises to the highest point in a circumferential direction and then rapidly falls, the internal barrel 1 gradually rises in a direction from the center to the internal barrel wall 12, and the highest point is connected with the internal barrel wall 12.

[0037] In the washing process, in the circumferential direction, during forward rotation, the clothing rises along a smooth gentle slope rising side 21 of the water stirring blade 2 to the highest point and then falls and is beaten along a subvertical steep slope falling side 22 to be affected by an impact force, and during reverse rotation, the clothing hits the subvertical steep slope falling side 22 to be affected by an impact force. In a barrel diameter direction, centrifugal force produced by rotation and the tendency that the water stirring blade 2 of the internal barrel bottom 11 gradually rises from the center of the internal barrel to the internal barrel wall make the clothing turned outwardly and upwardly along the water stirring blade 2, and turned inwardly and downwardly after going to the internal barrel wall 12. Falling and beating of the clothing after pull-up when rotating forward in the circumferential direction or striking when rotating reversely and turning in the radial direction are carried out at the same time, to make the clothing always in a continuous rolling state in the internal barrel and collide with and rub the internal barrel bottom and the internal barrel wall, so as to always wash different positions.

[0038] It is provided that, when the internal barrel 1 rotates along a rising and extending direction, it is called reverse rotation, and otherwise called forward rotation.

[0039] Preferably, the number of the water stirring blade 2 is 2-4, and the water stirring blades 2 are evenly distributed around an axis of the internal barrel 1 along the internal barrel bottom 11, and rise and extend along the circumference of the internal barrel bottom 11 clockwise or counterclockwise in the same direction. When the number of the water stirring blade 2 is two, the two water stirring blades 2 are centrosymmetrically distributed, when the number of the water stirring blade is three, an angle between any two water stirring blades 2 is 120 degrees, and when the number of the water stirring blade 2 is multiple, the multiple water stirring blades 2 are evenly distributed around the axis of the internal barrel 1 like a spoke.

[0040] When rising and extending along the circumference of the internal barrel bottom 11 clockwise or counterclockwise, the water stirring blade 2 smoothly transits from low to high, the water stirring blade 2 smoothly transits from low to high along a direction in which the barrel diameter extends outwardly, and the width between two sides in an extending direction from low to high gradually increases, which is maximum at the internal barrel wall 12.

[0041] A gentle slope rising side 21 of the water stirring blade 2 smoothly rises, a steep slope falling side 22 of the water stirring blade 2 smoothly falls, the internal barrel bottom 11 transits smoothly with the gentle slope rising side 21 and the steep slope falling side 22, the water stirring blade 2 smoothly rises outwardly along a radial direction of the internal barrel bottom 11, and the internal barrel wall 12 transits smoothly with the water stirring blade 2.

[0042] Highest points of the water stirring blade 2 form a ridge 23 of the water stirring blade 2 in different radial positions of the internal barrel bottom 11, the ridge 23 is made up of two arcs, circle centers of the two arcs are distributed on different sides of the ridge 23, the circle center of the arc near the center of the internal barrel 1 is on the gentle slope rising side 21, and the circle center of the arc near the internal barrel wall 12 is on the steep slope falling side 22. A joint between the two arcs smoothly butts, and the water stirring blade 2 is similar to "~" when viewed from top to bottom along the internal barrel 1.

[0043] A cross section cut by a cylindrical surface, where any point on the ridge 23 is, coaxial with the internal barrel 1 tilts on two sides of the point in different degrees, and a tilt degree of the gentle slope rising side 21 is less than that of the steep slope falling side 22.

[0044] An intersecting line between the water stirring blade 2 and the internal barrel bottom 11 is an arc, bending directions of an intersecting line a between the gentle slope rising side 21 and the internal barrel bottom 11 and an intersecting line b between the steep slope falling side 22 and the internal barrel bottom 11 are the same, bending radiuses are different, the bending radius of the intersecting line a between the gentle slope rising side 21 and the internal barrel bottom 11 is less than that of the intersecting line b between the steep slope falling side 22 and the internal barrel bottom 11, and each intersecting line smoothly transits with the outermost circumference of the internal barrel bottom 11. Such a structure will definitely result in that the width between two sides in an extending direction from low to high gradually increases, which is maximum at the internal barrel wall 12.

[0045] A ratio range of the height of the internal barrel 1 to the diameter of the internal barrel 1 is 0.4-2, preferably the height of the internal barrel 1 is less than or equal to the diameter of the internal barrel 1, the height of the washing portion inside the internal barrel is less than the minimum diameter of the internal barrel, and preferably, the ratio range of the height of the internal barrel 1 to the diameter of the internal barrel 1 is 0.6, which makes full use of hitting and centrifugal rolling effects of the water stirring blade on the clothing.

[0046] The internal barrel wall 12 and/or the internal barrel bottom 11 of the internal barrel 1 are/is provided thereon with reinforcing ribs 3 that reduces deformation of the internal barrel 1, the reinforcing ribs 3 are disposed on an outer surface of the internal barrel wall 12 of the internal barrel 1 along an axial direction and/or a circumferential direction, and the reinforcing ribs 3 are disposed an outer surface of the internal barrel bottom 11 of the internal barrel 1 along a radial direction and/or a circum-

ferential direction.

[0047] The reinforcing ribs 3 on the outer surface of the internal barrel wall 12 are disposed on the outer surface of the internal barrel wall 12 along the axial direction or horizontally disposed along the circumferential direction or staggered axially or circumferentially; the reinforcing ribs on the outer surface of the internal barrel bottom 11 are disposed on the outer surface of the internal barrel bottom 11 along the circumferential direction or disposed along the radial direction or staggered circumferentially or radially, which greatly increases the strength of the internal barrel 1.

[0048] The central position of the internal barrel bottom 11 is provided with an axle hole 4 (refer to FIG. 4) that allows a power shaft to penetrate, the axle hole 4 penetrates the axle hoe to drive the internal barrel to rotate, to complete a washing process, and multiple water leakage holes 5 are distributed on the internal barrel wall 12 and/or the internal barrel bottom 11 of the internal barrel 1, to facilitate exchange of internal and external water currents during washing and drainage.

[0049] The present invention discloses a washing method, wherein the method turns clothing in an internal barrel by controlling a washing machine to rotate forward and reversely at intervals, to complete washing, in the method, the washing machine rotates forward and reversely at different angles each time, the forward rotation angle each time is not equal to the reverse rotation angle each time, by means of an integrated structure of an internal barrel and an impeller, in the event of forward rotation in a circumferential direction, the clothing is pulled up and then falls subvertically, in the event of reverse rotation, the clothing is impacted by a subvertical plane in the circumferential direction, and in forward and reverse rotation processes, under the guide of centrifugal force produced by radial rotation and an internal barrel bottom structure, the clothing is turned outwardly and upwardly, and is turned inwardly and downwardly after arriving at an internal barrel wall.

[0050] Falling and beating of the clothing after pull-up when rotating forward in the circumferential direction or striking when rotating reversely and turning in the radial direction are carried out at the same time, to make the clothing always in a continuous rolling state in the internal barrel and collide with and rub the internal barrel bottom and the internal barrel wall, to be evenly washed and increase the washing rate.

[0051] Motions of the clothing in the circumferential direction and in the radial direction are guided by a projection structure of the internal barrel bottom.

[0052] In the washing process, in the circumferential direction, during forward rotation, the clothing, after rising to the highest point along a smooth rising and extending plane of the projection structure, falls and beats along a subvertical steep slope plane, and during reverse rotation, the clothing hits the subvertical steep slope plane. In the washing process, in a barrel diameter direction, centrifugal force produced by rotation makes the clothing turned outwardly and upwardly along the projection structure, and turned inwardly and downwardly after going to the internal barrel wall.

[0053] In the washing method, in a washing or rinsing process, the internal barrel increases to a forward rotation speed X at a certain acceleration, rotates forward for a certain time T1, pauses for a period of time, then increases to a reverse rotation speed Y at a certain acceleration, and rotates reversely for a certain time T2, a forward rotation angle each time is not equal to a reverse rotation angle, and the process is repeated 5-500 times for each washing or rinsing. The forward rotation angle each time is greater than or less than the reverse rotation angle.

[0054] The forward rotation speed X and the reverse rotation speed Y are 20-100 rpm respectively, the forward rotation time T1 and the reverse rotation time T2 are 1-5 s respectively, and $X \times T1 \neq Y \times T2$, $X \times T1 > Y \times T2$ or $X \times T1 < Y \times T2$.

[0055] The washing method includes the following steps:

1) placing a detergent along with the clothing into a washing internal barrel, and starting the washing machine;

2) controlling the washing internal barrel to increase to the forward rotation speed X at a certain acceleration, rotate forward for a certain time T1, pause for a period of time, then increase to a reverse rotation speed Y at a certain acceleration, and rotate reversely for a certain time T2, a forward rotation angle each time being not equal to a reverse rotation angle, and the process being repeated 5-500 times;

3) proceeding to a dewatering stage: controlling the washing internal barrel to rotate forward and reversely, and after even distribution of the clothing, the internal barrel rotating at a high speed for dewatering;

4) if the clothing needs to be washed multiple times, adding the detergent again to repeat steps 2) and 3); and

5) controlling water injection of the washing machine, and repeating steps 2) and 3) 1-8 times.

[0056] A washing machine that uses the washing method is provided. Trajectories of the clothing are varied, and the clothing is uniformly washed omnidirectionally through combined actions of lifting beating, centrifugal force turnover, impact striking, and friction rubbing. Turning of the clothing in the circumferential direction and turning in the radial direction are carried out at the same time, to wash the clothing more evenly and have a better washing effect.

Embodiment 1

[0057] As shown in FIG. 2, in this embodiment, the number of the water stirring blade 2 is two, the two water stirring blades are centrosymmetrically distributed, each water stirring blade 2 extends from the center of the internal barrel bottom 11 to the internal barrel wall 12, the water stirring blade 2 of the internal barrel 11 gradually slowly rises to the highest point in the circumferential direction and then rapidly falls, the internal barrel 1 gradually rises in a direction from the center to the internal barrel wall 12, and the highest point is connected with the internal barrel wall 12.

[0058] A ratio range of the height of the internal barrel 1 to the diameter of the internal barrel 1 is 0.8, which makes full use of hitting and centrifugal rolling effects of the water stirring blades on the clothing, has a small height and saves installation space.

Embodiment 2

[0059] As shown in FIG. 5, in this embodiment, the number of the water stirring blade 2 is three, the three water stirring blades are evenly distributed along the center of the internal barrel, an angle between each two water stirring blades is 120 degrees, each water stirring blade 2 extends from the center of the internal barrel bottom 11 to the internal barrel wall 12, the water stirring blade 2 of the internal barrel 11 gradually slowly rises to the highest point in the circumferential direction and then rapidly falls, the internal barrel 1 gradually rises in a direction from the center to the internal barrel wall 12, and the highest point is connected with the internal barrel wall 12.

[0060] A ratio range of the height of the internal barrel 1 to the diameter of the internal barrel 1 is 0.7, which makes full use of hitting and centrifugal rolling effects of the water stirring blades on the clothing, has a small height and saves installation space.

Embodiment 3

[0061] As shown in FIG. 3 and FIG. 6, in this embodiment, the number of the water stirring blade 2 is four, the four water stirring blades are evenly distributed along the center of the internal barrel, an angle between each two water stirring blades is 90 degrees, each water stirring blade 2 extends from the center of the internal barrel bottom 11 to the internal barrel wall 12, the water stirring blade 2 of the internal barrel 11 gradually slowly rises to the highest point in the circumferential direction and then rapidly falls, the internal barrel 1 gradually rises in a direction from the center to the internal barrel wall 12, and the highest point is connected with the internal barrel wall 12.

[0062] A ratio range of the height of the internal barrel 1 to the diameter of the internal barrel 1 is 0.9, which makes full use of hitting and centrifugal rolling effects of the water stirring blades on the clothing, has a small height and saves installation space.

Embodiment 4

[0063] As shown in FIG. 4, this embodiment provides a washing machine having the integrated structure of an internal barrel and an impeller, inside an outer barrel of the washing machine is coaxially provided with the integrated structure of an internal barrel and an impeller, and a power shaft of the washing machine extends into the axle hole in the central position of the internal barrel bottom 11. When the washing machine is started, the power shaft drives the integrated structure of an internal barrel and an impeller to rotate, to wash the clothing inside the internal barrel 1.

[0064] According to the integrated structure of an internal barrel and an impeller of the present invention, washing, rinsing and dewatering processes can be completed only through one washing barrel, which makes the structure of the washing machine simple, simplifies an installation process and reduces the cost; a water stirring blade structure is added to the internal barrel bottom, and the structure extends from the center of the internal barrel bottom to the internal barrel wall, enables the clothing to be lifted, fall and be hit in the circumferential direction, and also enables the clothing to be turned in a radial direction, to uniformly wash the clothing in all directions, which has a good washing effect; gradual rising and rapid falling of the water stirring blade of the internal barrel bottom in the circumferential direction have an effect of lifting and then beating the clothing during forward rotation, and have an effect of impacting the clothing during reverse rotation; the internal barrel gradually rises in a direction from the center to the internal barrel wall, and the highest point is connected with the internal barrel wall, to turn the clothing upwardly and outwardly in the radial direction and turn the clothing downwardly and inwardly after going to the internal barrel wall.

Embodiment 5

[0065] As shown in FIG. 7, the washing method includes the following steps:

1) placing a detergent along with the clothing into a washing internal barrel, wherein, if necessary, a softener may also be added, and starting the washing machine;

2) controlling the washing internal barrel to increase to the forward rotation speed X at a certain acceleration, rotate forward for a certain time T1, pause for a period of time, then increase to a reverse rotation speed Y at a certain acceleration, and rotate reversely for a certain time T2, a forward rotation angle each time being not equal to a reverse rotation angle, and the process being repeated 30 times, wherein the

forward rotation speed X and the reverse rotation speed Y are 20-100 rpm respectively, the forward rotation time T1 and the reverse rotation time T2 are 1-5 s respectively, and X×T1>Y×T2, the forward rotation speed X and the reverse rotation speed Y are set as 50 rpm, and the forward rotation time T1 and the reverse rotation time T2 are respectively 3 s and 2 s;

3) proceeding to a dewatering stage: controlling the washing internal barrel to rotate forward and reversely, and after even distribution of the clothing, the internal barrel rotating at a high speed for dewatering;

4) if the clothing is dirty and needs to be washed twice, adding the detergent again to repeat steps 2) and 3); and

5) controlling water injection of the washing machine, and repeating steps 2) and 3) twice, to complete rinsing and dewatering.

[0066] After the last dewatering ends, the internal barrel is controlled to rotate forward and reversely, and the clothing squeezed together after dewatering is scattered, to facilitate the user to take out and dry the clothing.

Embodiment 6

[0067] As shown in FIG. 7, the washing method includes the following steps:

1) placing a detergent along with the clothing into a washing internal barrel, wherein, if necessary, a softener may also be added, and starting the washing machine;

2) controlling the washing internal barrel to increase to the forward rotation speed X at a certain acceleration, rotate forward for a certain time T1, pause for a period of time, then increase to a reverse rotation speed Y at a certain acceleration, and rotate reversely for a certain time T2, a forward rotation angle each time being not equal to a reverse rotation angle, and the process being repeated 30 times, wherein the forward rotation speed X and the reverse rotation speed Y are 20-100 rpm respectively, the forward rotation time T1 and the reverse rotation time T2 are 1-5 s respectively, and X×T1<Y×T2, the forward rotation speed X and the reverse rotation speed Y are set as 50 rpm, and the forward rotation time T1 and the reverse rotation time T2 are respectively 2 s and 3 s;

3) proceeding to a dewatering stage: controlling the washing internal barrel to rotate forward and reversely, and after even distribution of the clothing, the internal barrel rotating at a high speed for dewatering;

4) if the clothing is dirty and needs to be washed twice, adding the detergent again to repeat steps 2) and 3); and

5) controlling water injection of the washing machine, and repeating steps 2) and 3) twice, to complete rinsing and dewatering.

[0068] After the last dewatering ends, the internal barrel is controlled to rotate forward and reversely, and the clothing squeezed together after dewatering is scattered, to facilitate the user to take out and dry the clothing.

Embodiment 7

[0069] As shown in FIG. 8, FIG. 9 and FIG. 10, in this embodiment, trajectories of the clothing in the internal barrel 1 are analyzed, and it is defined that, when the internal barrel 1 rotates along a rising and extending direction, it is called reverse rotation, and otherwise called forward rotation.

[0070] FIG. 8 is a cross section obtained by cutting the internal barrel along a vertical plane of the center line of the internal barrel, as shown in the figure, due to the tendency that the water stirring blade 2 gradually rises along a radial direction, the clothing moves outwardly and upwardly along the radial direction, and after arriving at the internal barrel wall 12, the clothing is affected by an opposite acting force of the internal barrel wall 12 and begins to move inwardly and downwardly.

[0071] FIG. 9 and FIG. 10 are expanded views of a cross section of the internal barrel cut along a cylindrical surface coaxial with the internal barrel 1, as shown in FIG. 9, during forward rotation, due to the tendency that the water stirring blade 2 gradually rises along a circumferential direction, the clothing is gradually pulled up along the circumferential direction, and as the water stirring blade 2 rapidly falls after rising to the highest point along the circumferential direction, the clothing is pulled up and then falls, during pull-up, the clothing rubs with the internal barrel, and during falling, the clothing is beaten, to have a washing effect on the clothing.

[0072] As shown in FIG. 10, during reverse rotation, the clothing moves downwardly along the gentle slope rising side of the water stirring blade 2, and after arriving at the steep slope falling side, the clothing hits the steep slope falling side to be stricken, which has a washing effect on the clothing with rubbing between the clothing and the internal barrel.

[0073] In the washing process, falling and beating of the clothing after pull-up when rotating forward in the circumferential direction or striking when rotating reversely and turning in the radial direction are carried out at the same time, to make the clothing always in a continuous rolling state in the internal barrel and collide with and rub the internal barrel bottom and the internal barrel wall, to be evenly washed.

[0074] The above are merely preferred implementa-

tions of the present invention, and it should be indicated that, various transformations and improvements can be made by those of ordinary skill in the art without departing from the principle of the present invention, which should also fall within the protection scope of the present invention.

Claims

1. An integrated structure of an internal barrel and an impeller, the structure comprising an internal barrel (1) which is used vertically and water stirring blades (2) at an internal barrel bottom (11), wherein the water stirring blades (2) and the internal barrel bottom (11) are arranged integrally; and the water stirring blades (2) are of a projection structure arranged at the internal barrel bottom (11), the number of the water stirring blades (2) is at least two, each water stirring blade (2) extends to an internal barrel wall (12) from the center of the internal barrel bottom (11), and each water stirring blade (2) raises up and extends in an outward radial direction of the internal barrel bottom (11) to the highest point, then is connected to the internal barrel wall (12), and raises up and extends in the shape of a gentle slope in a circumferential direction from one side to the highest point, and then descends in the shape of a steep slope to the internal barrel bottom (11).

2. The integrated structure of an internal barrel and an impeller according to claim 1, **characterized in that**: the number of the water stirring blades (2) is 2-4, and the water stirring blades (2) are evenly distributed around an axis of the internal barrel radially along the circumference of the internal barrel bottom (11) clockwise or counterclockwise, and raise up and extend along the circumference of the internal barrel bottom (11) clockwise or counterclockwise in the same direction.

3. The integrated structure of an internal barrel and an impeller according to claim 2, **characterized in that**: a gentle slope rising side (21) of the water stirring blade (2) smoothly rises, a steep slope falling side (22) of the water stirring blade (2) smoothly descends, the internal barrel bottom (11) transits smoothly with the gentle slope rising side (21) and the steep slope falling side (22), the water stirring blade (2) smoothly rises outwardly along a radial direction of the internal barrel bottom (11), and the internal barrel wall (12) transits smoothly with the water stirring blade (2).

4. The integrated structure of an internal barrel and an impeller according to claim 3, **characterized in that**: highest points of the water stirring blade (2) form a ridge (23) of the water stirring blade (2) in different radial positions of the internal barrel bottom (11), the ridge (23) is made up of two arcs, circle centers of the two arcs are distributed on different sides of the ridge (23), the center circle of the arc near the center of the internal barrel (1) is on the gentle slope rising side (21), and the circle center of the arc near the internal barrel wall (12) is on the steep slope falling side (22).

5. The integrated structure of an internal barrel and an impeller according to claim 4, **characterized in that**: the water stirring blade (2) tilts on two sides of any point on the ridge (23) in different degrees, and a tilt degree of the gentle slope rising side (21) is less than that of the steep slope falling side (22).

6. The integrated structure of an internal barrel and an impeller according to claim 5, **characterized in that**: an intersecting line between the water stirring blade (2) and the internal barrel bottom (11) is an arc, bending directions of an intersecting line between the gentle slope rising side (21) and the internal barrel bottom (11) and an intersecting line between the steep slope falling side (22) and the internal barrel bottom (11) are the same, and each intersecting line smoothly transits with the outermost circumference of the internal barrel bottom (11).

7. The integrated structure of an internal barrel and an impeller according to any one of claims 1-6, **characterized in that**: a ratio range of the height of the internal barrel (1) to the diameter of the internal barrel (1) is 0.4-2, preferably the height of the internal barrel (1) is less than or equal to the diameter of the internal barrel (1).

8. The integrated structure of an internal barrel and an impeller according to claim 7, **characterized in that**: a ratio of the height of the internal barrel (1) to the diameter of the internal barrel (1) is 0.6.

9. The integrated structure of an internal barrel and an impeller according to claim 8, **characterized in that**: the central position of the internal barrel bottom (11) is provided with an axle hole (4) that allows a power shaft to penetrate, and multiple water leakage holes are distributed on the internal barrel wall (12) and/or the internal barrel bottom (11) of the internal barrel.

10. A washing machine having the integrated structure of an internal barrel and an impeller according to any one of claims 1-9, **characterized in that**: inside an outer barrel (6) of the washing machine is coaxially provided with the integrated structure of an internal barrel and an impeller, and a power shaft (7) of the washing machine extends into the axle hole (4) in the central position of the internal barrel bottom (11) in the integrated structure of an internal barrel and

an impeller.

11. A washing method, the method turning clothing in an internal barrel by controlling a washing machine to rotate forward and reversely at intervals, to complete washing, **characterized in that**, in the method, the washing machine rotates forward and reversely at different angles each time, the forward rotation angle each time is not equal to the reverse rotation angle each time, by means of an integrated structure of an internal barrel and an impeller, in the event of forward rotation in a circumferential direction, the clothing is pulled up and then falls subvertically, in the event of reverse rotation, the clothing is impacted by a subvertical plane in the circumferential direction, and in forward and reverse rotation processes, under the guide of centrifugal force produced by radial rotation and an internal barrel bottom structure, the clothing is turned outwardly and upwardly, and is turned inwardly and downwardly after arriving at an internal barrel wall.

12. The washing method according to claim 11, **characterized in that**: falling and beating of the clothing after pull-up when rotating forward in the circumferential direction or striking when rotating reversely and turning in the radial direction are carried out at the same time, to make the clothing always in a continuous rolling state in the internal barrel and collide with and rub the internal barrel bottom and the internal barrel wall, to be evenly washed.

13. The washing method according to claim 12, **characterized in that**: motions of the clothing in the circumferential direction and in the radial direction are guided by a projection structure of the internal barrel bottom.

14. The washing method according to claim 13, **characterized in that**: the number of the projection structure is at least two, preferably 2-4, the projection structures are evenly distributed around an axis of the internal barrel radially along the circumference of the internal barrel bottom clockwise or counterclockwise, and rise and extend along the circumference of the internal barrel bottom clockwise or counterclockwise in the same direction, and the projection structures rise and extend along a radial outward direction of the internal barrel bottom, after extending to the highest point, are connected with the internal barrel wall, and after rising and extending to the highest point along the circumferential direction from one side in a shape of a gentle slope, drop back to the internal barrel bottom in a shape of a steep slope.

15. The washing method according to claim 14, **characterized in that**: in the washing process, in the circumferential direction, during forward rotation, the clothing, after rising to the highest point along a smooth rising and extending plane of the projection structure, falls and beats along a subvertical steep slope plane, and during reverse rotation, the clothing hits the subvertical steep slope plane.

16. The washing method according to claim 14, **characterized in that**: in the washing process, in a barrel diameter direction, centrifugal force produced by rotation makes the clothing turned outwardly and upwardly along the projection structure, and turned inwardly and downwardly after going to the internal barrel wall.

17. The washing method according to any one of claims 11 to 16, **characterized in that**: in the washing method, in a washing or rinsing process, the internal barrel increases to a forward rotation speed X at a certain acceleration, rotates forward for a certain time T1, pauses for a period of time, then increases to a reverse rotation speed Y at a certain acceleration, and rotates reversely for a certain time T2, a forward rotation angle each time is not equal to a reverse rotation angle, and the process is repeated 5-500 times for each washing or rinsing.

18. The washing method according to claim 15, **characterized in that**: the forward rotation speed X and the reverse rotation speed Y are 20-100 rpm respectively, the forward rotation time T1 and the reverse rotation time T2 are 1-5 s respectively, and $X \times T1 \neq Y \times T2$.

19. The washing method according to claim 11 or 18, **characterized in that**: the washing method comprises the following steps:

1) placing a detergent along with the clothing into a washing internal barrel, and starting the washing machine;
2) controlling the washing internal barrel to increase to the forward rotation speed X at a certain acceleration, rotate forward for a certain time T1, pause for a period of time, then increase to a reverse rotation speed Y at a certain acceleration, and rotate reversely for a certain time T2, a forward rotation angle each time being not equal to a reverse rotation angle, and the process being repeated 5-500 times;
3) proceeding to a dewatering stage: controlling the washing internal barrel to rotate forward and reversely, and after even distribution of the clothing, the internal barrel rotating at a high speed for dewatering;
4) if the clothing needs to be washed multiple times, adding the detergent again to repeat steps 2) and 3); and
5) controlling water injection of the washing ma-

chine, and repeating steps 2) and 3) 1-8 times.

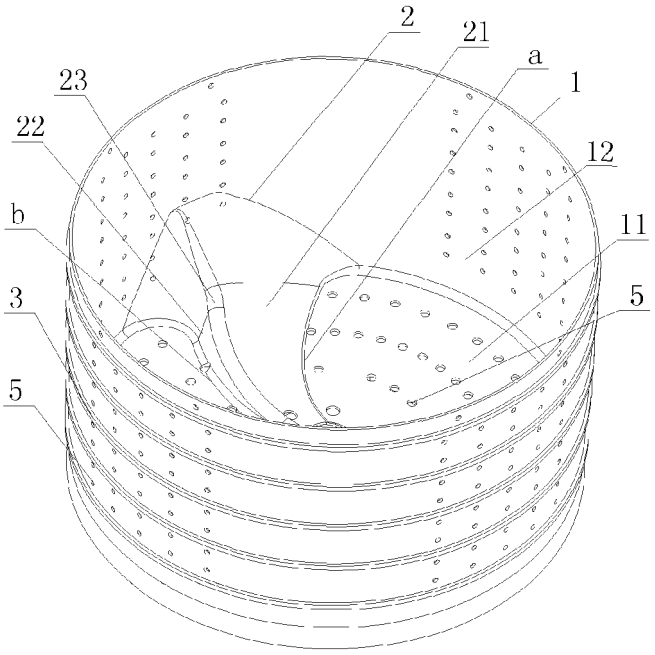

FIG. 1

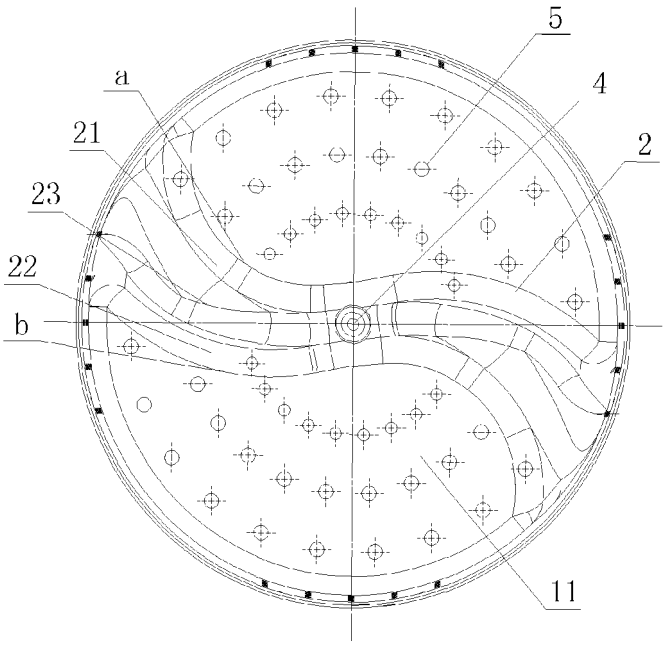

FIG. 2

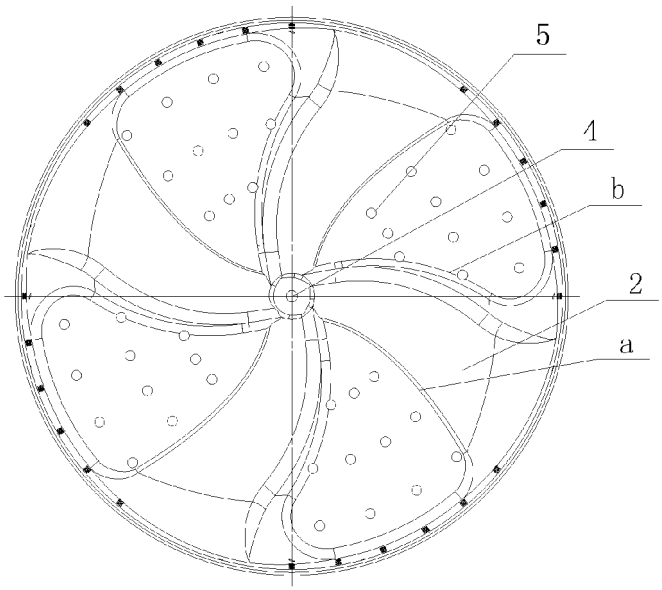

FIG. 3

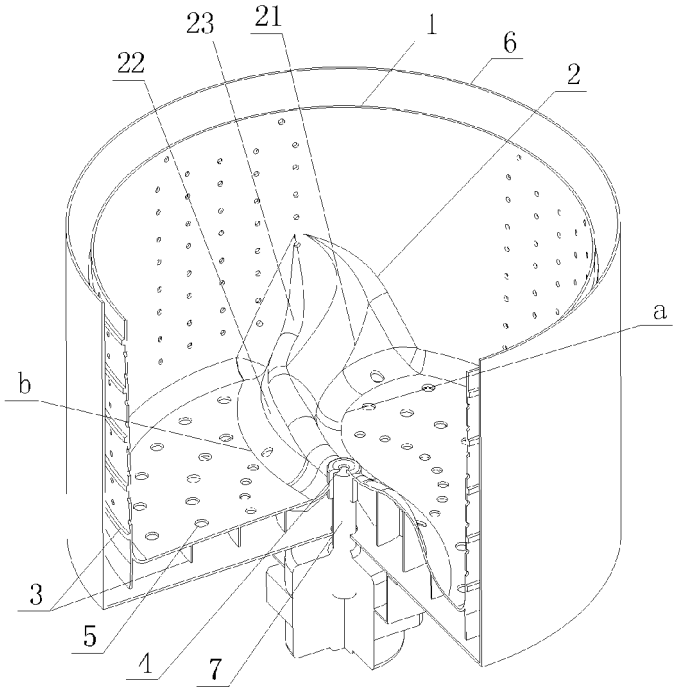

FIG. 4

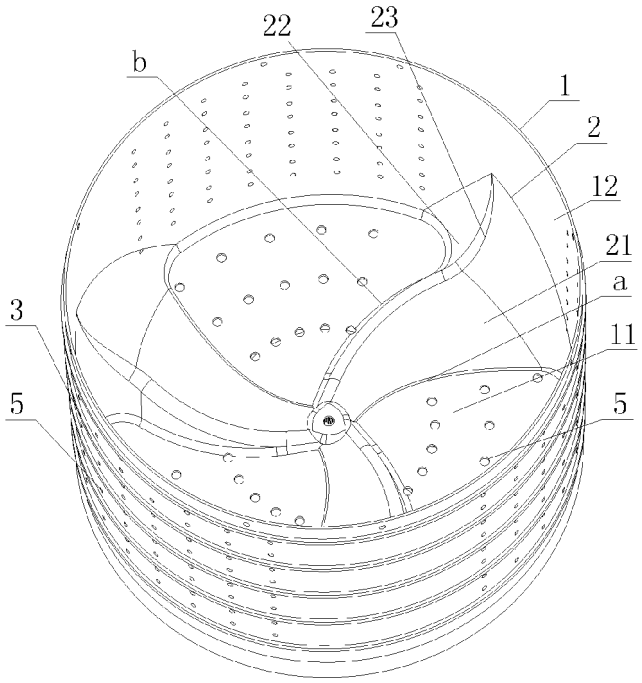

FIG. 5

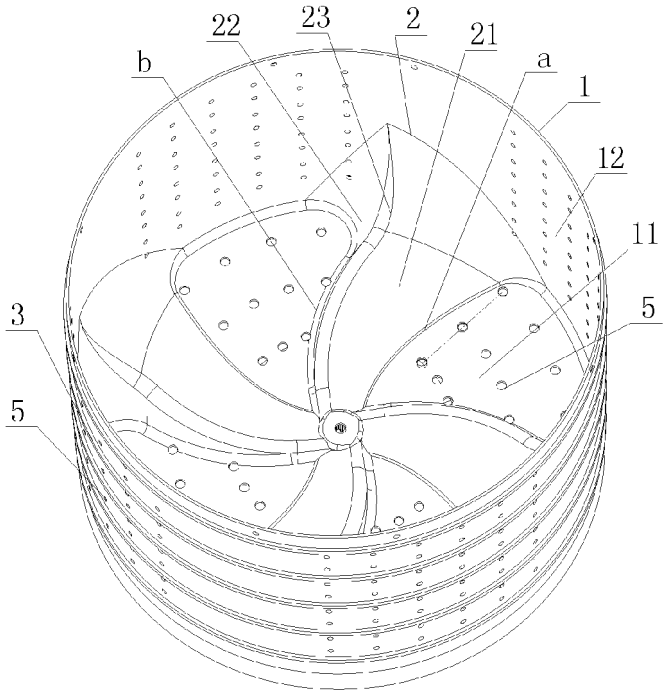

FIG. 6

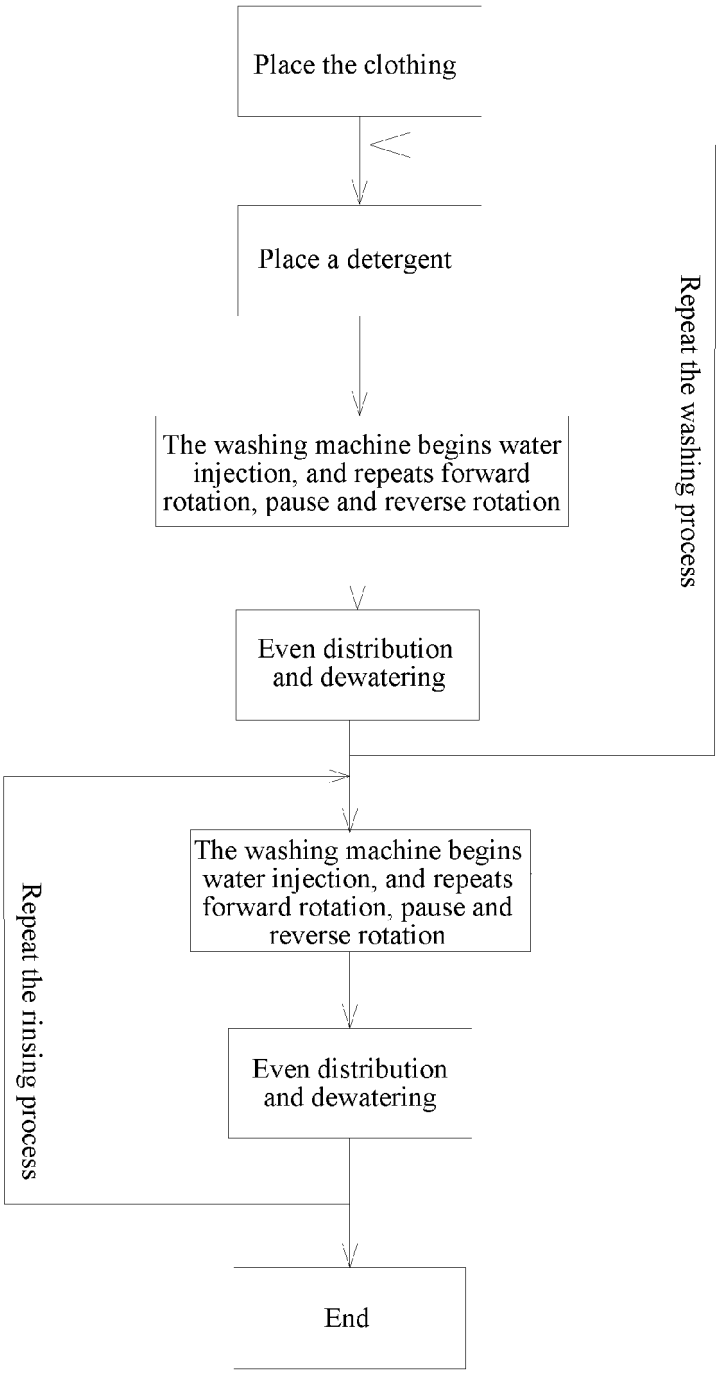
Place the clothing
Place a detergent
The washing machine begins water injection, and repeats forward rotation, pause and reverse rotation
Even distribution and dewatering
Repeat the washing process
The washing machine begins water injection, and repeats forward rotation, pause and reverse rotation
Even distribution and dewatering
Repeat the rinsing process
End

FIG. 7

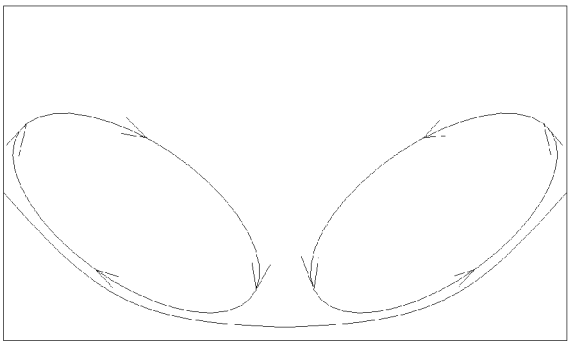

FIG. 8

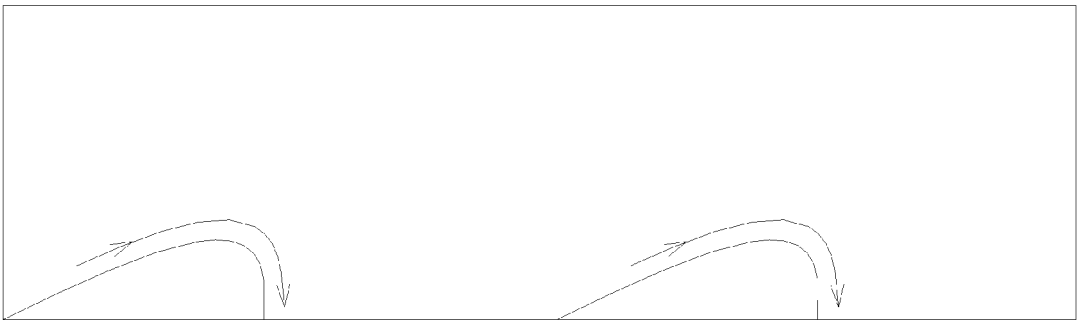

FIG. 9

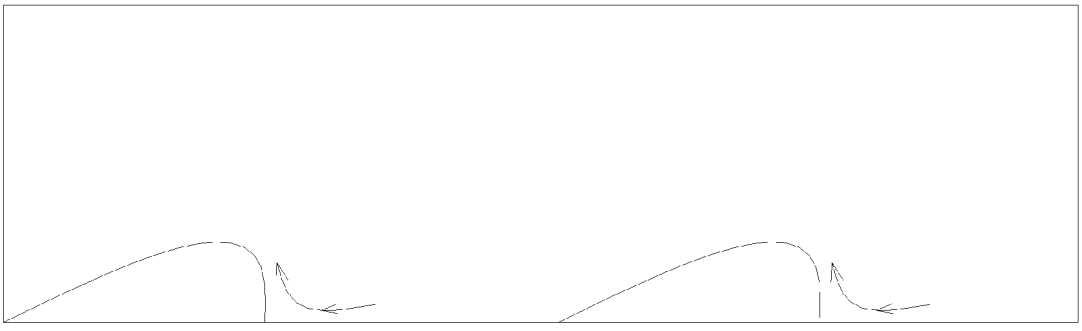

FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/090110

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

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)

IPC: D06F

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 practicable, search terms used)

CNPAT, VEN: tub, tumble, roller, drum, barrel, tank, basket, impeller, agitator, blade, stir, stirrer, pulsator, turbine, turbo, integra+, HAIER, rotary wing, rotating body, stir water

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 102587072 A (WUXI LITTLE SWAN CO., LTD.), 18 July 2012 (18.07.2012), description, paragraphs [0017]-[0023], and figures 1-3	11-13, 17, 19
X	CN 202500016 U (WUXI LITTLE SWAN CO., LTD.), 24 October 2012 (24.10.2012), description, paragraphs [0019]-[0024], and figures 1-3	11-13, 17, 19
A	JPH 08164290 A (TOSHIBA KK), 25 June 1996 (25.06.1996), the whole document	1-19

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 March 2014 (04.03.2014)	**27 March 2014 (27.03.2014)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **BAI, Ying** Telephone No.: (86-10) **62084625**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/090110

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 102587072 A	18.07.2012	None	
CN 202500016 U	24.10.2012	None	
JPH 08164290 A	25.06.1996	JP 3315279 B2	19.08.2002

Form PCT/ISA/210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/090110

CONTINUATION OF SECOND SHEET: A. CLASSIFICATION OF SUBJECT MATTER:

D06F 17/10 (2006.01) i

D06F 33/02 (2006.01) i

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

Form PCT/ISA/210 (extra sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 200510094191 **[0005]**
- CN 03276136 **[0006]**
- CN 00215731 **[0007]**