

(19)



(11)

**EP 2 589 697 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:  
**10.02.2016 Bulletin 2016/06**

(51) Int Cl.:  
**D06F 39/08 (2006.01) D06F 39/12 (2006.01)**  
**D06F 39/10 (2006.01)**

(21) Application number: **12748940.9**

(86) International application number:  
**PCT/JP2012/001189**

(22) Date of filing: **22.02.2012**

(87) International publication number:  
**WO 2012/114734 (30.08.2012 Gazette 2012/35)**

(54) **DRUM-TYPE WASHING MACHINE**

TROMMELWASCHMASCHINE

MACHINE À LAVER DU TYPE À TAMBOUR

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

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(30) Priority: **23.02.2011 JP 2011036750**

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(43) Date of publication of application:  
**08.05.2013 Bulletin 2013/19**

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(56) References cited:  
**EP-A1- 2 471 993 WO-A2-2009/125952**  
**WO-A2-2009/125952 DE-A1- 2 817 813**  
**JP-A- 2004 173 743 JP-A- 2006 068 192**  
**JP-A- 2006 068 192 JP-A- 2006 239 141**  
**JP-A- 2007 117 138 JP-A- 2009 297 139**  
**JP-A- 2010 268 843 US-A1- 2010 000 266**

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**Description**

## TECHNICAL FIELD

**[0001]** The present invention relates to a front-loading-type washing machine that washes laundry contained within a rotary drum.

## BACKGROUND ART

**[0002]** In the related art, front-loading-type washing machines that improve washing performance by discharging washing water to laundry are suggested (for example, refer to PTL 1).

**[0003]** Hereinafter, the configuration of a front-loading-type washing machine of the related art shown in PTL 1 will be described using Fig. 4.

**[0004]** Fig. 4 is a cross-sectional view of the front-loading-type washing machine of the related art.

**[0005]** As shown in Fig. 4, the front-loading-type washing machine of the related art is equipped with at least drum 21, water-receiving tub 23 that is a water tub, heater 36, and a circulation device.

**[0006]** Drum 21 is provided inside water-receiving tub 23 so as to be rotatable in the horizontal direction. Lid 31 that allows laundry, such as clothing, to be taken into and out of drum 21, is openably and closably provided in the front surface of the water-receiving tub 23 so as to face an opening portion of the front surface of drum 21.

**[0007]** Heater 36 that is a heating portion that heats the washing water stored within water-receiving tub 23 is provided on the bottom side of water-receiving tub 23.

**[0008]** The circulation device is constituted by circulating pump 37 that suctions the washing water from opening portion 34 provided at the bottom of water-receiving tub 23, circulation hose 38 that is connected to a discharge port side of circulating pump 37, and discharge port 39 that is connected to one end side of circulation hose 38.

**[0009]** Discharge port 39 is provided on upside of drum 21 at a position that faces a front opening portion of drum 21, and as shown by B in the drawing, discharges the washing water toward the central portion of drum 21.

**[0010]** The front-loading-type washing machine of the related art configured as described above lifts the laundry contained within drum 21 by the rotation of drum 21, and stirs the laundry within drum 21. At this time, the washing water heated by heater 36 can be jetted onto the laundry within drum 21 by circulating pump 37, thereby enhancing the cleaning effect on the laundry.

**[0011]** However, the front-loading-type washing machine of the related art causes the washing water to be jetted from one discharge port 39 of upside of drum 21. Therefore, when the laundry has fallen within drum 21 due to its own weight, the washing water can be sprayed onto the laundry. However, in a case where the laundry sticks to drum 21 and is rotating, the washing water is not easily sprayed onto the laundry. As a result, the wash-

ing water cannot be uniformly sprayed onto the laundry within the water tub, and a stable cleaning effect is not easily obtained.

## 5 Citation List

## Patent Literature

**[0012]** PTL 1 Japanese Patent Unexamined Publication No. JP H 09-215893 A.

**[0013]** EP 2 471 993 A1, which is a later published document, relates to a drum type washing machine. A drum type washing machine is provided with: an outer box; a water tub which has a closed-bottomed cylindrical shape having the rear surface side thereof closed and is elastically supported within the outer box in such a manner that the center axis of the water tub is located on an axis extending downward and rearward; a drum which is provided within the water tub so as to be rotatable about the axis, has a closed-bottomed cylindrical shape having the rear surface side thereof closed, and is provided with a large number of holes in the peripheral wall of the drum; a washing machine motor which is provided to the outside of the rear surface of the water tub and drives the drum in the forward direction and the reverse direction; baffles which are provided to the inner peripheral section of the drum and extend in the front-rear direction along the axis; a water intake opening section which is formed in the bottom of the water tub; first and second water discharge opening sections; which are formed on the front surface side of the water tub at positions in the upper part thereof; a circulation path which connects the water intake opening section and the first and second water discharge opening sections; a circulation pump which is provided in the circulation path and discharges water, which is taken out of the water intake opening section of the water tub, from the first and second water discharge opening sections to the inside of the drum; and a control means which controls the washing machine motor and the circulation pump.

**[0014]** JP 2006-239141 A, which discloses the preamble of claim 1, relates to a drum type washing machine. Inside the water tub, a drum for housing laundry is freely rotatably arranged. The drum is provided with a small hole for communicating a space between the water tub and the drum and a space inside the drum. By the operation of a circulation pump, water between the water tub and the drum is put out of the water tub and sent to a nozzle for washing and a nozzle for foreign matter removal. While the nozzle for washing jets the water toward the inside of the drum, the nozzle for foreign matter removal jets the water toward a part between the water tub and the drum.

**[0015]** JP 2004-173743 A relates to a drum type washing machine. The rotary drum having a rotating shaft almost in the horizontal direction or in the direction of inclination is included in the tub where the washing water is stored and a tub receiving part is installed overlapping

the rotary drum on the side of the inlet opening of the rotary drum. A channel-shaped washing water path is provided in the surface as opposed to the rotary drum at the upper part of the tub receiving part. The washing water path has a washing water inflow part formed in the rotating direction of the rotary drum and a drain guide part formed toward the inlet opening.

**[0016]** JP 2007-117138 A relates to a drum type washing machine. This drum type washing machine is equipped with: a water intake port; a discharging port; circulation paths which connect the water intake port with the discharging port; a water draining path which drains the washing water in an external tub; a water draining means which controls the water discharge; and a third water feeding path which pours water into the fourth circulation path. In this case, the washing water which rotates in the external tub accompanying the rotation of a rotary drum enters the water intake port. The discharging port discharges the washing water which has been taken in from the water intake port into the rotary drum. The washing water remaining in the circulation paths is drained by the draining means which communicates with a water purging path by the water pouring from the third water feeding path.

**[0017]** JP 2010-268843 A relates to a spin dryer washer. A water receiving portion, flow paths, and water discharge port portions are provided in an overhang portion covering a spin-dry tub of the water tub cover, the supplied water is received by the water receiving portion, the water flows to the flow paths extending in a plurality of different directions from the water receiving portion, then the water is discharged from the water discharge port portions present at the respective end portions of the flow paths and the water is supplied to the inside of the spin-dry tub. Thus, the water is directly applied to the laundry placed inside the spin-dry tub in a wide range, thereby the water directly permeates the laundry in the wide range, and the laundry is quickly immersed in the water.

**[0018]** US 2010/0000266 A1 relates to a washing machine. A washing machine has a water spray device to efficiently wet the laundry by spraying washing water to the laundry with uniform pressure. The washing machine includes an outer tub, and a water spray device installed at an upper portion of the outer tub to spray washing water. The water spray device includes a diffusion duct for diffusing the washing water around the outer tub and a spray member provided in the diffusion duct to spray the washing water into the outer tub.

#### SUMMARY OF THE INVENTION

**[0019]** It is an object of the present invention to provide an improved and useful front-loading-type washing machine in which the above-mentioned problems are eliminated. In order to achieve the above-mentioned object, there is provided a front-loading-type washing machine according to claim 1. Advantageous embodiments are defined by the dependent claims.

**[0020]** Advantageously, a front-loading-type washing machine includes a rotary drum that is formed in the shape of a bottomed cylinder; a water tub that rotatably includes the rotary drum; a motor that rotationally drives the rotary drum; a filter case that communicates with the water tub via a drain pipe connected to the bottom of the water tub and has a filter provided therein; a circulating pump that communicates with the filter case via a circulating water suction pipe connected to the filter case; a channel that communicates with the circulating pump via a circulating water discharge pipe connected to the circulating pump, and is formed on the front inner side of the water tub; a plurality of jetting ports that are provided on the inner peripheral side of the channel and discharge washing water into the water tub; and a control device that controls at least steps of washing, rinsing, and spin-drying. The opening area of the jetting port provided at the farthest position from a connecting portion between the circulating water discharge pipe and the channel is larger than the opening area of the jetting port provided at the nearest position from the connecting portion.

**[0021]** Thereby, the jetting amounts of the washing water from the individual jetting ports are made almost equal, and the washing water is uniformly jetted onto laundry within the water tub. As a result, the front-loading-type washing machine with stable washing performance can be realized.

#### BRIEF DESCRIPTION OF DRAWINGS

##### **[0022]**

Fig. 1 is a cross-sectional view of a front-loading-type washing machine in an embodiment of the invention.

Fig. 2 is a cross-sectional view when the front of the rotary drum of the front-loading-type washing machine is viewed from the inside.

Fig. 3 is an exploded perspective view of main portions of the front-loading-type washing machine.

Fig. 4 is a cross-sectional view of a front-loading-type washing machine of the related art.

#### DESCRIPTION OF EMBODIMENTS

**[0023]** Hereinafter, an embodiment of the invention will be described, referring to the drawings. The invention is not limited by the present embodiment.

50 (Embodiment)

**[0024]** Fig. 1 is a cross-sectional view of a front-loading-type washing machine in the embodiment of the invention.

**[0025]** As shown in Fig. 1, the front-loading-type washing machine of the embodiment is equipped with rotary drum 43, water tub 42, motor 45, filter case 83 that communicates with water tub 42, circulating pump 67 that

communicates with filter case 83, channel 85 that communicates with circulating pump 67, jetting ports 70, and control device 81.

**[0026]** Water tub 42 is swingably provided inside main body 41, and rotary drum 43 is rotatably provided inside water tub 42. Rotary drum 43 is rotated in normal and reverse directions around rotating shaft 44 that is provided in the horizontal direction and is a rotation center shaft that is coupled via belt 46 to motor 45 attached to a lower portion of water tub 42 on the back side.

**[0027]** The inner wall surface of rotary drum 43 is provided with a plurality of, for example, projection plates 47 that stir laundry, and a number of water passing holes 48 that communicate with the inside of water tub 42.

**[0028]** Water tub unit 49 is constituted by the above-described water tub 42, rotary drum 43, motor 45, and belt 46. Water tub unit 49 is supported in a vibration-absorbing manner by a plurality of spring bodies 50 from an upper portion of main body 41, and by a plurality of vibration-absorbing dampers 51 from a lower portion of main body 41.

**[0029]** An upper rear portion of water tub 42 is provided with vibration detector 78 including, for example, an acceleration sensor or the like, which detects the vibration of water tub unit 49. Vibration detector 78 detects vibration in triaxial directions of front and rear, left and right, and upper and lower. The operation of water tub unit 49 is controlled on the basis of the vibration information detected by vibration detector 78. Since the vibration of water tub unit 49 is not necessarily in one direction, the vibration of water tub unit 49 is detected with high precision by using a multi-axial acceleration sensor as vibration detector 78.

**[0030]** Openable and closable lid body 52 is provided at the front surface of main body 41 so as to face main body opening portion 40 of rotary drum 43. Lid body 52 seals water tub 42 via seal packing 82 that connects a front portion of water tub 42 and main body opening portion 40 for vibration-absorbing and water sealing.

**[0031]** Control device 81 is provided above water tub 42. A front upper portion of main body 41 is equipped with operation panel 79 having input setting unit 80a and display unit 80b.

**[0032]** If a control method is input via input setting unit 80a of operation panel 79, the input information is displayed on display unit 80b of operation panel 79. A control unit (not shown) of control device 81 automatically controls motor 45, water supply device 54, drainage device 55, and water circulation device 56 according to input setting information or a control program. Thereby, control device 81 controls a series of steps, such as washing, rinsing, and spin-drying.

**[0033]** First water supply valve 57, second water supply valve 58, first water supply pipe 59, second water supply pipe 60, water level detector 76, detergent supply device 61, water supply connecting pipe 62, water tub air vent pipe 77, and control device 81 are provided above water tub 42.

**[0034]** Detergent supply device 61 stores, for example, detergents and a fabric softener and houses detergent case 61a therein that is drawable from main body 41. In a rear upper portion of detergent supply device 61, water tub air vent pipe 77 constituted by a flexible hose is connected to detergent supply device 61. For example, during a washing step, the air within water tub 42 pressurized by the formation of bubbles is released via water tub air vent pipe 77.

**[0035]** Water supply device 54 timely supplies water into water tub 42 from water supply connecting pipe 62 via detergent supply device 61 through first water supply pipe 59 or second water supply pipe 60 by the opening and closing of first water supply valve 57 or second water supply valve 58.

**[0036]** Drain pipe 64, filter case 83, drain pump 63, circulating pump 67, and drain hose 66 are provided at the bottom of water tub 42.

**[0037]** Filter case 83 houses filter 65 that traps, for example, lint or the like. Filter 65 is detachably provided from main body 41 by knob 84 provided at filter 65.

**[0038]** Filter case 83 communicates with water tub 42 via drain pipe 64 connected to the bottom of water tub 42. Drain pump 63 communicates with filter case 83 via drainage suction pipe 90 connected to filter case 83. Circulating pump 67 communicates with filter case 83 via circulating water suction pipe 68 connected to filter case 83. Circulating pump 67 further communicates with channel 85 annularly (including a circular-arc shape) formed on the front inner side of water tub 42 via circulating water discharge pipe 69 connected to circulating pump 67.

**[0039]** At the time of the completion of the washing step, at the time of the completion of a rinsing step, or the like, the washing water within water tub 42 is drained via drainage device 55 if necessary. Specifically, drainage device 55 passes the washing water within water tub 42 through filter 65 within filter case 83 via drain pipe 64 by the driving of drain pump 63, sends the washing water into drain pump 63 via drainage suction pipe 90, and then drains the washing water to the exterior of the front-loading-type washing machine via drain hose 66.

**[0040]** In a prewashing step, the washing step, the rinsing step, or the like, the washing water within water tub 42 circulates via water circulation device 56 if necessary. Specifically, water circulation device 56 passes the washing water within water tub 42 through filter 65 within filter case 83 via drain pipe 64 by the driving of circulating pump 67, and further sends the washing water into circulating pump 67 via circulating water suction pipe 68. Thereafter, the washing water sent into circulating pump 67 is sent into channel 85 via circulating water discharge pipe 69. The washing water sent into channel 85 is jetted into rotary drum 43, as shown by arrow A in Fig. 1, from jetting ports 70 provided on the inner peripheral side of channel 85 that faces clothing entrance 53 of rotary drum 43. At this time, the washing water is jetted from jetting ports 70 to rotary drum 43, for example in predetermined directions, such as a radial direction and in a predeter-

mined shape by jetting guide plate 86 provided on the front inner surface side of water tub 42. The details will be described below using Fig. 2.

**[0041]** Thereby, a detergent loaded into water tub 42 is quickly dissolved in the washing water, biasing of the detergent that comes into contact with laundry is prevented, and the detergent is activated. As a result, the washing or rinsing performance is improved.

**[0042]** Heating heater 72 including, for example, a sheathed heater or the like is provided in the horizontal direction in recess 71 formed at the bottom within water tub 42 to heat the washing water within water tub 42. For example, a temperature detector 73, such as a thermistor, which detects the water temperature of the washing water within water tub 42, is provided in the vicinity of heating heater 72.

**[0043]** The washing water within water tub 42 heated by heating heater 72 is circulated via water circulation device 56 and discharged into rotary drum 43 by the aforementioned circulating pump 67. At this time, the washing water is heated and the activity of water molecules increases. The washing performance of the front-loading-type washing machine is improved by scattering the washing water containing the activated detergent onto laundry.

**[0044]** A rear side wall of the bottom of the outer periphery of water tub 42 is formed with air trap 74 that communicates with drain pipe 64. Air trap 74 is connected to water level detector 76 including, for example, a pressure sensor or the like, by air pipe 75. Water level detector 76 detects water levels at a plurality of steps by the hydraulic pressure of the washing water supplied into water tub 42.

**[0045]** Hereinafter, channel 85 and its peripheral structure of the embodiment will be described using Fig. 2, referring to Fig. 1.

**[0046]** Fig. 2 is a cross-sectional view when the front of the rotary drum of the front-loading-type washing machine in the embodiment of the invention is viewed from the inside.

**[0047]** As shown in Fig. 2, jetting ports 70 are constituted by a plurality of jetting ports 70a to 70e provided on the inner peripheral side of annular (including a circular-arc shape) channel 85. Jetting ports 70a to 70e are provided, for example, in a circle shape at regular angles in the circumferential direction with respect to rotating shaft 44 of rotary drum 43.

**[0048]** At this time, jetting port 70a and jetting port 70b are provided with the equal opening area, at positions where the distances within channel 85 from connecting portion 69a that connects a lowermost portion of channel 85 and circulating water discharge pipe 69 are equal, in the vertical direction of Fig. 2, at almost the same (including the same) height in the vertical direction of channel 85. Here, the opening area means the area of the inflow surface of the washing water that passes through jetting ports 70 by operating circulating pump 67.

**[0049]** Similarly, jetting ports 70c and 70d at higher po-

sitions than jetting port 70a and jetting port 70b are also provided with the equal opening area, at positions where the distances within channel 85 from connecting portion 69a are equal, at almost the same (including the same) height in the vertical direction. Jetting port 70e is provided at an uppermost portion in the vertical direction. That is, jetting port 70a and jetting port 70b, jetting port 70c, jetting port 70d, and jetting port 70e are provided in this order so as to be away from connecting portion 69a.

**[0050]** At this time, the opening area of jetting port 70e provided at the farthest position from connecting portion 69a is formed so as to be larger than the opening areas of jetting ports 70a and 70b provided at the nearest position from connecting portion 69a. Thereby, the jetting amounts of the washing water from individual jetting ports 70 are made almost equal, and the washing water is uniformly jetted onto laundry within water tub 42. As a result, the front-loading-type washing machine with stable washing performance can be realized.

**[0051]** The opening area of jetting ports 70a and 70b, the opening area of jetting ports 70c and 70d, and the opening area of jetting port 70e are formed so as to be larger than the latter one in this order. That is, the opening area of jetting port 70e is formed so as to be the largest among a plurality of jetting ports 70a to 70e provided on the inner peripheral side of channel 85, and jetting ports 70 are formed so that the opening area becomes larger as being away (provided on the upper side in the vertical direction) from connecting portion 69a. Thereby, the jetting amounts of the washing water from individual jetting ports 70 are efficiently made almost equal, and the washing water is uniformly jetted onto laundry within water tub 42. As a result, the front-loading-type washing machine with more stable washing performance can be realized.

**[0052]** The "distances within channel 85 are equal" means that the distance from circulating water discharge pipe 69 to jetting port 70a in the clockwise direction within channel 85 and the distance from circulating water discharge pipe 69 to jetting port 70b in the counterclockwise direction are equal, with respect to a straight line that connects circulating water discharge pipe 69 and rotating shaft 44.

**[0053]** Although it is preferable that the cross-sectional shape of jetting ports 70 in the horizontal direction has, for example, a circle shape, the invention is not limited to this. For example, the jetting port may be formed in a substantially triangular shape (including a triangular shape) or in a substantially quadrangular shape (including a quadrangular shape). Thereby, the washing water is jetted into water tub 42 from jetting ports 70.

**[0054]** The washing water discharged from circulating pump 67 is sent into channel 85 formed on the front inner side of water tub 42 from the bottom side of water tub 42 via circulating water discharge pipe 69. The washing water sent into channel 85 is radially jetted into rotary drum 43 from all directions of the circumference of annular (including a circular-arc shape) channel 85, from a plurality of jetting ports 70 formed in channel 85.

**[0055]** As described above, the jetting amounts from individual jetting ports 70a to 70e provided at almost equal angles (including equal angles) in the circumferential direction can be made almost equal by changing the opening areas of jetting ports 70a to 70e. Although the flow velocity of the washing water decreases as it goes to the upper side of channel 85, a decrease in the flow rate of the washing water jetted from jetting ports 70 is prevented by this configuration. As a result, the washing performance of the front-loading-type washing machine can be stabilized.

**[0056]** Hereinafter, filter case 83 and its peripheral structure of the embodiment will be described using Fig. 3.

**[0057]** Fig. 3 is an exploded perspective view of main portions of the front-loading-type washing machine in the embodiment of the invention.

**[0058]** As shown in Fig. 3, drain pump 63 is connected to an upper side portion of filter case 83 connected to drain pipe 64, via drainage suction pipe 90. Circulating pump 67 is connected to the other side portion of filter case 83 via circulating water suction pipe 68.

**[0059]** Filter 65 provided within filter case 83 is equipped with a plurality of opening portions 89. Opening portions 89 of filter 65 are constituted by a plurality of drain-side opening portions 88a sectioned by ribs of drain-side rib portion 88 that is a grid-like rib structure that is provided on drain pump 63 side, and a plurality of circulation-side opening portions 87a sectioned by ribs of circulation-side rib portion 87 that is a grid-like rib structure that is provided on circulating-pump 67 side. At this time, it is preferable that drain-side opening portions 88a be formed to be larger than circulation-side opening portions 87a. Thereby, for example, lint or foreign matter can be removed from the washing water circulated into water tub 42, and the cleaning effect can be further enhanced.

**[0060]** If drain pump 63 is driven during drainage, the washing water that has flowed into filter case 83 via drain pipe 64 from water tub 42 passes through drain-side rib portion 88 of filter 65, passes through drain pump 63, and is drained from drain hose 66. Here, lint or the like within the washing water that is larger than the openings of drain-side opening portions 88a is trapped by meshes formed by drain-side rib portion 88 and drain-side opening portions 88a, and lint or the like that is smaller than the openings of drain-side opening portions 88a is discharged to the exterior of the front-loading-type washing machine.

**[0061]** If circulating pump 67 is driven during circulation, the washing water that has flowed into filter case 83 via drain pipe 64 from water tub 42 passes through circulation-side rib portion 87 of filter 65, and is sent to circulating pump 67 from circulating water suction pipe 68. Thereafter, the washing water is jetted into rotary drum 43 from jetting ports 70a to 70e via circulating water discharge pipe 69. Here, lint or the like within the washing water that is larger than the openings of circulation-side

opening portions 87a is trapped by the meshes formed by circulation-side rib portion 87 and circulation-side opening portions 87a.

**[0062]** Then, as a user rotates knob 84 of filter 65 to detach the filter from the outside, the lint or the like trapped in filter 65 can be discarded, and filter 65 can be cleaned.

**[0063]** At this time, the individual opening areas of jetting ports 70a to 70e provided on the inner peripheral side of channel 85 are made larger than any of individual opening portions 89 that constitute the aforementioned filter 65 through which the washing water passes when circulating through water circulation device 56. Thereby, the lint or the like that has passed through the meshes of circulation-side rib portion 89 is reliably trapped by filter 65, and jetting ports 70a to 70e are prevented from being clogged. As a result, the individual jetting amounts of the washing water from jetting ports 70a to 70e are continuously kept almost equal, and decline in washing efficiency is prevented.

**[0064]** In the present embodiment, it is preferable that the opening area of jetting ports 70a and 70b, the opening area of jetting ports 70c and 70d, and the opening area of jetting port 70e be formed so as to be larger in this order. However, the invention is not limited to this. As long as the size of the opening area of at least jetting port 70e is the largest, the opening areas of jetting ports 70a to 70d may have arbitrary sizes if necessary. That is, for example, the opening area of jetting port 70e may be made to be the largest, and the opening areas of jetting ports 70a, 70b, 70c, and 70d other than jetting port 70e may be made to have the same size. Also, for example, the opening areas of jetting ports 70c, 70d, and 70e may be made to have the same size, and the opening areas of jetting ports 70a and 70b may be made to be smaller than that of jetting ports 70c, 70d, and 70e. This raises the degree of freedom in design.

**[0065]** Although an example in which jetting ports 70 are provided in five locations at equal angles in the circumference direction has been described in the embodiment, the invention is not limited to this. For example, an arbitrary number of jetting ports may be arranged depending on the internal diameter, shape, or the like of water tub 42. Thereby, the same effects are obtained.

#### INDUSTRIAL APPLICABILITY

**[0066]** As described above, since the front-loading-type washing machine of the invention can exhibit stable washing performance by virtue of the configuration of the water circulation device, this washing machine is useful for applications of other washing machines that have the function to circulate washing water.

#### REFERENCE NUMERALS IN THE DRAWINGS

**[0067]**

- 41: MAIN BODY
- 42: WATER TUB
- 43: ROTARY DRUM
- 44: ROTATING SHAFT (ROTATION CENTER SHAFT) 5
- 45: MOTOR
- 46: BELT
- 47: PROJECTION PLATE
- 48: WATER PASSING HOLE
- 49: WATER TUB UNIT 10
- 50: SPRING BODY
- 51: VIBRATION-ABSORBING DAMPER
- 52: LID BODY
- 53: CLOTHING ENTRANCE
- 54: WATER SUPPLY DEVICE 15
- 55: DRAINAGE DEVICE
- 56: WATER CIRCULATING DEVICE
- 63: DRAIN PUMP
- 64: DRAIN PIPE
- 65: FILTER 20
- 66: DRAIN HOSE
- 67: CIRCULATING PUMP
- 68: CIRCULATING WATER SUCTION PIPE
- 69: CIRCULATING WATER DISCHARGE PIPE
- 70, 70a TO 70e: JETTING PORT 25
- 81: CONTROL DEVICE
- 83: FILTER CASE
- 85: CHANNEL
- 86: JETTING GUIDE PLATE
- 87: CIRCULATION-SIDE RIB PORTION 30
- 87a: CIRCULATION-SIDE OPENING PORTION
- 88: DRAIN-SIDE RIB PORTION
- 88a: DRAIN-SIDE OPENING PORTION
- 89: OPENING PORTION
- 90: DRAINAGE SUCTION PIPE 35

pump (67), and a control device (81) that controls steps of at least washing, rinsing, and spin-drying, **characterized in that** said channel is formed on a front inner side of the water tub (42); a plurality of jetting ports (70) are provided on an inner peripheral side of the channel (85), and discharge washing water into the water tub (42); and the jetting ports (70) are provided in the circumferential direction with respect to the rotating shaft (44), wherein an opening area of the jetting port (70e) provided at the farthest position from a connecting portion (69a) between the circulating water discharge pipe (69) and the channel (85) is larger than an opening area of the first and second jetting ports (70a, 70b) provided at the nearest position from the connecting portion (69a), wherein the first and second jetting ports (70a, 70b) are provided with the equal opening area, at positions where the distances within the channel (85) from the connecting portion (69a) are equal.

**Claims**

- 1. A front-loading-type washing machine comprising: 40
  - a rotary drum (43) that is formed in a shape of a bottomed cylinder and that is rotatable around a rotating shaft (44);
  - a water tub (42) that rotatably includes the rotary drum (43);
  - a motor (45) that rotationally drives the rotary drum (43);
  - a filter case (83) that communicates with the water tub (42) via a drain pipe (64) connected to a bottom of the water tub (42), and has a filter (65) provided therein;
  - a circulating pump (67) that communicates with the filter case (83) via a circulating water suction pipe (68) connected to the filter case (83); 50
  - a channel (85) that communicates with the circulating pump (67) via a circulating water discharge pipe (69) connected to the circulating

- 2. The front-loading-type washing machine of Claim 1, wherein at least the opening area of the jetting port (70e) provided at the farthest position from the connecting portion (69a) is the largest among the plurality of jetting ports (70).
- 3. The front-loading-type washing machine of Claim 1, wherein the opening areas of the jetting ports (70) are larger in an order of a distance from the connecting portion (69a).
- 4. The front-loading-type washing machine of Claim 1, wherein the jetting ports (70) provided at the same distance from the circulating water discharge pipe (69) have a same opening area.
- 5. The front-loading-type washing machine of Claim 1 or 4, wherein the opening areas of the jetting ports (70) are larger than opening portions (89) that constitute the filter (65).
- 6. The front-loading-type washing machine of Claim 5, wherein the opening portions (89) are constituted by circulation-side opening portions (87a) provided on a circulating pump side and drain-side opening portions (88a) provided on a drain pump side, and wherein the drain-side opening portions are larger than the circulation-side opening portions.

**Patentansprüche**

- 1. Frontladewaschmaschine, die Folgendes umfasst:

- eine drehbare Trommel (43), die in Form eines mit einem Boden versehenen Zylinders ausgebildet ist und die um eine sich drehende Welle (44) gedreht werden kann;
- einen Wasserbottich (42), der die drehbare Trommel (43) drehbar enthält;
- einen Motor (45), der die drehbare Trommel (43) drehend antreibt;
- ein Filtergehäuse (83), das mit dem Wasserbottich (42) über eine Ablaufleitung (64), die mit einem Boden des Wasserbottichs (42) verbunden ist, kommuniziert und in dem ein Filter (65) vorgesehen ist;
- eine Zirkulationspumpe (67), die mit dem Filtergehäuse (83) über eine Zirkulationswasser-Saugleitung (68), die mit dem Filtergehäuse (83) verbunden ist, kommuniziert;
- einen Kanal (85), der mit der Zirkulationspumpe (67) über eine Zirkulationswasser-Abflussleitung (69), die mit der Zirkulationspumpe (67) verbunden ist, kommuniziert, und
- eine Steuervorrichtung (81), die wenigstens die Schritte Waschen, Spülen und Schleudern steuert,
- dadurch gekennzeichnet, dass**
- der Kanal an einer vorderen Innenseite des Wasserbottichs (42) ausgebildet ist;
- mehrere Ausstoßöffnungen (70) an einer inneren Umfangsseite des Kanals (85) vorgesehen sind und Waschwasser in den Wasserbottich (42) abgeben; und
- die Ausstoßöffnungen (70) in Bezug auf die sich drehende Welle (44) in Umfangsrichtung vorgesehen sind,
- wobei eine Öffnungsfläche der Ausstoßöffnung (70e), die von einem Verbindungsabschnitt (69a) zwischen der Zirkulationswasser-Abflussleitung (69) und dem Kanal (85) bei der am weitesten entfernten Position ist, größer als eine Öffnungsfläche der ersten und zweiten Ausstoßöffnung (70a, 70b) ist, die bei der am nächsten liegenden Position von dem Verbindungsabschnitt (69a) vorgesehen sind,
- wobei die erste und die zweite Ausstoßöffnung (70a, 70b) an Positionen, an denen die Abstände in dem Kanal (85) von dem Verbindungsabschnitt (69a) gleich sind, mit der gleichen Öffnungsfläche versehen sind.
2. Frontladewaschmaschine nach Anspruch 1, wobei wenigstens die Öffnungsfläche der Ausstoßöffnung (70e), die bei der am weitesten entfernten Position von dem Verbindungsabschnitt (69a) vorgesehen ist, die größte der mehreren Ausstoßöffnungen (70) ist.
  3. Frontladewaschmaschine nach Anspruch 1, wobei die Öffnungsflächen der Ausstoßöffnungen

(70) in der Reihenfolge des Abstands von dem Verbindungsabschnitt (69a) größer sind.

4. Frontladewaschmaschine nach Anspruch 1, wobei die Ausstoßöffnungen (70), die im gleichen Abstand von der Zirkulationswasser-Abflussleitung (69) vorgesehen sind, die gleiche Öffnungsfläche aufweisen.
5. Frontladewaschmaschine nach Anspruch 1 oder 4, wobei die Öffnungsflächen der Ausstoßöffnungen (70) größer als Öffnungsabschnitte (89) sind, die den Filter (65) bilden.
6. Frontladewaschmaschine nach Anspruch 5, wobei die Öffnungsabschnitte (89) durch zirkulationsseitige Öffnungsabschnitte (87a), die auf einer Zirkulationspumpenseite vorgesehen sind, und ablaufseitige Öffnungsabschnitte (88a), die auf einer Ablaufpumpenseite vorgesehen sind, gebildet sind und wobei die ablaufseitigen Öffnungsabschnitte größer als die zirkulationsseitigen Öffnungsabschnitte sind.

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#### Revendications

1. Lave-linge à ouverture frontale, comportant :
  - un tambour rotatif (43) ayant la forme d'un cylindre à fond pouvant tourner autour d'un arbre rotatif (44) ;
  - une cuve à eau (42) qui comprend le tambour rotatif (43) de manière rotative ;
  - un moteur (45) qui entraîne le tambour rotatif (43) en rotation ;
  - un boîtier de filtre (83) qui communique avec la cuve à eau (42) via un tuyau de drainage (64) relié à un fond de la cuve à eau (43) et comportant un filtre (65) ;
  - une pompe de circulation (67) qui communique avec le boîtier de filtre (83) via un tuyau d'aspiration d'eau de circulation (68) relié au boîtier de filtre (83) ;
  - un canal (85) qui communique avec la pompe de circulation (67) via un tuyau d'évacuation d'eau de circulation (69) relié à la pompe de circulation (67), et
  - un dispositif de commande (81) qui commande au moins une étape de lavage, de rinçage et d'essorage,

**caractérisé en ce que** ledit canal est formé sur un côté intérieur avant de la cuve à eau (42) ;

une pluralité d'orifices d'éjection (70) sont prévus sur un côté périphérique extérieur du canal (85) et évacuent de l'eau de lavage dans la cuve à eau (42) ; et

les orifices d'éjection (70) sont disposés dans la



- direction circonférentielle par rapport à l'arbre de rotation (44),  
 où une surface d'ouverture de l'orifice d'éjection (70e) disposé dans la position la plus éloignée d'une partie de liaison (69a) entre le tuyau d'évacuation d'eau de circulation (69) et le canal (85) est plus grande qu'une surface d'ouverture du premier et second orifice d'éjection (70a, 70b) disposés dans la position la plus proche de la partie de liaison (69a),  
 où le premier et second orifice d'éjection (70a, 70b) sont disposés avec leurs surfaces d'ouverture égales en des positions dans lesquelles les distances dans le canal (85) par rapport à la partie de liaison (69a) sont égales.
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2. Lave-linge à ouverture frontale selon la revendication 1,  
 où au moins la surface d'ouverture de l'orifice d'éjection (70e) disposée dans la position la plus éloignée de la partie de liaison (69) est la plus grande parmi la pluralité d'orifices d'éjection (70).
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3. Lave-linge à ouverture frontale selon la revendication 1,  
 où les surfaces d'ouverture des orifices d'éjection (70) sont de plus en plus grands dans l'ordre de la distance de la partie de liaison (69a).
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4. Lave-linge à ouverture frontale selon la revendication 1,  
 où les orifices d'éjection (70) disposés à la même distance du tuyau d'évacuation de l'eau de circulation (69) ont la même surface d'ouverture.
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5. Lave-linge à ouverture frontale selon la revendication 1 ou 4,  
 où les surfaces d'ouverture des orifices d'éjection (70) sont plus grandes que les parties d'ouverture (89) formant le filtre (65).
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6. Lave-linge à ouverture frontale selon la revendication 5,  
 où les parties d'ouverture (89) sont formées par des parties d'ouverture côté circulation (87a) disposées du côté de la pompe de circulation et des parties d'ouverture côté drainage (88a) disposées du côté d'une pompe de drainage, et  
 où les parties d'ouverture côté drainage sont plus grandes que les parties d'ouverture côté circulation.
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FIG. 1

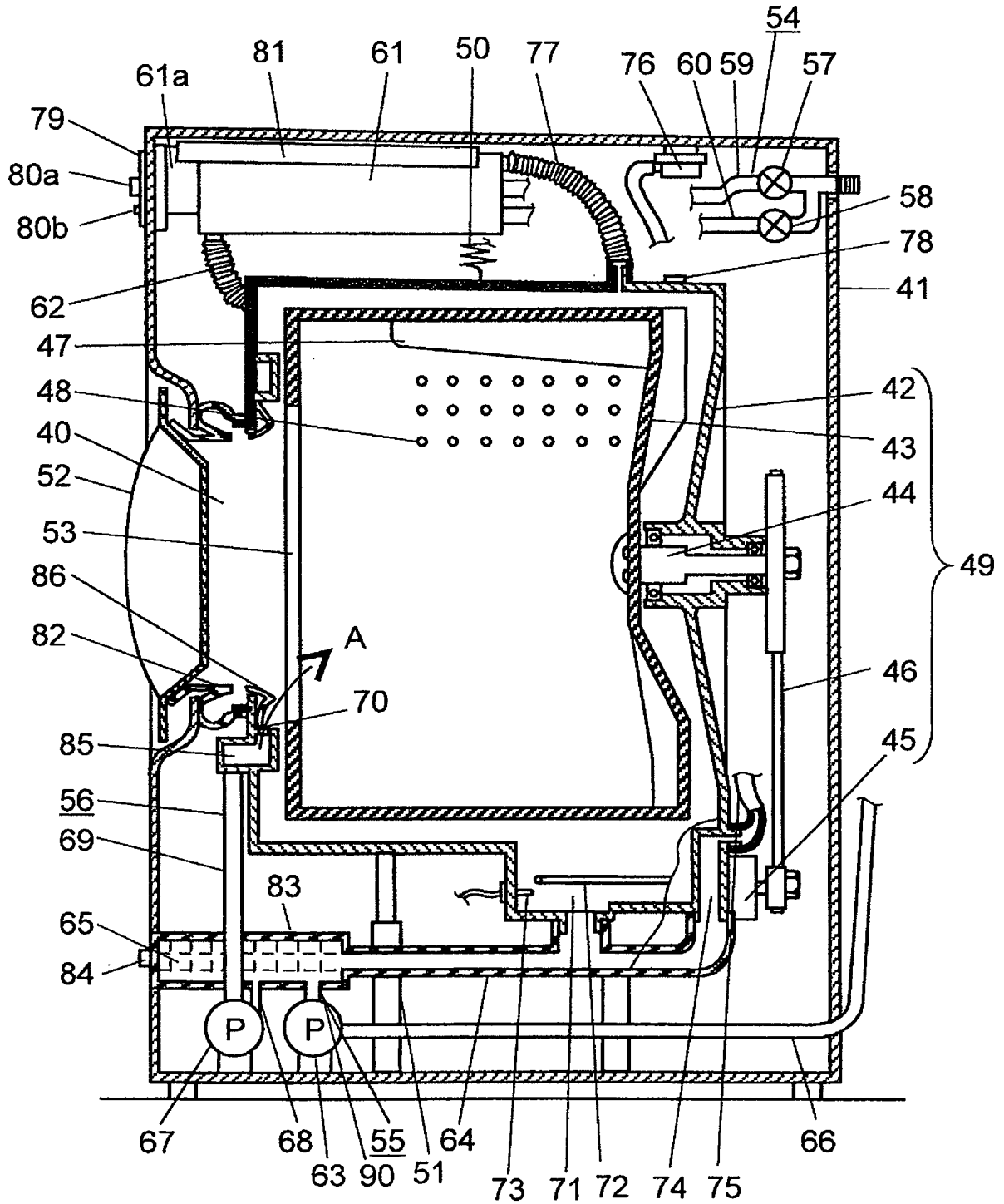


FIG. 2

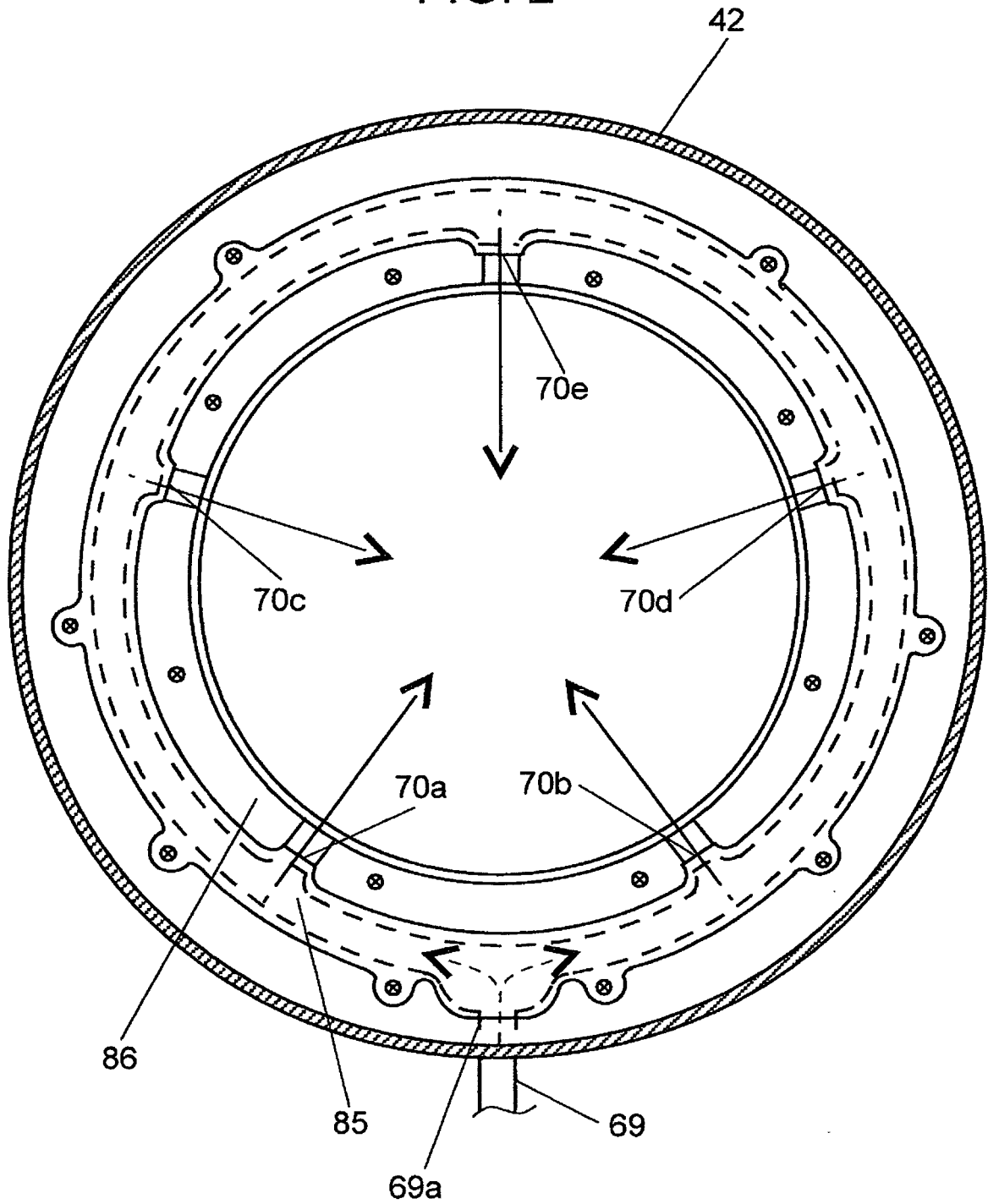


FIG. 3

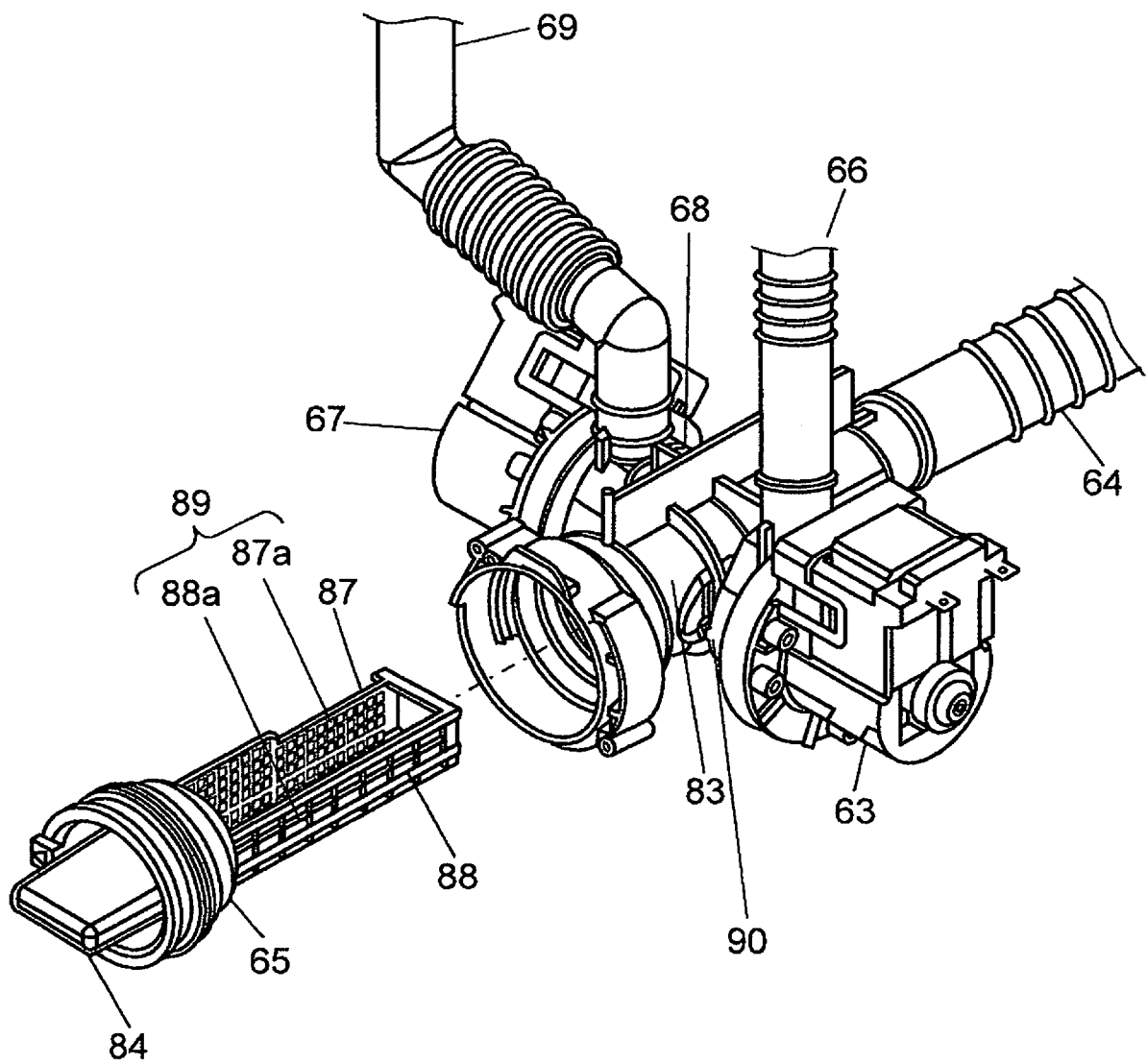
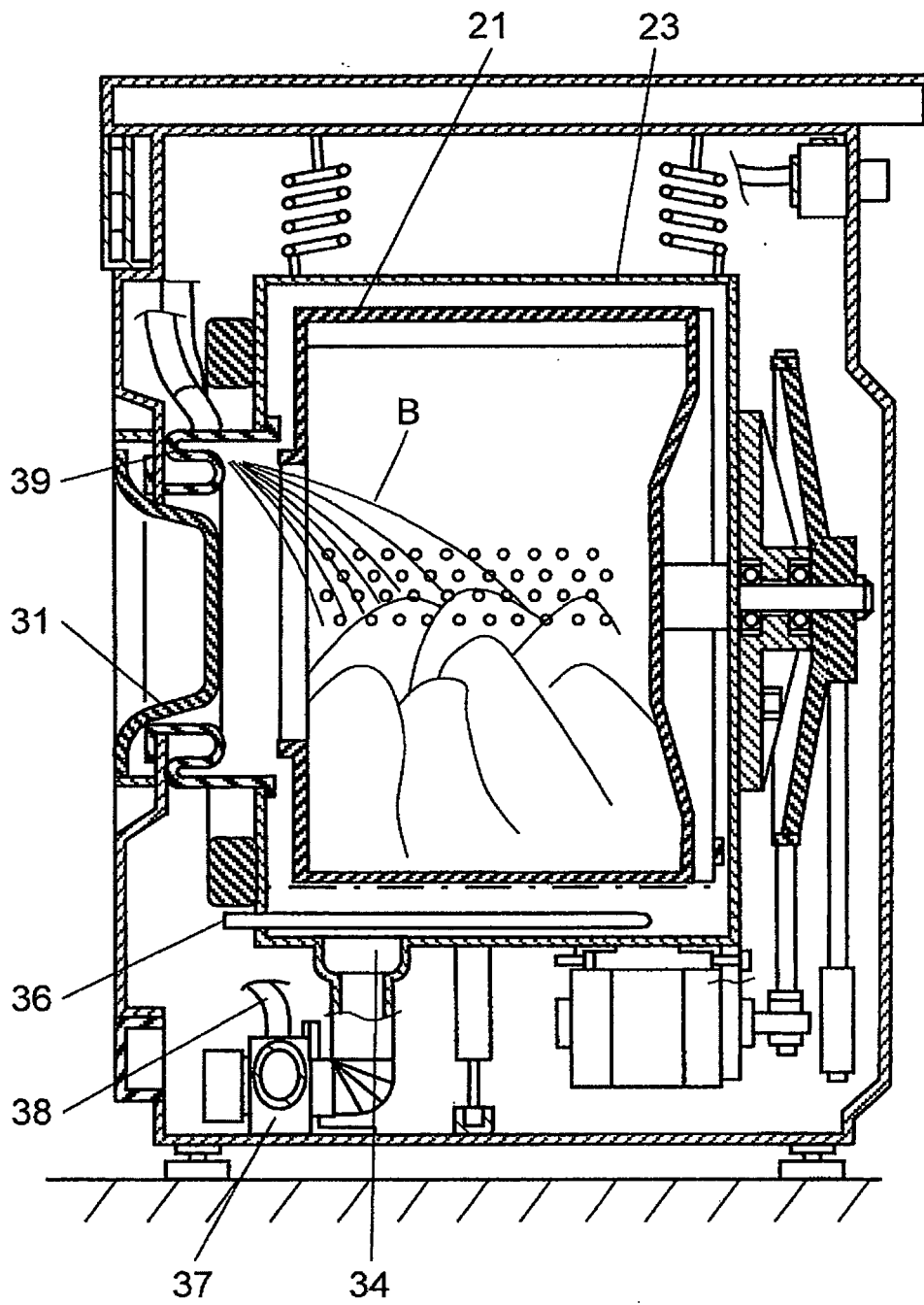


FIG. 4



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- JP H09215893 A [0012]
- EP 2471993 A1 [0013]
- JP 2006239141 A [0014]
- JP 2004173743 A [0015]
- JP 2007117138 A [0016]
- JP 2010268843 A [0017]
- US 20100000266 A1 [0018]