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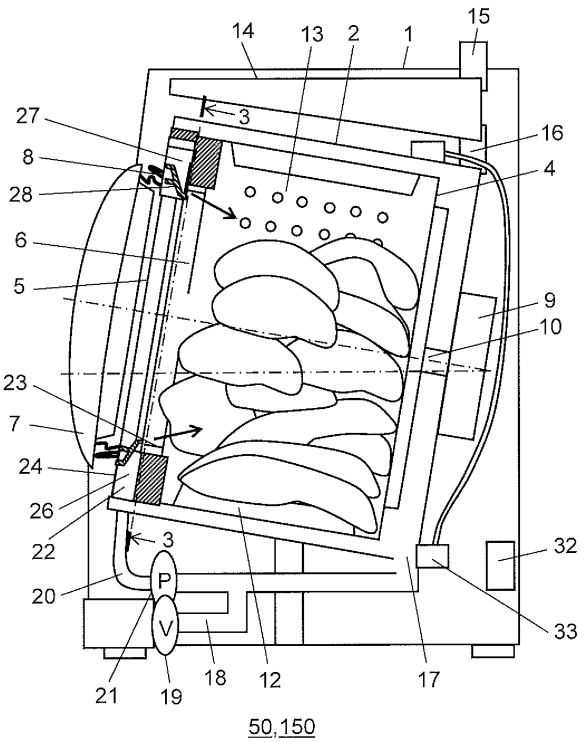
(54) Drum type washing machine

(57) A drum type washing machine (50) includes a water tub (2); a rotary drum (4); a water supply valve (15); a water level detection unit (33); a motor (9); a circulating water channel (20); a pump (21); a nozzle (26); and a controller (32) that controls a rinsing process by driving the water supply valve (15), the motor (9) and the pump (21). In the rinsing process, the controller (32) performs a high speed rotation process of rotating the rotary drum (4) at such a speed so as to allow the laundry inside the rotary drum (4) to cling to an inner peripheral wall of the rotary drum (4) and a low speed rotation process of rotating the rotary drum (4) at such a speed so as not to allow the laundry inside the rotary drum (4) to cling to the inner peripheral wall of the rotary drum. In the high speed rotation process, the controller (32) operates the water supply valve (15) to supply the water into the water tub (2) so as to have a first predetermined water level, and then drives the pump (21) to eject the water from the nozzle (26) onto the laundry clinging to the inner peripheral wall of the rotary drum (4).

FIG. 1



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Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The present invention relates to a washing machine, and particularly to a drum type washing machine (front-loading washing machine) which performs at least a rinsing process while circulating water inside a water tub into a rotary drum.

BACKGROUND ART

[0002] In general, a drum type washing machine consumes less water than a vertical washing machine (top-loading washing machine). This causes a difficulty in dipping all laundry inside a rotary drum into washing water. For this reason, a drum type washing machine has been proposed which performs a washing process or a rinsing process while circulating the washing water inside a water tub into a rotary drum and ejecting the washing water onto the laundry (for example, refer to Japanese Patent Unexamined Publication No. 10-127978).

[0003] Such a drum type washing machine has a plurality of ejecting ports for ejecting circulating water. An example in Japanese Patent Unexamined Publication No. 10-127978 is configured to have the plurality of ejecting ports, each of which ejects the circulating water from a front surface side to a center side of the rotary drum by changing an angle gradually. The ejecting ports are disposed above the front surface side of the rotary drum, and the circulating water is ejected downward through the ejecting port.

[0004] Such a configuration in the related art has a difficulty in that the laundry placed at various positions inside the rotary drum is unlikely to be uniformly soaked with the circulating water even though the circulating water is ejected through the plurality of ejecting ports in a depth direction of the rotary drum by changing the angle gradually.

[0005] In particular, when accommodating a large amount of laundry inside the rotary drum, only the laundry placed on a surface near the ejecting ports is soaked with the circulating water. Thus, since the circulating water is unlikely to permeate piles of laundry, there exists a disadvantage that a rinsing effect cannot be sufficiently obtained.

SUMMARY OF THE INVENTION

[0006] The present invention is made in view of such a disadvantage in the related art, and aims to provide a drum type washing machine which can uniformly soak all laundry inside a rotary drum with circulating water regardless of a laundry volume and exhibits excellent performance in rinsing.

[0007] A drum type washing machine according to the present invention includes a water tub that stores water; a rotary drum that is rotatably arranged inside the water tub, has an opening and accommodates laundry; a water supply valve that performs water supplying into the water tub; a water level detection unit that detects a water level inside the water tub; a motor that drives the rotary drum to be rotated; a circulating water channel that circulates the water inside the water tub into the rotary drum; a pump that supplies the water inside the water tub to the circulating water channel; a nozzle that ejects the water supplied by the pump into the rotary drum through a peripheral edge portion of the opening; and a controller that controls a rinsing process by driving the water supply valve, the motor and the pump. In the rinsing process, the controller is configured to perform a high speed rotation process of rotating the rotary drum at such a speed so as to allow the laundry inside the rotary drum to cling to an inner peripheral wall of the rotary drum and a low speed rotation process of rotating the rotary drum at such a speed so as not to allow the laundry inside the rotary drum to cling to the inner peripheral wall of the rotary drum. Further, in the high speed rotation process, the controller is configured to operate the water supply valve to supply the water into the water tub so as to have a first predetermined water level, and then to drive the pump to eject the water from the nozzle onto the laundry clinging to the inner peripheral wall of the rotary drum.

[0008] According to this configuration, out of the laundry clinging to the inner peripheral wall inside the rotary drum, a portion of the laundry positioned outside the rotary drum is soaked with the water supplied into the water tub, and a portion of the laundry positioned inside the rotary drum is soaked with the water ejected into the rotary drum by the pump. In this manner, the entire load of laundry can be uniformly soaked with rinsing water regardless of a laundry volume, thereby improving rinsing performance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a schematic diagram illustrating a cross-sectional configuration of a drum type washing machine according to a first embodiment of the present invention.

FIG. 2 is a cross-sectional view of a main portion in a front lower side of a water tub of the drum type washing machine according to the first embodiment of the present invention.

FIG. 3 is a cross-sectional view taken along a line 3-3 in FIG. 1.

FIG. 4 is a cross-sectional view illustrating a configuration of a nozzle of the drum type washing machine according to the first embodiment of the present invention.

FIG. 5 illustrates a cross-sectional configuration of a general nozzle as a comparative example.

FIG. 6A is a schematic diagram illustrating a state of laundry inside a rotary drum of the drum type washing machine according to the first embodiment of the present invention.

FIG. 6B is a schematic diagram illustrating a state of the laundry inside the rotary drum of the drum type washing machine according to the first embodiment of the present invention.

FIG. 6C is a schematic diagram illustrating a state of the laundry inside the rotary drum of the drum type washing machine according to the first embodiment of the present invention.

FIG. 6D is a schematic diagram illustrating a state of the laundry inside the rotary drum of the drum type washing machine according to the first embodiment of the present invention.

FIG. 7A is a schematic diagram illustrating a state of laundry when circulating water is ejected through one nozzle in the drum type washing machine according to the first embodiment of the present invention.

FIG. 7B illustrates conditions of water supply and spin-drying for the laundry in the situation illustrated in FIG. 7A.

FIG. 8A is a schematic diagram illustrating a situation of laundry when circulating water is ejected through a plurality of nozzles in the drum type washing machine according to the first embodiment of the present invention.

FIG. 8B illustrates conditions of water supply and spin-drying for the laundry in the situation illustrated in FIG. 8A.

FIG. 9A is a time chart illustrating an operation during a washing process in the drum type washing machine according to the first embodiment of the present invention.

FIG. 9B is a time chart illustrating a low speed rotation process and a high speed rotation process in detail, in the washing process illustrated in FIG. 9A.

FIG. 10A is a time chart illustrating an operation during a washing process in a drum type washing machine according to a second embodiment of the present invention.

FIG. 10B is a time chart illustrating a low speed rotation process and a high speed rotation process in detail, in the washing process illustrated in FIG. 10A.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0010] Hereinafter, embodiments according to the present invention will be described with reference to the accompanying drawings. The following embodiments are one specific example according to the present invention, and thus are not intended to limit the technical scope of the present invention.

First Embodiment

[0011] Hereinafter, a first embodiment according to the present invention will be described with reference to the drawings.

[0012] FIG. 1 is a schematic diagram illustrating a cross-sectional configuration of drum type washing machine 50 according to the first embodiment of the present invention. FIG. 2 is a cross-sectional view of a main portion in a front lower side of water tub 2 of drum type washing machine 50. FIG. 3 is a cross-sectional view taken along line 3-3 in FIG. 1. FIG. 4 is a cross-sectional view illustrating a configuration of nozzle 26 of drum type washing machine 50 according to the first embodiment of the present invention.

[0013] Water tub 2 formed in a bottomed cylinder shape is elastically supported inside housing 1. Rotary drum 4 formed in a bottomed cylinder shape is rotatably arranged inside water tub 2. Rotary shaft axis 10 of rotary drum 4 substantially coincides with a cylindrical central axis of rotary drum 4 and a cylindrical central axis of water tub 2.

[0014] Openings 5 and 6 are respectively disposed on a front surface side of water tub 2 and rotary drum 4. Opening 5 side of water tub 2 is arranged on a front side of housing 1. Rotary drum 4 is supported so that rotary shaft axis 10 is tilted (for example, 10° to 20°) forward and upward based on a horizontal direction. Since rotary shaft axis 10 is tilted forward and upward, it is possible to deeply store water using a small amount of water, thereby improving a water saving effect. Drum type washing machine 50 according to the present invention is not limited to this example, but for example, if the water saving effect is not considered, rotary shaft axis 10 may be horizontally arranged.

[0015] Door 7 which is openable and closeable opposing opening 5 of water tub 2 and opening 6 of rotary drum 4 is disposed on a front surface of housing 1. A user can load and unload the laundry in rotary drum 4 by opening door 7.

[0016] Flexible bellows 8 formed from an elastic body such as rubber for example is arranged around opening 5 of water tub 2. If door 7 is closed, one end of bellows 8 comes into pressurizing contact with an inner surface of door 7, thereby sealing opening 5 with door 7.

[0017] Motor 9 for driving rotary drum 4 to be rotated is attached to a bottom surface of a side opposite to opening 5 (rear surface side) of water tub 2. A rotor of motor 9 is connected to rotary drum 4 in rotary shaft axis 10 of rotary drum 4, and rotation of motor 9 is transmitted to rotary drum 4 by rotary shaft axis 10.

[0018] A plurality of projections 12 are disposed to protrude toward rotary shaft axis 10 on a peripheral wall of the rotary drum 4. Rotating rotary drum 4 leads to an agitating operation in which the laundry is caught on projections 12 to be lifted upward and dropped from a height of some extent.

[0019] A plurality of holes 13 is disposed over the entire

peripheral wall of rotary drum 4. If the washing water inside water tub 2 is stored at a predetermined water level, washing water is configured to flow into rotary drum 4 through holes 13. Here, the washing water represents water including a component of detergent to be used in a washing process.

[0020] Detergent container 14 which contains the detergent is disposed above water tub 2. Detergent container 14 is connected to water supply valve 15 connected to a water faucet. Opening and closing water supply valve 15 allows tap water to be supplied to and disconnected from detergent container 14.

[0021] Water supply channel 16 which guides the tap water guided into detergent container 14 into water tub 2 together with the detergent is disposed below detergent container 14.

[0022] Drainage outlet 17 which discharges the washing water inside water tub 2 and drainage channel 18 which guides the washing water discharged from drainage outlet 17 outward from housing 1 are disposed below water tub 2. Drainage valve 19 which opens and closes drainage channel 18 is disposed in the middle of drainage channel 18. Water level detection unit 33 that detects a water level inside water tub 2 is disposed below water tub 2.

[0023] Circulating water channel 20 which re-guides the washing water discharged from water tub 2 into water tub 2 through rotary drum 4 is connected to drainage outlet 17. Circulating water channel 20 is disposed to be branched from drainage channel 18 in a middle portion. Circulating water channel 20 is arranged forward from a rear lower portion of water tub 2, substantially horizontally below water tub 2.

[0024] Pump 21 is disposed in the middle of circulating water channel 20. Driving pump 21 causes the washing water inside water tub 2 to flow into circulating water channel 20 from drainage outlet 17. Then, the washing water flowing in circulating water channel 20 is pressurized and supplied to rotary drum 4. Thus, it is possible to circulate the washing water inside water tub 2 in water tub 2 through circulating water channel 20.

[0025] Nozzle water channel 22 is disposed on a front inner side of water tub 2, that is, when viewed from the rear surface side, on an outer peripheral side of circular opening 5 disposed in water tub 2 (refer to FIG. 3). Nozzle water channel 22 is disposed in a substantially circular shape, further outside than peripheral edge 23 of opening 6 disposed in a circular shape in rotary drum 4 (refer to FIG. 2).

[0026] Opening 5 disposed in water tub 2, opening 6 disposed in rotary drum 4, and nozzle water channel 22 are respectively formed in a substantially concentric circle. Inner peripheral edge 24 of nozzle water channel 22 is positioned further radially outside than peripheral edge 23 of opening 6.

[0027] A function of pump 21 allows the washing water inside water tub 2 to be guided from inlet 25 disposed in nozzle water channel 22 into nozzle water channel 22 through circulating water channel 20. Then, the washing water is guided to at least three or more nozzles (seven nozzles are illustrated in FIG. 3), that is, a plurality of nozzles 26a to 26g (collectively referred to as nozzle 26) which are disposed in nozzle water channel 22. Nozzle 26 is disposed so as to eject the washing water from the nozzle water channel 22 toward a direction of rotary shaft axis 10 of rotary drum 4.

[0028] Space 27 is disposed between nozzle 26 and peripheral edge 23 of opening 6. Reflection portion 28 which reflects the washing water ejected onto space 27 through nozzle 26 toward opening 6 is disposed in space 27. Reflection portion 28 is configured to guide the washing water ejected onto space 27 to opening 6 and to guide the washing water into rotary drum 4.

[0029] According to such a configuration, each of the plurality of nozzles 26 is formed at a position away from peripheral edge 23 of opening 6 of rotary drum 4. Thus, nozzles 26 are not exposed to opening 6 of rotary drum 4. In addition, the plurality of nozzles 26 are configured to be capable of spraying diffused washing water onto the laundry inside rotary drum 4. Accordingly, when the laundry is loaded into rotary drum 4, or when the laundry is unloaded, the laundry is unlikely to be damaged by being caught on opening 6. This facilitates loading and unloading of the laundry, thereby enabling very convenient drum type washing machine 50 to be provided.

[0030] The present embodiment does not employ a water guide wall surface for guiding an ejected stream of the washing water ejected through nozzles 26 to reflection portion 28. The ejected stream through nozzles 26 is discharged to space 27 and then collides with collision surface 28a of reflection portion 28.

[0031] Nozzles 26 are configured such that the ejected stream through nozzles 26 is spread and guided from opening 6 of rotary drum 4 into rotary drum 4. For this reason, even when nozzles 26 are formed at the position away from peripheral edge 23 of opening 6 of rotary drum 4, the ejected stream through nozzles 26 is guided into rotary drum 4 without receiving unnecessary wall surface resistance. According to such a configuration, a decrease in a flow rate is suppressed to a minimum and thus the washing water can be vigorously supplied to the laundry inside rotary drum 4.

[0032] In addition, according to the present embodiment, it is not necessary to arrange nozzles 26 in a flat shape so as to be along the water guide wall surface. Therefore, it is possible to form a cross-sectional shape of nozzles 26 so as to be a round hole which allow the smallest pressure loss in an identical cross-section. In this manner, it is possible to suppress the decrease in the flow rate of the washing water ejected through nozzles 26 to a minimum. Thus, it is possible to supply a sufficient amount of the washing water to the laundry inside the rotary drum 4. In addition, reflection portion 28 can spread the ejected stream which is rod-shaped. Therefore, it is possible to widely spray the washing water onto the laundry inside rotary drum 4, thereby improving

washing performance and rinsing performance.

[0033] Reflection portion 28 is arranged in an annular shape around opening 5 so as to oppose the front surface of rotary drum 4. Then, collision surface 28a with which the washing water ejected through nozzles 26 collides is disposed to be tilted in a direction of the ejected stream from nozzles 26. In this manner, the ejected stream from nozzles 26 is not scattered on collision surface 28a in many directions. Accordingly, the ejected stream can stably reach collision surface 28a and can spread while flowing along a tilted surface. Therefore, it is possible to supply the washing water to the laundry inside rotary drum 4 in a stable spreading condition.

[0034] If a tilting angle of collision surface 28a with respect to the direction of the ejected stream from nozzles 26 is as gentle as possible, it is possible to cause the ejected stream to more stably reach the surface and spread. However, when reflection portion 28 is configured to have only collision surface 28a, if the tilting angle of collision surface 28a with respect to the direction of the ejected stream from nozzles 26 is arranged to be gentle, the ejected stream cannot be guided to an inner side rear direction of rotary drum 4, and thus the washing water can be supplied only to clothes placed in the front inside rotary drum 4.

[0035] Therefore, in the present embodiment, in reflection portion 28, guide portion 28b which guides the ejected stream to the inner side rear direction of rotary drum 4 after the ejected stream from nozzles 26 collides with collision surface 28a is disposed on an inner peripheral edge of collision surface 28a.

[0036] Collision surface 28a is more gently tilted in the direction of the ejected stream from nozzles 26 than guide portion 28b. In this manner, regardless of a direction for guiding the ejected stream from nozzles 26 into rotary drum 4, it is possible to set the tilting angle of collision surface 28a to have a gentle angle with respect to the direction of the ejected stream from nozzles 26. In this manner, the ejected stream can more stably reach collision surface 28a and spread.

[0037] Thus, the ejected stream collides with collision surface 28a and then is guided in the direction of rotary drum 4 by guide portion 28b. Therefore, it is possible to supply the washing water to the laundry inside rotary drum 4 in a stable spreading condition.

[0038] In addition, in the present embodiment, a length for guiding the washing water in guide portion 28b (range with which the ejected stream comes into contact) is shorter than a length for guiding the washing water on collision surface 28a. In order to allow the ejected stream from nozzles 26 to stably reach collision surface 28a and spread, it is necessary to configure a region with which the ejected stream comes into contact in collision surface 28a to have a length of a collision range of the ejected stream or larger. In contrast, since guide portion 28b has a function of only changing the direction of the ejected stream, it is sufficient if the ejected stream is merely brought into contact with a smaller range than collision surface 28a. In this manner, a decrease in a flow rate is suppressed to a minimum in guide portion 28b and thus the washing water can be vigorously supplied to the laundry inside rotary drum 4, thereby improving washing performance and rinsing performance.

[0039] As described above, the washing water supplied by pump 21 is ejected, in a rod-shaped stream, from the plurality of nozzles 26a to 26g disposed in nozzle water channel 22 onto rotary shaft axis 10 side. The washing water ejected onto space 27 collides with collision surface 28a of reflection portion 28, is reflected toward opening 6 of rotary drum 4, and spreads over in a rotation direction of rotary drum 4. Then, the washing water is ejected from a portion near peripheral edge 23 of opening 6 into rotary drum 4 by guide portion 28b.

[0040] The plurality of nozzles 26 are disposed in nozzle water channel 22 disposed in a substantially circular shape, outside peripheral edge 23 of opening 6. Nozzles 26a to 26g are configured such that based on a direction facing rotary shaft axis 10 of rotary drum 4, an ejecting direction of the washing water has predetermined displacement angle (shift angle) $\theta 1$ in an identical direction when viewed from the opening surface side of rotary drum 4. In the present embodiment, nozzles 26a to 26g are respectively set to have same displacement angle (shift angle) $\theta 1$ as each other.

[0041] According to such a configuration, it is possible to increase a range through which the washing water ejected into rotary drum 4 passes. Therefore, the washing water can be efficiently, uniformly and continuously supplied to the laundry inside rotary drum 4. Excessively large displacement angle (shift angle) $\theta 1$ may cause a portion of laundry through which the washing water does not pass near rotary shaft axis 10. Thus, as an example of not causing the portion through which the washing water does not pass near rotary shaft axis 10, with respect to rotary shaft axis 10, it is desirable to set displacement angle (shift angle) $\theta 1$ for displacing ejecting direction P of the washing water to approximately half (for example, 5° to 15°) of spread angle $\theta 2$ (for example, approximately 10° to 30°) of the washing water spreading in the rotation direction of rotary drum 4.

[0042] As illustrated in FIG. 4, bulging portion 29 which bulges to rotary shaft axis 10 side of rotary drum 4 is disposed in a portion of nozzle water channel 22. Circular nozzle hole 31 is disposed on flat surface 30 of bulging portion 29. In this manner, nozzles 26 are formed.

[0043] Nozzle hole 31 is configured such that length (thickness of the flat surface 30) L of nozzle hole 31 is diameter d of nozzle hole 31 or smaller. Flat surface 30 is orthogonal to the ejecting direction of the washing water ejected through nozzle hole 31, and is tilted toward displacement angle (shift angle) $\theta 1$ of nozzles 26.

[0044] An inner portion of bulging portion 29 is isolated from a main stream (dotted arrow in FIG. 4) of the washing water flowing to end portion 22a inside nozzle water channel 22. Accordingly, nozzles 26 are less affected by the main stream of the washing water. In this manner,

by providing bulging portion 29, it is possible to suppress the ejected stream ejected through nozzles 26 from being in disorder, thereby enabling the washing water to be ejected in a stable direction.

[0045] In addition, since bulging portion 29 is present, the ejected stream can be contracted in nozzles 26. Thus, it is possible to accelerate a flow rate and strengthen a force of the washing water to be ejected. This operation will be described in detail.

[0046] FIG. 5 illustrates a cross-sectional configuration of general nozzle 100 as a comparative example.

[0047] As illustrated in FIG. 5, normally, in order to minimize a pressure loss as much as possible, nozzle 100 is formed such that inner wall surface 103 of nozzle water channel 102 is gradually and smoothly narrowed toward nozzle hole 101. This configuration prevents a water flow inside nozzle water channel 102 from being separated from inner wall surface 103 until an ejected stream is ejected through nozzle hole 101, thereby enabling efficient nozzle 100 to be configured.

[0048] In nozzle 100 having such a configuration, if a flow rate of the ejected stream is identical, the flow rate of the ejected stream from nozzle hole 101 is determined by a cross-section area of nozzle hole 101. Accordingly, in order to accelerate the flow rate of the ejected stream, it is necessary to increase a flow volume or to decrease the cross-section area of nozzle hole 101.

[0049] However, if the nozzle illustrated in FIG. 5 is applied to the present embodiment, when a circulating flow volume of circulating water channel 20 which supplies the washing water to nozzle water channel 22 is increased, the water level inside water tub 2 is lowered and air is likely to be mixed into pump 21. In other words, this case is a so-called air-biting state, thereby causing an adverse effect in that the flow volume is decreased. In the present embodiment, when the washing is performed by using a small amount of water stored inside water tub 2, there is a limit in increasing the flow volume circulating in circulating water channel 20. In addition, if the cross section of nozzle hole 31 is decreased, in a view of reliability, there occurs a problem such as a clogged hole caused by yarn waste generated from the laundry. Therefore, there is also a limit in decreasing the cross section of nozzle hole 31.

[0050] Therefore, in the present embodiment, as illustrated in FIG. 4, bulging portion 29 which bulges to rotary shaft axis 10 side of rotary drum 4 is disposed in nozzle water channel 22, and flat surface 30 which is substantially perpendicular to an insertion direction of nozzle hole 31 is disposed around nozzle hole 31. The flow near inner wall surface 22b inside nozzle water channel 22 which is created by bulging portion 29 has a tendency to flow along inner wall surface 22b by way of fluid viscosity. However, when the ejected stream is ejected through nozzle hole 31, since inner wall surface 22b is sharply bent by 90 degrees, the flow is separated from a peripheral wall of nozzle hole 31. Therefore, as illustrated in FIG. 4, cross section Q of the ejected stream becomes smaller than cross section R of nozzle hole 31. That is, the ejected stream is contracted by disposing bulging portion 29.

[0051] In this manner, according to nozzle 26 of the present embodiment, even if the flow volume is the same, and the cross section of nozzle hole 31 is the same as those of a normal product (refer to FIG. 5), the flow rate can be accelerated compared to the normal product. Thus, it is possible to strengthen the force of the washing water to be ejected through nozzle 26.

[0052] In addition, nozzle hole 31 is configured such that a cross-sectional shape (cross-sectional shape taken along a line E-E in FIG. 4) has a circular shape. In this manner, the ejected stream is uniformly contracted. Therefore, it is possible to suppress the ejected stream ejected through nozzle hole 31 from being in disorder, thereby enabling the washing water to be ejected onto the laundry in a preset direction. In addition, since nozzle hole 31 has no angle, yarn waste generated from the laundry is unlikely to be caught on nozzle hole 31. Therefore, it is possible to prevent occurrence of a clogged hole caused by the yarn waste.

[0053] In addition, as described above, the present embodiment is configured such that length L of nozzle hole 31 is diameter d of nozzle hole 31 or smaller. If nozzle hole 31 is excessively long in the ejecting direction, the flow which is once separated from the peripheral wall of nozzle hole 31 and contracted spreads gradually so as to be ejected, thereby eliminating an effect of accelerating the flow rate. Therefore, it is preferable to set length L of nozzle hole 31 to diameter d of nozzle hole 31 or smaller. Accordingly, the flow rate of the ejected stream from nozzle hole 31 can be reliably accelerated and the force of the washing water to be ejected can be reliably strengthened.

[0054] In addition, as illustrated in FIG. 3, the present embodiment is configured such that nozzle water channel 22 is branched into two directions from inlet 25 and extends toward two end portions 22a. According to such a configuration, a channel of the water flowing inside nozzle water channel 22 is divided into two. Accordingly, even if nozzle water channel 22 is formed to be annularly elongated so as to surround opening 5, it is possible to shorten a flow channel, thereby enabling a decrease in the pressure loss in the channel.

[0055] As described above, according to the present embodiment, a sufficient pressure can be applied to respective nozzles 26a to 26g, and the flow rate of the ejected flow ejected through nozzle 26 can be ensured. Therefore, it is possible to uniformly spray the washing water onto the laundry inside rotary drum 4. Nozzle water channel 22 may be configured to be annularly formed without disposing end portion 22a. Since the water flow is branched into two directions from inlet 25, this case can also exhibit the same advantageous effect as that of a case where end portion 22a is disposed.

[0056] In addition, the present embodiment is configured such that an inlet direction of the washing water

from inlet 25 to nozzle water channel 22 is the direction of rotary shaft axis 10 of rotary drum 4 (direction of an arrow S). According to this configuration, the flow of the washing water can be smoothly branched into two directions. Accordingly, a sufficient pressure can be applied to respective nozzles 26a to 26g, and the flow rate of the ejected flow ejected through nozzle 26 can be ensured.

[0057] Referring to FIG. 1 again, drum type washing machine 50 according to the present embodiment has controller 32 in a rear lower potion inside housing 1. Controller 32 controls motor 9, water supply valve 15, drainage valve 19 and pump 21, and controls an operation of each process such as washing, rinsing and spin-drying based on a preset program.

[0058] With regard to drum type washing machine 50 having the above-described configuration, hereinafter, the operation and the effect will be described.

[0059] FIGS. 6A to 6D are schematic diagrams illustrating states of the laundry inside rotary drum 4 of drum type washing machine 50 according to the first embodiment of the present invention. FIG. 7A is a schematic diagram illustrating a state of the laundry when ejecting circulating water through one nozzle 26 in drum type washing machine 50. FIG. 7B illustrates conditions of water supply and spin-drying for the laundry in the state illustrated in FIG. 7A. FIG. 8A is a schematic diagram illustrating a state of the laundry when ejecting the circulating water through a plurality of nozzles 26 in drum type washing machine 50. FIG. 8B illustrates conditions of water supply and spin-drying for the laundry in the state illustrated in FIG. 8A. FIG. 9A is a time chart illustrating an operation during a washing process in drum type washing machine 50. FIG. 9B is a time chart illustrating a low speed rotation process and a high speed rotation process in detail, in the washing process illustrated in FIG. 9A.

[0060] A user opens door 7, loads the laundry into rotary drum 4 and starts to operate drum type washing machine 50. Then, controller 32 detects a volume of the loaded laundry. Thereafter, water supply valve 15 is opened, the washing water dissolves the detergent stored inside detergent container 14, and the water is supplied from water supply channel 16 into water tub 2. The water level of the washing water is preset according to a laundry' s falling distance to the washing water which enables a beat-washing effect to be obtained, and then the washing water is stored in the lower portion inside the rotary drum 4 (water supply process).

[0061] The water level of the washing water stored inside water tub 2 is detected by water level detection unit 33. If a water volume which has been preset according to a volume of the laundry is stored inside water tub 2, controller 32 starts a washing process by stopping the water supply.

[0062] In the washing process, rotary drum 4 is driven and rotated in forward and rearward directions by motor 9. The laundry accommodated inside rotary drum 4 is lifted up in the rotation direction by projections 12 disposed on cylindrical wall 11 of rotary drum 4, and then is dropped. In this manner, the laundry is washed by a beat-washing operation (low speed rotation process).

[0063] A speed of rotary drum 4 at this time is a speed of such an extent not to allow the laundry to cling to the inner peripheral wall of rotary drum 4.

[0064] As illustrated in FIG. 9B, if the beat-washing is performed for a predetermined period of time, controller 32 starts a high speed rotation process in which rotary drum 4 is rotated at such a speed so as to allow the laundry to cling to the inner peripheral wall of rotary drum 4. In the high speed rotation process, the speed of rotary drum 4 is such a speed that the laundry clings to the inner peripheral wall of rotary drum 4. Thus, a centrifugal force is applied to the laundry. Stains come out of the laundry by using the centrifugal force, and so-called centrifugal force washing is performed during the high speed rotation process.

[0065] If the high speed rotation process is performed for a predetermined period of time, controller 32 re-performs the low speed rotation process of rotating at such a speed so as not to allow the laundry to cling to the inner peripheral wall of rotary drum 4 (refer to FIG. 9A). If the low speed rotation process is performed for a predetermined period of time, controller 32 completes the washing process.

[0066] Next, controller 32 starts drainage by opening drainage valve 19 and starts an intermediate spin-drying process. If the spin-drying process is performed for a predetermined period of time through a balance control operation for adjusting biased laundry inside rotary drum 4, controller 32 stops the rotation of rotary drum 4 and completes the intermediate spin-drying process.

[0067] Subsequently, the rinsing process is started. During the rinsing process in drum type washing machine 50, controller 32 generally performs the water supply and beat-rinsing while rotating rotary drum 4 at such a speed so as not to allow the laundry inside rotary drum 4 to cling to the inner peripheral wall of rotary drum 4. For example, rotating rotary drum 4 at a speed of 45 r/min leads to an effect of the beat-rinsing. However, in some cases, depending on a volume of the laundry and types of stains, the entire laundry may be effectively soaked or centrifugal force rinsing may be effectively performed by rotating rotary drum 4 at such a speed so as to allow the laundry inside rotary drum 4 to cling to the inner peripheral wall of rotary drum 4. In this case, for example, the entire laundry can be soaked with rinsing water by supplying the circulating water while rotating rotary drum 4 at a speed of 100 r/min. In addition, rotating the rotary drum at the speed of 100 r/min applies the centrifugal force to the laundry. Accordingly, the rinsing water moves outward together with the stains and the detergent from the inside of rotary drum 4.

[0068] That is, as illustrated in FIG. 6A, when a large volume of laundry is accommodated inside rotary drum 4, in some cases, a sufficient effect of the beat-rinsing cannot be obtained. In particular, the laundry positioned

in the central portion of rotary drum 4 is not only rotated near the central portion but also unlikely to be soaked with the rinsing water. Thus, the sufficient effect of the rinsing is unlikely to be obtained. That is, in the rinsing process, the detergent component can be removed if the rinsing water passes through fibers of the laundry, but as described above, unless the entire laundry is soaked with the rinsing water, the effect of the rinsing cannot be expected.

[0069] Therefore, in the present embodiment, when starting the rinsing process, the high speed rotation process is first performed in which rotary drum 4 is rotated at such a speed so as to allow the laundry inside rotary drum 4 to cling to the inner peripheral wall of the rotary drum 4 (refer to FIG. 9A). At this time, if necessary, the balance control operation is performed in order to adjusting the biased laundry inside rotary drum 4. However, this stage is normally immediately before the intermediate spin-drying is completed. Accordingly, in many cases, the biased laundry inside rotary drum 4 has already been adjusted. Therefore, it is possible to shorten the rinsing time, since balanced high speed rotation can be started.

[0070] If the rotation speed of rotary drum 4 reaches such a speed so as to allow the laundry to cling to the inner peripheral wall of rotary drum 4, controller 32 starts the water supply by opening the water supply valve 15 while rotary drum 4 continues rotating. As illustrated in FIG. 6B, the laundry clinging to the inner peripheral wall of rotary drum 4 is sequentially rinsed by the rinsing water stored inside water tub 2, and the laundry portion placed outside rotary drum 4 is soaked with the rinsing water while being rotated.

[0071] If water level detection unit 33 detects that the rinsing water is stored in water tub 2 up to a first predetermined water level, controller 32 stops the water supply, and the rinsing water is ejected through nozzle 26. As illustrated in FIG. 6C, the high speed rotation causes the laundry to cling to rotary drum 4, thereby making space in the central portion of rotary drum 4. Accordingly, the rinsing water ejected through nozzles 26 can be directly brought into contact with the laundry portion placed inside rotary drum 4.

[0072] Therefore, the laundry portion placed inside rotary drum 4 can also be soaked with the rinsing water. Since the above-described soaking method (method where the laundry portion placed outside rotary drum 4 is soaked with the rinsing water while being rotated) has already been performed, the entire laundry can be uniformly soaked with the rinsing water. In addition, as illustrated in FIG. 6D, the centrifugal force during the high speed rotation process causes the rinsing water to pass through the fibers and to move outward from the inside of rotary drum 4 together with the detergent. In this manner, since the so-called centrifugal force rinsing is performed, the detergent component adhering to the laundry positioned at the central portion of rotary drum 4 can also be efficiently removed. Therefore, it is possible to improve the rinsing performance.

[0073] As described above, in the present embodiment, nozzle 26 uniformly supply the rinsing water to the entire laundry inside rotary drum 4 and the high speed rotation process is performed, thereby enabling a desired effect of the centrifugal rinsing to be efficiently obtained.

[0074] Here, as illustrated in FIG. 7A, it is assumed that the rinsing water is supplied to laundry A to G inside rotary drum 4 through one nozzle 26a. In this case, as illustrated in FIG. 7B, while rotary drum 4 is rotated once, the rinsing water soaking and the spin-drying, that is, detergent component removing are performed once for each of laundry A to G (when the rinsing water is applied through nozzle 26a). Accordingly, in order to obtain a desired effect of the rinsing, it is necessary to perform the high speed rotation process for long time, thereby inevitably causing prolonged process time and waste of power consumption.

[0075] In contrast, by using the plurality of nozzles 26, during the high speed rotation process, the rinsing water inside water tub 2 which passes through circulating water channel 20, nozzle water channel 22 and the plurality of nozzles 26 by driving pump 21 can always be uniformly supplied to the entire laundry clinging to the inner peripheral wall of rotary drum 4. In this manner, the above-described problem can be avoided.

[0076] That is, as illustrated in FIG. 8A, it is assumed that the plurality of nozzles 26, for example, seven nozzles 26a to 26g supply the rinsing water to laundry A to G inside rotary drum 4. In this case, as illustrated in FIG. 8B, while rotary drum 4 is rotated once, the rinse water soaking and the spin-drying are repeatedly performed seven times for each of laundry A to G. That is, compared to a case of one nozzle 26 illustrated in FIG. 7A, the detergent component is removed seven times within the same time period. Accordingly, in the example of FIG. 8A, the effect of the rinsing of seven times can be obtained compared to the case illustrated in FIG. 7A. As a result, even when the time for the process is reduced to one seventh, the same effect can be exhibited, thereby enabling process time to be shortened and power consumption to be reduced.

[0077] Referring to FIG. 9A again, if the high speed rotation process is performed for a predetermined period of time, controller 32 completes the rinsing process and starts the intermediate spin-drying process. When the intermediate spin-drying is performed after performing the high speed rotation process in the rinsing process, the laundry is in a state of clinging to the inner peripheral wall of rotary drum 4. Therefore, the balance control can be skipped, thereby enabling quick transfer to the intermediate spin-drying process.

[0078] As described above, in the present embodiment, during the rinsing process after the washing process is completed and then the intermediate spin-drying process is completed, without performing agitating by using the low speed rotation, the high speed rotation process is performed. That is, in a state where the laundry clings to the inner peripheral wall of rotary drum 4, the

intermediate spin-drying process can be transferred to the high speed rotation process in the rinsing process. Accordingly, unbalanced laundry does not interfere with driving rotary drum 4. Therefore, it is possible to further shorten the rinsing time.

[0079] In addition, in the rinsing process, during the high speed rotation process, controller 32 may be configured to repeatedly perform a series of operations multiple times in which drainage valve 19 is open to drain the rinsing water inside water tub 2, then the rinsing water is supplied into rotary drum 4 again, and the rinsing water is ejected through nozzles 26. In this manner, it is possible to further improve the effect of the rinsing. This is because in the above-described centrifugal force rinsing, compared to the low speed rotation process, the soaking and the spin-drying for the laundry are very frequently performed. For example, when comparing a case where the low speed rotation process is performed for two minutes by using 20 L of water to a case where the centrifugal force rinsing is performed twice for one minute of the process time by using 10 L of water, the case of the centrifugal rinsing shows a result that a rate of dilution (degree of the rinsing) becomes several times higher.

[0080] If a predetermined number of the rinsing process is completed, controller 32 drains the rinsing water inside water tub 2 by opening drainage valve 19. Thereafter, controller 32 performs the spin-drying on the rinsing water contained in the laundry through the high speed rotation of rotary drum 4. After the spin-drying process is performed for a predetermined period of time, controller 32 stops operating. When drum type washing machine 50 has a function of drying, a drying process subsequent to the spin-drying process may be performed by using a drying device.

[0081] As described above, according to drum type washing machine 50 of the present embodiment, the rinsing water can be uniformly supplied to the laundry inside rotary drum 4 by ejecting the washing water through a plurality of places positioned at the peripheral edge of opening 6 of rotary drum 4. Furthermore, it is possible to enhance the effect of the rinsing by ejecting the above-described washing water during the high speed rotation process in which rotary drum 4 is rotated at such a speed so as to allow the laundry inside rotary drum 4 to cling to the inner peripheral wall of rotary drum 4.

Second Embodiment

[0082] FIG. 10A is a time chart illustrating an operation during the washing process in drum type washing machine 150 according to a second embodiment of the present invention. In addition, FIG. 10B is a time chart illustrating the low speed rotation process and the high speed rotation process in detail, in the washing process illustrated in FIG. 10A.

[0083] A configuration of drum type washing machine 150 according to the present invention is the same as that of drum type washing machine 50 according to the first embodiment, and thus the description thereof will not be repeated. In drum type washing machine 150 according to the present embodiment, when compared to drum type washing machine 50 according to the first embodiment, an operation in the rinsing process is different. Accordingly, description will be made with reference to FIGS. 1 to 4, FIGS. 6A to 8B, and FIGS. 10A and 10B.

[0084] As illustrated in FIG. 10A, if the rinsing process is started, controller 32 starts the high speed rotation process in which rotary drum 4 is rotated at such a rotation speed so as to allow the laundry to cling to the inner peripheral wall of rotary drum 4.

[0085] When starting the high speed rotation process, the balance control operation is performed to adjust the biased laundry inside rotary drum 4. However, since the time is immediately after the intermediate spin-drying is completed, balanced high speed rotation can be started, thereby allowing shortened process time. If the rotation speed reaches such a speed so as to allow the laundry to cling to the inner peripheral wall of rotary drum 4, controller 32 starts the water supply by opening water supply valve 15 while the rotary drum 4 continues rotating.

[0086] As illustrated in FIG. 6B, the laundry clinging to the inner peripheral wall of rotary drum 4 is sequentially rinsed by the rinsing water stored inside water tub 2, and the laundry portion placed outside rotary drum 4 is soaked with the rinsing water while being rotated.

[0087] Water level detection unit 33 detects the water level of the rinsing water stored inside water tub 2. As illustrated in FIG. 6B, if the water is stored up to the first predetermined water level, controller 32 stops the water supply and drives pump 21. Then, the rinsing water is ejected through the plurality of nozzles 26 and the rinsing water is supplied to the laundry clinging to the inner peripheral wall of rotary drum 4.

[0088] At this time, as illustrated in FIG. 6C, the high speed rotation causes the laundry to cling to rotary drum 4, thereby making space in the central portion of rotary drum 4. Accordingly, the rinsing water ejected through nozzles 26 can be brought into direct contact with the laundry portion placed inside rotary drum 4. Therefore, the laundry portion placed inside rotary drum 4 can also be soaked with the rinsing water. Since the above-described soaking method (method where the laundry portion placed outside rotary drum 4 is sequentially dipped into the rinsing water stored in water tub 2 and soaked with the rinsing water while being rotated) has been already performed, the entire laundry can be uniformly soaked with the rinsing water.

[0089] In addition, even in the present embodiment, as illustrated in FIG. 6D, the centrifugal force during the high speed rotation process causes the rinsing water to pass through the fibers and to move outward from the inside of rotary drum 4 together with the detergent. In this manner, since the so-called centrifugal force rinsing is performed, the detergent component adhering to the laundry positioned at the central portion of the rotary drum 4 can also be efficiently removed.

[0090] As described above, even in the present embodiment, similar to the first embodiment, during the high speed rotation process, the rinsing water inside the water tub 2 which passes through circulating water channel 20, nozzle water channel 22 and the plurality of nozzles 26 by driving pump 21 can be always uniformly supplied to the entire laundry clinging to the inner peripheral wall of rotary drum 4.

[0091] In this manner, as illustrated in FIG. 8A, when the plurality of nozzles 26, for example, seven nozzles 26a to 26g supply the rinsing water to laundry A to G inside rotary drum 4, as illustrated in FIG. 8B, while rotary drum 4 is rotated once, the rinse water soaking and the spin-drying are repeatedly performed seven times for each of laundry A to G. Therefore, compared to a case of one nozzle 26 (refer to FIG. 7A), the detergent component of seven times is removed even within the same time period. Accordingly, the effect of the rinsing of seven times can be obtained. As a result, even when the time for the process is reduced to one seventh, the same effect can be exhibited, thereby enabling process time to be shortened and power consumption to be reduced.

[0092] Next, in the present embodiment, after performing the high speed rotation process for a predetermined period of time, controller 32 performs the low speed rotation process (refer to FIG. 10A). Controller 32 starts the water supply while rotating rotary drum 4 at such a speed so as not to allow the laundry inside rotary drum 4 to cling to the inner peripheral wall of rotary drum 4. Controller 32 supplies the water up to a second predetermined water level in water tub 2 by opening water supply valve 15.

[0093] Here, the second predetermined water level is preset based on a laundry' s falling distance to the rinsing water which enables a beat-rinsing effect to be obtained, and then the washing water is stored below inside rotary drum 4. The second predetermined water level is preset according to the volume of the laundry, but as illustrated in FIG. 6A, is preset to be higher than the water level of the high speed rotation process illustrated in FIG. 6B, that is, the first predetermined water level. The water level of the rinsing water stored inside water tub 2 is detected by water level detection unit 33.

[0094] As described above, in the rinsing process of drum type washing machine 150 according to the present embodiment, controller 32 rotates the rotary drum 4 at such a speed so as not to allow the laundry inside rotary drum 4 to cling to the inner peripheral wall of rotary drum 4. In this manner, it is possible to achieve the effect of the beat-rinsing. For example, it is possible to perform the beat-rinsing by rotating rotary drum 4 at a speed of 45 r/min, in which the laundry is lifted upward inside rotary drum 4, is caused to fall down by its own weight and is collided with a water surface down in the rotary drum 4 or other laundry.

[0095] Thus, in the present embodiment, the rinsing process includes press-rinsing performed by using the ejection of the rinsing water through the plurality of nozzles 26 and the efficient centrifugal force in the high speed rotation process, and the beat-rinsing in the low speed rotation process. In this manner, the laundry can obtain the effects of the different rinsing, thereby enabling the rinsing performance to be further improved.

[0096] In addition, when starting the high speed rotation process, it is necessary to perform the balance control operation for adjusting the biased laundry inside rotary drum 4. However, since the high speed rotation process is performed before the low speed rotation process is performed, the high speed rotation process can be started in a state where the intermediate spin-drying process is immediately completed. That is, since the time is immediately after the intermediate spin-drying is completed, the biased laundry inside rotary drum 4 has been already adjusted and balanced high speed rotation can be started, thereby allowing shortened time required for the entire rinsing process.

[0097] As described above, drum type washing machines 50 and 150 according to the first embodiment and the second embodiment include water tub 2 that stores the water; rotary drum 4 that is rotatably arranged inside water tub 2, has opening 5 and accommodates laundry; water supply valve 15 that performs the water supply into water tub 2; and water level detection unit 33 that detects the water level inside water tub 2. In addition, drum type washing machines 50 and 150 include motor 9 that drives rotary drum 4 to be rotated; circulating water channel 20 that circulates the water inside water tub 2 to rotary drum 4; and pump 21 that supplies the water inside water tub 2 to circulating water channel 20. Furthermore, drum type washing machines 50 and 150 include nozzle 26 that ejects the water supplied by pump 21 into rotary drum 4 through the peripheral edge portion of opening 5; and controller 32 that controls the rinsing process by driving water supply valve 15, motor 9 and pump 21.

[0098] Then, in the rinsing process, controller 32 is configured to perform the high speed rotation process in which rotary drum 4 is rotated at such a speed so as to allow the laundry inside rotary drum 4 to cling to the inner peripheral wall of rotary drum 4 and the low speed rotation process in which rotary drum 4 is rotated at such a speed so as not to allow the laundry inside rotary drum 4 to cling to the inner peripheral wall of rotary drum 4. Further, in the high speed rotation process, controller 32 is configured to operate water supply valve 15 to supply the water into water tub 2 so as to have the first predetermined water level, and then to drive pump 21 to eject the water from nozzle 26 onto the laundry clinging to the inner peripheral wall of rotary drum 4.

[0099] According to this configuration, within the laundry clinging to the inner peripheral wall inside rotary drum 4, the outer laundry portion of rotary drum 4 is soaked with the water supplied into water tub 2 and the inner laundry portion of rotary drum 4 is soaked with the water ejected into rotary drum 4 by pump 21. In this manner, the entire laundry can be uniformly soaked with the rinsing water regardless of a laundry volume, thereby ena-

bling the rinsing performance to be improved. In particular, during the high speed rotation process, the rinsing water is adapted to efficiently flow to the laundry in the outer portion of rotary drum 4 from the laundry in the inner portion of rotary drum 4. Therefore, the effect of the centrifugal force rinsing is further enhanced, thereby enabling the washing performance to be improved.

[0100] In addition, in the present embodiment, controller 32 is configured to perform the low speed rotation process during the rinsing process after the high speed rotation process, and to operate water supply valve 15 in the low speed rotation process so as to perform the water supply up to the second predetermined water level which is different from the first predetermined water level.

[0101] This leads to the performance of the press-rinsing performed by using the efficient centrifugal force caused by the ejection of the rinsing water through nozzle 26 in the high speed rotation process, and the performance of the beat-rinsing in the low speed rotation process. Accordingly, the laundry can obtain the effects of the different rinsings, thereby enabling the rinsing performance to be further improved. Then, since the high speed rotation process is performed before the low speed rotation process is performed, the high speed rotation process can be started in a state where the intermediate spin-drying process has just been completed. In this case, the biased laundry inside rotary drum 4 has been already adjusted and the balanced high speed rotation can be started, thereby allowing shortened time required for the entire rinsing process.

[0102] Furthermore, in the present embodiment, the second predetermined water level is set to be higher than the first predetermined water level.

[0103] This enables the effect of the beat-rinsing to be further enhanced. If the first predetermined water level becomes higher than the second predetermined water level, when the water existing between rotary drum 4 and water tub 2 is agitated, an abnormal foaming is occurred, the rinsing effect is lost, or the load applied to motor 9 becomes large (overcurrent is flowed) due to the high speed rotation, as the first predetermined water level becomes higher. However, by setting the second predetermined water level higher than the first predetermined water level, these disadvantages hardly occur.

[0104] As described above, according to the drum type washing machine of the present invention, the entire laundry can be uniformly soaked with rinsing water regardless of a laundry volume inside the rotary drum, thereby enabling a particular effect to be achieved in that the rinsing performance is improved. Accordingly, the present invention can be usefully applied to be used in drum type washing machines for both household purposes and business purposes.

Claims

1. A drum type washing machine comprising:

a water tub that stores water;
a rotary drum that is rotatably arranged inside the water tub, has an opening and accommodates laundry;
a water supply valve that performs water supply into the water tub;
a water level detection unit that detects a water level inside the water tub;
a motor that drives the rotary drum to be rotated;
a circulating water channel that circulates the water inside the water tub to the rotary drum;
a pump that supplies the water inside the water tub to the circulating water channel;
a nozzle that ejects the water supplied by the pump into the rotary drum through a peripheral edge portion of the opening; and
a controller that controls a rinsing process by driving the water supply valve, the motor and the pump,
wherein in the rinsing process, the controller performs a high speed rotation process of rotating the rotary drum at such a speed so as to allow the laundry inside the rotary drum to cling to an inner peripheral wall of the rotary drum and a low speed rotation process of rotating the rotary drum at such a speed so as not to allow the laundry inside the rotary drum cling to the inner peripheral wall of the rotary drum, and
wherein in the high speed rotation process, the controller operates the water supply valve to supply the water into the water tub so as to have a first predetermined water level, and then drives the pump to eject the water from the nozzle onto the laundry clinging to the inner peripheral wall of the rotary drum.

2. The drum type washing machine of claim 1,
wherein in the rinsing process, the controller performs the low speed rotation process after the high speed rotation process, and in the low speed rotation process, operates the water supply valve to supply the water so as to have a second predetermined water level different from the first predetermined water level.

3. The drum type washing machine of claim 2,
wherein the second predetermined water level is higher than the first predetermined water level.

FIG. 1

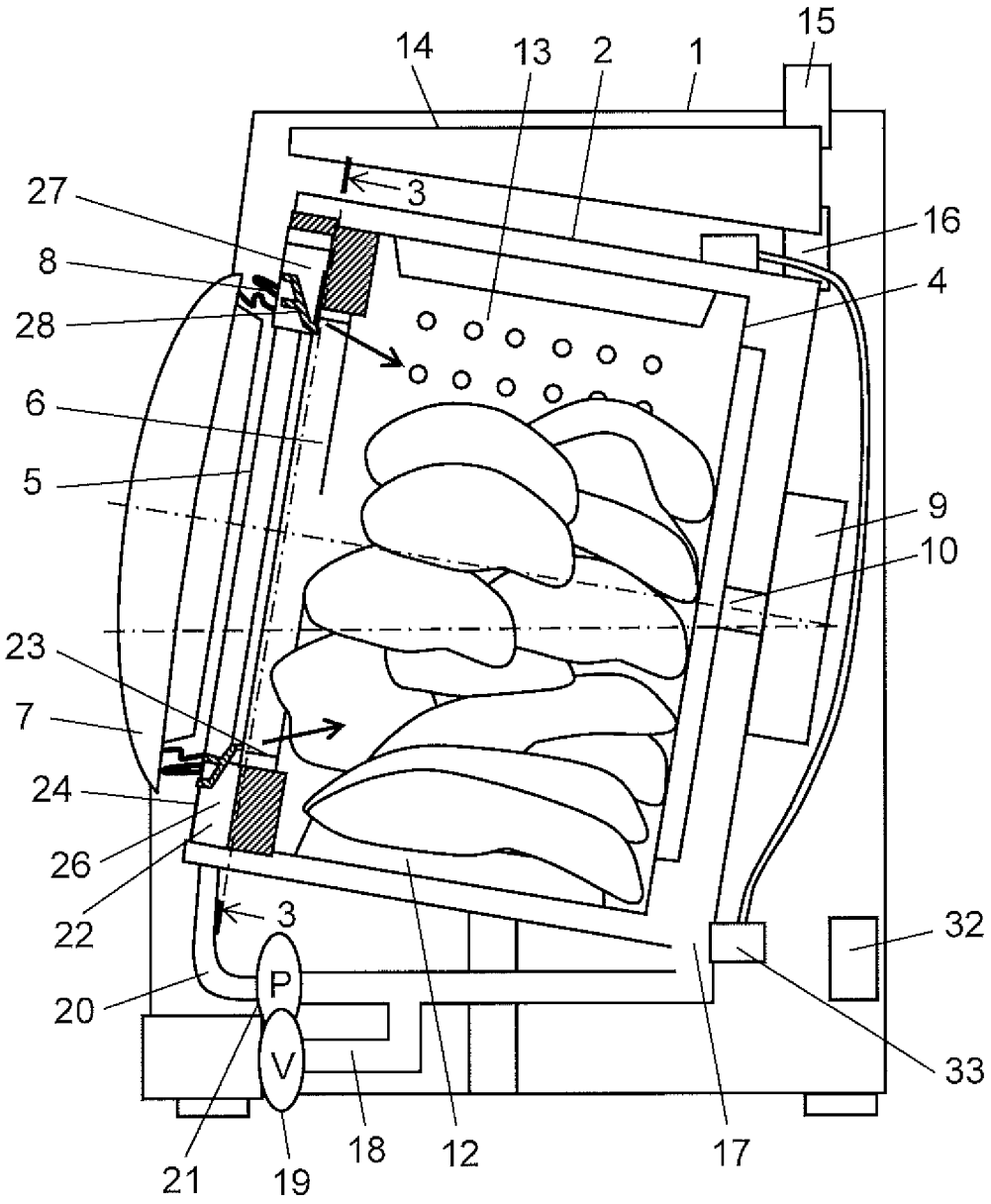

14
13
2
1
15
27
3
16
8
4
28
6
5
9
10
23
7
24
26
22
3
32
P
20
V
33
21
19
18
12
17
50,150

FIG. 2

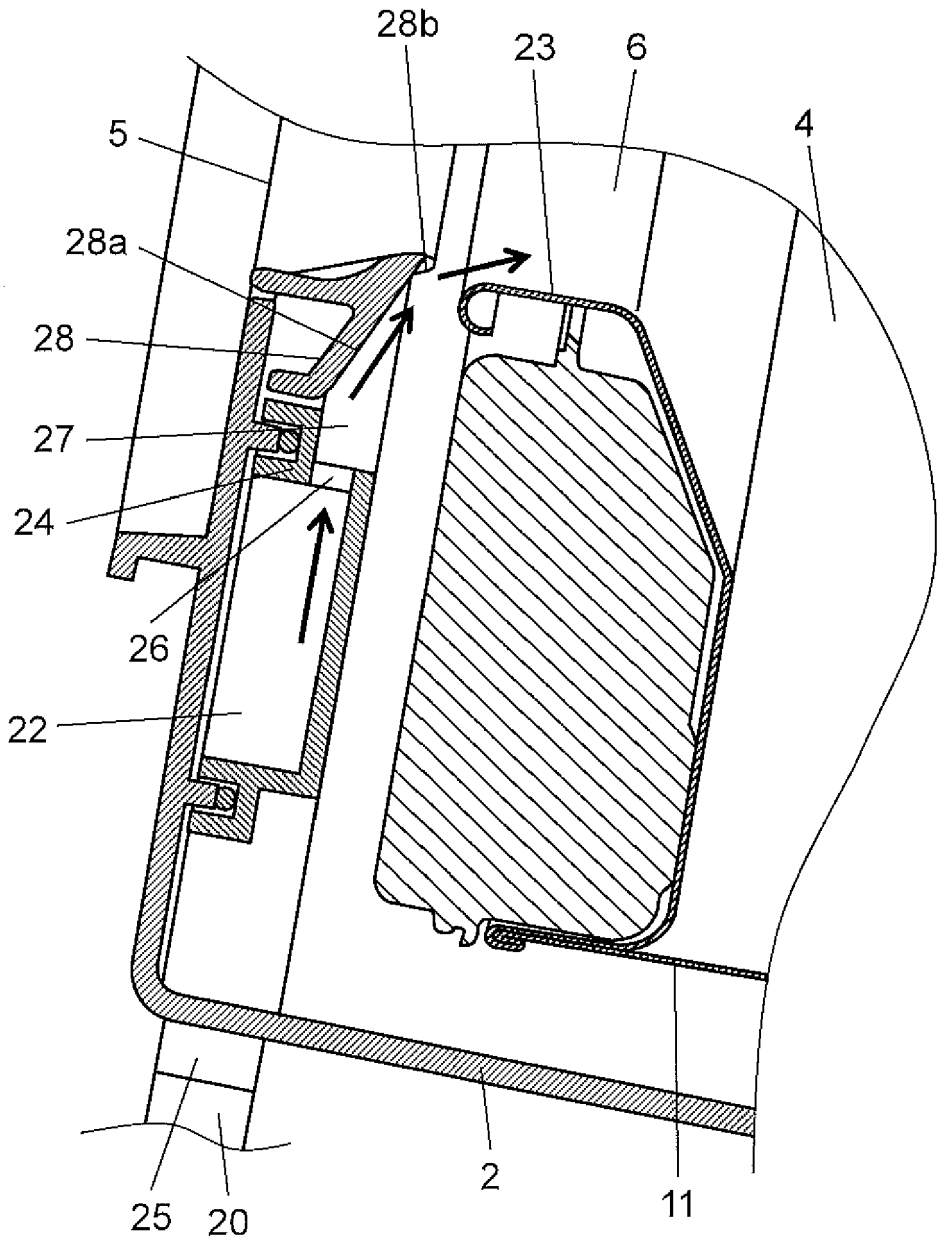


FIG. 3

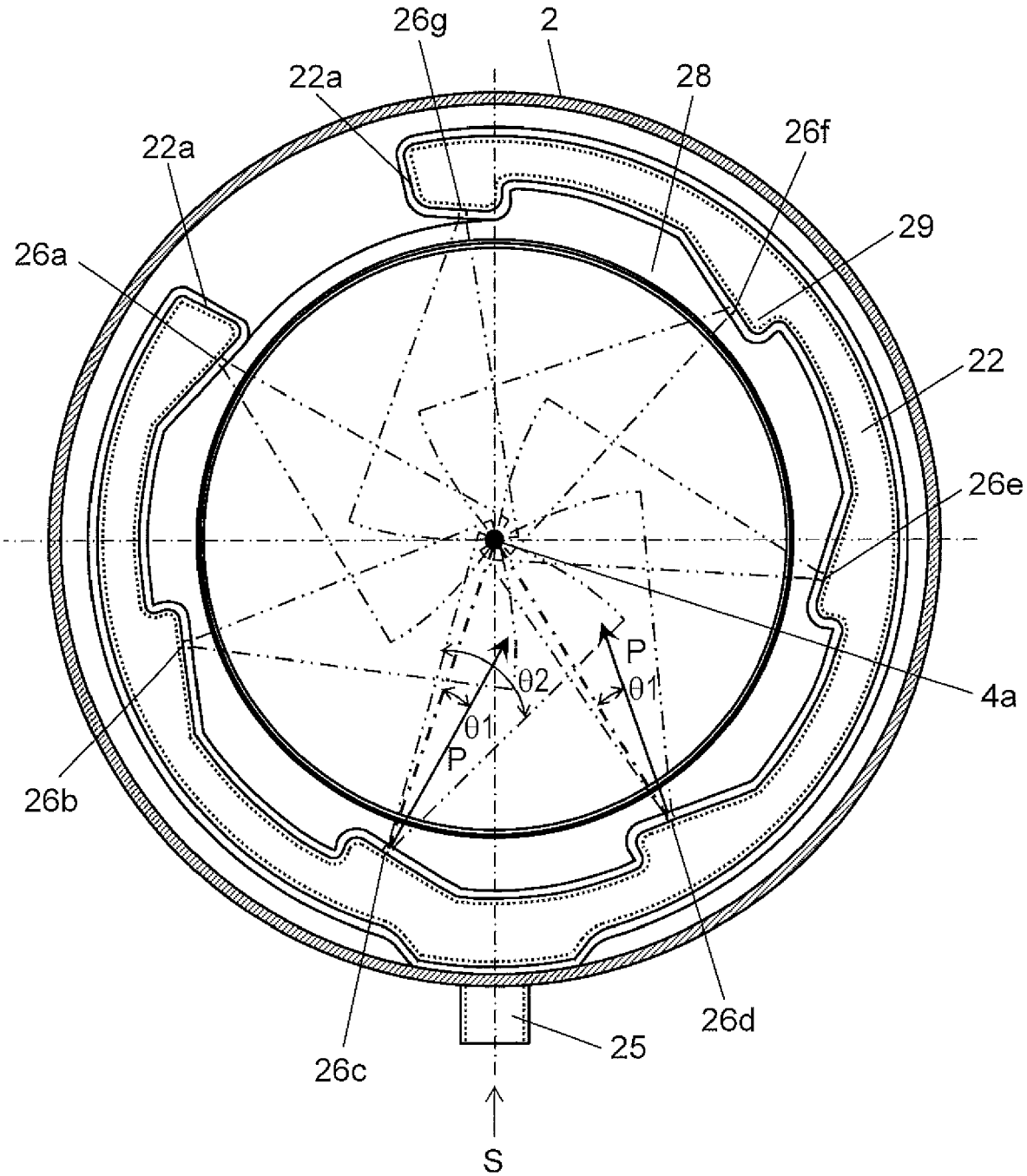


FIG. 4

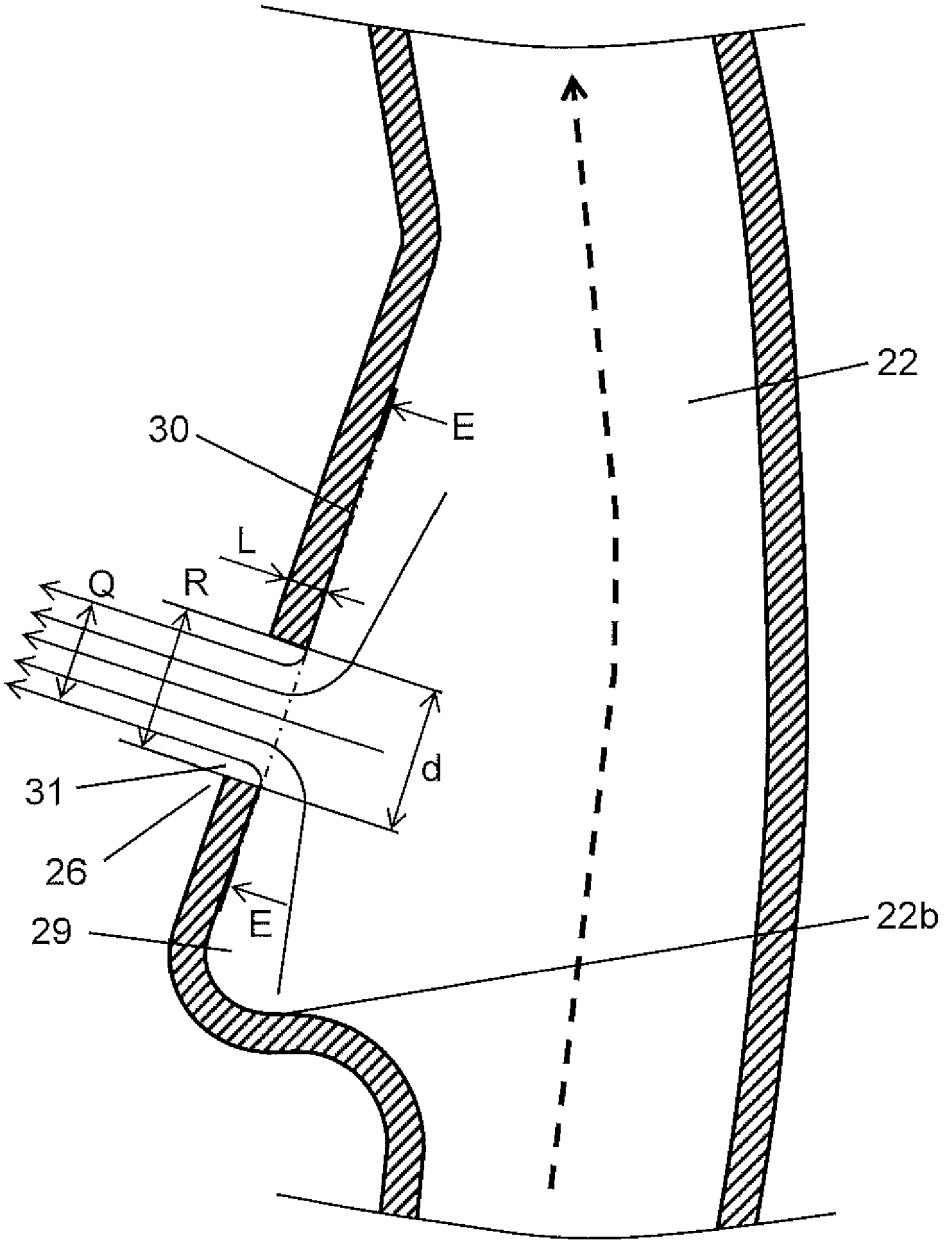


FIG. 5

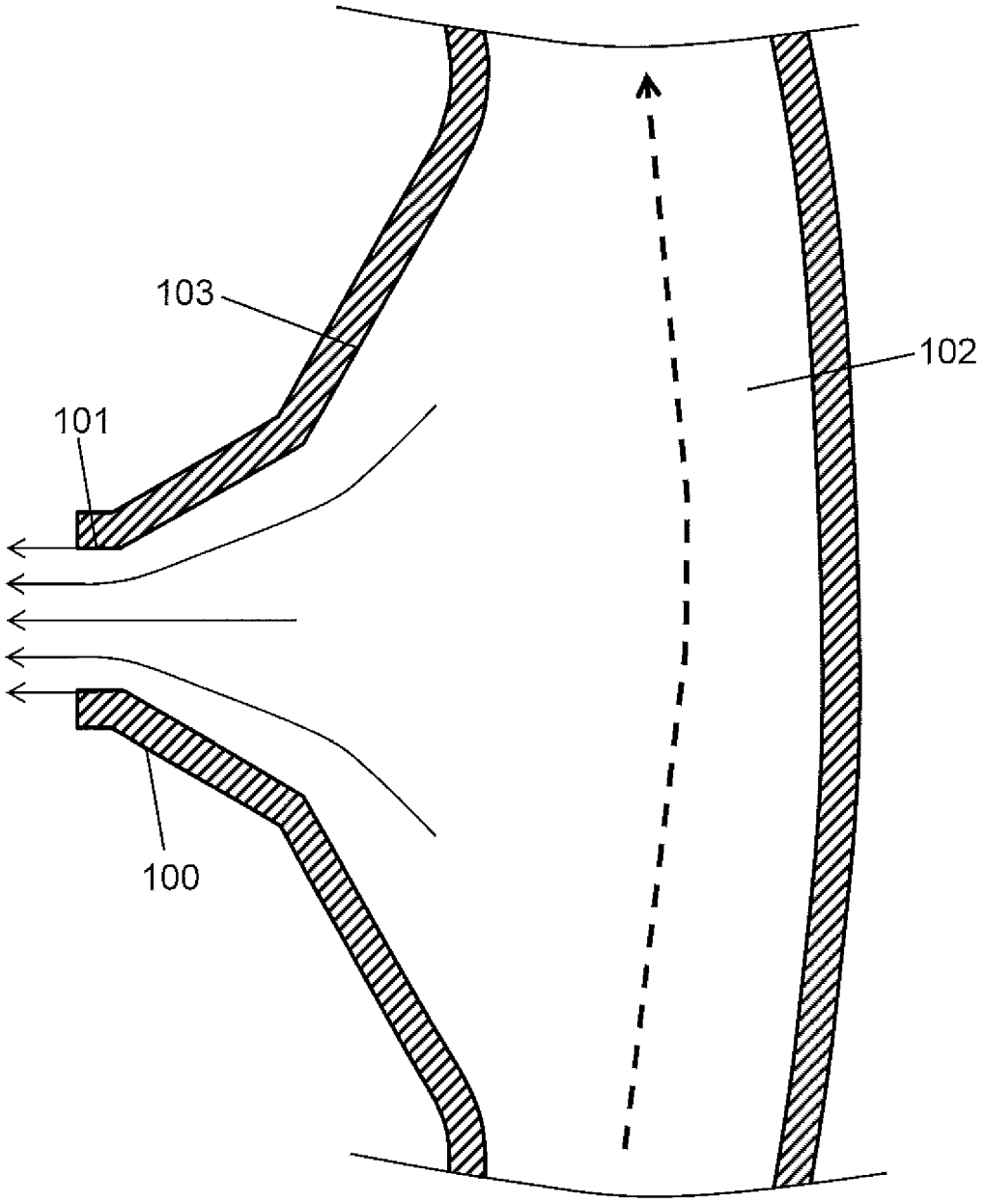


FIG. 6A

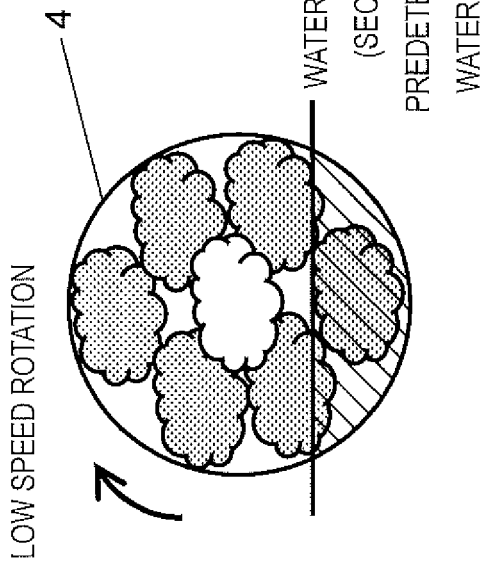


FIG. 6B

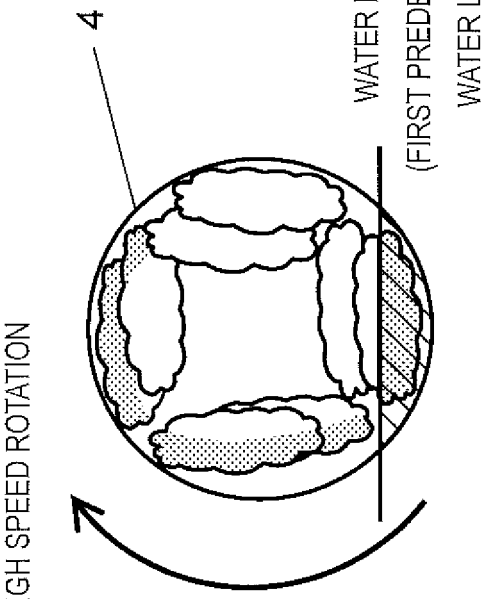


FIG. 6C

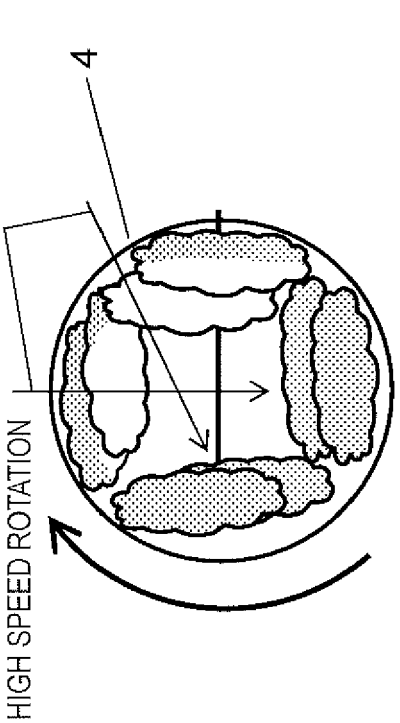


FIG. 6D

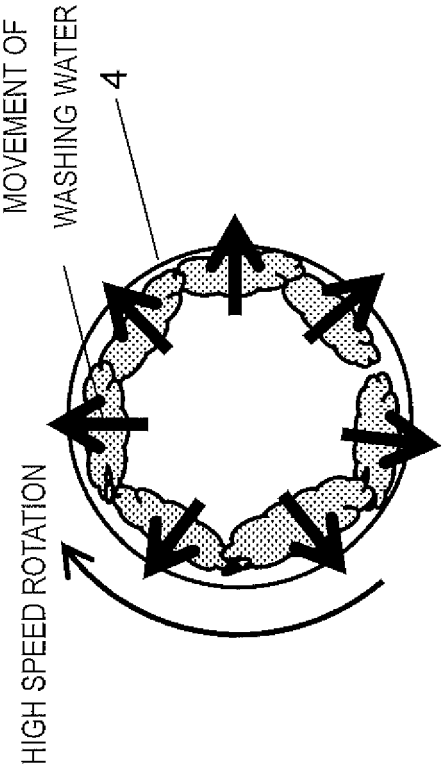


FIG. 7A

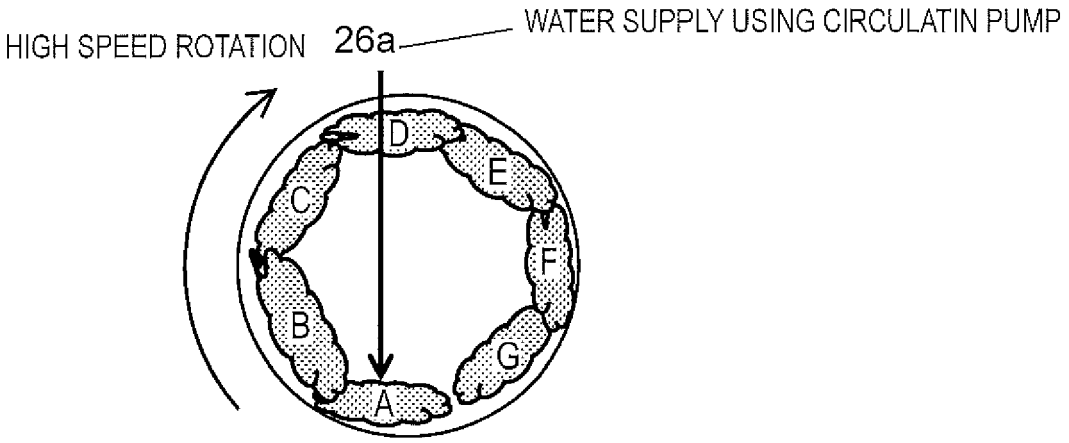

HIGH SPEED ROTATION
26a
WATER SUPPLY USING CIRCULATIN PUMP
A
B
C
D
E
F
G

FIG. 7B

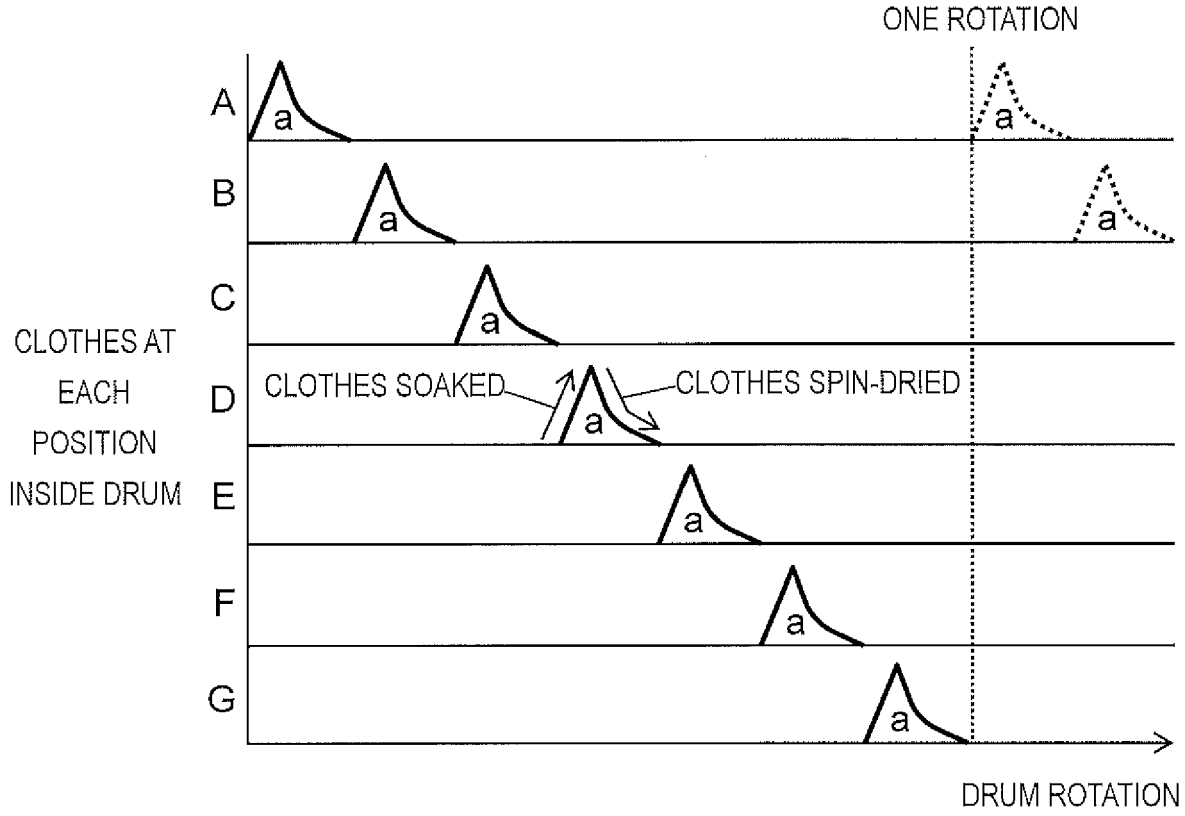

ONE ROTATION
A
B
C
D
E
F
G
a
CLOTHES AT EACH POSITION INSIDE DRUM
CLOTHES SOAKED
CLOTHES SPIN-DRIED
DRUM ROTATION

FIG. 8A

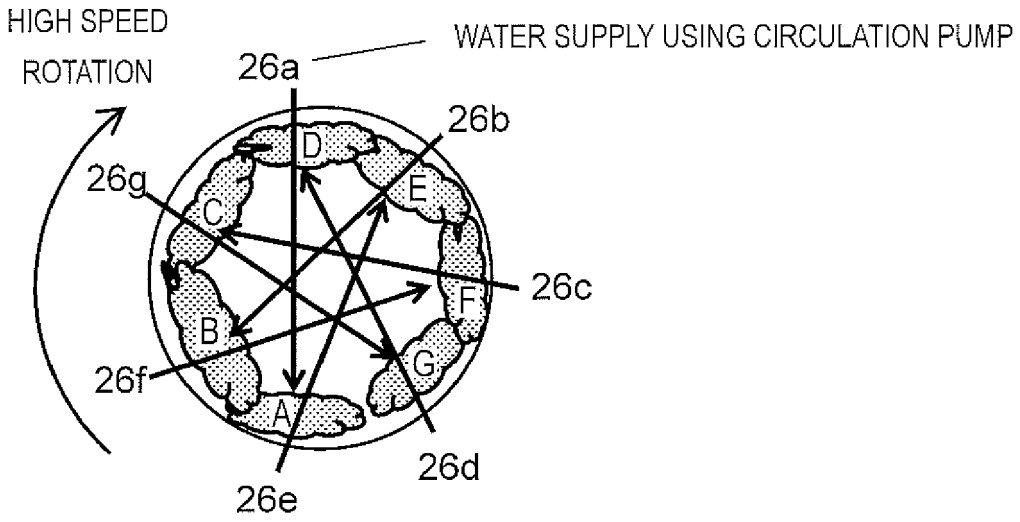
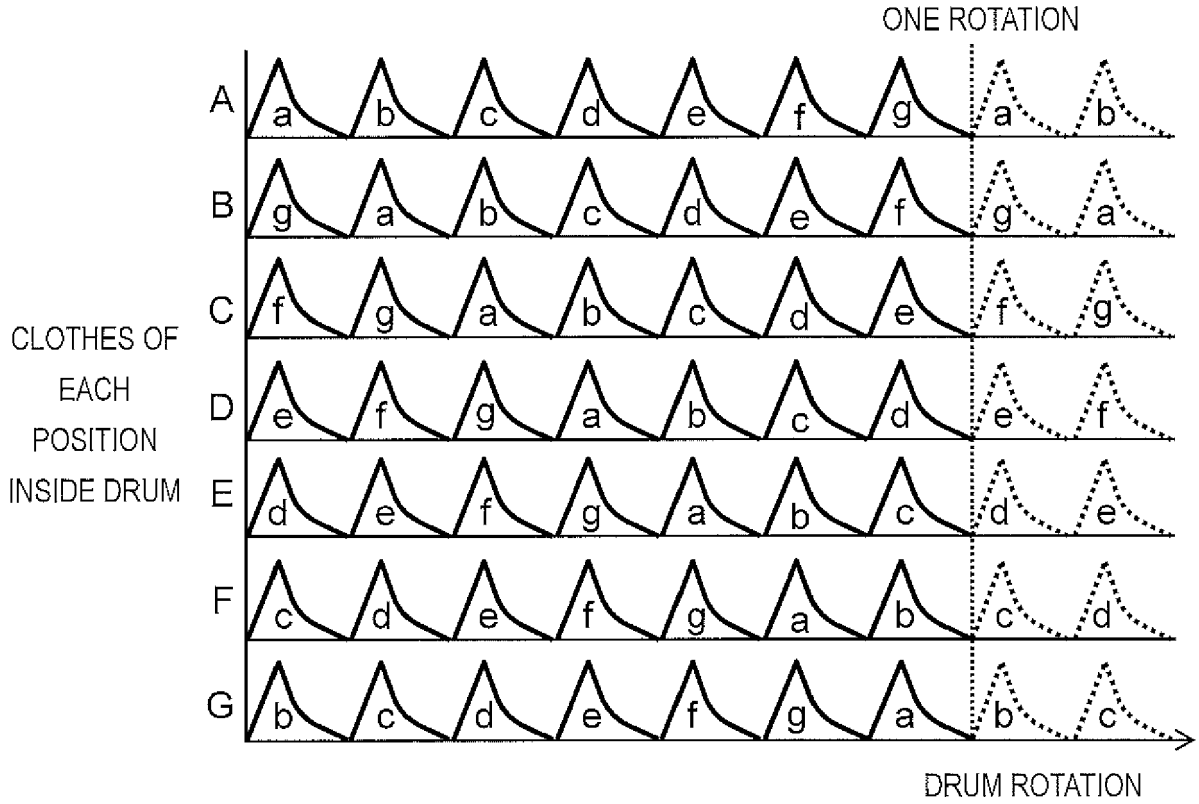

HIGH SPEED
ROTATION
WATER SUPPLY USING CIRCULATION PUMP
26a
26b
26c
26d
26e
26f
26g
A
B
C
D
E
F
G

FIG. 8B


ONE ROTATION
CLOTHES OF EACH POSITION INSIDE DRUM
A
B
C
D
E
F
G
DRUM ROTATION

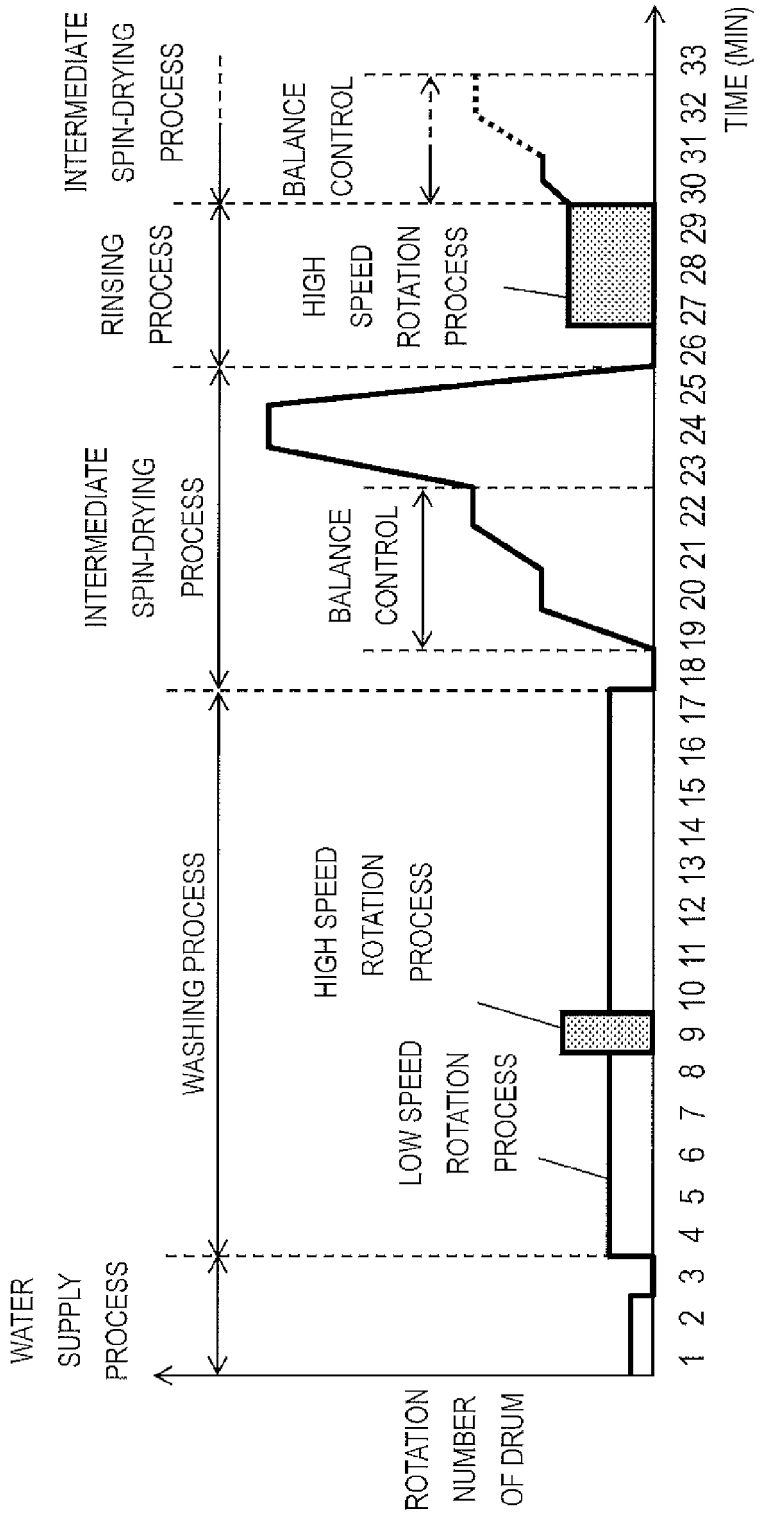

WATER SUPPLY PROCESS
WASHING PROCESS
INTERMEDIATE SPIN-DRYING PROCESS
RINSING PROCESS
INTERMEDIATE SPIN-DRYING PROCESS
LOW SPEED ROTATION PROCESS
HIGH SPEED ROTATION PROCESS
BALANCE CONTROL
HIGH SPEED ROTATION PROCESS
BALANCE CONTROL
ROTATION NUMBER OF DRUM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
TIME (MIN)

FIG. 9A

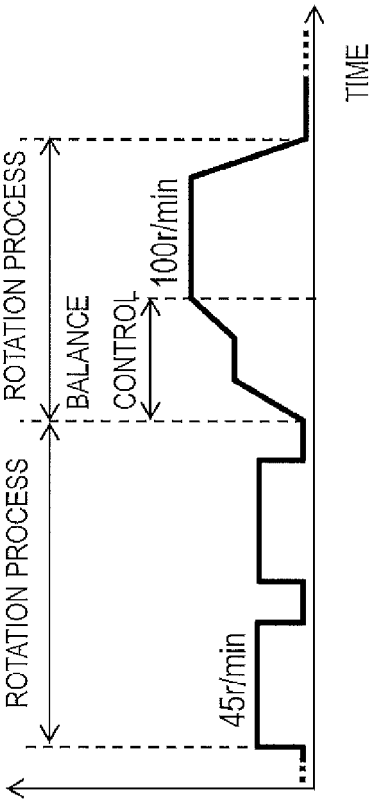

LOW SPEED ROTATION PROCESS
HIGH SPEED ROTATION PROCESS
BALANCE CONTROL
45r/min
100r/min
ROTATION NUMBER OF DRUM
TIME

FIG. 9B

FIG. 10A

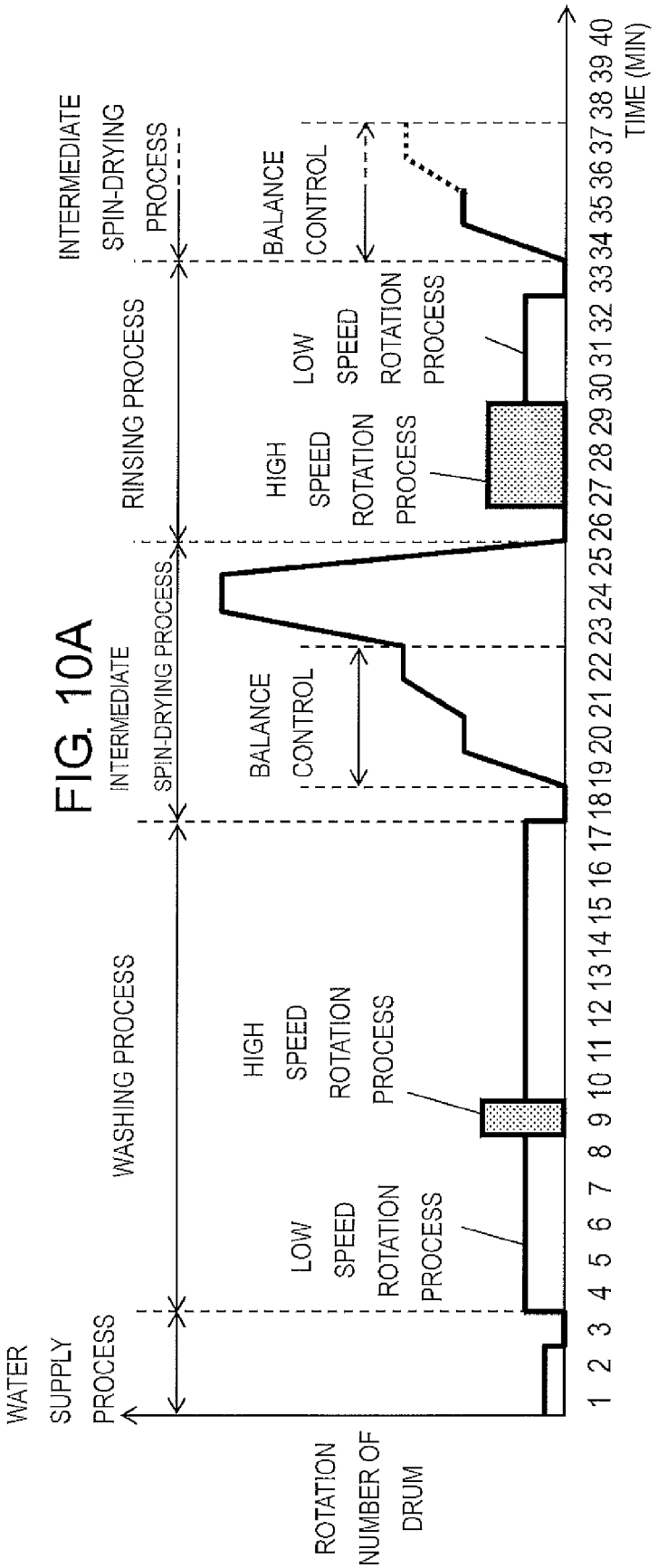
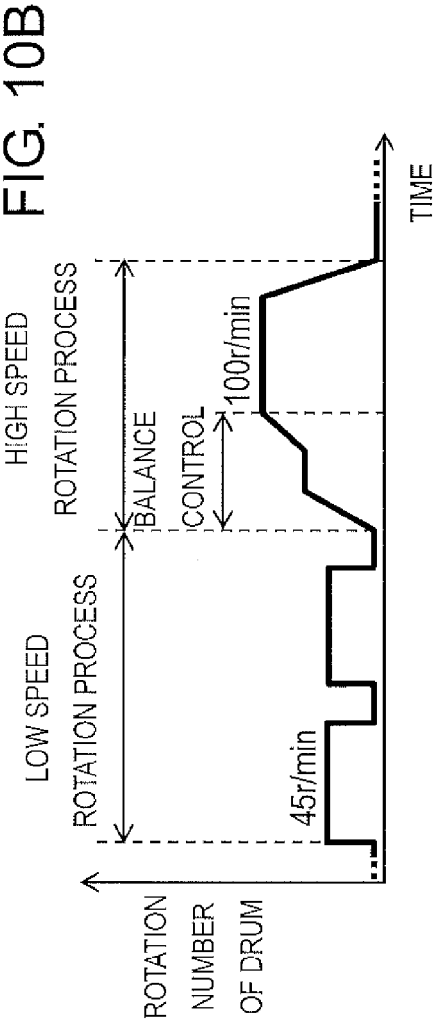


FIG. 10B



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 19 0281

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2011/154580 A1 (KIM CHANGOH [KR] ET AL) 30 June 2011 (2011-06-30) * paragraphs [0032] - [0035] * * paragraph [0041] * * paragraphs [0047] - [0048] * * paragraphs [0141] - [0146] * * paragraphs [0170] - [0172] * * paragraphs [0186] - [0187] * * figures 1-3, 10 * -----	1-3	INV. D06F35/00
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TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 December 2013	Weidner, Maximilian

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 19 0281

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