(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 April 2011 (21.04.2011)

PCT

(10) International Publication Number
WO 2011/046363 A2

(51) International Patent Classification:
D06F 37/02 (2006.01)

(21) International Application Number:
PCT/KR2010/006999

(22) International Filing Date:
13 October 2010 (13.10.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10-2009-0097351 13 October 2009 (13.10.2009) KR
10-2009-0100287 21 October 2009 (21.10.2009) KR

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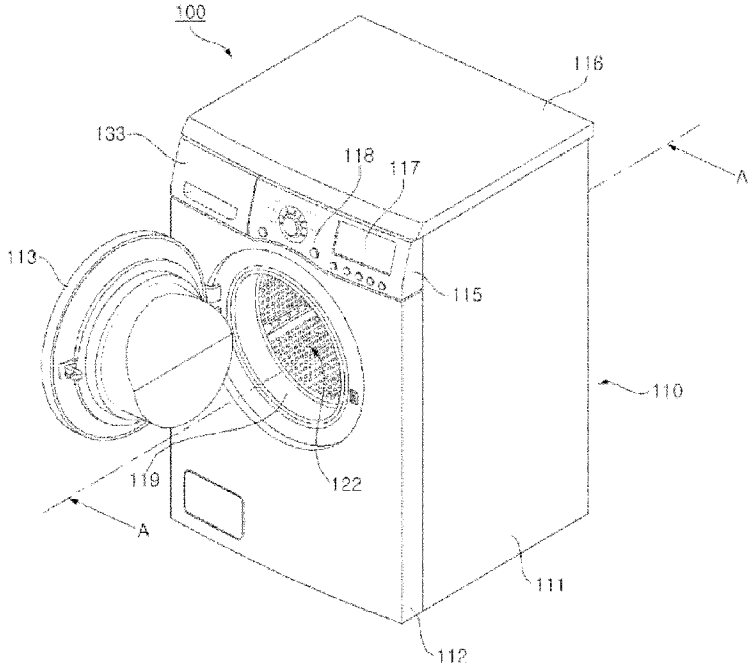
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,

[Continued on next page]

(54) Title: LAUNDRY TREATING APPARATUS AND METHOD

[Fig. 1]



(57) Abstract: A laundry treating apparatus with improved laundry treating performance is disclosed. The laundry treating apparatus includes a cabinet, a tub provided in the cabinet, a drum rotatably provided in the tub for receiving laundry, a gasket provided between the cabinet and the tub, a plurality of spray nozzles provided at a lower part of the gasket for spraying wash water upward into the drum, and a pump for pumping wash water to the spray nozzles.

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CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

Description

Title of Invention: LAUNDRY TREATING APPARATUS AND METHOD

Technical Field

[1] The present invention relates to a laundry treating apparatus, and, more particularly, to a laundry treating apparatus with improved laundry treating performance.

Background Art

[2] Generally, a laundry treating apparatus is a common designation for various kinds of treating apparatus that treat laundry by applying physical and chemical actions to the laundry, such as a washing machine that removes contaminants from clothes, bedding, etc. (hereinafter, referred to as `laundry`) using a chemical decomposition action of water and detergent and a physical action, such as friction, between water and laundry, a drying machine that dries wet laundry by spinning, and a refresher that sprays heated steam to laundry for preventing the occurrence of allergic reaction due to the laundry and, in addition, easily and conveniently wash the laundry.

Disclosure of Invention

Technical Problem

[3] When laundry is treated in the laundry treating apparatus, wash water is circulated. At this time, the wash water is circulated by a circulation pump. However, spraying of the wash water is limited during circulation of the wash water.

Solution to Problem

[4] It is an object of the present invention to provide a laundry treating apparatus that sprays wash water into a drum, thereby improving laundry treating performance.

[5] In accordance an aspect of with the present invention, the above and other objects can be accomplished by the provision of a laundry treating apparatus including a cabinet, a tub provided in the cabinet, a drum rotatably provided in the tub for receiving laundry, a gasket provided between the cabinet and the tub, a plurality of spray nozzles provided at a lower part of the gasket for spraying wash water upward into the drum, and a pump for pumping wash water to the spray nozzles.

[6] In accordance another aspect of with the present invention, there is provided a laundry treating apparatus including a cabinet, a tub provided in the cabinet, a drum rotatably provided in the tub for receiving laundry, a gasket provided between the cabinet and the tub, and a plurality of spray nozzles provided at the gasket for spraying wash water into the drum in a plurality of directions.

[7] In accordance a further aspect of with the present invention, there is provided a laundry treating method including, in a wash cycle or a rinse cycle, supplying wash

water into a tub, rotating a drum provided in the tub for receiving laundry, and pumping the wash water in the tub when the drum is rotated and spraying the wash water into the drum from a front of the drum below the drum in a plurality of directions.

Brief Description of Drawings

[8] FIG. 1 is a perspective view showing a laundry treating apparatus according to an embodiment of the present invention;

[9] FIG. 2 is a side sectional view of the laundry treating apparatus taken along line A-A of FIG. 1;

[10] FIG. 3 is a view showing a wash water spray structure of a laundry treating apparatus according to an embodiment of the present invention;

[11] FIG. 4 is a sectional view taken along line B-B of FIG. 3;

[12] FIGS. 5A and 5B are views showing an embodiment of a spray nozzle applied to a laundry treating apparatus according to the present invention;

[13] FIG. 6 is a view showing another embodiment of a spray nozzle applied to a laundry treating apparatus according to the present invention;

[14] FIG. 7 is an enlarged partial view showing part C of FIG. 6;

[15] FIG. 8 is an enlarged sectional view of part E taken along line D-D of FIG. 7;

[16] FIGS. 9 and 10 are conceptual views showing forms of wash water sprayed into a drum by a spray nozzle of a laundry treating apparatus according to an embodiment of the present invention;

[17] FIG. 11 is a view showing the section of wash water sprayed by a spray nozzle to explain a spray region of the wash water;

[18] FIG. 12 is a flow chart showing a laundry treating method according to an embodiment of the present invention;

[19] FIG. 13 is a view showing various drum motions in a laundry treating method according to an embodiment of the present invention;

[20] FIG. 14 is a view showing a squeezing motion in a laundry treating method according to an embodiment of the present invention; and

[21] FIG. 15 is a flow chart showing a laundry treating method according to another embodiment of the present invention.

Best Mode for Carrying out the Invention

[22] The advantages and features of the present invention, and the way of attaining them, will become apparent with reference to embodiments described below in conjunction with the accompanying drawings. However, the present invention is not limited to the embodiments disclosed below and will be embodied in a variety of different forms; rather, these embodiments are provided so that this disclosure will be thorough and

complete, and will fully convey the scope of the present invention to those skilled in the art, and the scope of the present invention will be defined by the appended claims. Like reference numerals refer to like elements throughout the specification.

[23] Now, exemplary embodiments of a laundry treating apparatus according to the present invention will hereinafter be described in detail with reference to the accompanying drawings.

[24] FIG. 1 is a perspective view showing a laundry treating apparatus according to an embodiment of the present invention. FIG. 2 is a side sectional view of the laundry treating apparatus taken along line A-A of FIG. 1. FIG. 3 is a view showing a wash water spray structure of a laundry treating apparatus according to an embodiment of the present invention. FIG. 4 is a sectional view taken along line B-B of FIG. 3.

[25] Referring to FIGS. 1 to 4, a laundry treating apparatus 100 according to an embodiment of the present invention includes a cabinet 110, a tub 121 disposed in the cabinet 110 for containing wash water supplied from outside, a drum 122 disposed in the tub 121 for receiving laundry, a drive unit 130 for supplying rotational force to the drum 122, a water supply valve 125 for supplying wash water supplied an external water source, a drainage hose 151 for draining wash water from the tub 121, and a pump 160.

[26] The cabinet 110 includes a cabinet body 111 forming an external appearance of the laundry treating apparatus 100, the cabinet body 111 being open at the front and the top thereof, a front cover 112 having a laundry entrance hole 119 for introducing laundry therethrough, the front cover 112 being coupled to the front of the cabinet body 111, a control panel 115 provided at the top of the front cover 112 for providing a user interface, and a top cover 116 provided at the top of the cabinet body 111.

[27] At the front cover 112 is hingedly provided a door 113 for opening and closing the laundry entrance hole 119. At the control panel 115 are provided a display 117 for displaying various kinds of state information of the laundry treating apparatus 100 and an input unit 118 for allowing a user to input various kinds of control commands, such as washing courses, operation time for each cycle, and reservation.

[28] The washing courses include a normal course, a lingerie/wool course, a boiling course, a speedy wash course, a functional clothes course, and a quiet course, which differ depending upon kinds or functions of laundry. The laundry treating apparatus mainly performs a wash cycle, a rinse cycle, and a spin cycle. In each cycle, water supplying, washing, rinsing, draining, spinning, or drying is performed.

[29] A detergent box 133 contains detergent, such as a wash detergent, a fabric softener, or a decolorant. The detergent box 133 is preferably provided at the front of the front cover 112 such that the detergent box 133 is easily withdrawn from the front of the front cover 112. When wash water is supplied, the detergent in the detergent box 133 is

mixed with the wash water, and the mixture is introduced into the tub 121.

[30] The tub 121 is suspended from the top cover 116 by springs 124 and is supported by a damper 126 to absorb vibration generated during the rotation of the drum 122. The drum 122 is rotated by the drive unit 130. Inside the drum 122 are provided lifters 135 for lifting laundry during the rotation of the drum 122.

[31] A gasket 140 is provided between the cabinet 110 and the tub 121. One side of the gasket 140 is coupled to the cabinet 110, and the other side of the gasket 140 is coupled to the circumference of an open front of the tub 121. Consequently, wash water contained in the tub 121 is prevented from leaking between the tub 121 and the cabinet 110. Also, the gasket 140 is formed so as to have pleats along the circumference thereof for absorbing vibration of the tub 121.

[32] Referring to FIG. 4, the gasket 140 includes a tub coupling part 141 coupled to the tub 121, a cabinet coupling part 144 coupled to the cabinet 110, a pleat part 143 disposed between the tub coupling part 141 and the cabinet coupling part 144 such that the pleat part 143 is bent so as to have pleats for absorbing vibration, and a groove part 142 formed by the pleat part 143.

[33] Connectors 164 are coupled through the groove part 142. Spray holes 165 may be formed such that some of the wash water flowing to spray nozzles 170 and 180 through the connectors 164 is sprayed to the groove part 142. Wash water sprayed through the spray holes 165 flows downward along the groove part 142 to sweep away residual detergent or contaminants separated from laundry. Consequently, the gasket 140 is preferably provided at the lower part thereof with a drainage hole (not shown) through which the wash water flowing downward along the groove part 142 is drained.

[34] The gasket 140 may be formed of a single material. Alternatively, the tub coupling part 141 of the gasket 140 may be formed of a solid material so as to secure coupling strength with the tub 140 and sufficient rigidity, and the cabinet coupling part 144 of the gasket 140 may be formed of an elastic material so as to alleviate vibration transmitted from the tub 121 to the cabinet 110.

[35] The gasket 140 may be provided at the inner circumference thereof with a protrusion 145 for preventing laundry from being discharged from the drum 122 and caught between the gasket 140 and the cabinet 110 by the rotation of the drum 122 or preventing laundry from pouring out when the door 113 is opened after washing.

[36] Meanwhile, the gasket 140 is provided with a first spray nozzle 170 and a second spray nozzle 180 for spraying wash water discharged from the tub 121 into the drum 122. In this embodiment, the two spray nozzles 170 and 180 are used to spray wash water. However, the present invention is not limited thereto. For example, two or more spray nozzles may be provided to spray wash water into the drum 122 in a plurality of directions.

[37] Also, in this embodiment, the two spray nozzles 170 and 180 are provided at the gasket 140; however, the spray nozzles 170 and 180 may be provided at various positions as long as wash water is sprayed into the drum 122 by the spray nozzles 170 and 180. For example, the spray nozzles 170 and 180 may be provided in front of the drum 122 for spraying wash water into the drum 122. Preferably, the spray nozzles 170 and 180 are provided in front of the drum 122 below the drum 122 for spraying wash water upward into the drum 122.

[38] After the wash water contained in the tub 121 is pumped by the pump 160, the wash water is sprayed into the drum 122 by the first spray nozzle 170 and the second spray nozzle 180. In this way, circulation of wash water is achieved. In this embodiment, drainage and circulation of wash water are achieved by a single pump 160. However, the present invention is not limited thereto. For example, a pump for drainage and a pump for circulation may be separately provided.

[39] The wash water pumped by the pump 160 is distributed by a distributer 161, and is guided to the first spray nozzle 170 and the second spray nozzle 180 along a first spray channel 162 and a second spray channel 163, respectively. At this time, the pump 160 may pump wash water such that the wash water is sprayed simultaneously by the first spray nozzle 170 and the second spray nozzle 180. Consequently, the wash water is sprayed to laundry in opposite directions, thereby effectively treating the laundry. In addition, it is possible to treat laundry with uniform performance irrespective of the rotation direction of the drum 122.

[40] The tub 121 is provided at the upper side and/or the lower side thereof with weights 155 and 156 for maintaining stability of the tub 121 by inertia thereof when the drum 122 is vibrated. The weights 155 and 156 may include an upper weight 155 provided at the upper side of the tub 121 and a lower weight 156 provided at the lower side of the tub 121.

[41] The spray nozzles 170 and 180 may be connected to the gasket 140 by the connectors 164. A connector 164 for connecting the first spray nozzle 170 to the gasket 140 is shown in FIG. 4. Of course, the second spray nozzle 180 is connected to the gasket 140 in the same structure. The connector 164 extends through the gasket 140 to connect the first spray channel 162 and the first spray nozzle 170.

[42] In this embodiment, the first spray nozzle 170 and the second spray nozzle 180 are arranged at opposite sides of the lower weight 156 such that the connectors 164 connected to the first spray nozzle 170 and the second spray nozzle 180 do not interfere with the lower weight 156. In a structure in which no connectors 164 are provided at the gasket 140, unlike this embodiment, the arrangement of the first spray nozzle 170 and the second spray nozzle 180 is not limited.

[43] Meanwhile, in order to uniformly spray wash water into the drum 122, the first spray

nozzle 170 and the second spray nozzle 180 may be provided at the left and right sides of a perpendicular symmetrical line passing through the center of the gasket 140 such that the first spray nozzle 170 and the second spray nozzle 180 are symmetrical to each other about the perpendicular symmetrical line.

[44] In this structure, the first spray nozzle 170 is provided at the left lower part of the gasket 140 for spraying wash water into a region of the drum 122 ranging approximately from the left upper part to the right lower part thereof, and the second spray nozzle 180 is provided at the right lower part of the gasket 140 for spraying wash water into a region of the drum 122 ranging approximately from the right upper part to the left lower part thereof.

[45] FIGS. 5A and 5B are views showing an embodiment of a spray nozzle applied to a laundry treating apparatus according to the present invention. Referring to FIGS. 5A and 5B, a spray nozzle 170 includes an introduction part 171 for introducing wash water therethrough, a first surface 172 for directing the sprayed wash water into the drum 122, and second and third surfaces 173 and 174 extending from opposite sides of the first surface 172 for restricting the spray width of the wash water.

[46] The wash water, pumped by the pump 160 and introduced through the introduction part 171, is guided along the first surface 172, which is formed opposite to an outlet end 171h of the introduction part 171 and extends into the drum 122 in an inclined shape, and is then sprayed. At this time, since the wash water is guided along the first surface 172 by the pumping pressure of the pump 160, the wash water is sprayed in a spread state such that the sprayed wash water reaches the drum 122 in a fan shape. Although the same amount of wash water is sprayed, therefore, the wash water is sprayed over a wide region. When the first spray nozzle 170 and the second spray nozzle 180 are provided at the opposite sides of the gasket 140 as in this embodiment, wash water is effectively sprayed over a wider region.

[47] Meanwhile, the first surface 172 is formed such that the width of the first surface 172 is gradually increased toward the outlet end. The second surface 173 and the third surface 174 extend from the opposite sides of the first surface 172. Consequently, the second surface 173 and the third surface 174 restrict the spray width of sprayed wash water. Also, the second surface 173 forms the lower limit of sprayed wash water, and the third surface 174 forms the upper limit of sprayed wash water. At this time, the second surface 173 and the third surface 174 are formed such that a spray region between the upper limit a2 and the lower limit a3 of the sprayed wash water intersects a rotation axis of the drum 122 as indicated by point P of FIG. 10.

[48] Meanwhile, the first surface 172 may be provided with a plurality of ribs 175 arranged in the flow direction of wash water. The depth of wash water guided along the first surface 172 is changed by the ribs 175. As a result, water currents sprayed

between the neighboring ribs 175 constitute main spray streams of a large thickness, and thin water films are formed respectively between the main spray streams.

[49] As wash water is sprayed in the above-described form, the main spray streams apply strong impact to contaminants attached to laundry and, in addition, bend and stretch the laundry, thereby improving washing performance. Also, the spray area of the wash water is still sufficiently secured by the water films.

[50] FIG. 6 is a view showing another embodiment of a spray nozzle applied to a laundry treating apparatus according to the present invention. FIG. 7 is an enlarged partial view showing part C of FIG. 6. FIG. 8 is an enlarged sectional view of part E taken along line D-D of FIG. 7.

[51] Referring to FIGS. 6 to 8, this embodiment is different from the previous embodiment in that spray nozzles 270 and 280 are formed at a gasket 240 as one body. The spray nozzles 270 and 280 protrude from the gasket 240. The gasket 240 is provided with a gasket channel 271 for guiding wash water to the spray nozzles 270 and 280. The gasket channel 271 may be connected to the spray channels 162 and 163 by the connectors 164.

[52] In this embodiment, grooves 275 are formed at a first surface 275 of the spray nozzle 270 unlike the previous embodiment. However, this embodiment is not distinguished from the previous embodiment in terms of such a structural difference. The ribs 175 may be formed at the spray nozzle 270 of this embodiment, and the grooves 275 may be formed at the spray nozzle 170 of the previous embodiment. That is, the structure of the ribs 175 or the grooves 275 is irrespective of whether the spray nozzle is formed at the gasket as one body, and any structure may be applied to the respective embodiments.

[53] FIGS. 9 and 10 are conceptual views showing forms of wash water sprayed into a drum by a spray nozzle of a laundry treating apparatus according to an embodiment of the present invention. FIG. 11 is a view showing the section of wash water sprayed by a spray nozzle to explain a spray region of the wash water.

[54] The first spray nozzle 170 and the second spray nozzle 180 are provided at opposite sides of the lower part of the gasket 140 below half the height of the gasket 140. The first spray nozzle 170 sprays wash water upward into the drum 122 from the left lower part of the gasket 140, and the second spray nozzle 180 sprays wash water upward into the drum 122 from the right lower part of the gasket 140. Laundry 10 lifted and dropped by the lifters 135 during rotation of the drum 122 passes through the spray region defined by the first spray nozzle 170 and the second spray nozzle 180 such that the laundry 10 is treated. In this embodiment, the spray nozzles spray wash water upward to falling laundry to apply strong impact to the laundry and bend and stretch the laundry, thereby improving laundry treating performance. In order to achieve such

an effect, therefore, it is necessary to study washing motion in which laundry is lifted along the inside of the drum and dropped, which will be described in more detail with reference to FIGS. 13 and 14.

[55] Meanwhile, the spray nozzle 170 sprays wash water such that an upper spray angle θ1, which is an angle between a middle spray stream st1 joining a rotation axis C of the drum 122 and an upper limit spray stream st2 defining the upper limit of the sprayed wash water, is greater than a lower spray angle θ2, which is an angle between the middle spray stream st1 and a lower limit spray stream st3 defining the lower limit of the sprayed wash water. Consequently, wash water is more concentratively sprayed to the upper region of the drum 122.

[56] Owing to positional features of the first spray nozzle 170 and the second spray nozzle 180 provided at the lower part of the gasket 140, the first spray nozzle 170 sprays wash water to a region ranging from the left upper part to the right lower part of the drum 122 along a slanted line, and the second spray nozzle 180 sprays wash water to a region ranging from the right lower part to the left upper part of the drum 122 along a slanted line l. When viewing on a predetermined projection plane T perpendicular to the rotation axis of the drum 122, a wash water spray plane S and the projection plane T join to form the slanted line l.

[57] When the form of the sprayed wash water on the projection plane T is considered referring back to FIG. 11, the wash water sprayed by the first spray nozzle 170 forms a slanted line ranging from a second quarter plane II to a fourth quarter plane IV on the projection plane T, and the wash water sprayed by the second spray nozzle 180 forms a slanted line ranging from a first quarter plane I to a third quarter plane III on the projection plane T. As a result, the first spray nozzle 170 and the second spray nozzle 180 spray wash water toward all of the first, second, third, and fourth quarter planes I, II, III, and IV. When looking into this in terms of the interior of the drum 122, wash water is uniformly sprayed into the drum 122 by the first spray nozzle 170 and the second spray nozzle 180.

[58] The spray nozzles 170 and 180 may be formed such that at least one of the main spray streams a1, a2, a3, a4, and a5 is sprayed to the upper region of the drum 122, and at least one of the main spray streams a1, a2, a3, a4, and a5 is sprayed to the lower region of the drum 122. The upper region of the drum 122 is an interior space of the drum 122 above half the height of the drum 122, and the lower region of the drum 122 is an interior space of the drum 122 below half the height of the drum 122.

[59] In this embodiment, the number of the main spray streams sprayed to the upper region of the drum 122 is greater than that of the main spray streams sprayed to the lower region of the drum 122. Consequently, wash water is more concentratively sprayed to the upper region of the drum 122.

[60] Referring to FIG. 11, three, i.e., a1, a2, and a3, of the main spray streams a1, a2, a3, a4, and a5 are sprayed to the first and second quarter planes I and II, and the others, i.e., a4 and a5, are sprayed to the third and fourth quarter planes III and IV. The first quarter plane I is diagonally opposite to the second quarter plane II, and the third quarter plane III is diagonally opposite to the fourth quarter plane IV.

[61] FIG. 12 is a flow chart showing a laundry treating method according to an embodiment of the present invention.

[62] Water supplying is performed during a wash cycle or a rinse cycle (S210). The laundry treating apparatus mainly performs a wash cycle, a rinse cycle, and a spin cycle. In each cycle, water supplying, washing, rinsing, draining, spinning, or drying is performed. In the wash cycle, laundry is soaked in wash water containing a wash detergent, and the drum 122 is rotated to remove contaminants from the laundry. In the rinse cycle, the laundry is soaked in wash water containing a fabric softener, and the drum 122 is rotated to remove detergent residue from the laundry.

[63] Water supplying serves to supply wash water from an external water source into the tub 121. During water supplying, the water supply valve 125 is opened, and wash water is introduced into the tub 121 from the external water source via the detergent box 133. In the detergent box 133, the wash water may be mixed with a wash detergent or a fabric softener.

[64] The water supplying is continued until the wash water reaches a target water level. The target water level is set based on the amount of laundry (hereinafter, referred to as a'load') measured before the water supplying or a selected course. During water supplying, laundry soaking, in which the drum 122 is rotated, may be performed such that the laundry is uniformly soaked in the wash water containing the wash detergent.

[65] When the water supplying is completed, the drum 122 is rotated (S220). The drum 122, in which the laundry is placed, is rotated to perform washing or rinsing.

[66] The washing or the rinsing is to rotate the drum 122 in which the laundry, soaked in the wash water containing the wash detergent or the fabric softener, is placed. When the drum 122 is rotated by the drive unit 130, the laundry in the drum 122 is lifted and dropped by the lifters 135. Contaminants or residual detergent are removed from the laundry by friction between the laundry articles and falling of the laundry.

[67] During the washing, the drum 122 may be rotated at various speeds or in various directions, which will be described later in detail with reference to FIG. 13.

[68] The wash water is pumped and sprayed into the drum 122 (S230). During rotation of the drum 122, the wash water in the tub 121 is pumped by the pump 160, and is then sprayed into the drum 122 by the first spray nozzle 170 and the second spray nozzle 180. The wash water pumped by the pump 160 is distributed by the distributer 161, and is then guided to the first spray nozzle 170 and the second spray nozzle 180 along

the first spray channel 162 and the second spray channel 163, respectively. At this time, the pump 160 may pump the wash water such that the wash water is sprayed simultaneously by the first spray nozzle 170 and the second spray nozzle 180.

[69] The first spray nozzle 170 is provided at the left lower part of the gasket 140 for spraying the wash water into a region of the drum 122 ranging approximately from the left upper part to the right lower part thereof, and the second spray nozzle 180 is provided at the right lower part of the gasket 140 for spraying wash water into a region of the drum 122 ranging approximately from the right upper part to the left lower part thereof. The first spray nozzle 170 and the second spray nozzle 180 preferably spray the wash water upward to falling laundry.

[70] FIG. 13 is a view showing various drum motions in a laundry treating method according to an embodiment of the present invention.

[71] (a) of FIG. 13 shows a motion in which the drive unit 130 rotates the drum 122 in a predetermined direction so that the laundry is lifted from the lowest position of the drum 122 and dropped in the vicinity of half the height of the drum 122 (hereinafter, referred to as a"tumbling motion"). In the tumbling motion, the drum 122 is continuously rotated at about 45 rpm, and the laundry in the drum 122 is washed by impact and frictional force.

[72] (b) of FIG. 13 shows a motion in which the drive unit 130 rotates the drum 122 in a predetermined direction so that the laundry is lifted from the lowest position of the drum 122 and dropped at a height not exceeding half the height of the drum 122 (hereinafter, referred to as a"rolling motion"). In the rolling motion, the drum 122 is continuously rotated at about 40 rpm or below, and the laundry in the drum 122 is washed by bending and stretching force and frictional force by being dropped as if rolling over.

[73] (c) of FIG. 13 shows a motion in which the drive unit 130 rotates the drum 122 in alternating directions so that the laundry is lifted from the lowest position of the drum 122 and dropped in the vicinity of half the height of the drum 122 (hereinafter, referred to as a"swing motion"). In the swing motion, the drum 122 is rotated at about 40 rpm or below in alternating directions. The laundry in the drum 122 is washed by bending and stretching force and frictional force by being dropped as if rolling over.

[74] (d) of FIG. 13 shows a motion in which the drive unit 130 rotates the drum 122 in a predetermined direction so that the laundry is lifted from the lowest position of the drum 122 and dropped in the vicinity of the top of the drum 122 (hereinafter, referred to as a"step motion"). In the step motion, the drum 122 is rotated at about 60 rpm or above to raise the laundry. The laundry is raised higher than half the height of the drum 122 and then the drive unit 130 controls the drum 122 so that the laundry is dropped in the vicinity of the top of the drum 122. After the laundry is dropped, the drum 122

raises the laundry by rotating in the same direction. The laundry in the drum 122 is washed by a high impact force caused due to the falling of the laundry.

[75] (e) of FIG. 13 shows a squeezing motion in which the drive unit 130 changes the speed of the drum 122 in short cycle so that the laundry is gathered and distributed in a repeated manner. In the squeezing motion, the speed of the drum 122 is changed in short cycle within a speed range of about 50 rpm to about 100 rpm to cause the laundry to cling to and be separated from the inside of the drum in a repeated manner. As the movement of the laundry is facilitated, washing deviation is reduced and the laundry is brought into uniform contact with the wash water. In addition, when the laundry clings to the inside of the drum, the wash water soaking through the laundry is discharged as if being squeezed out of the laundry. Therefore, contaminants are discharged from the laundry during washing as if being squeezed out, and residual detergent is discharged from the laundry as if being squeezed out. Moreover, as the laundry clings to and is separated from the inside of the drum in a repeated manner, a user may visually check the movement of the laundry.

[76] When each of the above-described drum motions is performed, it is preferable for the wash water to be pumped by the pump 160 and be sprayed into the drum 122 by the first spray nozzle 170 and the second spray nozzle 180. The first spray nozzle 170 and the second spray nozzle 180 preferably spray the wash water upward to falling laundry.

[77] FIG. 14 is a view showing a squeezing motion in a laundry treating method according to an embodiment of the present invention.

[78] In a laundry treating method according to an embodiment of the present invention, a squeezing motion is a motion repeated in short cycle in which the drum 122 is accelerated to a high speed during a wash cycle or a rinse cycle to cause laundry 10 in the drum 122 to rotate, clinging to the inside of the drum 122, and then the drum 122 is decelerated to cause the laundry to be separated from the inside of the drum.

[79] In (a) of FIG. 14, when the drum 122 is rotated at a high speed, the laundry 10 in the drum 122 rotates, clinging to the inside of the drum 122. If the drum 122 is rotated at about 100 RPM, the laundry 10 rotates, clinging to the inside of the drum by centrifugal force. Preferably, the drum 122 is rotated for an appropriate amount of time at an appropriate speed so that the laundry 10 is uniformly distributed and clings to the inside of the drum 122.

[80] At this time, it is preferable for the wash water to be pumped by the pump 160 and sprayed into the drum 122 by the first spray nozzle 170 and the second spray nozzle 180. The first spray nozzle 170 and the second spray nozzle 180 preferably spray the wash water upward to falling laundry.

[81] In (b) of FIG. 14, when the drum 122 is decelerated, the laundry 10 is separated from the inside of the drum 122. When the drum 122 is decelerated to a speed at which no

centrifugal force is applied to the laundry 10, the laundry 10 is separated from the drum 122 by gravity, and the drum 122 rotates, thus moving and mixing the laundry 10 uniformly.

[82] At this time, similarly to the above, it is preferable for the wash water to be pumped by the pump 160 and sprayed into the drum 122 by the first spray nozzle 170 and the second spray nozzle 180.

[83] In (c) of FIG. 14, when the drum 122 is fully decelerated, the laundry 10 is gathered at the center of the drum 122. When the drum 122 is rotated at about 50 RPM, the laundry 10 is gathered at the center of the drum and rolls over. As described above, wash water may be introduced from a water supply bellows 154 or a nozzle 165 and uniformly sprayed onto the laundry.

[84] Afterwards, the drum 122 is accelerated again so that the laundry 10 gathered as shown in (a) of FIG. 14 rotates, while being uniformly distributed and clings to the inside of the drum 122.

[85] Each of the above steps is preferably repeated in short cycle. Cycle time in which acceleration and deceleration are repeated is preferably 1 to 4 seconds. Time to accelerate from 50 rpm to 100 rpm is 2 seconds or less, preferably about 1.2 seconds. Time to decelerate from 100 rpm to 50 rpm is 1 second or less, preferably about 0.5 seconds.

[86] FIG. 15 is a flow chart showing a laundry treating method according to another embodiment of the present invention.

[87] Load of laundry placed in the drum 122 is sensed (S410). When a user selects a washing course through the input unit 118 and depresses a washing start button, a wash cycle is started, and the load is sensed. The washing course selected by the user may be a washing course in which a squeezing motion is performed. To wash a large amount of laundry, the user may select a specific washing course in which a squeezing motion is performed.

[88] Load sensing may be performed by various methods or devices. In this embodiment, the drive unit 130 rotates the drum 120 at a predetermined speed for a predetermined period of time, and then deceleration time is measured to sense the load. The longer the deceleration time of the drum 122, the higher the level of the load.

[89] Initial water supplying is performed (S420). When the water supply valve 125 is opened, wash water is supplied into the tub 122 from an external water source via the detergent box 133. In the detergent box 133, the wash water may be mixed with a wash detergent or a fabric softener.

[90] Upon completion of the water supplying or during the water supplying, laundry soaking is performed (S430). The laundry soaking is a process for moving laundry so that the laundry placed in the drum 122 is soaked in the wash water supplied into the tub 121. In general, the laundry soaking is performed by a tumbling motion, but may

also be performed by the above-described squeezing motion. During the laundry soaking, the wash water may be pumped by the pump 160 and sprayed into the drum 122 by the first spray nozzle 170 and the second spray nozzle 180.

[91] It is determined whether or not the load exceeds a set range (S440). It is determined whether or not the sensed load is more than a predetermined level to decide a drum motion in a washing cycle.

[92] When the load exceeds the set range, a general motion is performed (S450), and a squeezing motion is performed (S460). The general motion refers to a rolling motion, a swing motion, and a step motion as well as a tumbling motion of FIG. 13.

[93] If the general motion is repeated when the load is large, the laundry may become entangled, thus disabling the movement of the laundry. Accordingly, the general motion is performed for a predetermined period of time, and then the squeezing motion is performed. Also, if the load is small, the laundry clings to the inside of the drum even at a low rpm, thus hindering the squeezing motion.

[94] The squeezing motion changes the speed of the drum 122 in short cycle to move the laundry by repeatedly gathering and spreading the laundry. As the movement of the laundry is facilitated, washing deviation is reduced and the laundry is brought into uniform contact with the wash water. In addition, when the laundry clings to the inside of the drum 122, the wash water soaking through the laundry is discharged as if being squeezed out of the laundry. Therefore, contaminants are discharged from the laundry during washing as if being squeezed out, and residual detergent is discharged from the laundry as if being squeezed out. Moreover, as the laundry clings to and is separated from the inside of the drum 122 in a repeated manner, a user may visually check the movement of the laundry.

[95] Execution time of the squeezing motion during the wash cycle is preferably about 10 minutes, but this may differ according to the load or washing course.

[96] In the squeezing motion, it is preferable for the wash water to be pumped by the pump 160 and sprayed into the drum 122 by the first spray nozzle 170 and the second spray nozzle 180. The first spray nozzle 170 and the second spray nozzle 180 preferably spray the wash water upward to falling laundry.

[97] It is determined how many (N) times the general motion and the squeezing motion have been repeated (S470). The general motion and the squeezing motion are performed N times so as to generate no washing deviation by virtue of the movement of the laundry. The repeated number of times N may be varied depending upon the selected course and the load.

[98] When the general motion and the squeezing motion have been repeated N times, sub spinning is performed (S490). The sub spinning is a process for discharging the wash water used in washing to the outside.

[99] When the load is within the set range, the general motion is performed (S480), and the sub spinning is performed (S490).

[100] The process up to the sub spinning step (S490) is a general washing process. The water supplying step (S420) is performed again to start a rinse cycle. The wash water supplied at this time is water not mixed with a wash detergent, but may be mixed with a fabric softener.

[101] Execution time of a squeezing motion during the rinse cycle is preferably about 3 minutes, but this may differ depending upon a load or a washing course.

[102] Preferably, steps corresponding to those of the wash cycle are repeated even during the rinse cycle. However, the operation time of each step and the repeated number of times N may be changed.

[103] It will be understood by those skilled in the art that example embodiments can be implemented in other specific forms without changing the technical spirit or essential features of the present invention. Therefore, it should be noted that the forgoing embodiments are merely illustrative in all aspects and are not to be construed as limiting the invention. The scope of the invention is defined by the appended claims rather than the detailed description of the invention. All changes or modifications or their equivalents made within the meanings and scope of the claims should be construed as falling within the scope of the invention.

[104] According to the laundry treating apparatus of the present invention, one or more effects as follows may be achieved.

[105] First, wash water is uniformly sprayed into the drum.

[106] Second, wash water is sprayed into the drum in a plurality of directions.

[107] Third, wash water is sprayed upward into the drum.

[108] Fourth, wash water is sprayed to laundry such that the wash water applies strong impact to the laundry.

[109] Fifth, wash water, sprayed to laundry, penetrates the laundry, thereby improving washing and rinsing performances.

[110] Sixth, wash water, sprayed to the laundry, bends and stretches the laundry, thereby improving washing and rinsing performances.

[111] Seventh, the spray nozzles are provided at the lower part of the gasket such that the spray nozzles are adjacent to the pump, thereby increasing the amount of wash water sprayed by the spray nozzles.

[112] Eighth, non-uniform contact between wash water and laundry is prevented during washing or rinsing, thereby improving washing performance.

[113] Ninth, the movement of laundry is facilitated, thereby reducing washing deviation during washing or rinsing of a large amount of laundry.

[114] The effects of the present invention are not limited to the above-mentioned effects,

and other effects not mentioned above can be clearly understood from the definitions in the claims by one skilled in the art.

Claims

[Claim 1] A laundry treating apparatus comprising:
a cabinet;
a tub provided in the cabinet;
a drum rotatably provided in the tub for receiving laundry;
a gasket provided between the cabinet and the tub;
a plurality of spray nozzles provided at a lower part of the gasket for spraying wash water upward into the drum; and
a pump for pumping wash water to the spray nozzles.

[Claim 2] The laundry treating apparatus according to claim 1, wherein each of the spray nozzles comprises a first surface for guiding wash water such that the wash water is sprayed into the drum.

[Claim 3] The laundry treating apparatus according to claim 2, wherein a wash water spray plane defined by the first surface forms a slanted line on a predetermined projection plane perpendicular to a rotation axis of the drum.

[Claim 4] The laundry treating apparatus according to claim 1, wherein each of the spray nozzles comprises:
a second surface for defining a lower limit; and
a third surface for defining an upper limit, whereby
a spray region between the lower limit and the upper limit of the sprayed wash water intersects a rotation axis of the drum.

[Claim 5] The laundry treating apparatus according to claim 4, wherein each of the spray nozzles sprays wash water such that an upper spray angle, which is an angle between a middle spray stream joining the rotation axis of the drum and an upper limit spray stream defining the upper limit of the sprayed wash water, is greater than a lower spray angle, which is an angle between the middle spray stream and a lower limit spray stream defining the lower limit of the sprayed wash water.

[Claim 6] The laundry treating apparatus according to claim 1, further comprising a weight provided at the gasket, wherein the spray nozzles comprise a first spray nozzle and a second spray nozzle arranged such that the weight is disposed between the first spray nozzle and the second spray nozzle.

[Claim 7] The laundry treating apparatus according to claim 1, wherein the spray nozzles comprise a first spray nozzle and a second spray nozzle arranged such that the first spray nozzle and the second spray nozzle

are symmetrical to each other about a perpendicular symmetrical line of the gasket.

[Claim 8] The laundry treating apparatus according to claim 1, further comprising connectors for connecting the spray nozzles and the gasket.

[Claim 9] The laundry treating apparatus according to claim 8, wherein the connectors guide the wash water pumped by the pump to the corresponding spray nozzles.

[Claim 10] The laundry treating apparatus according to claim 1, wherein the pump pumps wash water in the tub.

[Claim 11] The laundry treating apparatus according to claim 1, wherein the pump pumps the wash water simultaneously to the spray nozzles.

[Claim 12] The laundry treating apparatus according to claim 1, further comprising a distributer for distributing the wash water pumped by the pump to the respective spray nozzles.

[Claim 13] The laundry treating apparatus according to claim 1, wherein the pump pumps the wash water when the laundry clings to and is separated from an inside of the drum in a repeated manner by accelerating and decelerating the drum.

[Claim 14] The laundry treating apparatus according to claim 1, wherein the pump pumps the wash water when the laundry in the drum is dropped in a repeated manner by rotating the drum.

[Claim 15] The laundry treating apparatus according to claim 1, wherein the spray nozzles are formed at the gasket as one body.

[Claim 16] A laundry treating apparatus comprising:
a cabinet;
a tub provided in the cabinet;
a drum rotatably provided in the tub for receiving laundry;
a gasket provided between the cabinet and the tub; and
a plurality of spray nozzles provided at the gasket for spraying wash water into the drum in a plurality of directions.

[Claim 17] The laundry treating apparatus according to claim 16, wherein the spray nozzles comprise:
a first spray nozzle for spraying wash water along a slanted line ranging from a second quarter plane to a fourth quarter plane on a predetermined projection plane perpendicular to a rotation axis of the drum; and
a second spray nozzle for spraying wash water along a slanted line ranging from a first quarter plane to a third quarter plane.

[Claim 18] A laundry treating method comprising:
in a wash cycle or a rinse cycle,
supplying wash water into a tub;
rotating a drum provided in the tub for receiving laundry; and
pumping the wash water in the tub when the drum is rotated and spraying the wash water into the drum from a front of the drum below the drum in a plurality of directions.

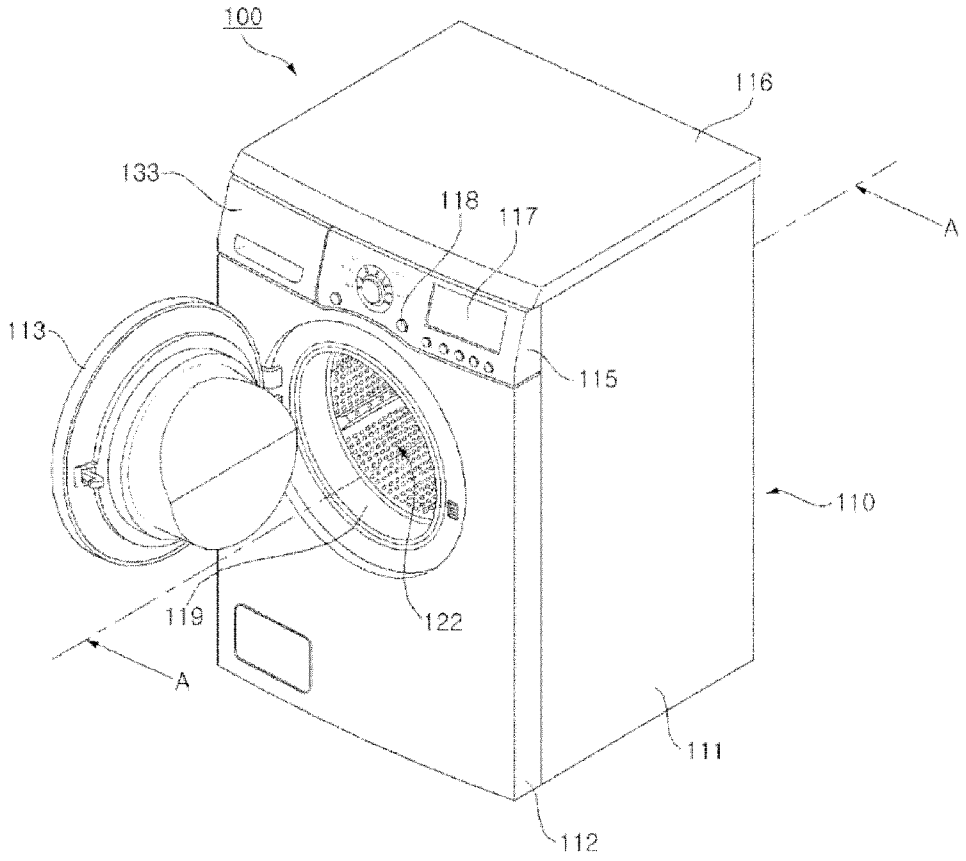
[Claim 19] The laundry treating method according to claim 18, wherein the step of rotating the drum comprises rotating the drum in a predetermined direction to drop the laundry in a repeated manner.

[Claim 20] The laundry treating method according to claim 18, wherein the step of rotating the drum comprises accelerating and decelerating the drum such that the laundry clings to and is separated from an inside of the drum in a repeated manner.

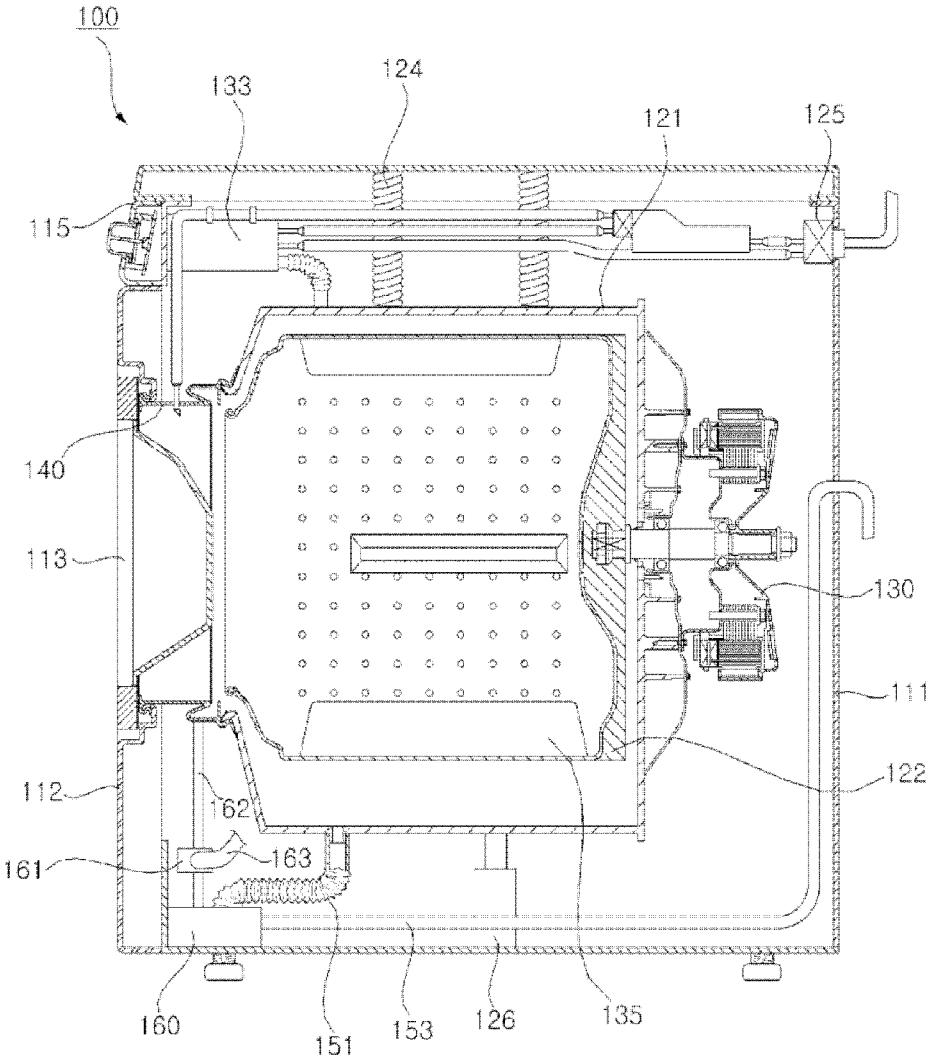
[Claim 21] The laundry treating method according to claim 18, wherein the step of rotating the drum comprises:
calculating a load of the laundry in the drum; and
accelerating and decelerating the drum, when the load exceeds a reference load, such that the laundry clings to and is separated from an inside of the drum in a repeated manner.

[Claim 22] The laundry treating method according to claim 18, wherein the step of spraying the wash water comprises spraying wash water along a slanted line ranging from a second quarter plane to a fourth quarter plane on a predetermined projection plane perpendicular to a rotation axis of the drum and spraying wash water along a slanted line ranging from a first quarter plane to a third quarter plane.

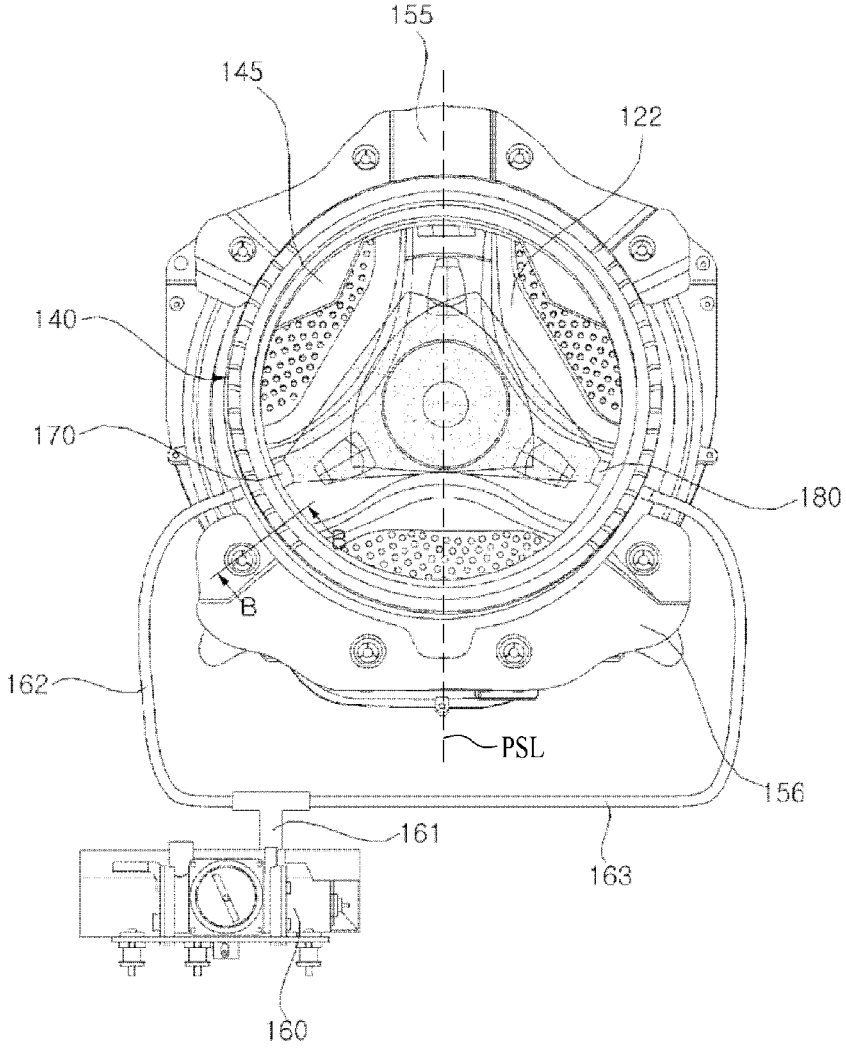
[Fig. 1]



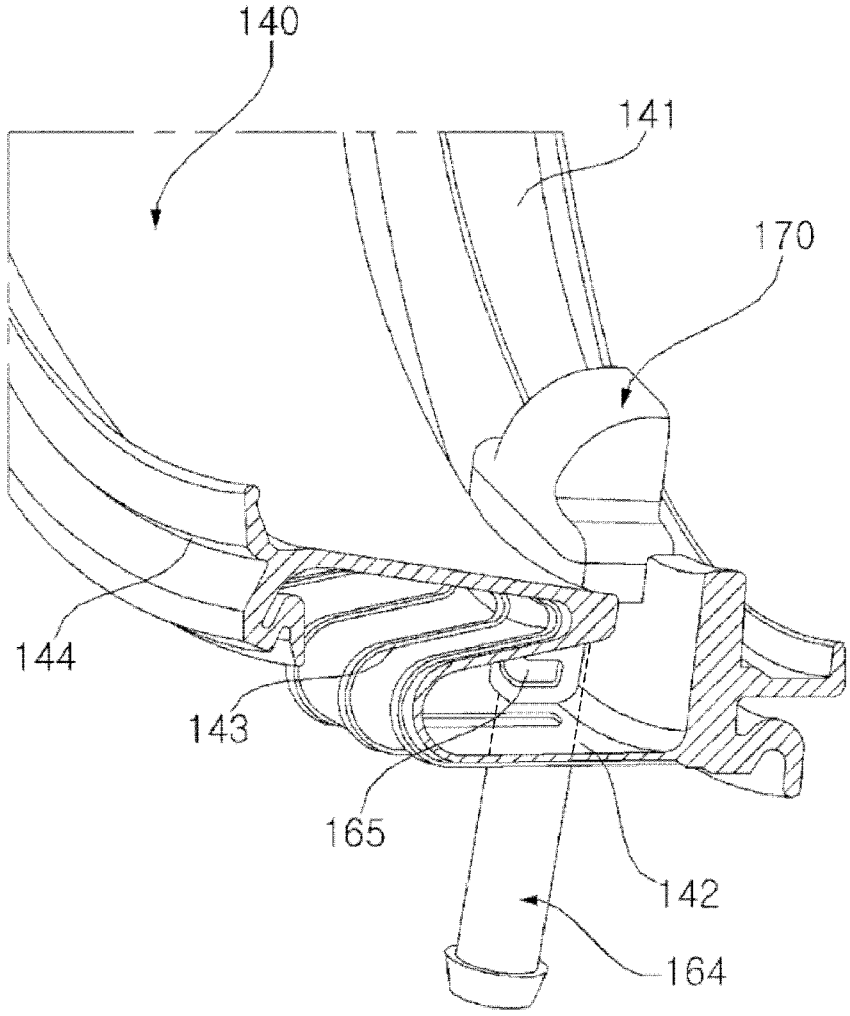
[Fig. 2]


100
133
124
121
125
115
140
113
130
111
122
112
162
161
163
160
151
153
126
135

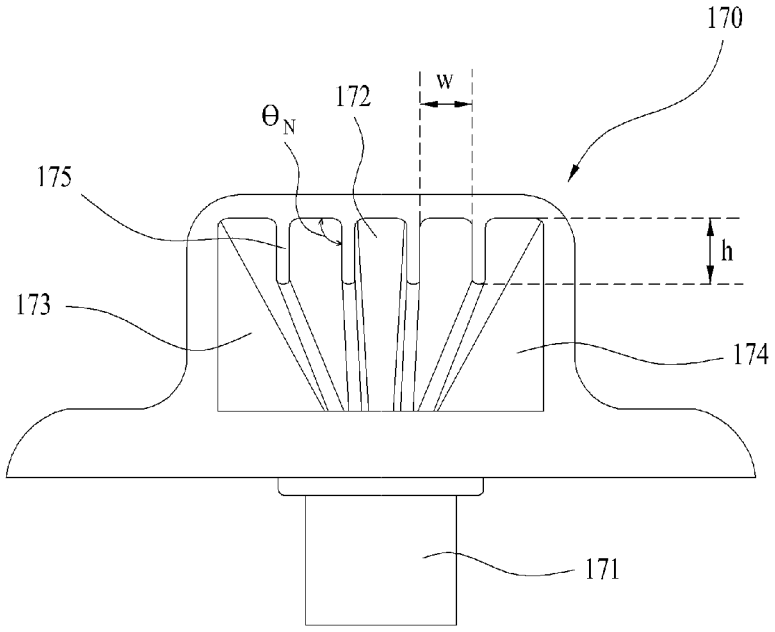
[Fig. 3]



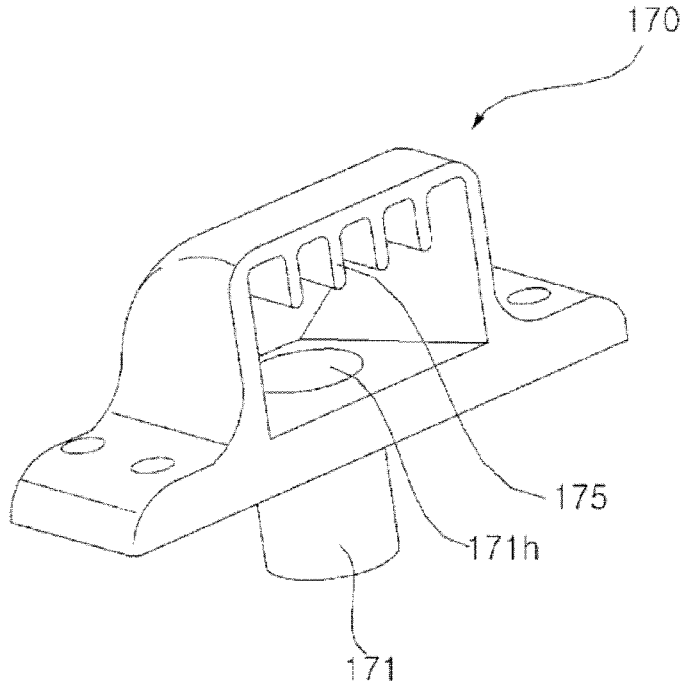
[Fig. 4]



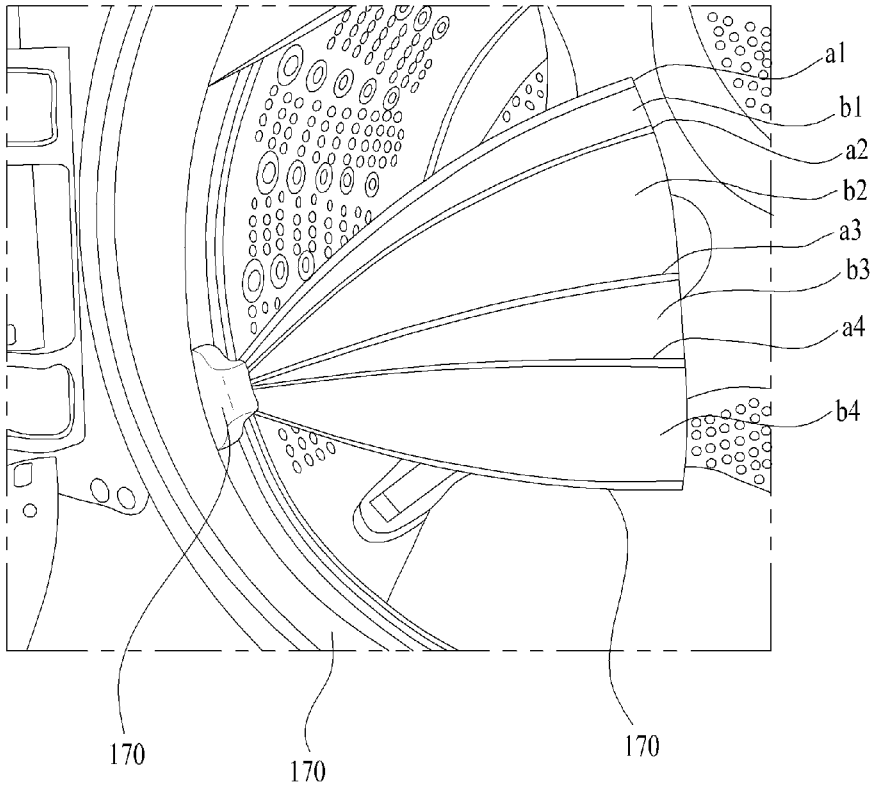
[Fig. 5a]



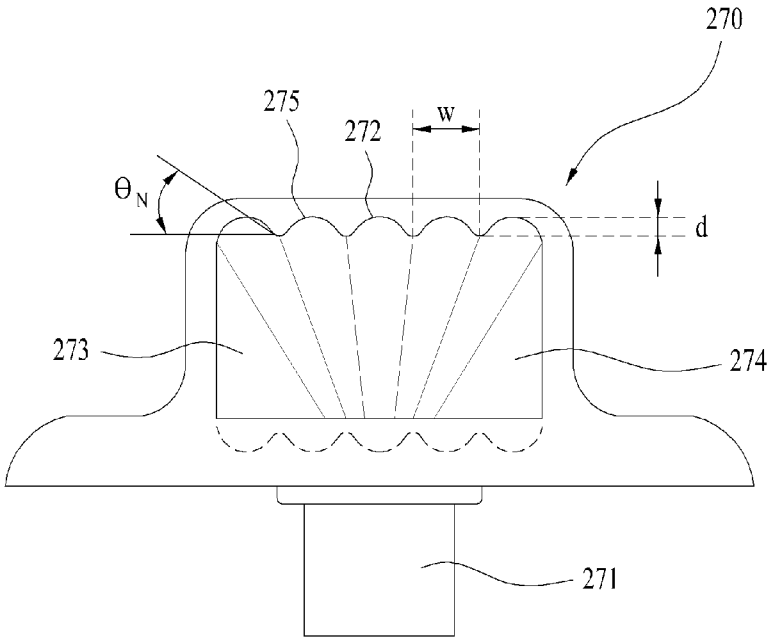
[Fig. 5b]



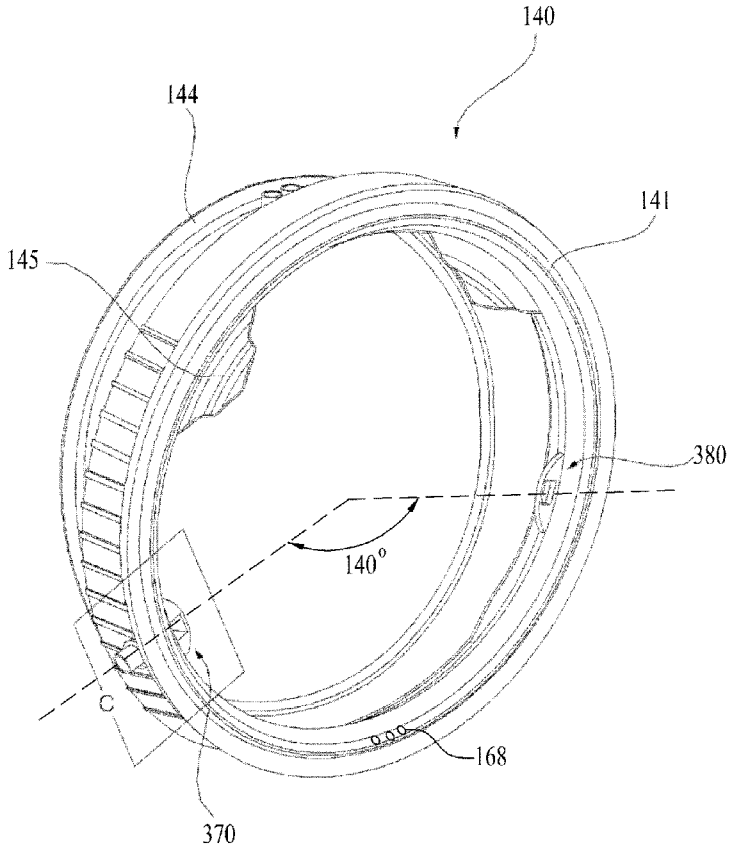
[Fig. 6]



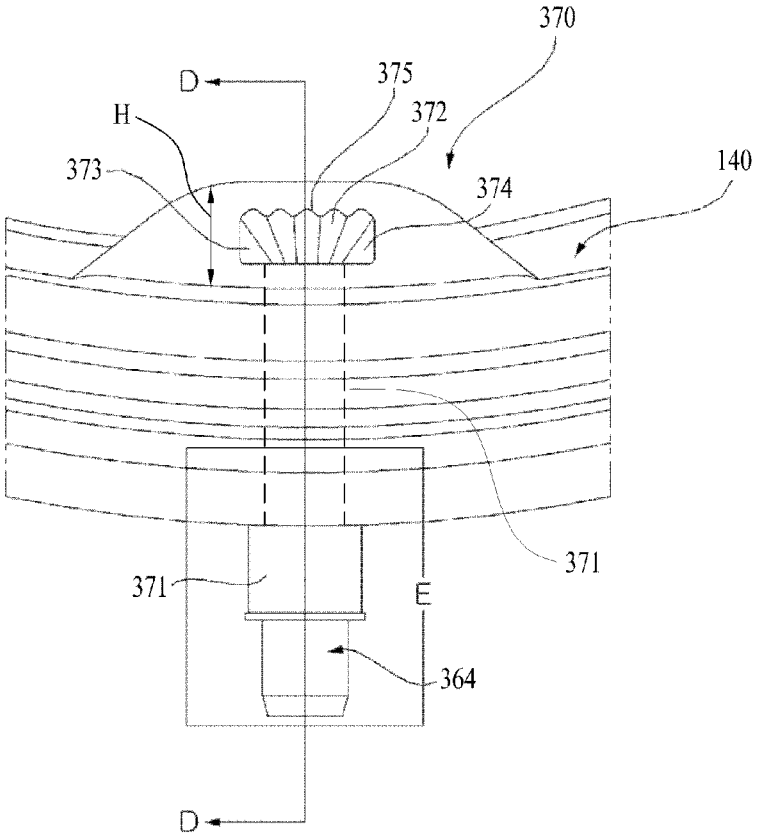
[Fig. 7]


270
275
272
w
θ_N
d
273
274
271

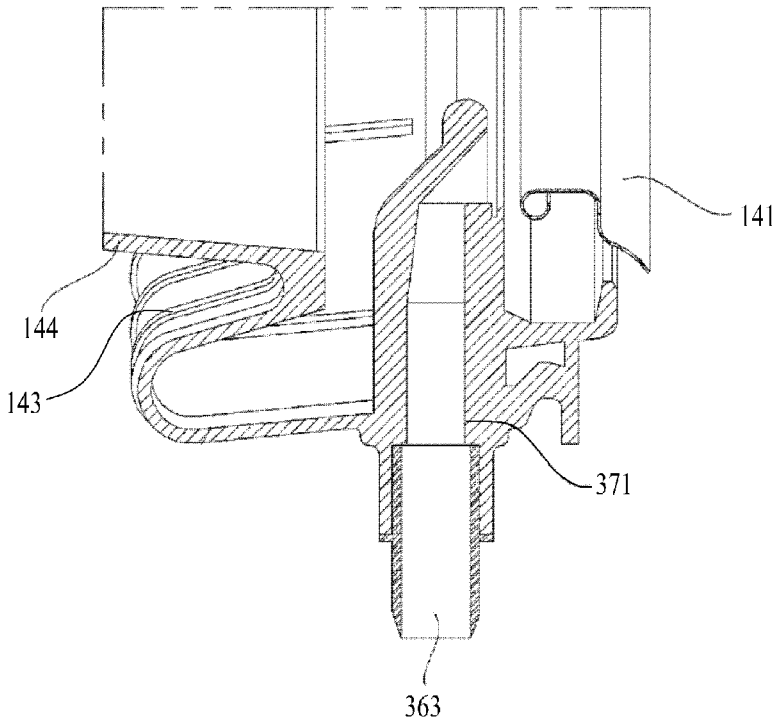
[Fig. 8]


140
144
141
145
380
140°
C
168
370

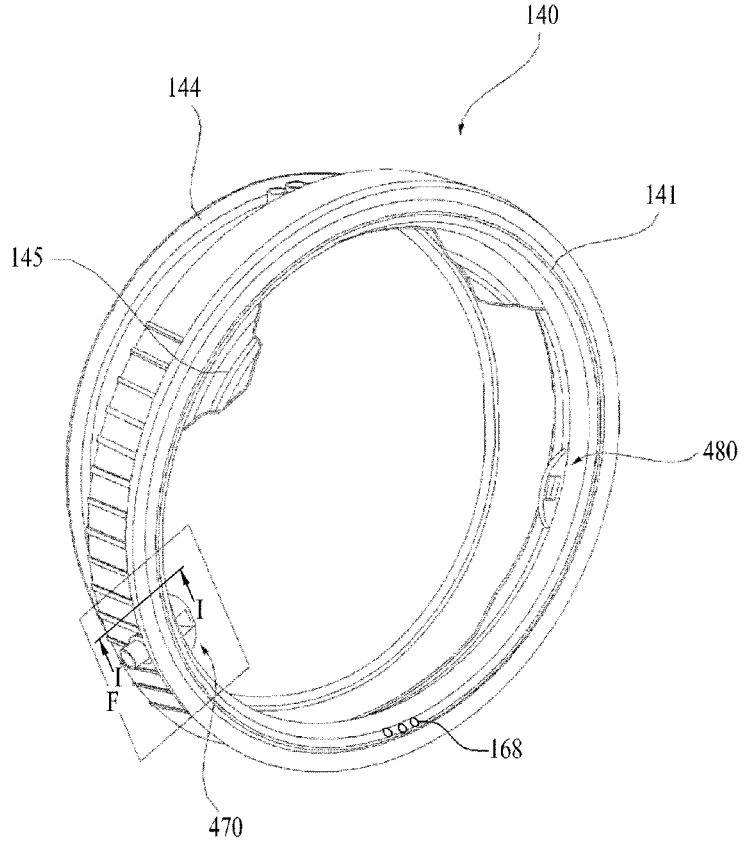
[Fig. 9]



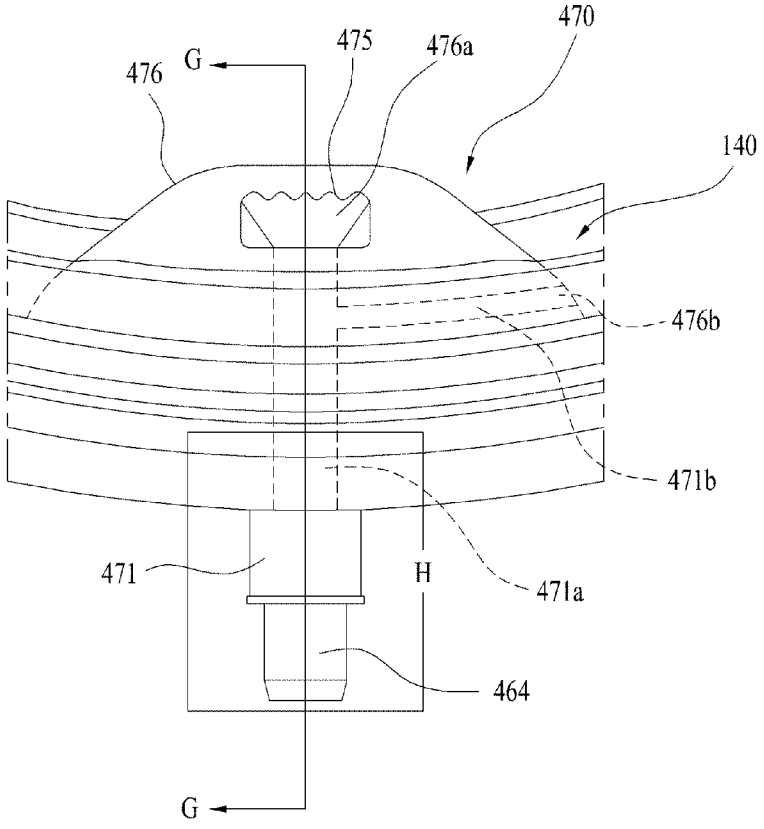
[Fig. 10]



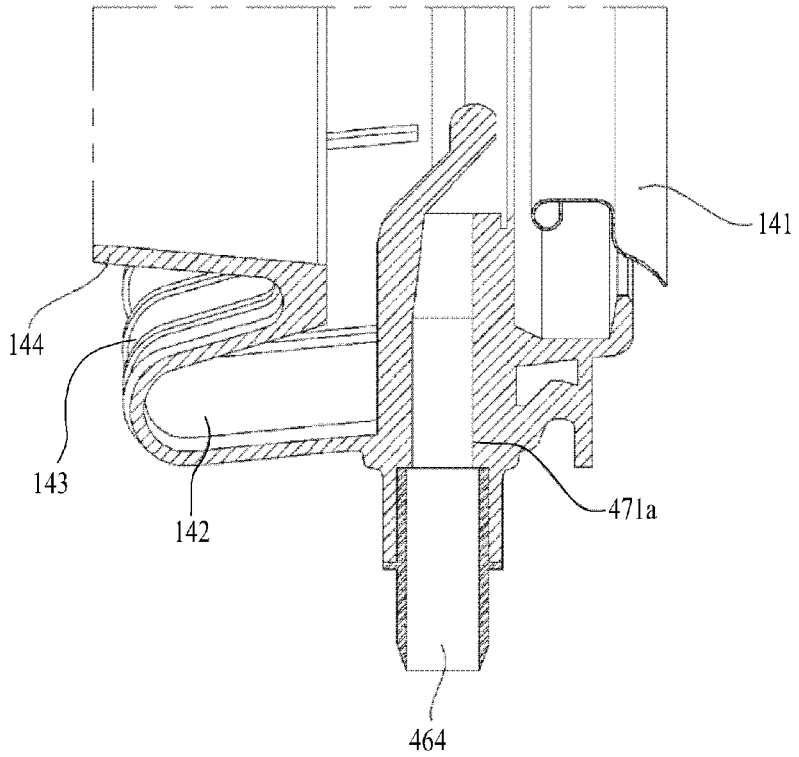
[Fig. 11]


140
144
141
145
480
I
I
F
168
470

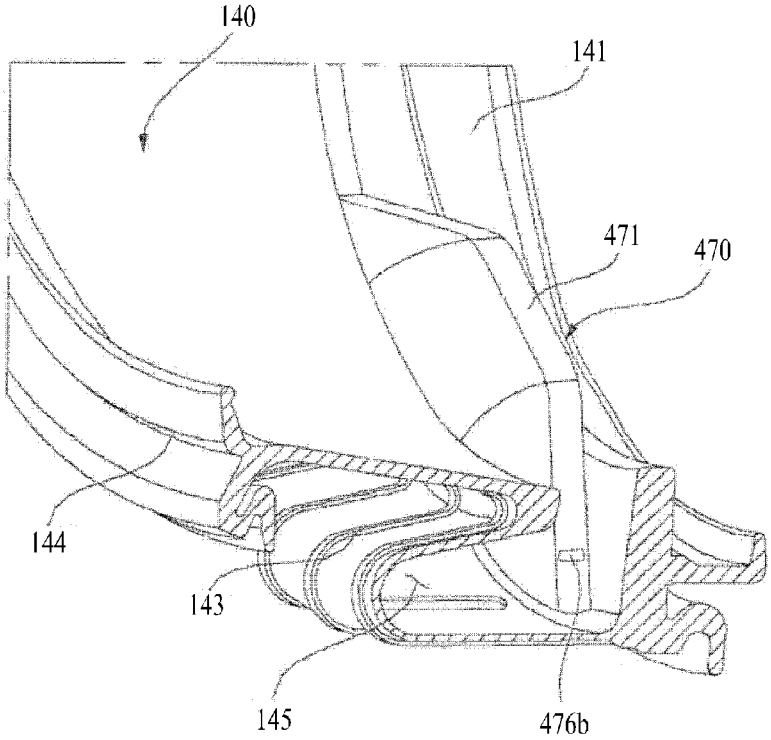
[Fig. 12]


470
475
476a
476
G
140
476b
471b
471
H
471a
464
G

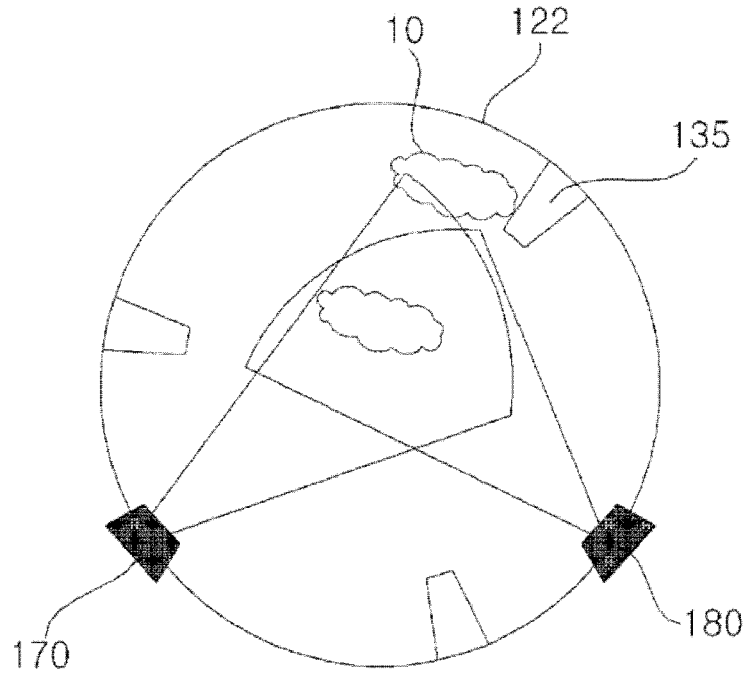
[Fig. 13]



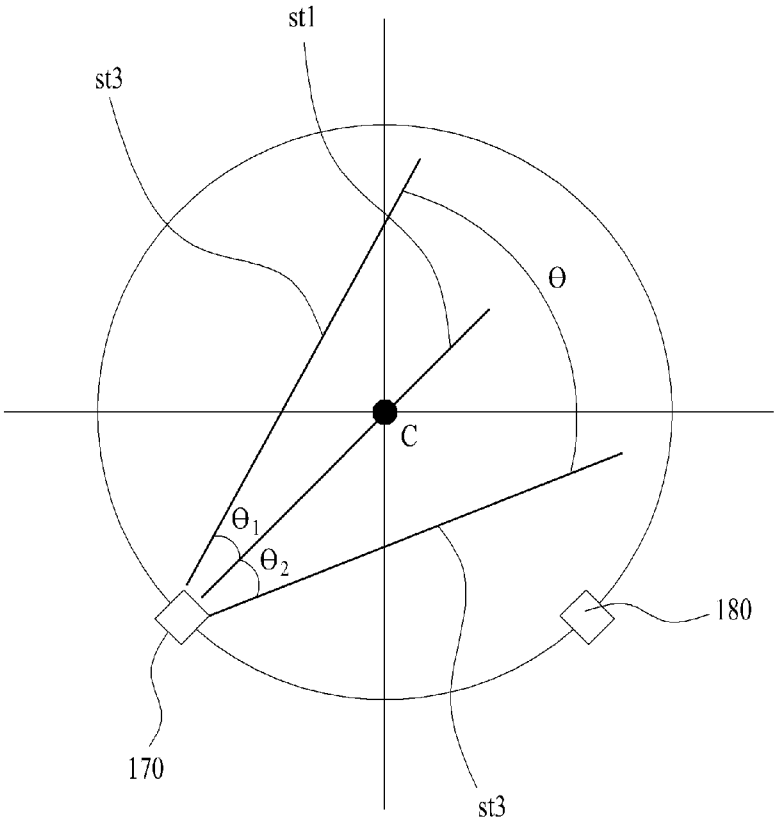
[Fig. 14]



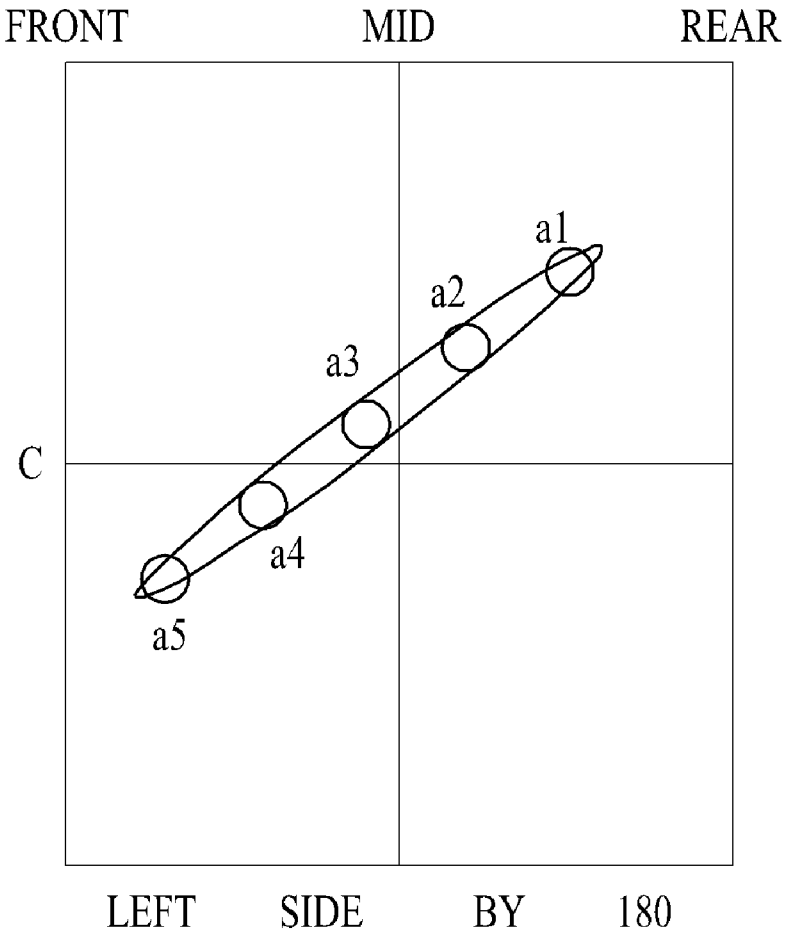
[Fig. 15]



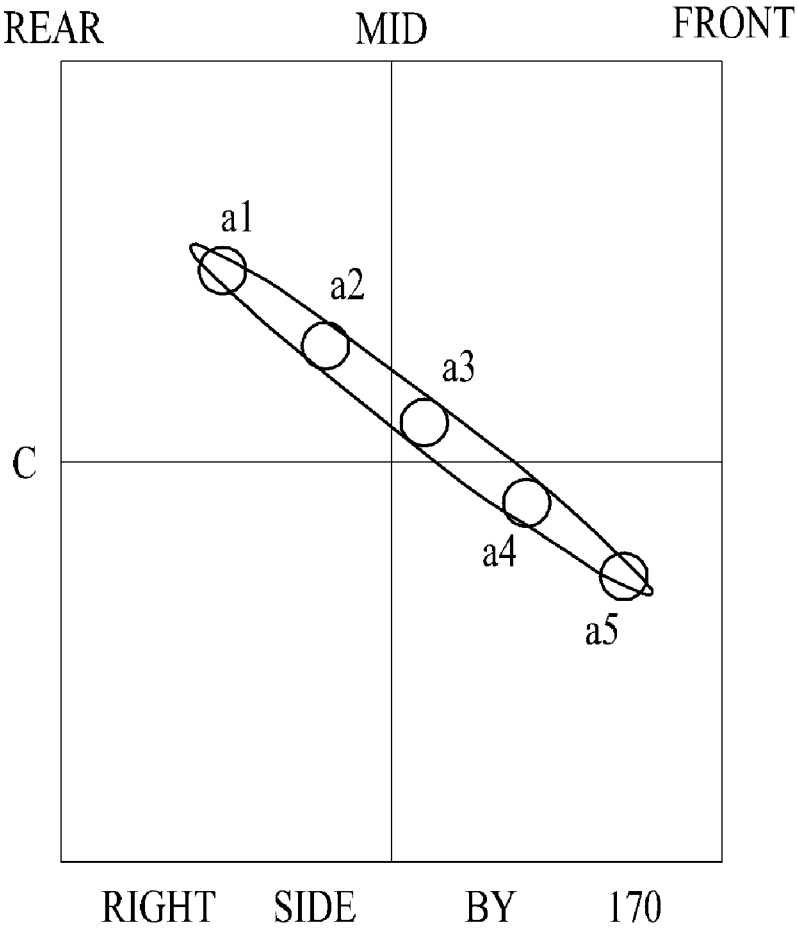
[Fig. 16]



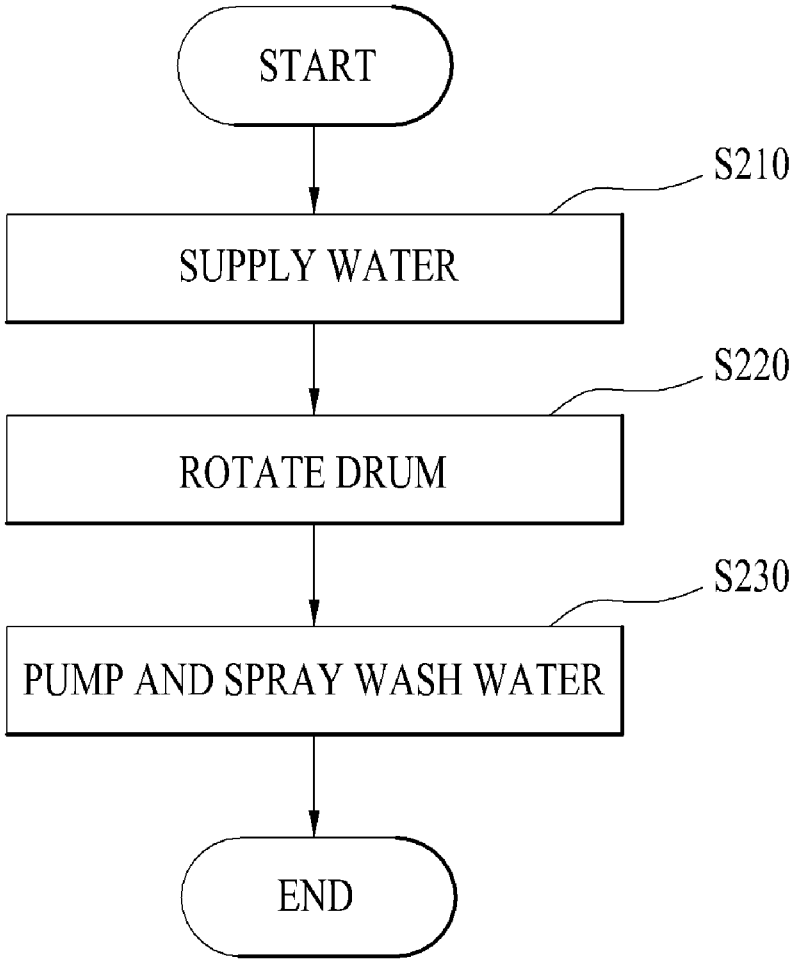
[Fig. 17a]



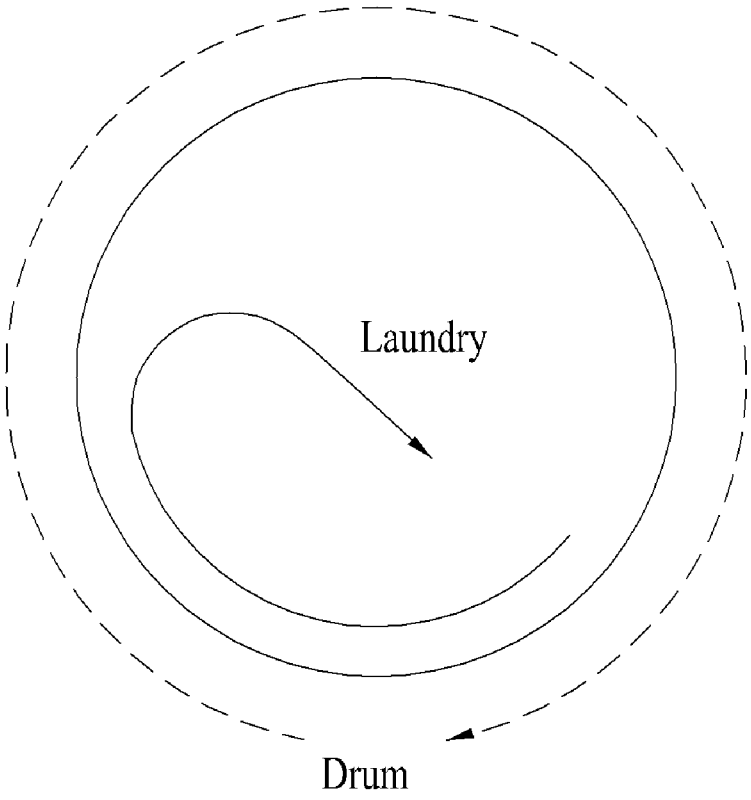
[Fig. 17b]



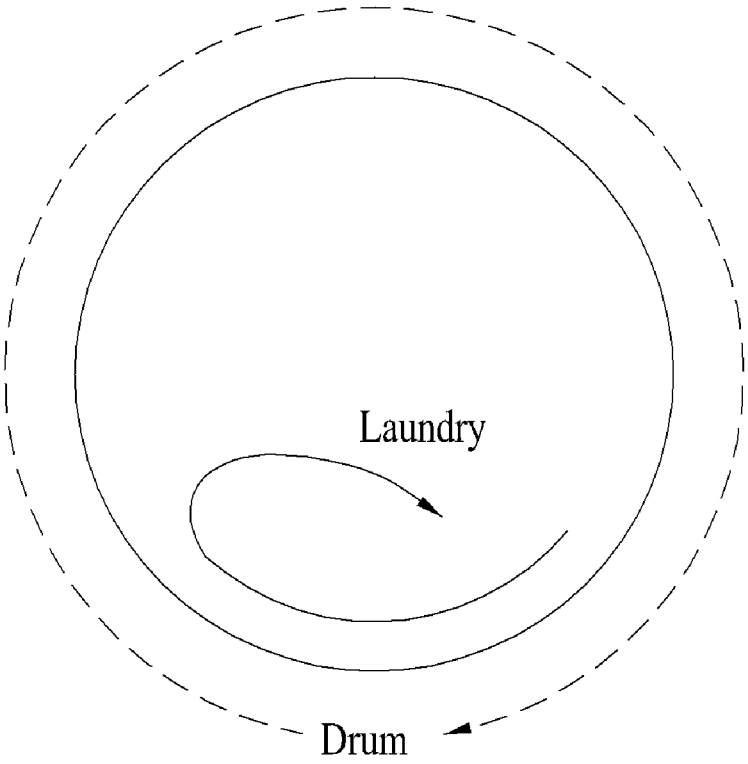
[Fig. 18]


START
S210
SUPPLY WATER
S220
ROTATE DRUM
S230
PUMP AND SPRAY WASH WATER
END

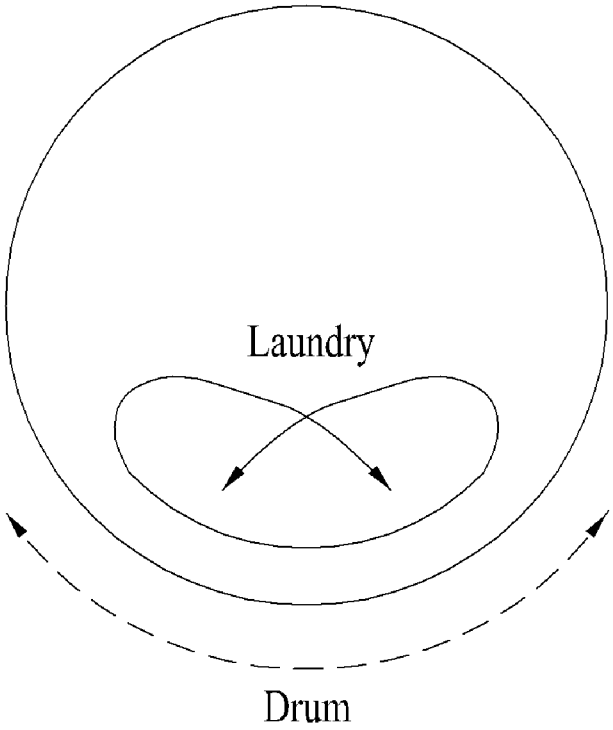
[Fig. 19a]



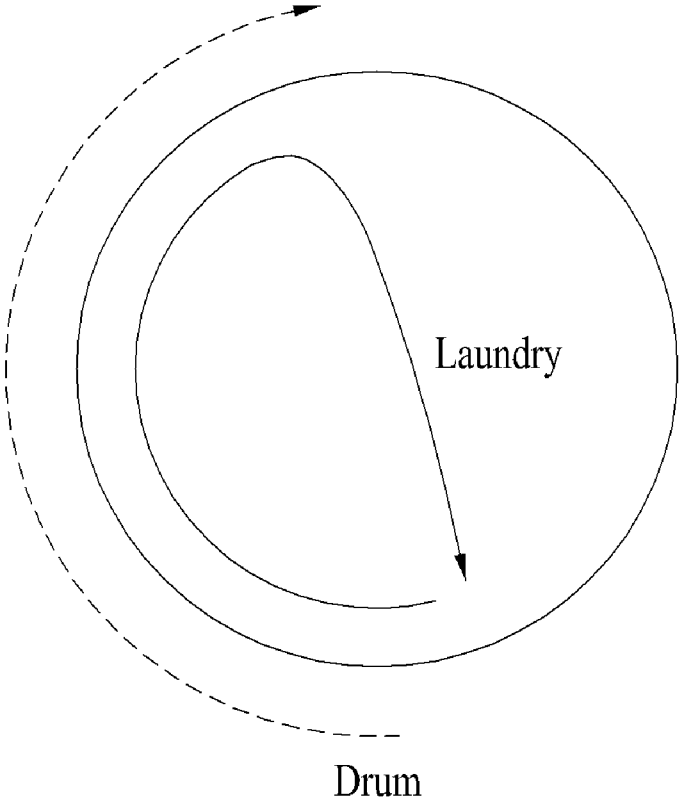
[Fig. 19b]



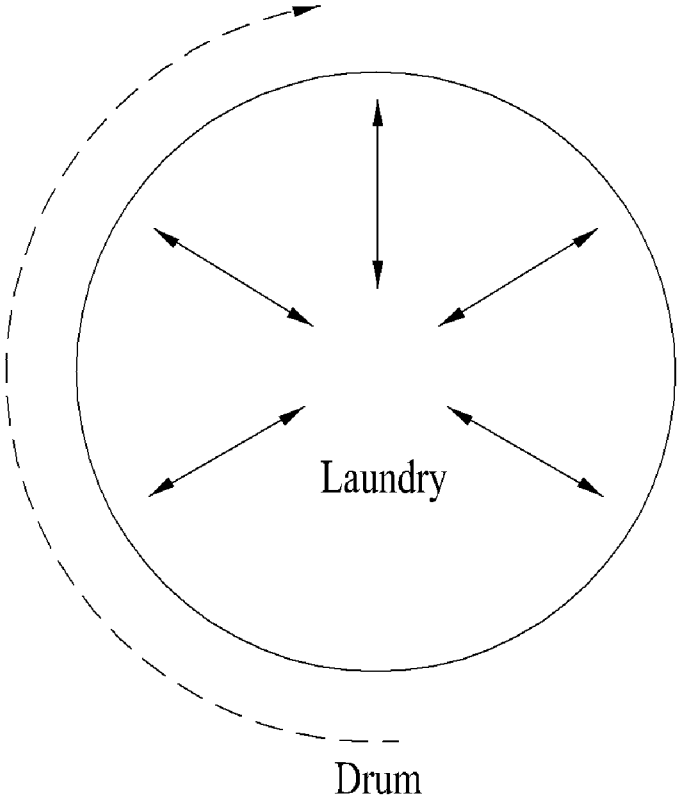
[Fig. 19c]



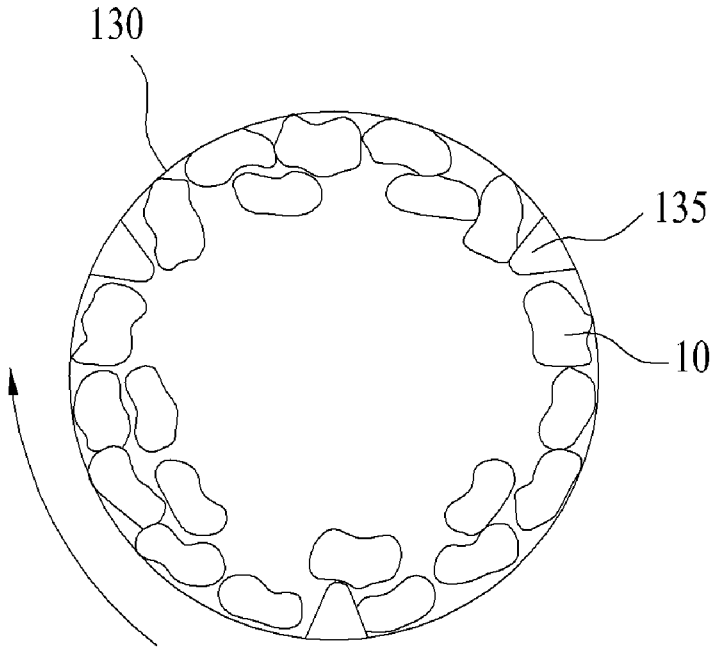
[Fig. 19d]



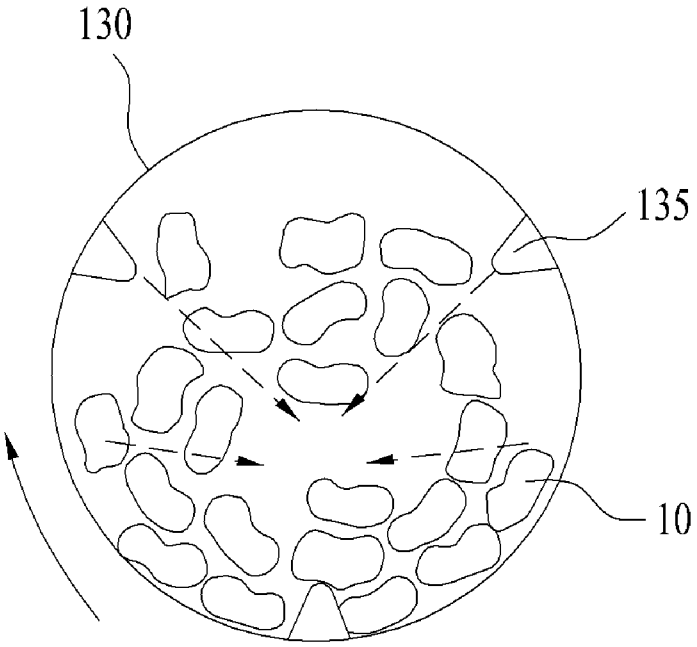
[Fig. 19e]



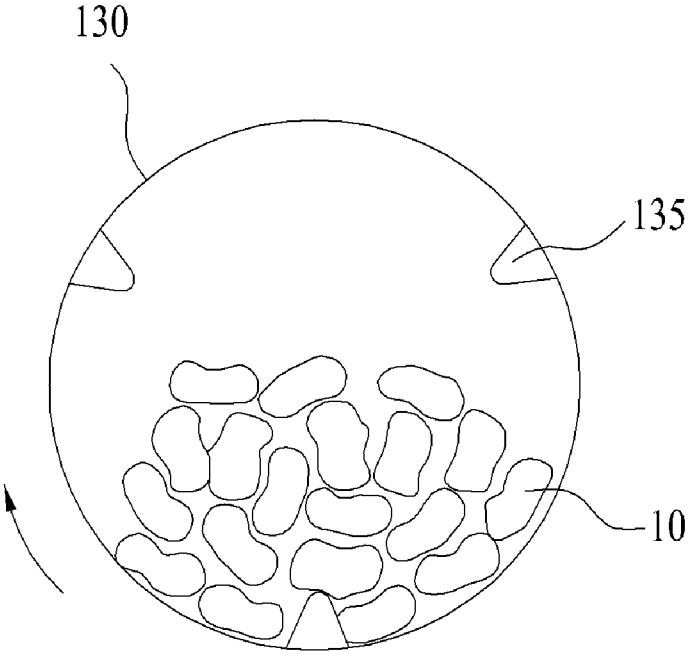
[Fig. 20a]



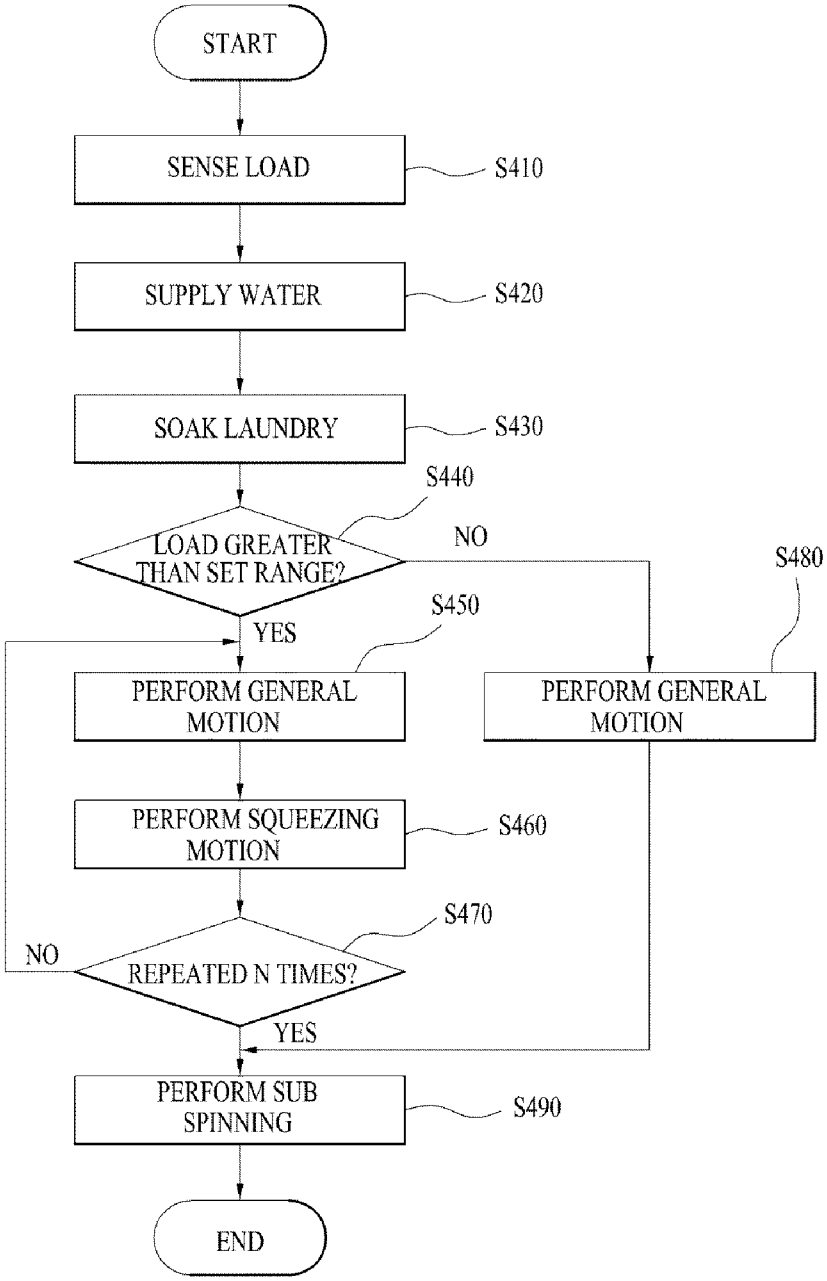
[Fig. 20b]



[Fig. 20c]



[Fig. 21]


START
SENSE LOAD
S410
SUPPLY WATER
S420
SOAK LAUNDRY
S430
S440
LOAD GREATER THAN SET RANGE?
NO
S480
YES
S450
PERFORM GENERAL MOTION
PERFORM GENERAL MOTION
PERFORM SQUEEZING MOTION
S460
S470
NO
REPEATED N TIMES?
YES
PERFORM SUB SPINNING
S490
END