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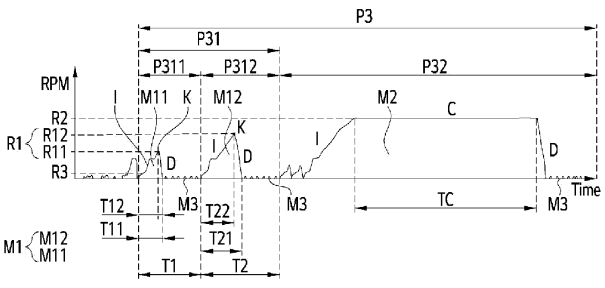
(54) CLOTHING PROCESSING APPARATUS AND CONTROL METHOD THEREFOR

(57) A laundry treating apparatus (clothing processing apparatus) and a control method for the same are disclosed, and the laundry treatment apparatus according to an embodiment of the present invention comprises: a cabinet; a tub; a drum; and a control unit provided to control rotation of the drum and perform a spin-drying cycle of clothes, wherein: the spin-drying cycle includes a first spin-drying cycle and a second spin-drying cycle; in the first spin-drying cycle, the rpm of the drum decreases immediately after increasing up to a peak rpm set in the control unit, so as to perform a peak motion of the drum; and in the second spin-drying cycle, the rpm of the drum increases up to a hold rpm set in the control unit, is kept at the hold rpm for a predetermined time, and then decreases, so as to perform a hold motion of the drum.

【FIG. 7】



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Description

[Technical Field]

[0001] The present disclosure relates to a laundry treatment apparatus and a method for controlling the same, and more particularly to a laundry treatment apparatus for performing a dehydration cycle to remove moisture from clothes.

[Background Art]

[0002] A laundry treatment apparatus may refer to an apparatus for washing laundry, an apparatus for drying wet or washed laundry, and/or an apparatus for performing washing and drying of laundry. The laundry treatment apparatus may conceptually include a washing machine for washing laundry, a dryer for drying wet or washed laundry, a refresher (styler) for deodorizing and refreshing laundry, and the like.

[0003] The laundry treatment apparatuses can be classified into a front-loading type laundry treatment device in which laundry is put into a drum through an inlet provided at a front surface of the front-loading type laundry treatment device, and a top-loading type laundry treatment device in which laundry is put into a drum through an inlet provided at a top surface of the top-loading type laundry treatment device.

[0004] The washing machine, etc. that performs a washing cycle for laundry can remove contamination from the laundry (e.g., clothes, bedding, etc.) placed in the drum. The washing cycle for laundry may include a washing cycle, a rinsing cycle, a dehydration cycle, a drying cycle, and the like.

[0005] The dehydration cycle for laundry may be performed to remove moisture from the laundry. In more detail, the dehydration cycle for laundry may remove moisture from the laundry in a physical manner by providing centrifugal force to the laundry through rotation of the drum.

[0006] The related art "Korean Patent Laid-Open Publication No. 10-1997-0011147 A1" has disclosed a laundry treatment apparatus that performs a dehydration cycle. The laundry treatment apparatus disclosed in the above related art removes moisture from laundry through high-speed rotation of the drum.

[0007] However, rotation of the drum to remove moisture from clothes may cause a fabric attachment phenomenon in which clothes adhere (or stick) to an inner circumferential surface of the drum and have difficulty falling off the inner circumferential surface of the drum.

[0008] Specifically, centrifugal force generated when the drum rotates during the dehydration cycle may act as force to push the clothes inside the drum in a radial direction of the drum. That is, the clothes may be pressed toward the inner circumferential surface of the drum by centrifugal force.

[0009] Moisture present in clothes may have viscosity due to surface tension, etc., and characteristics of such moisture may cause fabric attachment between the inner circumferential surface of the drum and the clothes.

[0010] Additionally, tangles between clothes may occur during rotation of the drum, which may further aggravate the fabric attachment phenomenon. Furthermore, a plurality of through-holes for allowing water to pass therethrough may exist on the circumferential surface of the drum, and during the dehydration cycle, fibers, etc. constituting clothes may be deformed and left inserted into the through-holes, resulting in occurrence of the fabric attachment phenomenon.

[0011] Meanwhile, the fabric attachment phenomenon caused by the dehydration cycle may hinder smooth discharge of moisture separated from the clothes, and may cause inconvenience to the user who desires to take out the clothes from the drum after completion of the treating process of the clothes.

[0012] Furthermore, the laundry treatment apparatus may further perform a drying cycle after the dehydration cycle. The drying cycle is a cycle that removes moisture through gasification of moisture by applying heat to the inside of the drum. The surface area of the clothes to which heat is provided may act as an important factor of the drying efficiency according to the drying cycle.

[0013] As the fabric attachment phenomenon of clothes becomes more severe due to the dehydration cycle, the surface area for heat to be applied to the entire clothes or the surface area for moisture to vaporize decreases, and thus the drying efficiency can be greatly reduced.

[0014] Therefore, important tasks of the present disclosure are to increase the dehydration efficiency of the dehydration cycle by minimizing the fabric attachment phenomenon of clothes during the dehydration cycle, to reduce user inconvenience, and to effectively improve the drying efficiency of the drying cycle that can be performed after the dehydration cycle.

[Disclosure]

[Technical Problem]

[0015] An object of the present disclosure is to provide a laundry treatment apparatus capable of effectively performing a dehydration cycle of clothes, and a method for controlling the same.

[0016] Another object of the present disclosure is to provide a laundry treatment apparatus capable of effectively improving the fabric attachment phenomenon of clothes during a dehydration cycle, and a method for controlling the same.

[0017] Another object of the present disclosure is to provide a laundry treatment apparatus capable of effectively improving the dehydration efficiency of the dehydration cycle, and a method for controlling the same.

[0018] Another object of the present disclosure is to provide a laundry treatment apparatus for allowing a user

to conveniently withdraw clothes from a drum thereof after completion of the dehydration cycle, and a method for controlling the same.

[0019] Another object of the present disclosure is to provide a laundry treatment apparatus capable of effectively improving the drying efficiency in the drying cycle to be performed after the dehydration cycle, and a method for controlling the same.

[Technical Solutions]

[0020] In accordance with an embodiment of the present disclosure, a laundry treatment apparatus may perform a first dehydration cycle and a second dehydration cycle from among the entire dehydration cycle. A peak motion of the drum may be performed in the first dehydration cycle, and a maintenance motion of the drum may be performed in the second dehydration cycle.

[0021] In the peak motion of the drum, based on a maximum RPM of the drum, the RPM of the drum may increase to the maximum RPM before reaching the maximum RPM, and may then decrease from the maximum RPM after reaching the maximum RPM.

[0022] That is, in the peak motion of the drum, the RPM of the drum may be a motion in which the drum is decelerated again after instantaneously reaching the maximum RPM through rotational acceleration. In the peak motion of the drum, the maintenance time of the maximum RPM is omitted, so that centrifugal force acting on the clothes and the fabric attachment phenomenon caused by the centrifugal force can be minimized.

[0023] The maintenance motion of the drum may be a motion in which the maximum RPM of the drum is maintained for a predetermined time. That is, in the maintenance motion, the RPM of the drum may increase toward the maximum RPM, the maximum RPM may be maintained for a predetermined time, and the RPM of the drum may decrease again after lapse of the predetermined time.

[0024] That is, the maintenance of the drum is a motion in which the maximum RPM of the drum is maintained for a predetermined time, and thus the dehydration effect on the clothes may be maximized.

[0025] According to an embodiment of the present disclosure, in a state in which the deformability of the clothes is high due to the excessive amount of moisture contained in the clothes, deformation of the clothes (i.e., the fabric attachment phenomenon of the clothes) can be minimized and at the same time the moisture can be removed from the clothes. When the moisture contained in the clothes is reduced to a preset level, the moisture removal rate of the clothes is maximized through the maintenance motion of the drum, thereby suppressing the fabric attachment phenomenon.

[0026] The laundry treatment apparatus according to an embodiment of the present disclosure may include a cabinet, a tub, a drum, and a controller. The tub may be provided in the cabinet to accommodate water, the drum may be rotatably provided in the tub to accommodate clothes, and a plurality of through-holes through which water accommodated in the tub passes may be formed.

[0027] The control unit may be provided to control the rotation of the drum and to perform dehydration of the clothes.

[0028] The dehydration cycle may include a first dehydration cycle and a second dehydration cycle. In the first dehydration cycle, the RPM of the drum may increase to a peak RPM set in the control unit, may decrease from the peak RPM, so that a peak motion of the drum can be performed.

[0029] In the second dehydration cycle, the RPM of the drum may increase to the maintenance RPM set in the control unit, may maintain the maintenance RPM for a predetermined time, and may then decrease from the maintenance RPM, so that the maintenance motion of the drum can be performed.

[0030] The drive unit may be provided inside the cabinet and connected to the drum to provide rotational force. The control unit may control the drive unit to adjust the RPM of the drum.

[0031] In the first dehydration cycle, the control unit may control the rotation of the drum to sequentially perform a first acceleration period and a first deceleration period, wherein the first acceleration period is performed such that the RPM of the drum increases to the peak RPM; and the first deceleration period is performed after the first acceleration period such that the RPM of the drum reaches the peak RPM and at the same time decreases from the peak RPM.

[0032] In the second dehydration cycle, the control unit controls the rotation of the drum to sequentially perform a second acceleration period, a maintenance period, and a second deceleration period, wherein the second acceleration period is performed such that the RPM of the drum increases to the maintenance RPM; the maintenance period is performed after the second acceleration period such that the RPM of the drum is kept at the maintenance RPM; and the second deceleration period is performed after the maintenance period such that the RPM of the drum decreases from the maintenance RPM.

[0033] The maintenance RPM may have a higher value than the peak RPM. In the first dehydration cycle, the drum may repeatedly perform a fabric untangling motion after completion of the peak motion. In the fabric untangling motion, the drum may rotate at a fabric untangling RPM lower than the peak RPM and then stops rotation.

[0034] The first dehydration cycle may include a (1-1)st dehydration cycle and a (1-2)nd dehydration cycle. In the (1-1)st dehydration cycle, the RPM of the drum may decrease immediately after rising to the first peak RPM so that a first peak motion of the drum is performed; and in the (1-2)nd dehydration cycle, the RPM of the drum may decrease immediately after rising to the second peak RPM different from the first peak RPM so that a second peak motion of the drum is performed.

[0035] The second peak RPM may be set to have a

higher value than the first peak RPM. The maintenance RPM may be set to have a higher value than the second peak RPM.

[0036] In the (1-1)st dehydration cycle, after completion of the first peak motion, the drum may repeatedly perform a fabric untangling motion in which the drum rotates at a fabric untangling RPM lower than the first peak RPM and then stops rotation.

[0037] The control unit may control the rotation of the drum such that the drum performs the fabric untangling motion after performing each of the first peak motion, the second peak motion, and the maintenance motion.

[0038] The control unit may set the first peak RPM so that a moisture content of the clothes is within a predetermined first range in a situation in which the drum rotates at the first peak RPM in the (1-1)st dehydration cycle.

[0039] The control unit may set the second peak RPM so that the moisture content of the clothes is within a second range lower than the first range in a situation in which the drum rotates at the second peak RPM in the (1-2)nd dehydration cycle.

[0040] A measurement unit may be provided in the cabinet to measure the moisture content of the clothes. The control unit may recognize the moisture content of the clothes through a value measured by the measurement unit.

[0041] The control unit may adjust the peak RPM according to a moisture content of the clothes, and may set a constant maintenance RPM regardless of the moisture content of the clothes. The predetermined time during which the maintenance RPM may be maintained in the second dehydration cycle is set to be longer than an execution time of the first peak motion or an execution time of the second peak motion.

[0042] The predetermined time during which the maintenance RPM is maintained in the second dehydration cycle may be set to be longer than an execution time of the (1-1)st dehydration cycle or an execution time of the (1-2)nd dehydration cycle.

[0043] A time taken for the RPM of the drum to reach the first peak RPM in the (1-1)st dehydration cycle may be shorter than a time taken for the RPM of the drum to reach the second peak RPM in the (1-2)nd dehydration cycle.

[0044] A drying unit may be provided in the cabinet to increase a temperature inside the tub. The control unit may be provided to perform a drying cycle for the clothes after completion of the dehydration cycle.

[0045] In accordance with another embodiment of the present disclosure, a method for controlling the laundry treatment apparatus may include a first dehydration cycle performing step and a second dehydration cycle performing step. In the first dehydration cycle performing step, the RPM of the drum may increase to a peak RPM set in the control unit and may then decrease from the peak RPM, so that a peak motion of the drum is performed.

[0046] In the second dehydration cycle performing step, the RPM of the drum may increase to a maintenance RPM set in the control unit, may maintain the maintenance RPM for a predetermined time, and may then decrease from the maintenance RPM, so that a maintenance motion of the drum is performed.

[0047] The first dehydration cycle may include a (1-1)st dehydration cycle performing step and a (1-2)nd dehydration cycle performing step. In the (1-1)st dehydration cycle performing step, the RPM of the drum may decrease immediately after rising to a first peak RPM so that a first peak motion of the drum is performed. In the (1-2)nd dehydration cycle performing step, the RPM of the drum may decrease immediately after rising to the second peak RPM higher than the first peak RPM so that a second peak motion of the drum is performed.

[0048] The control unit may control the rotation of the drum to perform a fabric untangling motion in which the drum rotates at a fabric untangling RPM lower than the first peak RPM after completion of each of the first peak motion, the second peak motion, and the maintenance motion, and then stops rotation.

[Advantageous Effects]

[0049] As is apparent from the above description, the embodiments of the present disclosure may provide the laundry treatment apparatus capable of effectively performing a dehydration cycle of clothes, and a method for controlling the same.

[0050] The embodiments of the present disclosure may provide the laundry treatment apparatus capable of effectively improving the fabric attachment phenomenon of clothes during a dehydration cycle, and a method for controlling the same.

[0051] The embodiments of the present disclosure may provide the laundry treatment apparatus capable of effectively improving the dehydration efficiency of the dehydration cycle, and a method for controlling the same.

[0052] The embodiments of the present disclosure may provide the laundry treatment apparatus for allowing a user to conveniently withdraw clothes from a drum thereof after completion of the dehydration cycle, and a method for controlling the same.

[0053] The embodiments of the present disclosure may provide the laundry treatment apparatus capable of effectively improving the drying efficiency in the drying cycle to be performed after the dehydration cycle, and a method for controlling the same.

[Description of Drawings]

[0054]

FIG. 1 is a front perspective view illustrating the interior of a laundry treatment apparatus according to an embodiment of the present disclosure.

FIG. 2 is a rear perspective view illustrating the interior of the laundry treatment apparatus according

to an embodiment of the present disclosure.

FIG. 3 is a cross-sectional view illustrating the interior of the laundry treatment apparatus according to an embodiment of the present disclosure.

FIG. 4 is a flowchart illustrating a laundry treatment method according to an embodiment of the present disclosure.

FIG. 5 is a flowchart illustrating a dehydration cycle of clothes according to an embodiment of the present disclosure.

FIG. 6 is a graph showing changes in drum RPM during the dehydration cycle from which a peak motion of a drum is omitted according to an embodiment of the present disclosure.

FIG. 7 is a graph showing changes in drum RPM during the dehydration cycle including the peak motion of the drum according to an embodiment of the present disclosure.

FIG. 8 is a diagram conceptually classifying moisture contained in clothes into a plurality of moisture types according to an embodiment of the present disclosure.

FIG. 9 is a diagram schematically illustrating clothes caught in a through-hole of a drum during the dehydration cycle according to an embodiment of the present disclosure.

FIG. 10 is a graph showing whether the fabric attachment phenomenon occurs according to changes in first peak RPM during the (1-1)st dehydration cycle according to an embodiment of the present disclosure.

FIG. 11 is a graph showing whether the fabric attachment phenomenon occurs according to changes in second peak RPM during the (1-2)nd dehydration cycle according to an embodiment of the present disclosure.

FIG. 12 is a graph showing changes in moisture content of clothes according to a maintenance time of a maintenance RPM during the second dehydration cycle according to an embodiment of the present disclosure.

FIG. 13 is a flowchart illustrating a method for controlling the laundry treatment apparatus according to an embodiment of the present disclosure.

[Best Mode]

[0055] Hereinafter, embodiments of the present disclosure will be described in detail with reference to the accompanying drawings so that the present disclosure may be easily realized by those skilled in the art.

[0056] However, the present disclosure may be achieved in various different forms and is not limited to the embodiments described herein. In the drawings, parts that are not related to a description of the present disclosure are omitted to clearly explain the present disclosure and similar reference numbers will be used throughout this specification to refer to similar parts.

[0057] In the present specification, redundant descriptions of the same components are omitted.

[0058] It will be understood that, when an element is referred to as being "connected to" another element, the element can be connected to the other element or intervening elements may also be present. In contrast, when an element is referred to as being "directly connected to" another element, there are no intervening elements present.

[0059] Specific terminology used in this specification is only for convenience of description and is not intended to be limiting of the illustrative embodiments.

[0060] A singular representation may include a plural representation unless it represents a definitely different meaning from the context.

[0061] In description of the present disclosure, the terms "comprising," "including," and "having" shall be understood to designate the presence of particular features, numbers, steps, operations, elements, parts, or combinations thereof, but not to preclude the presence or addition of one or more other features, numbers, steps, operations, elements, parts, or combinations thereof.

[0062] In description of the present disclosure, the term "and/or" may include a combination of a plurality of items or any one of a plurality of listed items. For example, "A or B" may include "only A", "only B", and/or "both A and B".

[0063] FIG. 1 is a front perspective view illustrating the interior of a laundry treatment apparatus 1 according to an embodiment of the present disclosure. Referring to FIG. 1, the laundry treatment apparatus 1 may include a cabinet 10, and the cabinet 10 may provide a space in which a tub 20 and a drum 30 are arranged.

[0064] The cabinet 10 may include a space therein, may surround the space, and may be separated from the outside. As can be seen from FIG. 1, the cabinet 10 is shown in a transparent manner to show the inside of the laundry treatment apparatus 1.

[0065] The cabinet 10 may form exterior appearance of the laundry treatment apparatus 1 and may include an inlet through which clothes are put into the drum. FIG. 1 shows the cabinet 10 with the inlet that is provided toward a user. That is, the inlet of the cabinet 10 may be provided in a forward direction.

[0066] The tub 20 may be provided inside the cabinet 10 and may store water therein. The tub 20 may include a tub opening 25 that opens toward the inlet. The tub opening 25 may communicate with the inlet so that clothes put into the drum by the user can be delivered into the tub 20.

[0067] The water supply unit 40 may receive water by connecting to an external water supply source located outside the cabinet 10. The water supply unit 40 may supply water directly to the tub 20 or may supply water to the tub 20 through a detergent supply unit 70. A drain unit 50 may be provided to selectively discharge water stored in the tub 20 to the outside of the tub 20.

[0068] The drum 30 may be provided inside the tub 20. The drum 30 may be installed to be rotatable, and may

be rotated by receiving rotational force from a drive unit 80 to be described later. The drum 30 may be provided to accommodate clothes within the tub 20.

[0069] The drum 30 may include a drum opening 35 facing the tub opening 25. Clothes introduced into the drum 30 through the inlet of the cabinet 10 may pass through the tub opening 25 and the drum opening 35, and may thus be accommodated in the drum 30.

[0070] Each of the tub 20 and the drum 30 may have a cylindrical shape, and each of the tub opening 25 and the drum opening 35 may be open in a forward direction. That is, the laundry treatment apparatus according to the embodiment of the present disclosure may be a front-loading laundry treatment apparatus in which a rotary shaft of the drum 30 is approximately parallel to the ground and the drive unit 80 is disposed at the rear of the tub 20. However, the scope or spirit of the present disclosure is not limited thereto, and the laundry treatment apparatus may also be implemented as a top-loading type laundry treatment apparatus as needed.

[0071] The laundry treatment apparatus according to the embodiment of the present disclosure may include a drying unit 90 as needed. That is, the laundry treatment apparatus 1 may be provided not only to perform the washing cycle P1 and the rinsing cycle P2 of clothes using water, but also to perform the drying cycle P4 for vaporizing and removing moisture contained in the clothes by supplying heat to the inside of the tub 20 or the drum 30.

[0072] The laundry treatment apparatus according to the embodiment of the present disclosure may include a control unit 100. The control unit 100 may be connected to various components (e.g., the water supply unit 40, the drive unit 80, the drain unit 50, the drying unit 90, etc.) and may control the above-described components. The number of the control units 100 and the positions of the control units 100 may be changed in various ways.

[0073] The control unit 100 may pre-store information about execution of the washing cycle P1, the rinsing cycle P2, the dehydration cycle P3, and/or the drying cycle P4, and may perform at least one cycle according to a user's request, etc.

[0074] The cabinet 10 may be provided with a control panel 60. The control panel 60 may be provided with a plurality of buttons that can be operated by the user, and may include a screen output unit capable of displaying visual information and/or a sound output unit capable of outputting auditory information.

[0075] The control panel 60 may be connected to the control unit 100, and the control panel 60 may transmit an operation signal generated by user manipulation to the control unit 100, and the control unit 100 may perform the laundry treating process based on the operation signal. The control unit 100 may provide information about the laundry treating process to the user through the control panel 60.

[0076] FIG. 2 is a rear perspective view illustrating the interior of the laundry treatment apparatus 1 according to an embodiment of the present disclosure.

[0077] The water supply unit 40 may be disposed at the rear side of the cabinet 10. The water supply unit 40 may penetrate a rear panel of the cabinet 10 and may be connected to the external water supply source. The detergent supply unit 70 may include a space where detergent is stored, and may deliver the detergent into the tub 20 together with water supplied from the water supply unit 40.

[0078] The drying unit 90 may serve as a means for supplying heat to the inside of the tub 20 and may be provided in various types and shapes. Referring to FIG. 2, the drying unit 90 according to an embodiment of the present disclosure may supply heated air (i.e., hot air) into the tub 20 and/or the drum 30.

[0079] The drying unit 90 may suction and heat air inside or outside the tub 20, and may supply the heated air to the inside of the tub 20. The drying unit 90 may include a blower unit 92 including a motor and a fan so as to allow hot air to flow, may include a flow channel 94 through which air flows, and may include a heater 96 for heating the air flowing through the flow channel 94.

[0080] An outlet of the flow channel 94 may communicate with the inside of the tub 20, so that hot air can be supplied into the tub 20. Thereafter, the drying cycle P4 may be performed by evaporating and removing moisture from the clothes heated by the hot air.

[0081] FIG. 3 is a cross-sectional view illustrating the interior of the laundry treatment apparatus 1 according to an embodiment of the present disclosure.

[0082] Referring to FIG. 3, the water supply unit 40 described above may be connected to the external water supply source to receive water, may control flow of water through a water supply valve 42, may allow water to flow through a water supply pipe 44, may finally supply the water to the tub 20.

[0083] The detergent supply unit 70 may be connected to the water supply unit 40 through the water supply pipe 44 or the like. The detergent supply unit 70 may store detergent for the washing cycle P1 of clothes. The detergent supply unit 70 may simultaneously supply water and detergent delivered from the water supply unit 40 to the inside of the tub 20.

[0084] The tub 20 may contain water therein, and may include a tub opening 25 that opens toward the inlet of the cabinet 10. The tub 20 may include a front surface of the tub 20, a circumferential surface of the tub 20, and a rear surface of the tub 20, and the tub opening 25 may be located at the front surface of the tub 20.

[0085] The laundry treatment apparatus according to the embodiment of the present disclosure may include a gasket 18 for sealing between the inlet and the tub opening 25. The gasket 18 may prevent water contained in the tub 20 from leaking to the outside of the tub 20 through the tub opening 25.

[0086] The cabinet 10 may be provided with a door 15. The door 15 may be rotatably provided on the front surface of the cabinet 10 and may be provided to open and

close the inlet depending on the rotation position thereof.

[0087] The tub opening 25 may be blocked from the outside of the tub 20 by the door 15 and the gasket 18. Accordingly, water can be prevented from leaking to the outside through the tub opening 25 in a state in which the tub 20 stores water in the washing cycle P1 or the like.

[0088] The drum 30 may be provided inside the tub 20 and may be provided to be rotatable with a rotary shaft substantially parallel to the ground. However, if necessary, the rotary shaft may also be defined to be inclined upward as it approaches the front surface of the drum 30.

[0089] The drum 30 may include a front surface of the drum 30, a circumferential surface of the drum 30, and a rear surface of the drum 30. The front surface of the drum 30 and the rear surface of the drum 30 may be connected through the circumferential surface of the drum 30. The drum opening 35 described above may be located at the front surface of the drum 30, and a plurality of through-holes 38 may be formed at the circumferential surface of the drum 30 to allow the water contained in the tub 20 to pass therethrough.

[0090] Accordingly, when water is stored in the tub 20, water may also exist in the drum 30, and clothes accommodated in the drum 30 may be submerged in water. The drive unit 80 may be fixed to the tub 20 or the cabinet 10, and a drive shaft of the drive unit 80 may be connected to the rear surface of the drum 30 by penetrating the rear surface of the tub 20.

[0091] The drain unit 50 may include a drain pipe 54 connected to the tub 20, and may include a drain pump 52 that generates flow of water discharged from the tub 20. The drying unit 90 may discharge the air inside the tub 20 to the outside, may heat the air, and may supply hot air back into the tub 20.

[0092] Meanwhile, FIG. 4 conceptually illustrates a plurality of cycles included in the laundry treating process according to the embodiment of the present disclosure. The laundry treating process may include at least one of a washing cycle P1, a rinsing cycle P2, a dehydration cycle P3, and a drying cycle P4.

[0093] The plurality of cycles may be performed by the control unit 100. The control unit 100 may control the water supply unit 40 and the detergent supply unit 70 in the washing cycle P1 to supply water and detergent into the tub 20, may control the drive unit 80 to rotate the drum 30, and may thus remove contaminants from clothes.

[0094] In the rinsing cycle P2, the control unit 100 may control the water supply unit 40 to supply water into the tub 20 to separate detergent and contaminants from the clothes, and may control the drain unit 50 to discharge water including contaminants to the outside of the tub 20.

[0095] In the dehydration cycle P3, the control unit 100 may control rotation of the drum 30 and may perform dehydration of the clothes. In the dehydration cycle P3, the control unit 100 may control the drive unit 80 to rotate the drum 30, and centrifugal force can be applied to clothes accommodated in the drum 30 by rotation of the drum 30. The moisture contained in the clothes can be separated from the clothes by the centrifugal force.

[0096] In the dehydration cycle P3, moisture separated from the clothes may move to the outside of the drum 30 through the through-hole 38 of the drum 30, and may move to the outside of the tub 20 through the drain unit 50.

[0097] In the drying cycle P4, the control unit 100 may control the drying unit 90 to supply heat to the inside of the tub 20, and as a result, the moisture contained in the clothes may be heated to cause phase change thereof and hot air obtained by such phase change of the moisture may move to the atmosphere, thereby removing such moisture from the clothes.

[0098] Although the above-mentioned drying unit 90 is designed based on a method of raising temperature of the air inside the tub 20 using the heater 96 for heating the air inside the tub 20 through electric power and supplying the hot air back into the tub 20, the scope or spirit of the present disclosure is not limited thereto. If necessary, the drying unit 90 may include a heat-pump type heater 96 designed to use fluid for air heating, and/or may directly heat the inside of the tub 20 without using air as a medium.

[0099] FIG. 5 conceptually illustrates the dehydration cycle P3 according to an embodiment of the present disclosure. According to the embodiment of the present disclosure, the dehydration cycle P3 may include a first dehydration cycle P31 and a second dehydration cycle P32. The first dehydration cycle P31 may include a (1-1)st dehydration cycle P311 and a (1-2)nd dehydration cycle P312.

[0100] In the first dehydration cycle P31, the RPM of the drum 30 may increase to a peak RPM (R1) set in the control unit 100, and may decrease from the peak RPM (R1), so that a peak motion M1 of the drum 30 may be performed.

[0101] In addition, in the second dehydration cycle P32, the RPM of the drum 30 may increase to a maintenance RPM (R2) set in the control unit 100, may maintain the maintenance RPM (R2) for a predetermined time (TC), and may then decrease from the maintenance RPM (R2), so that a maintenance motion M2 of the drum can be performed.

[0102] According to the embodiment of the present disclosure, the drive unit 80 may be provided inside the cabinet 10, and may be connected to the drum 30 to generate rotational force. The control unit 100 may control the drive unit 80 during the dehydration cycle P3, thereby adjusting the RPM of the drum 30.

[0103] FIG. 6 is a graph showing changes in drum RPM during the dehydration cycle P3 from which the peak motion M1 of the drum is omitted according to an embodiment of the present disclosure. Referring to FIG. 6, the horizontal axis may represent a time axis, and the vertical axis may represent the RPM of the drum 30.

[0104] The dehydration cycle P3 may be performed after the washing cycle P1 and the rinsing cycle P2. In the dehydration cycle (P3), as the drum 30 rotates, mois-

ture can be separated and removed from clothes using centrifugal force.

[0105] The dehydration cycle P3 may include an acceleration period (I), a maintenance period (C), and a deceleration period (D) of the RPM of the drum 30. In the dehydration cycle P3, the motion of the drum 30 may be performed while including at least one of the acceleration period (I), the maintenance period (C), and the deceleration period (D).

[0106] In the acceleration period (I), the RPM of the drum 30 may gradually increase. In the acceleration period (I), the control unit 100 may control the drive unit 80 to increase the RPM of the drum 30. In the maintenance period (C), the RPM of the drum 30 can be kept constant. In the maintenance period (C), the control unit 100 may control the drive unit 80 to keep the RPM of the drum 30 constant. In the deceleration period (D), the drum's RPM may gradually decrease. In the deceleration period (D), the control unit 100 may control the drive unit 80 to reduce the RPM of the drum 30. In the deceleration period D, the RPM of the drum 30 may be gradually reduced. In the deceleration period (D), the control unit (100) controls the drive unit (80) to reduce the RPM of the drum 30.

[0107] In the dehydration cycle P3, dehydration of clothes may be performed through the drum's motion including high RPM rotation. However, as a maintenance time of the maintenance period (C) in which a relatively high RPM is maintained for dehydration of clothes increases, there is a higher possibility of causing the fabric attachment phenomenon of clothes.

[0108] Clothes containing moisture may increase the ease of deformation of the fibers (F). That is, clothes having a moisture content of at least a predetermined level can easily cause changes in the fibers (F) by external pressurization, and can be easily attached to the circumferential surface of the drum 30 by centrifugal force.

[0109] In the present disclosure, the fabric attachment phenomenon means that clothes are attached to the circumferential surface of the drum 30 by centrifugal force generated by the drum 30 so that the clothes cannot easily drop from the circumferential surface of the drum 30.

[0110] The fabric attachment phenomenon may be caused by the ease of deformation of the clothes or may be caused by viscosity based on the surface tension of moisture contained in the clothes. The fabric attachment phenomenon may cause close contact (attachment) between the circumferential surface of the drum 30 and the clothes or may cause close contact (attachment) between the clothes. After completion of the dehydration cycle P3, the fabric attachment phenomenon may cause inconvenience to the user who desires to withdraw the clothes from the drum 30. Alternatively, the fabric attachment phenomenon may deteriorate the dehydration efficiency in the dehydration cycle P3, or may deteriorate the drying efficiency of the drying cycle P4 to be performed after the dehydration cycle P3.

[0111] Specifically, through-holes 38 may be provided on the circumferential surface of the drum 30 for water to move into and out of the drum 30. When the preset amount of clothes is attached to the circumferential surface of the drum 30, it is difficult for water to be discharged outside through the through-holes 38, so that the dehydration efficiency can be deteriorated.

[0112] In addition, when the drying cycle P4 is performed after the dehydration cycle P3, the surface area exposed to the air from clothes may affect the drying efficiency due to characteristics of the drying cycle P4 based on the phase change of moisture.

[0113] However, if the clothes become entangled with each other and come into close contact with the circumferential surface of the drum 30 due to the fabric attachment phenomenon, the exposed surface area of the clothes may be greatly reduced compared to the amount of clothes, so that it is difficult for moisture to be evaporated and gasified from clothes.

[0114] Accordingly, according to the embodiment of the present disclosure, the dehydration cycle P3 may include the first dehydration cycle P31 and the second dehydration cycle P32 in order to prevent or suppress the fabric attachment phenomenon during the dehydration cycle P3. In the first dehydration cycle P31, the peak motion M1 of the drum 30 can be performed to remove moisture from the clothes while suppressing the fabric attachment phenomenon.

[0115] FIG. 7 is a graph showing changes in drum RPM during the dehydration cycle P3 including the first dehydration cycle P31 and the second dehydration cycle P32 according to an embodiment of the present disclosure. Referring to FIG. 7, the horizontal axis may represent a time axis, and the vertical axis may represent the RPM of the drum 30.

[0116] As described above, according to the embodiment of the present disclosure, the dehydration cycle P3 may include the first dehydration cycle P31 and the second dehydration cycle P32. The peak motion M1 of the drum 30 may be performed in the first dehydration cycle P31, and the maintenance motion M2 of the drum 30 may be performed in the second dehydration cycle P32.

[0117] According to the embodiment of the present disclosure, the peak motion M1 of the drum 30 may refer to a motion in which the RPM of the drum 30 gradually increases from a stationary state or other similar states and the drum 30 reaches the maximum RPM and then decreases from the maximum RPM.

[0118] That is, in the peak motion M1 of the drum 30, the RPM of the drum 30 may gradually increase up to the maximum RPM and at the same time may decrease from the maximum RPM. In the peak motion M1 of the drum 30, the maintenance period (C) in which the maximum RPM of the drum 30 is maintained may not exist.

[0119] The peak motion M1 may have a peak point (K) at which the maximum RPM is recorded instead of the maintenance period (C). It can be understood that the maintenance time of the peak point (K) does not exist. The acceleration period (I) may exist just before the peak point (K), and the deceleration period (D) may exist im-

mediately after the peak point (K).

[0120] Here, the fact that the maintenance period (C) does not exist means that the maintenance time of the maximum RPM based on the absolute time is so short in a manner that the maintenance time (C) cannot be identified and determined, and also means that the maintenance time of the maximum RPM includes a physically unavoidable maintenance time considering the rotational inertia of the drum 30.

[0121] For example, according to the embodiment of the present disclosure, the peak RPM (R1) corresponding to the maximum RPM from among the peak motion (M1) of the drum 30 may be observed for 1 second or less, 10 seconds or less, or 1 minute or less.

[0122] According to the embodiment of the present disclosure, in order to implement the peak motion M1 of the drum 30, if the RPM of the drum 30 reaches the peak RPM (R1), the control unit 100 may not perform the action for increasing the drum's RPM or the action for maintaining the drum's RPM.

[0123] In the dehydration cycle P3, one of the important causes of the fabric attachment phenomenon may be a high-RPM maintenance state. In the initial stage of the dehydration cycle P3, clothes may contain moisture of at least a predetermined level, so that the clothes can be easily deformed in shape.

[0124] In this case, as the maintenance period (C) during which the RPM of the drum 30 is kept constant increases, the clothes are deformed into the shape of the circumferential surface of the drum 30, for example, the shape corresponding to through-holes formed on the circumferential surface of the drum 30. From a microscopic point of view, the clothes may be partially inserted into through-holes 38, so that there is a higher possibility of causing the fabric attachment phenomenon.

[0125] On the other hand, in the acceleration period (I) where the RPM of the drum 30 is accelerated to increase, the moisture separation efficiency due to a difference in inertia between moisture and clothes may be relatively high. Therefore, the laundry treatment apparatus according to the embodiment of the present disclosure may use the peak motion M1 in which the deceleration period (D) begins without passing through the maintenance period (C) after completion of the acceleration period (I) in the first dehydration cycle P31, so that the fabric attachment phenomenon can be minimized and the moisture removal rate can be increased.

[0126] On the other hand, according to the embodiment of the present disclosure, the maintenance motion M2 of the drum 30 may include a maintenance period (C) in which the maximum RPM of the drum 30 is kept constant in the corresponding cycle. That is, the control unit 100 may control the drive unit 80 to increase the RPM of the drum 30 to the maximum RPM, and may then maintain the maximum RPM for a predetermined time (TC). The control unit 100 may reduce the RPM of the drum 30 after lapse of a predetermined time (TC), resulting in implementation of the maintenance motion M2 of the drum 30.

[0127] The maintenance motion M2 of the drum 30 may be more advantageous in increasing the moisture removal efficiency (i.e., the dehumidifying efficiency) from clothes when compared to the peak motion M1 described above. For example, in the second dehydration cycle P32, the control unit 100 may sufficiently remove the moisture from clothes by increasing the RPM maintenance period (C) from among the maintenance motion M2 of the drum 30 as needed.

[0128] That is, the laundry treatment apparatus according to the embodiment of the present disclosure may suppress the fabric attachment phenomenon of clothes and remove a preset amount of moisture from clothes through the peak motion (M1) of the drum 30 in the first dehydration cycle P31. The resultant clothes in which the preset amount of moisture is dehumidified through the first dehydration cycle P31 and the deformability of clothes is sufficiently reduced may be treated in the second dehydration cycle P31 in which the dehydration is performed through the maintenance motion M2 of the drum 30, so that the fabric attachment phenomenon can be effectively suppressed in the dehydration cycle P3 and moisture can be more effectively removed from the clothes.

[0129] In the first dehydration cycle P31, the control unit 100 may sequentially execute the first acceleration period (I) and the first deceleration period (D) by controlling rotation of the drum 30. Here, the first acceleration period (I) is a period in which the RPM of the drum 30 increases to the peak RPM (R1), and the first deceleration period (D) is a period in which the RPM of the drum 30 decreases from the peak RPM (R1) of the drum 30.

[0130] The peak RPM (R1) may correspond to the maximum RPM of the drum 30 in the first dehydration cycle P31, and the value of the peak RPM (R1) may be stored as a fixed value in the control unit 100 or may be adjusted based on the moisture content and the like.

[0131] The first acceleration period (I) and the first deceleration period (D) may be performed continuously. In the peak motion M1, the maintenance period (C) of the drum 30 RPM is omitted.

[0132] Meanwhile, in the second dehydration cycle P32, the control unit 100 may sequentially execute the second acceleration period (I), the maintenance period (C), and the second deceleration period (D) by controlling rotation of the drum 30. Here, the second acceleration period (I) is a period in which the RPM of the drum 30 increases to the maintenance RPM (R2), the maintenance period (C) is a period in which the RPM of the drum 30 is kept at the maintenance RPM (R2) after completion of the second acceleration period (I), and the second deceleration period (D) is a period in which the RPM of the drum 30 decreases from the maintenance RPM (R2) after completion of the maintenance period (C).

[0133] The maintenance RPM (R2) may correspond to the maximum RPM of the drum 30 during the second dehydration cycle P32 (i.e., the maintenance motion M2

of the drum 30). The maintenance period (C) may be performed after the second acceleration period (I), and the second deceleration period (D) may be performed after the maintenance period (C), thereby implementing the maintenance motion M2.

[0134] FIG. 8 is a diagram conceptually classifying moisture contained in clothes into a plurality of moisture types according to an embodiment of the present disclosure. Referring to FIG. 8, the moisture contained in clothes during the dehydration cycle P3 may be classified into free water (FW), stagnant water (SW), and bound water (BW).

[0135] Based on the fibers (F) constituting the clothes, free moisture (FW) may be the moisture located farthest from the fibers (F), and may be easily removed from the clothes through through-holes 38 of the drum 30 during rotation of the drum 30.

[0136] Stagnant water (SW) may not have a strong binding force with the fibers (F) compared to bound water (BW), but cannot be easily moved due to arrangement of clothes and the positions of the through-holes 38 of the drum 30 and can be discharged at a predetermined RPM or higher.

[0137] Boundary moisture (BW) has a high degree of adhesion to the fibers (F) and is not easily separated by centrifugal force generated by the drum 30, etc., and can be understood as moisture that can be removed through a phase change process such as evaporation or the like.

[0138] According to the embodiment of the present disclosure, free moisture (FW) that can be easily removed from clothes can be removed as much as possible through the peak motion M1 of the first dehydration cycle P31, and the moisture content of the fibers (F) may be reduced to a predetermined level or less due to dehumidification of free moisture (FW) so that the clothes may have less deformability. Thereafter, the maintenance motion M2 of the second dehydration cycle P32 is applied to the fiber (F), so that the stagnant water (SW) or the like can be effectively removed from the clothes, thereby suppressing the fabric attachment phenomenon.

[0139] FIG. 9 is a diagram schematically illustrating clothes caught in through-holes of the drum during the dehydration cycle according to an embodiment of the present disclosure.

[0140] Specifically, moisture contained in the drum 30 may be discharged to the outside of the drum 30 through the through-holes 38 of the drum 30. Moisture separated from the fibers (F) may come into close contact with the circumferential surface of the drum 30 by centrifugal force.

[0141] Meanwhile, the circumferential surface of the drum 30 may be provided with fine grooves indented around the through-hole 38, and moisture adhered to the circumferential surface of the drum 30 may flow through the through-hole 38 along the groove.

[0142] In this process, the moisture present on the circumferential surface of the drum 30 may provide adhesive force between the circumferential surface of the drum 30 and the clothes, and the adhesive force may induce the fabric attachment phenomenon of the clothes.

[0143] In addition, in the process of moisture movement, the moisture separated from the fibers (F) and the moisture still present in the clothes may move toward the through-hole 38. The fibers (F) around the through-hole 38 after being affected by movement of moisture may be deformed to correspond to the shape of the groove or through-hole 38 formed at the circumferential surface of the drum 30, so that the fibers (F) may be formed to be partially inserted into the through-hole 38.

[0144] Such deformation of the fibers (F) and the adhesive force of water may cause the fabric attachment phenomenon. The fabric attachment phenomenon can prevent moisture from being discharged through the through-holes 38, and the surface area of clothes exposed to the inside of the drum 30 can be reduced, resulting in reduction in the drying efficiency during the drying cycle P4.

[0145] More specifically, force causing the fabric attachment phenomenon may include frictional force between the through-hole 38 and the clothes caught in the through-hole 38 and adhesive force caused by water. The jamming state between the through-hole 38 and the clothes may be caused by centrifugal force resulting from the rotation of the drum 30.

[0146] On the other hand, the force acting in the direction of resolving the fabric attachment phenomenon may cause a motion momentum of the clothes, which is affected by the weight of the clothes and the fabric untangling motion M3. In other words, when the weight of the clothes becomes stronger than the sum of the frictional force between the through-hole 38 and the clothes and the adhesive force caused by water, the fabric attachment phenomenon can be naturally resolved.

[0147] Accordingly, the laundry treatment apparatus according to the embodiment of the present disclosure may remove moisture from the clothes using the peak motion M1 of the first dehydration cycle P31 in so far as the fabric attachment phenomenon does not occur. As moisture is removed from the clothes, the deformation rate of the clothes may be lowered so that the degree of fabric insertion into the through-hole 38 is reduced and the frictional force can be reduced and the adhesive force caused by water can also be reduced.

[0148] As described above, the laundry treatment apparatus may perform the second dehydration cycle P32 including the high-RPM maintenance period (C) so that the clothes with less moisture of a preset level or less are treated in the second dehydration cycle P32. As a result, the moisture reduction rate may gradually increase so that the sum of the frictional force and the adhesive force of the clothes is always less than the weight of the clothes, and the fabric attachment phenomenon can also be prevented in the second dehydration cycle P32.

[0149] Referring back to FIG. 7, according to the embodiment of the present disclosure, the maintenance

RPM (R2) may have a higher value than the peak RPM (R1). The peak RPM (R1) corresponds to a relatively low RPM, which can minimize deformation of the clothes, and the maintenance RPM (R2) corresponds to a relatively high RPM, which can increase the moisture removal efficiency.

[0150] Meanwhile, the drum 30 may perform the fabric untangling motion M3. In the first dehydration cycle P31, the drum 30 may repeatedly perform the fabric untangling motion M3 after completion of the peak motion M1.

[0151] In the fabric untangling motion M3, the drum 30 may stop rotation after being rotated at a fabric untangling RPM (R3) lower than the peak RPM (R1). Separation between the clothes may be performed through the fabric untangling motion M3 due to a difference in inertia between the circumferential surface of the drum 30 and the clothes.

[0152] FIG. 7 shows the RPM changes of the drum 30 that rotates and stops at the fabric untangling RPM (R3) corresponding to a relative low RPM as compared to the peak PRM (R1). In the fabric untangling motion M3, the drum 30 may be stopped after being rotated in one direction, and may rotate again in one direction. Alternatively, the drum 30 may be stopped after being rotated in one direction, and may rotate in the other direction opposite to the one direction. That is, in the repeated fabric untangling motion M3, the drum 30 may alternately rotate in one direction and the other direction.

[0153] Meanwhile, the first dehydration cycle P31 may include the (1-1)st dehydration cycle P311 and the (1-2)nd dehydration cycle P312. In the (1-1)st dehydration cycle P311, the RPM of the drum 30 may decrease immediately after rising to the first peak RPM (R11), so that the first peak motion M11 of the drum 30 can be performed. In the (1-2)nd dehydration cycle P312, the RPM of the drum 30 may decrease immediately after rising to the second peak RPM (R12) different from the first peak RPM (R11), so that the second peak motion M12 of the drum 30 can be performed.

[0154] In the (1-1)st dehydration cycle P311 and the (1-2)nd dehydration cycle P312, the peak motion M1 of the drum 30 may be performed at the first peak RPM (R11) and the second peak RPM (R12), so that the fabric attachment phenomenon can be more effectively prevented and moisture can be effectively removed from the clothes.

[0155] The second peak RPM (R12) may be set to have a higher value than the first peak RPM (R11), and the maintenance RPM (R2) may be set to have a higher value than the second peak RPM (R12).

[0156] That is, according to the embodiment of the present disclosure, the drum 30 may be rotated in a motion in which the maximum RPM gradually increases as the dehydration cycle (P3) progresses.

[0157] The first peak RPM (R11), the second peak RPM (R12), and the maintenance RPM (R2) may be determined based on experimental/statistical results, and may also be determined based on currently measured results such as moisture content of the clothes.

[0158] FIG. 10 is a graph showing whether the fabric attachment phenomenon occurs by changing the first peak RPM (R11) and the maintenance time of the first peak RPM (R11) with respect to the first peak motion (M11) according to an embodiment of the present disclosure.

[0159] In the graph of FIG. 10, the horizontal axis may represent the first peak RPM (R11), the vertical axis may represent the maintenance time of the first peak RPM (R11), a plurality of regions divided approximately diagonally may represent the moisture content levels of the clothes, and the symbol "O" may indicate a condition in which the fabric attachment phenomenon has been prevented, and the symbol "X" may indicate a condition in which the fabric attachment phenomenon has occurred.

[0160] Referring to the graph of FIG. 10, since the (1-1)st dehydration cycle P311 is the first (initial) dehydration situation in which moisture from the clothes was removed, it can be confirmed that the fabric attachment phenomenon was prevented at a lower RPM from among the plurality of RPMs that are used as the experimental conditions.

[0161] Accordingly, the first peak RPM (R11) may be determined within the lowest RPM range in relation to the second peak RPM (R12) and the maintenance RPM (R2). In addition, it can be confirmed that there is a limit to lowering of the moisture content of the clothes, which can be achieved through the first peak motion M11.

[0162] In relation to the above-described description, the first peak RPM (R11) may be set to a value between 300 rpm and 600 rpm. The first peak RPM (R11) may be set to a value between 350 rpm and 550 rpm. The first peak RPM (R11) may be set to a value between 400 rpm and 500 rpm.

[0163] Furthermore, referring to the duration of each RPM, if the maintenance period (C) for the corresponding RPM occurs, the fabric attachment phenomenon may occur. In addition, in a situation in which the maintenance period (C) is provided, the RPM under experimental conditions in which the fabric attachment phenomenon has not occurred is too low, so that it can be confirmed that the moisture removal efficiency is too low.

[0164] That is, the first peak RPM (R11) may be set to the lowest RPM in relation to the second peak RPM (R12) and the maintenance RPM (R2), and the maintenance period (C) may be omitted to prevent the fabric attachment phenomenon caused by the initial dehydration situation, so that the moisture content of clothes can be significantly reduced to the extent that the (1-2)nd dehydration cycle P312 is possible.

[0165] FIG. 11 is a graph showing whether the fabric attachment phenomenon occurs by changing the second peak RPM (R12) and the maintenance time of the second peak RPM (R12) with respect to the second peak motion (M12) according to an embodiment of the present disclosure.

[0166] In the graph of FIG. 11, the horizontal axis may

represent the second peak RPM (R12), the vertical axis may represent the maintenance time of the second peak RPM (R12), a plurality of regions divided approximately diagonally may represent the moisture content levels of the clothes, and the symbol "O" may indicate a condition in which the fabric attachment phenomenon has been prevented, and the symbol "X" may indicate a condition in which the fabric attachment phenomenon has occurred.

[0167] The second peak RPM (R12) displayed in the graph of FIG. 11 may have an overall higher value than the experimental conditions of the first peak RPM (R11) of FIG. 10. In addition, since all the free moisture (FW) of the clothes is not completely removed only through the (1-1)st dehydration cycle P311, it can be seen that, when the maintenance period (C) is set regardless of high or low levels of the RPMs shown in FIG. 11, the fabric attachment phenomenon has occurred at all of the RPMs.

[0168] On the other hand, it can be confirmed that the selectable range of the second peak RPM (R12) in the (1-2)nd dehydration cycle P312 to be performed after the (1-1)st dehydration cycle P311 has increased compared to that of the first peak RPM (R11).

[0169] For example, the second peak RPM (R12) may be set to a value between 750 rpm and 950 rpm. The second peak RPM (R12) may be set to a value between 800 rpm and 900 rpm. The second peak RPM (R12) may be set to a value between 820 rpm and 880 rpm. The second peak RPM (R12) may be set to a value between 840 rpm and 860 rpm.

[0170] The laundry treatment apparatus according to the embodiment of the present disclosure may perform the first dehydration cycle P31 in multiple stages using the peak motion M1, the moisture contained in the clothes can be removed step by step (stepwise) to effectively suppress the fabric attachment phenomenon, and the moisture content of the clothes can be reduced to the extent that the fabric attachment phenomenon does not occur even at a high RPM.

[0171] FIG. 12 is a graph showing a change in duration of the maintenance RPM (R2) for the maintenance motion M2 and a change in moisture content of clothes affected by the changed duration according to the embodiment of the present disclosure.

[0172] In the graph of FIG. 12, the horizontal axis may represent the maintenance RPM (R12), and the vertical axis may represent the moisture content of clothes. Referring to a dotted line parallel to the horizontal axis, upper data located above the dotted line may represent the results of the experiment on the clothes having a first fabric quality, and lower data located below the dotted line may represent the result of the experiment on the clothes having a second fabric quality.

[0173] A plurality of circles adjacent to each other and gradually moving downward may represent how the initial moisture content and the last moisture content that are measured in any one experimental group are changing.

[0174] After completion of the first dehydration cycle P31 including a plurality of steps, the moisture content of the clothes may be in a state where the fabric attachment phenomenon no longer occurs due to the influence of RPM. Accordingly, the maintenance RPM (R2) may be set to a sufficiently high RPM where even the aforementioned stagnant water (SW) can be removed.

[0175] For example, the maintenance RPM (R2) may be set to a value between 880 rpm and 1100 rpm. The maintenance RPM (R2) may be set to a value between 950 rpm and 1080 rpm. The maintenance RPM (R2) may be set to a value between 1000 rpm and 1060 rpm.

[0176] Meanwhile, during the maintenance motion (M2), the maintenance time for the maintenance period (C) may be determined by taking into account the energy efficiency and convenience of use as well as the moisture removal effect. For example, if the maintenance time is too short, the moisture content of the clothes may be too high after the second dehydration cycle P32, and if the maintenance time is too long, energy consumption in the second dehydration cycle P32 may be excessively increased and the execution time of the dehydration cycle P3 may become longer, so that convenience of use may be deteriorated.

[0177] Accordingly, the maintenance time may be selected to be not too long in consideration of energy efficiency, etc. such that the moisture content of the clothes can be effectively reduced for the maintenance time.

[0178] For example, the maintenance time may be set to a time between 6 minutes and 18 minutes. The maintenance time may be set to a value between 9 minutes and 12 minutes.

[0179] As a result, according to the embodiment of the present disclosure, the dehydration cycle P3 can be performed while being classified into the first dehydration cycle P31 and the second dehydration cycle P32. In the first peak motion M11 of the first dehydration cycle P31, the maintenance period (C) may be omitted to prevent the fabric attachment phenomenon, and it may be possible to select the peak RPM (R1) at which the free moisture (FW) of the cloths can be sufficiently removed and at the same time the fabric attachment phenomenon can also be prevented.

[0180] In addition, in order to reach the moisture content of clothes where the fabric attachment phenomenon can be prevented even at a high RPM for removing stagnant water (SW), the first dehydration cycle P31 may be performed in multiple cycles including the (1-1)st dehydration cycle P311 and the (1-2)nd dehydration cycle P311.

[0181] The first peak motion M11 of the (1-1)st dehydration cycle P311 is the initial (first) moisture removal process, so that the first peak RPM (R11) may be set to be lower than the second peak RPM (R12) and the maintenance RPM (R2). The second peak motion M12 of the (1-2)nd dehydration cycle P312 may be determined in a manner that the second peak RPM (R12) is set to be higher than the first peak RPM (R11) to more efficiently

increase the moisture removal effect than in the (1-1)st dehydration cycle P311.

[0182] Meanwhile, the laundry treatment apparatus according to the embodiment of the present disclosure may remove the free moisture (FW) from clothes through the first dehydration cycle P31, so that the second dehydration cycle P32 can be performed in a state in which the deformability of the clothes is at a low level and the fabric attachment phenomenon is prevented regardless of the RPM of the drum 30.

[0183] The maintenance motion M2 of the drum 30 performed in the second dehydration cycle P32 may be set to a high RPM where the stagnant water (SW) present in the clothes can be effectively removed, but the duration of the maintenance period (C) can be selected by considering the target moisture content of the clothes.

[0184] Referring back to FIG. 7, in the (1-1)st dehydration cycle P311, after completion of the first peak motion M11 of the drum 30, the fabric untangling motion M3 in which the drum is rotated at a lower fabric untangling RPM (R3) than the first peak RPM (R11) and then stops rotation can be repeatedly performed.

[0185] That is, the control unit 100 may control the drive unit 80 to perform the fabric untangling motion M3 several times between the first peak motion M11 of the (1-1)st dehydration cycle P311 and the second peak motion M12 of the (1-2) dehydration cycle P312, thereby preventing occurrence of the unexpected fabric attachment phenomenon.

[0186] Furthermore, the control unit 100 may control rotation of the drum 30 so that the drum 30 can perform the fabric untangling motion M3 after performing each of the first peak motion M11, the second peak motion M12, and the maintenance motion M2.

[0187] Accordingly, in the (1-1)st dehydration cycle P311, the drum 30 may perform the first peak motion M11 and the fabric untangling motion M3. In the (1-2)nd dehydration cycle P312, the drum 30 may perform the second peak motion M12 and the fabric untangling motion M3. In the second dehydration cycle P32, the drum 30 may perform the second maintenance motion M2 and the fabric untangling motion M3.

[0188] The control unit 100 may sequentially perform the dehydration cycle P3 while effectively preventing the fabric attachment phenomenon by shaking the clothes inside the drum 30 through the fabric untangling motion M3.

[0189] Meanwhile, according to the embodiment of the present disclosure, a predetermine value of the peak RPM (R1) may be adjusted by the control unit 100 based on the moisture content of the clothes. Alternatively, the predetermined value of the peak RPM (R1) may be determined based on the moisture content of the clothes recognized in the process of performing the first dehydration cycle P31, instead of using the predetermined value.

[0190] For example, in the (1-1)st dehydration cycle P311, the control unit 100 may set the first peak RPM (R11) such that the moisture content of the clothes in a state in which the drum 30 rotates at the first peak RPM (R11) is within a predetermined first range.

[0191] The first dehydration cycle P31 may be understood to be a cycle in which the moisture content of the clothes can reach a certain moisture content at which the fabric attachment phenomenon does not occur even at the maximum RPM to be performed in the second dehydration cycle P32. In addition, it can be understood that the (1-1)st dehydration cycle P311 aims to obtain the moisture content of the clothes to prevent the fabric attachment phenomenon from occurring even at the second peak RPM (R12) of the (1-2)nd dehydration cycle P312.

[0192] That is, the target moisture content of the clothes in the (1-1)st dehydration cycle P311 and the target moisture content of the clothes in the (1-2)nd dehydration cycle P312 can be determined. The RPM of the drum 30 obtained when the moisture content of the clothes reaches the target moisture content during execution of the first acceleration period (I) may be determined to be the first peak RPM (R11), and the RPM of the drum 30 obtained when the moisture content of the clothes reaches the target moisture content during execution of the second acceleration period (I) may be determined to be the second peak RPM (R12), and the first acceleration period (D) and the second acceleration period (D) can be carried out.

[0193] The target moisture content of the (1-1)st dehydration cycle P311 and the target moisture content of the (1-2)nd dehydration cycle P312 may be determined in various ways based on the maintenance RPM (R2), the maintenance time, the amount of clothes, etc.

[0194] The control unit 100 may determine the second peak RPM (R12) such that the moisture content of the clothes is within the second range lower than the first range in a state in which the drum 30 rotates with the second peak RPM (R12) in the (1-2)nd dehydration cycle P312.

[0195] The fabric attachment phenomenon may not occur in the clothes belonging to the second range even if the maintenance RPM (R2) of the second dehydration cycle P32 continues, and the first range and the second range of the moisture content of the clothes can be experimentally/statistically selected.

[0196] Meanwhile, the laundry treatment apparatus according to the embodiment of the present disclosure may include the measurement unit 28 shown in FIG. 3. The measurement unit 28 may be provided inside the cabinet 10 to mature the moisture content of the clothes.

[0197] The measurement unit 28 may be provided to measure the moisture content of clothes through contact with the clothes, or may be provided to measure the humidity of the air inside the tub 20. The control unit 100 may determine the moisture content of the clothes through the measured value of the measurement unit 28.

[0198] The control unit 100 may adjust the peak RPM (R1) according to the moisture content of the clothes,

and may set a constant maintenance RPM (R2) regardless of the moisture content of the clothes.

[0199] That is, according to the embodiment of the present disclosure, the peak RPM (R1) during the first dehydration cycle P31 may be determined or adjusted depending on whether the target moisture content of the clothes is reached, but the maintenance RPM (R1) during the second dehydration cycle P32 may be a value that is predetermined or fixed regardless of the changes in the moisture content of the clothes in order to ensure the moisture content removal effect by considering that the maintenance RPM (R2) in the second dehydration cycle P32 is the last dehydration process.

[0200] However, if necessary, the maintenance RPM (R2) can also be adjusted by the control unit 100 based on the amount of clothes, the initial clothing moisture content, the change in duration of the maintenance period (C), etc.

[0201] The predetermined time (TC) during which the maintenance RPM (R2) is maintained in the second dehydration cycle P32 may be set to be longer than the execution time T11 of the first peak motion M11 or the execution time T21 of the second peak motion M12.

[0202] In addition, the predetermined time (TC) during which the maintenance RPM (R2) is maintained in the second dehydration cycle P32 may be set to be longer than the execution time T1 of the (1-1)st dehydration cycle P311 or the execution time T2 of the (1-2)nd dehydration cycle P311.

[0203] The (1-1)st dehydration cycle P311 and the (1-2)nd dehydration cycle P312 can shorten the time taken to suppress the fabric attachment phenomenon, and the maintenance period (C) of the second dehydration cycle P32 can be performed for a sufficient duration to secure the effect of reducing the moisture content of the clothes.

[0204] Meanwhile, the time taken for the RPM of the drum 30 to reach the first peak RPM (R11) in the (1-1)st dehydration cycle P311, that is, the execution time (T12) of the acceleration period (I) for the first peak RPM (R11), may be shorter than the time taken for the RPM of the drum 30 to reach the second peak RPM (R12) in the (1-2)nd dehydration cycle P312, that is, the execution time T22 of the acceleration period (I) for the second peak RPM (R12).

[0205] Additionally, the drying cycle P4 can be performed after the dehydration cycle P3 is completed using the above-described drying unit 90. Free moisture (FW) and stagnant water (SW) of clothes can be removed through the dehydration cycle P3, and bound (or boundary) moisture (BW) of clothes can be removed through the drying cycle P4, so that the degree of dryness of the clothes can be greatly improved.

[0206] Furthermore, the fabric attachment phenomenon caused by the dehydration cycle P3 can be suppressed by separately using the peak motion M1 and the maintenance motion M2 in stages, so that the drying efficiency of the drying cycle P4 to be performed after the dehydration cycle P3 can be greatly improved.

[0207] FIG. 13 is a flowchart illustrating a method for controlling the laundry treatment apparatus 1 according to an embodiment of the present disclosure.

[0208] Referring to FIG. 13, a method for controlling the laundry treatment apparatus 1 according to an embodiment of the present disclosure may include a step of performing a washing cycle (S100). In the washing cycle performing step (S100), the control unit 100 may control the water supply unit 40, the detergent supply unit 70, and the drive unit 80, and may perform the washing cycle P1 of clothes.

[0209] The method for controlling the laundry treatment apparatus according to the embodiment of the present disclosure may include a step of performing the rinsing cycle (S200). In the rinsing cycle performing step S200, the control unit 100 may control the water supply unit 40 to supply water into the tub 20, and may discharge contaminants of the clothes together with water from the tub 20 through rotation of the drum 30.

[0210] The method for controlling the laundry treatment apparatus according to the embodiment of the present disclosure may include a step of performing the first dehydration cycle (S300). In the first dehydration cycle performing step (S300), the control unit 100 may perform the above-described first dehydration cycle P31. That is, in the first dehydration cycle performing step (S300), the RPM of the drum 30 may increase to the peak RPM (R1) set in the control unit 100 and then decrease immediately from the peak RPM (R1), so that the peak motion M1 of the drum 30 can be performed.

[0211] The method for controlling the laundry treatment apparatus according to the embodiment of the present disclosure may include a step of performing the second dehydration cycle (S400). In the second dehydration cycle performing step (S400), the control unit 100 may perform the above-described second dehydration cycle (P32). In the second dehydration cycle performing step (S400), after completion of the first dehydration cycle performing step (S300), the RPM of the drum 30 may increase to the maintenance RPM (R2) set in the control unit 100, and the maintenance RPM (R2) may be maintained for a predetermined time (TC) and then decrease, so that the maintenance motion M2 of the drum 30 can be carried out.

[0212] The first dehydration cycle performing step (S300) may include the (1-1)st dehydration cycle performing step (S310) and the (1-2)nd dehydration cycle performing step (S320).

[0213] In the (1-1)st dehydration cycle performing step (S310), the control unit 100 may perform the above-described (1-1)st dehydration cycle P311. In the (1-1)st dehydration cycle performing step (S310), the RPM of the drum 30 may increase to the first peak RPM (R11) and then decrease immediately so that the first peak motion (M11) of the drum 30 can be performed.

[0214] In the (1-2)nd dehydration cycle performing step (S320), the control unit 100 may perform the above-

described (1-2)nd dehydration cycle P312. In the (1-2)nd dehydration cycle performing step (S320), the RPM of the drum 30 may increase to the second peak RPM (R12) higher than the first peak RPM (R11), and may then decrease immediately, so that the second peak motion M12 can be performed.

[0215] The (1-1)st dehydration cycle performing step (S310) may include the (1-1)st RPM acceleration step (S311). In the (1-1)st RPM acceleration step (S311), the control unit 100 may control the drive unit 80 to perform the acceleration period (I) in which the RPM of the drum 30 is accelerated to the first peak RPM (R11).

[0216] The (1-1)st dehydration cycle performing step (S310) may include the (1-1)st moisture content determination step (S312). The control unit 100 may determine whether the moisture content of the clothes is within the first range in the (1-1)st moisture content determination step (S312).

[0217] The first range may correspond to the target moisture content of the (1-1)st dehydration cycle P311, and the control unit 100 may utilize the moisture content of the clothes or may recognize the moisture content of the clothes in various ways.

[0218] The (1-1)st dehydration cycle performing step S310 may include the first (1-2)st RPM deceleration step S313. In the (1-1)st moisture content determination step (S312), if the moisture content of the clothes is within the first range, the RPM of the drum 30 under the corresponding state may be determined to be the first peak RPM (R11), and the control unit 100 may perform the deceleration period (D) in which the RPM of the drum 30 is reduced. However, if necessary, the control unit 100 may determine the second peak RPM (R12) regardless of the moisture content of the clothes in advance.

[0219] The (1-1)st dehydration cycle performing step (S310) may include the (1-1)st fabric untangling step (S314). In the (1-1)st fabric untangling step (S314), the control unit 100 may control the drive unit 80 to perform the fabric untangling motion M3 of the drum in which the drum 30 rotates so that the drum's RPM can reach the fabric untangling RPM (R3) and stops rotation after lapse of a predetermined time.

[0220] In the (1-1)st untangling step (S314), the fabric untangling motion M3, which includes the rotation and stopped state of the drum 30, may be performed repeatedly several times. The control unit 100 may control the rotation of the drum 30 to perform the fabric untangling motion M3 of the drum after completion of each of the first peak motion M11, the second peak motion M12, and the maintenance motion M2, such that the drum 30 rotates at the fabric untangling RPM (R3) lower than the first peak RPM (R11) and then stops rotation to perform the fabric untangling motion M3 of the drum 30.

[0221] The (1-2)nd dehydration cycle performing step (S320) may include the (1-2)nd RPM acceleration step (S321). In the (1-2)nd RPM acceleration step (S321), the control unit 100 may control the drive unit 80 to perform the acceleration period (I) in which the RPM of the drum 30 is accelerated to the second peak RPM (R12).

[0222] The (1-2)nd dehydration cycle performing step (S320) may include the (1-2)nd moisture content determination step (S322). The control unit 100 may determine whether the moisture content of the clothes is within the second range in the (1-2)nd moisture content determination step (S322).

[0223] The second range may correspond to the target moisture content of the (1-2)nd dehydration cycle P312, and may correspond to a range having a lower value than the above-described first range. The laundry treatment apparatus can gradually reduce the moisture content of clothes by sequentially performing the (1-1)st dehydration cycle (S310) and the (1-2)nd dehydration cycle (S320).

[0224] The (1-2)nd dehydration cycle performing step (S320) may include the (1-2)nd RPM deceleration step (S323). If the moisture content of the clothes falls within the second range in the (1-2)nd moisture content determination step (S322), the RPM of the drum 30 under the corresponding state may be determined to be the second peak RPM (R12), and the control unit 100 may perform the deceleration period (D) in which the RPM of the drum 30 is reduced. However, if necessary, the control unit 100 may determine the second peak RPM (R12) regardless of the moisture content of the clothes in advance.

[0225] The (1-2)nd dehydration cycle performing step (S320) may include the (1-2)nd fabric untangling step (S324). In the (1-2)nd fabric untangling step (S324), the control unit 100 may control the drive unit 80 to perform the fabric untangling motion M3 of the drum 30 in which the drum 30 rotates so that the drum's RPM corresponds to the fabric untangling RPM (R3) and then stops rotation after lapse of a predetermined time. In the (1-2)nd fabric untangling step (S324), the fabric untangling motion M3, which includes the rotation and stopped state of the drum 30, may be performed repeatedly several times.

[0226] The second dehydration cycle performing step (S400) may include a second RPM acceleration step (S410). In the second RPM acceleration step (S410), the control unit 100 may control the drive unit 80 to perform the acceleration period (I) in which the RPM of the drum 30 is accelerated to the maintenance RPM (R2).

[0227] The second dehydration cycle performing step (S400) may include a maintenance RPM determination step (S420). In the maintenance RPM determination step (S420), the control unit 100 may determine whether the RPM of the drum 30 corresponds to a preset maintenance RPM (R2).

[0228] The second dehydration cycle performing step (S400) may include a second RPM maintenance step (S430). If it is determined that the RPM of the drum 30 corresponds to the maintenance RPM (R2) in the maintenance RPM determination step (S420), the control unit 100 may perform the maintenance period (C) in which the drive unit 80 is controlled such that the RPM of the drum 30 can be kept at the maintenance RPM (R2).

[0229] The second dehydration cycle performing step

(S400) may include the maintenance time determination step (S440). The control unit 100 may determine whether the second RPM maintenance step S430, that is, the maintenance time of the maintenance period (C), is equal to or longer than a preset maintenance time.

[0230] The second dehydration cycle performing step (S400) may include a second RPM deceleration step (S450). If the duration of the maintenance period (C) exceeds the maintenance time in the maintenance time determination step (S440), the control unit 100 may perform the deceleration period (D) in which the RPM of the drum 30 is reduced.

[0231] The second dehydration cycle performing step (S400) may include the second fabric untangling step (S460). In the second fabric untangling step (S460), the control unit 100 may control the drive unit 80 to perform the fabric untangling motion M3 of the drum 30 in which the drum 30 rotates so that the drum's RPM corresponds to the fabric untangling RPM (R3) and then stops rotation after lapse of a predetermined time. In the second fabric untangling step (S460), the fabric untangling motion M3, which includes the rotation and stopped state of the drum 30, may be performed repeatedly several times.

[0232] It will be apparent to those skilled in the art that various modifications and variations can be made in the present disclosure without departing from the spirit or scope of the inventions. Thus, it is intended that the present disclosure covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Claims

1. A laundry treatment apparatus comprising:

a cabinet;
a tub provided in the cabinet to accommodate water;
a drum rotatably provided in the tub to accommodate clothes and having a plurality of through-holes through which water contained in the tub passes; and
a control unit provided to control rotation of the drum and perform a dehydration cycle of the clothes,
wherein the dehydration cycle includes a first dehydration cycle and a second dehydration cycle,
wherein
in the first dehydration cycle, an RPM of the drum increases to a peak RPM set in the control unit and then decreases from the peak RPM, so that a peak motion of the drum is performed; and
in the second dehydration cycle, the RPM of the drum increases to a maintenance RPM set in the control unit, maintains the maintenance RPM for a predetermined time, and then decreases from the maintenance RPM, so that a maintenance motion of the drum is performed.

2. The laundry treatment apparatus according to claim 1, further comprising:

a drive unit provided in the cabinet and connected to the drum to provide rotational force,
wherein the control unit is configured to control the drive unit to adjust the RPM of the drum.

3. The laundry treatment apparatus according to claim 1, wherein:

in the first dehydration cycle, the control unit controls the rotation of the drum to sequentially perform a first acceleration period and a first deceleration period,
wherein
the first acceleration period is performed such that the RPM of the drum increases to the peak RPM; and
the first deceleration period is performed after the first acceleration period such that the RPM of the drum reaches the peak RPM and at the same time decreases from the peak RPM.

4. The laundry treatment apparatus according to claim 1, wherein:

in the second dehydration cycle, the control unit controls the rotation of the drum to sequentially perform a second acceleration period, a maintenance period, and a second deceleration period,
wherein
the second acceleration period is performed such that the RPM of the drum increases to the maintenance RPM;
the maintenance period is performed after the second acceleration period such that the RPM of the drum is kept at the maintenance RPM; and
the second deceleration period is performed after the maintenance period such that the RPM of the drum decreases from the maintenance RPM.

5. The laundry treatment apparatus according to claim 1, wherein:
the maintenance RPM has a higher value than the peak RPM.

6. The laundry treatment apparatus according to claim 1, wherein:

in the first dehydration cycle, the drum repeatedly performs a fabric untangling motion after completion of the peak motion,

wherein
in the fabric untangling motion, the drum rotates at a fabric untangling RPM lower than the peak RPM and then stops rotation.

7. The laundry treatment apparatus according to claim 1, wherein:

the first dehydration cycle includes a (1-1)st dehydration cycle and a (1-2)nd dehydration cycle, wherein
in the (1-1)st dehydration cycle, the RPM of the drum decreases immediately after rising to the first peak RPM so that a first peak motion of the drum is performed; and
in the (1-2)nd dehydration cycle, the RPM of the drum decreases immediately after rising to the second peak RPM different from the first peak RPM so that a second peak motion of the drum is performed.

8. The laundry treatment apparatus according to claim 7, wherein:
the second peak RPM is set to have a higher value than the first peak RPM.

9. The laundry treatment apparatus according to claim 8, wherein:
the maintenance RPM is set to have a higher value than the second peak RPM.

10. The laundry treatment apparatus according to claim 7, wherein:
in the (1-1)st dehydration cycle, after completion of the first peak motion, the drum repeatedly performs a fabric untangling motion in which the drum rotates at a fabric untangling RPM lower than the first peak RPM and then stops rotation.

11. The laundry treatment apparatus according to claim 10, wherein:
the control unit is configured to control the rotation of the drum such that the drum performs the fabric untangling motion after performing each of the first peak motion, the second peak motion, and the maintenance motion.

12. The laundry treatment apparatus according to claim 7, wherein:
the control unit is configured to set the first peak RPM so that a moisture content of the clothes is within a predetermined first range in a situation in which the drum rotates at the first peak RPM in the (1-1)st dehydration cycle.

13. The laundry treatment apparatus according to claim 12, wherein:
the control unit is configured to set the second peak RPM so that the moisture content of the clothes is within a second range lower than the first range in a situation in which the drum rotates at the second peak RPM in the (1-2)nd dehydration cycle.

14. The laundry treatment apparatus according to claim 12, further comprising:

a measurement unit provided in the cabinet to measure the moisture content of the clothes,
wherein the control unit recognizes the moisture content of the clothes through a value measured by the measurement unit.

15. The laundry treatment apparatus according to claim 1, wherein:
the control unit adjusts the peak RPM according to a moisture content of the clothes, and sets a constant maintenance RPM regardless of the moisture content of the clothes.

16. The laundry treatment apparatus according to claim 7, wherein:
the predetermined time during which the maintenance RPM is maintained in the second dehydration cycle is set to be longer than an execution time of the first peak motion or an execution time of the second peak motion.

17. The laundry treatment apparatus according to claim 7, wherein:
the predetermined time during which the maintenance RPM is maintained in the second dehydration cycle is set to be longer than an execution time of the (1-1)st dehydration cycle or an execution time of the (1-2)nd dehydration cycle.

18. The laundry treatment apparatus according to claim 7, wherein:
a time taken for the RPM of the drum to reach the first peak RPM in the (1-1)st dehydration cycle is shorter than a time taken for the RPM of the drum to reach the second peak RPM in the (1-2)nd dehydration cycle.

19. The laundry treatment apparatus according to claim 1, further comprising:

a drying unit provided in the cabinet to increase a temperature inside the tub,
wherein
the control unit is provided to perform a drying cycle for the clothes after completion of the dehydration cycle.

20. A method for controlling a laundry treatment apparatus that includes a cabinet, a tub provided in the cabinet to accommodate water, a drum rotatably pro-

vided in the tub to accommodate clothes and having a plurality of through-holes through which water contained in the tub passes, and a control unit provided to control rotation of the drum and perform a dehydration cycle of the clothes, the method comprising:

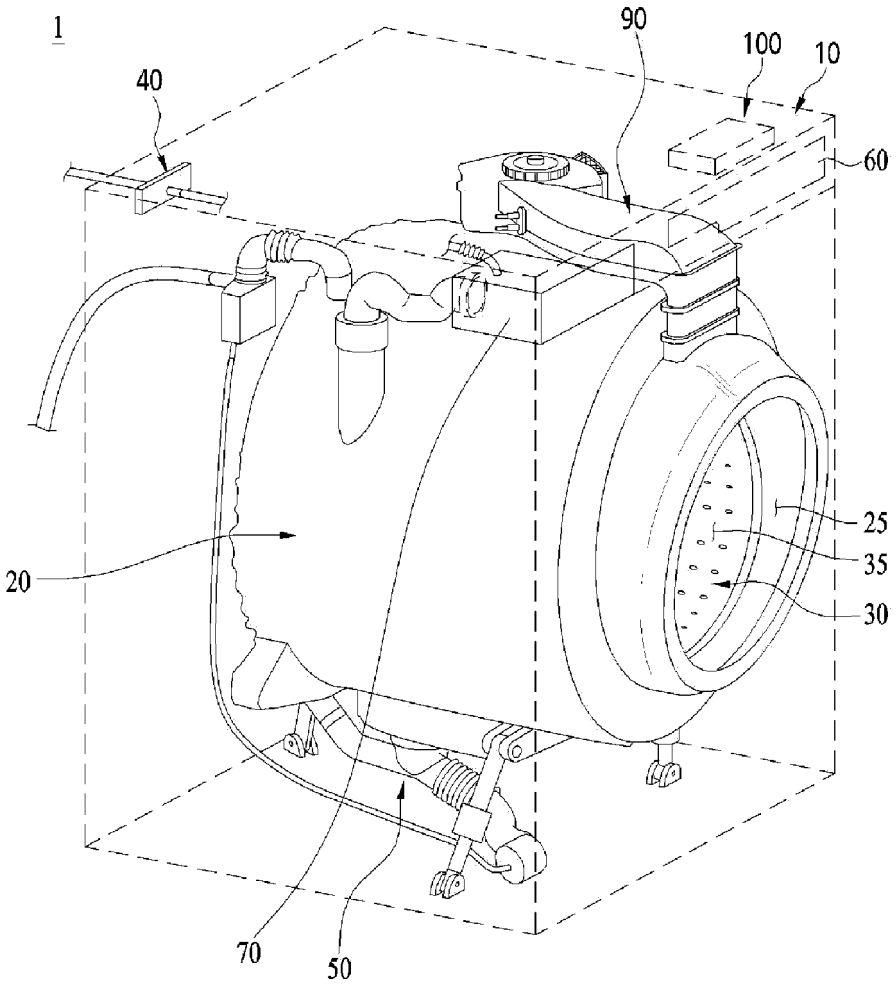
performing a first dehydration cycle in which an RPM of the drum increases to a peak RPM set in the control unit and then decreases from the peak RPM, so that a peak motion of the drum is performed; and
performing a second dehydration cycle in which the RPM of the drum increases to a maintenance RPM set in the control unit, maintains the maintenance RPM for a predetermined time, and then decreases from the maintenance RPM, so that a maintenance motion of the drum is performed.

21. The method according to claim 20, wherein:

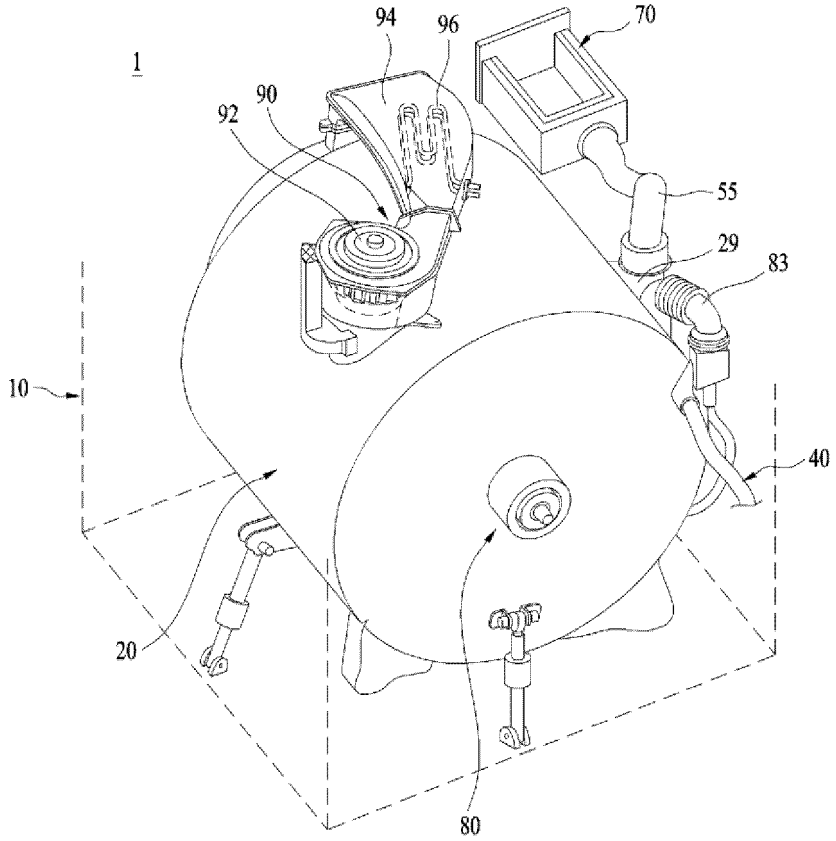
the first dehydration cycle includes a (1-1)st dehydration cycle performing step and a (1-2)nd dehydration cycle performing step,
wherein
in the (1-1)st dehydration cycle performing step, the RPM of the drum decreases immediately after rising to a first peak RPM so that a first peak motion of the drum is performed; and
in the (1-2)nd dehydration cycle performing step, the RPM of the drum decreases immediately after rising to the second peak RPM higher than the first peak RPM so that a second peak motion of the drum is performed.

22. The method according to claim 21, wherein:
the control unit controls the rotation of the drum to perform a fabric untangling motion in which the drum rotates at a fabric untangling RPM lower than the first peak RPM after completion of each of the first peak motion, the second peak motion, and the maintenance motion, and then stops rotation.

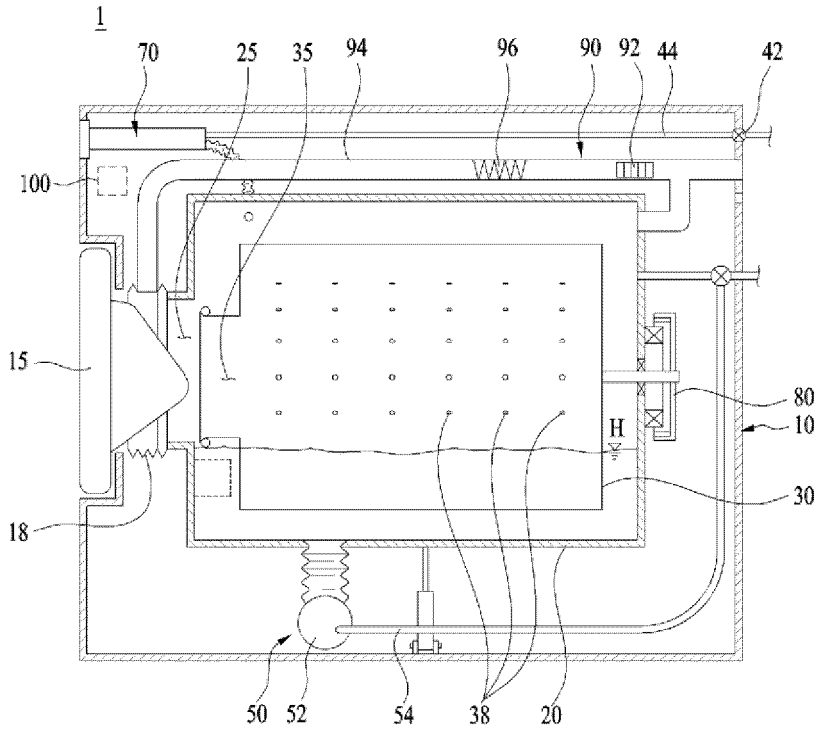
【FIG. 1】



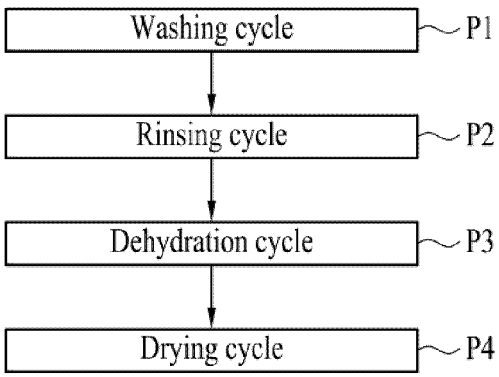
【FIG. 2】



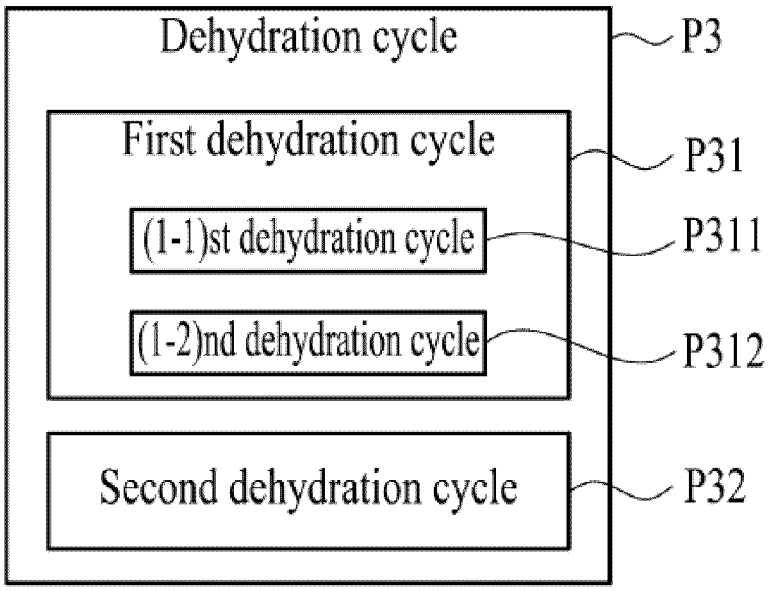
【FIG. 3】


1
70
25
35
94
96
90
92
44
42
100
15
80
10
H
30
18
50
52
54
38
20

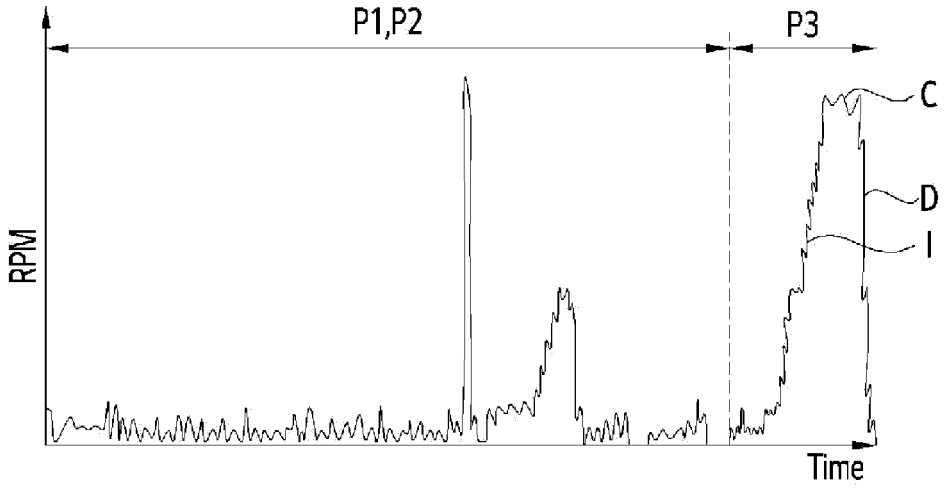
【FIG. 4】


Washing cycle
P1
Rinsing cycle
P2
Dehydration cycle
P3
Drying cycle
P4

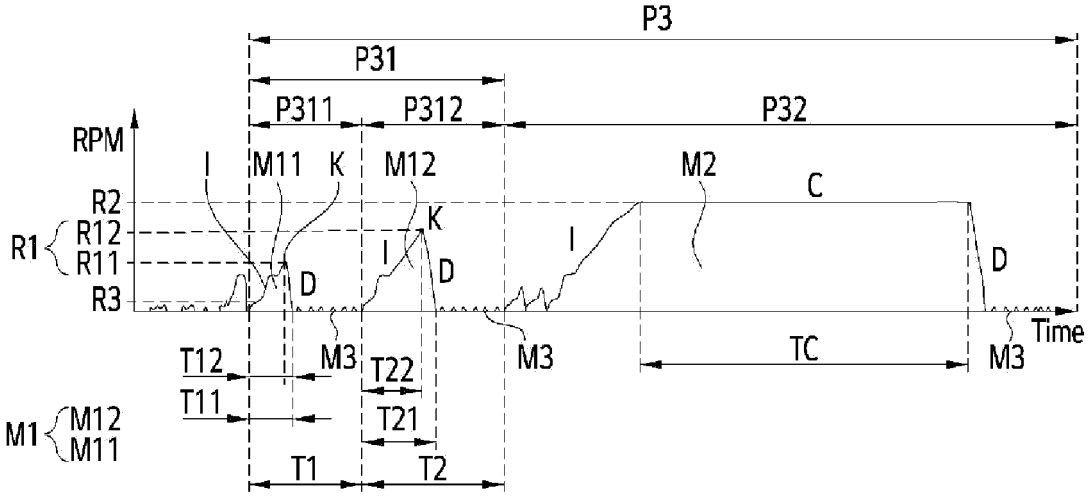
【FIG. 5】


Dehydration cycle
P3
First dehydration cycle
P31
(1-1)st dehydration cycle
P311
(1-2)nd dehydration cycle
P312
Second dehydration cycle
P32

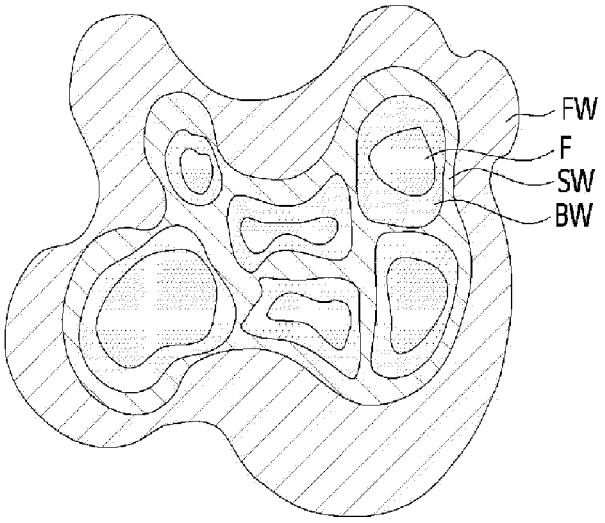
【FIG. 6】


P1,P2
P3
C
D
I
RPM
Time

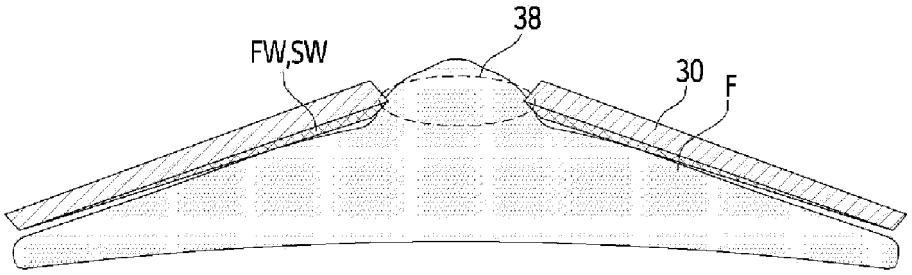
【FIG. 7】


P3
P31
P311
P312
P32
RPM
R2
R1
R12
R11
R3
I
M11
K
M12
M2
C
D
Time
T12
T11
T22
T21
T1
T2
TC
M3
M1
M12
M11

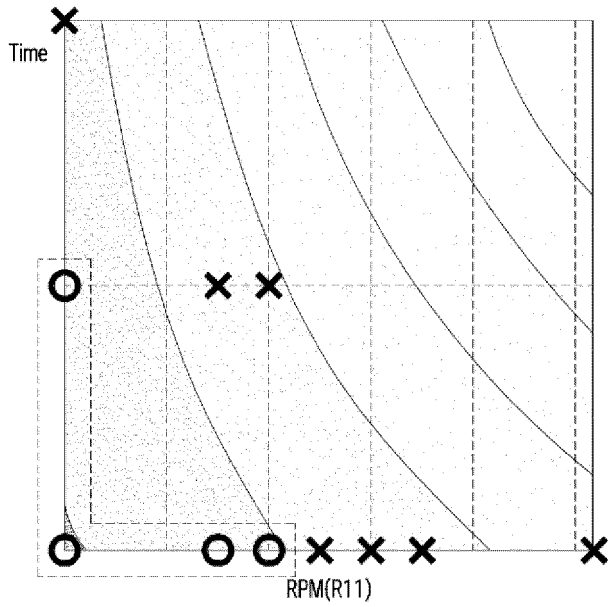
【FIG. 8】


FW
F
SW
BW

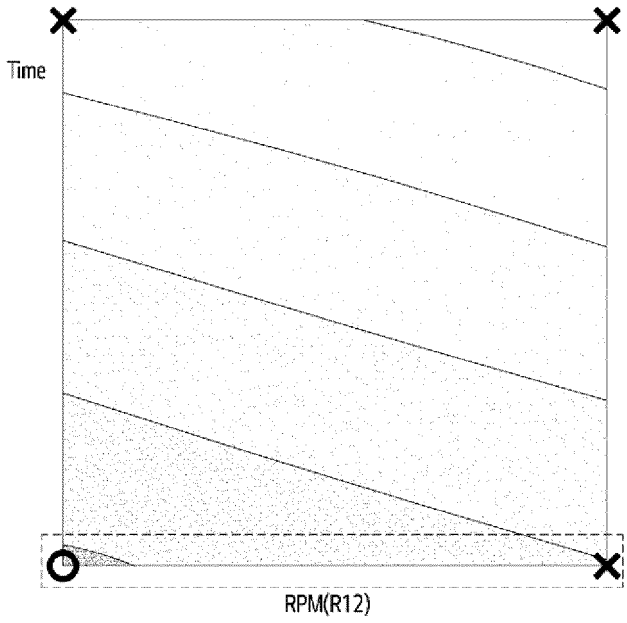
【FIG. 9】



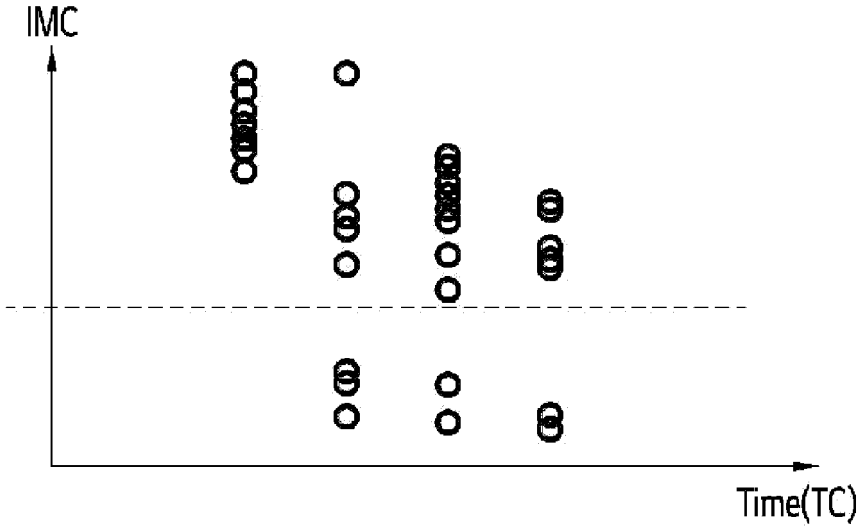
【FIG. 10】



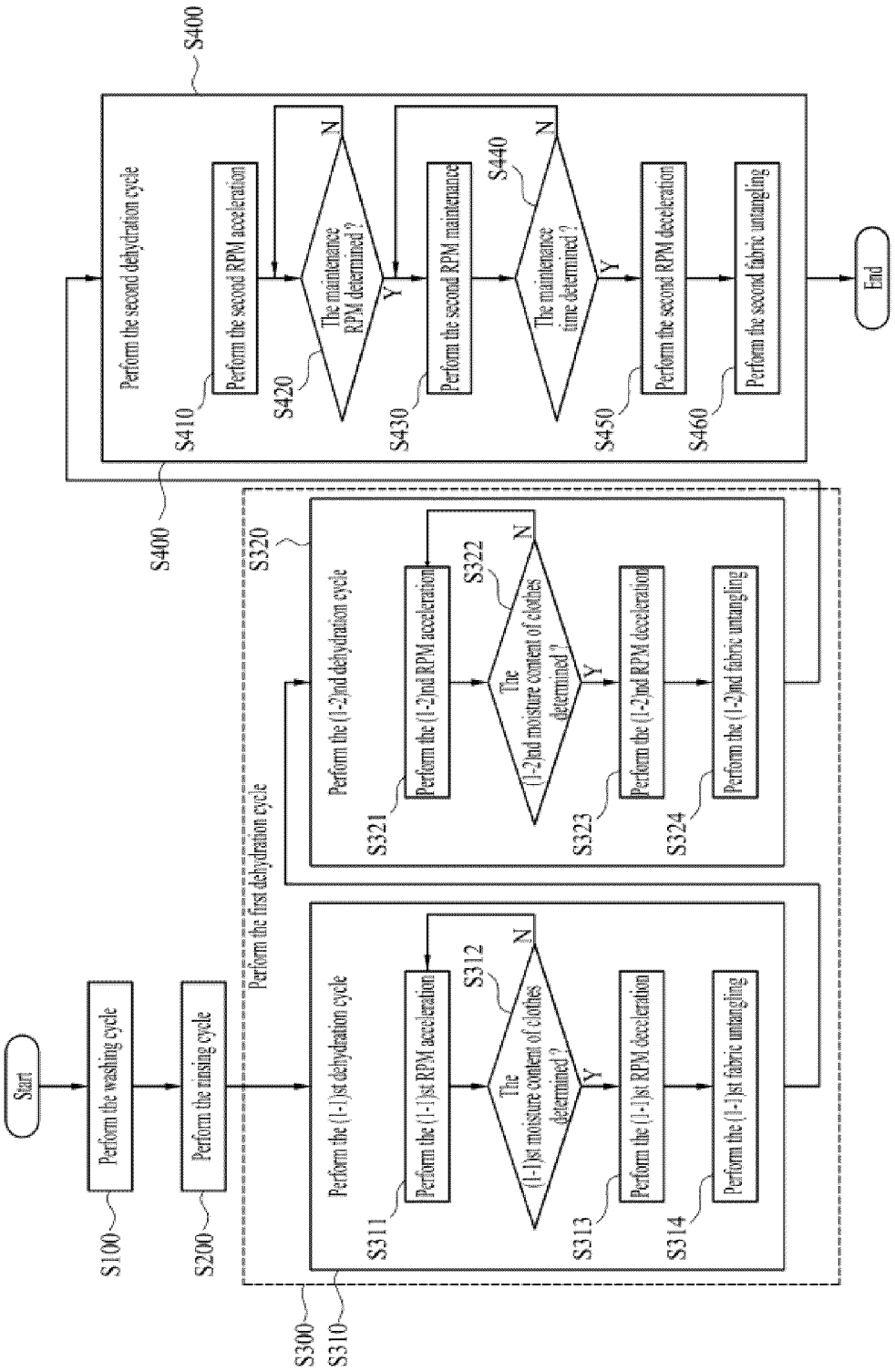
【FIG. 11】



【FIG. 12】



【FIG. 13】


Start
Perform the washing cycle
S100
Perform the rinsing cycle
S200
Perform the first dehydration cycle
S300
Perform the (1-1)st dehydration cycle
S310
Perform the (1-1)st RPM acceleration
S311
The (1-1)st moisture content of clothes determined ?
S312
N
Y
Perform the (1-1)st RPM deceleration
S313
Perform the (1-1)st fabric untangling
S314
Perform the (1-2)nd dehydration cycle
S320
Perform the (1-2)nd RPM acceleration
S321
The (1-2)nd moisture content of clothes determined ?
S322
N
Y
Perform the (1-2)nd RPM deceleration
S323
Perform the (1-2)nd fabric untangling
S324
S400
Perform the second dehydration cycle
S400
Perform the second RPM acceleration
S410
The maintenance RPM determined ?
S420
N
Y
Perform the second RPM maintenance
S430
The maintenance time determined ?
S440
N
Y
Perform the second RPM deceleration
S450
Perform the second fabric untangling
S460
End

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2022/018572

A. CLASSIFICATION OF SUBJECT MATTER

D06F 33/70(2020.01)i; **D06F 37/30**(2006.01)i; **D06F 58/38**(2020.01)i

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)

D06F 33/70(2020.01); D06F 23/04(2006.01); D06F 33/02(2006.01); D06F 33/40(2020.01); D06F 34/18(2020.01); D06F 37/36(2006.01); D06F 39/08(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & keywords: 드럼(drum), 세탁기(washing machine), 탈수(spin-dry), 회전(rotation), RPM, 피크(peak), 유지(maintain), 건조(dry)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2011-0022489 A (LG ELECTRONICS INC.) 07 March 2011 (2011-03-07) See paragraphs [0041]-[0066]; claim 22; and figures 1-4.	1-3,6,20
Y		4-5,19
A		7-18,21-22
Y	KR 10-2012-0073591 A (DAEWOO ELECTRONICS CORPORATION) 05 July 2012 (2012-07-05) See claim 2; and figure 2.	4-5
Y	KR 10-2021-0136376 A (LG ELECTRONICS INC.) 17 November 2021 (2021-11-17) See claim 1.	19
A	KR 10-1668455 B1 (DONGBU DAEWOO ELECTRONICS CORPORATION) 21 October 2016 (2016-10-21) See paragraphs [0020]-[0033]; and figure 2.	1-22

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

* Special categories of cited documents:
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-2013-0080105 A (SAMSUNG ELECTRONICS CO., LTD.) 12 July 2013 (2013-07-12) See claims 5-7; and figure 4.	1-22

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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KR 10-2012-0073591 A	05 July 2012	None	
KR 10-2021-0136376 A	17 November 2021	None	
KR 10-1668455 B1	21 October 2016	KR 10-2011-0133994 A	14 December 2011
KR 10-2013-0080105 A	12 July 2013	None	

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- KR 1019970011147 A1 **[0006]**