

DESCRIPTION

FRONT-LOADING WASHING MACHINE

5 TECHNICAL FIELD

[0001]

The present disclosure relates to a front-loading washing machine.

BACKGROUND ART

10 [0002]

A conventional front-loading washing machine includes a water tub which is elastically supported in a main body housing of the washing machine, a rotary drum which is rotatably contained in the water tub, a motor which rotates the rotary drum, a detergent dispenser which supplies detergent put in
15 the detergent dispenser to the rotary drum, and a dryer which blows dry air into the rotary drum. The detergent dispenser includes a water supply hose, a detergent case for holding the detergent, and a water supply path which connects the detergent case and the upper front portion of the water tub. The dryer includes a drying heater which heats the air and a blower fan which
20 blows the heated air into the rotary drum. A trap portion for storing water is provided at a point along the water supply path, and the water stored in the trap portion prevents the air heated by the dryer from entering the detergent case (for example, see Patent Literature (PTL) 1).

[0003]

25 In addition, another conventional front-loading washing machine includes a main body housing, a water tub which is elastically supported in the main body housing in a swingable manner, a rotary drum which is rotatably

contained in the water tub and accommodates laundry, a motor which rotates the rotary drum, a foam generator which generates foam and supplies the foam to the storage tub, and a circulation pump which supplies the washing liquid in the storage tub to the foam generator. The foam generator includes a housing.

5 The interior of the housing is partitioned into a water supply path which serves as a passage for washing liquid supplied from the circulation pump, and a foam generation chamber which communicates with the water supply path. The water discharged through the discharge outlet of the supply path collides with the liquid surface of the washing liquid stored in the foam generation chamber,

10 so that detergent foam is generated (see, for example, PTL 2).

Citation List

Patent Literature

[0004]

- 15 [PTL 1] Japanese Unexamined Patent Application Publication No. H11-114286
[PTL 2] Japanese Unexamined Patent Application Publication No. 2016-43184

SUMMARY (SUMMARY OF THE INVENTION)

[0005]

20 The present disclosure provides a front-loading washing machine which prevents the air heated by a dryer from entering a detergent holder and also prevents detergent and water from reaching the interior of a rotary drum at an inappropriate timing.

[0006]

25 A front-loading washing machine according to the present disclosure includes: a main body housing; a water tub which is supported in the main body housing in a swingable manner; a rotary drum which is rotationally provided in

the water tub; and a detergent dispenser which supplies detergent to the water tub or the rotary drum. The detergent dispenser includes: a detergent holder in which the detergent is put; a first flow path connected to the detergent holder and including a reservoir in which liquid can be stored; a second flow path
5 which communicates with the first flow path at downstream of and above the reservoir, and is connected to the water tub; and a third flow path which communicates with the first flow path at downstream of and above the second flow path, and communicates with an interior of the rotary drum.

[0007]

10 The front-loading washing machine according to the present disclosure prevents the air heated by the dryer from entering the detergent holder, and also prevents the detergent and water from reaching the interior of the rotary drum at an inappropriate timing.

[0008]

15 In addition, the present disclosure provides a front-loading washing machine capable of generating detergent foam with a simple configuration.

[0009]

A front-loading washing machine according to the present disclosure includes: a main body housing; a water tub which is elastically supported in the
20 main body housing in a swingable manner; a rotary drum which is rotatably contained in the water tub and accommodates laundry; a motor which rotates the rotary drum; a detergent dispenser which supplies detergent to the water tub or the rotary drum; and a water supply device which supplies water to the detergent dispenser. The detergent dispenser includes: a detergent holder in
25 which the detergent is put; a reservoir in which the detergent flowed down from the detergent holder is stored, and which is provided below the detergent holder; and an ejection hole which is provided above the reservoir and through

which the water supplied from the water supply device falls onto a liquid surface in the reservoir.

[0010]

The front-loading washing machine according to the present disclosure
5 is capable of generating detergent foam with a simple configuration.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

[FIG. 1]

10 FIG. 1 is an external perspective view of a front-loading washing machine according to a first embodiment.

[FIG. 2]

FIG. 2 is a vertical cross-sectional view of the front-loading washing machine according to the first embodiment.

15 [FIG. 3]

FIG. 3 is a block circuit diagram of the front-loading washing machine according to the first embodiment.

[FIG. 4]

FIG. 4 is an external perspective view of a detergent holder of the
20 front-loading washing machine according to the first embodiment.

[FIG. 5]

FIG. 5 is a partially see-through perspective view of peripheral portions of a reservoir of the front-loading washing machine according to the first embodiment.

25 [FIG. 6]

FIG. 6 is an external perspective view of the front-loading washing machine according to the first embodiment when viewed from the front.

[FIG. 7]

FIG. 7 is an external perspective view of the front-loading washing machine according to the first embodiment when viewed from the rear.

[FIG. 8]

5 FIG. 8 is a vertical cross-sectional view of the front-loading washing machine according to the first embodiment.

[FIG. 9]

FIG. 9 is a block circuit diagram of the front-loading washing machine according to the first embodiment.

10 [FIG. 10]

FIG. 10 is a partially see-through top view of the front-loading washing machine according to the first embodiment.

[FIG. 11]

15 FIG. 11 is a vertical cross-sectional view of an upper half of the front-loading washing machine according to the first embodiment.

[FIG. 12]

FIG. 12 is a partially see-through cross-sectional view of a foam generator of the front-loading washing machine according to the first embodiment when viewed from the front.

20 [FIG. 13]

FIG. 13 is a partially see-through cross-sectional view of a foam generator of a front-loading washing machine according to a second embodiment when viewed from the front.

[FIG. 14]

25 FIG. 14 is a partially see-through cross-sectional view of a foam generator of a front-loading washing machine according to another embodiment when viewed from the front.

DESCRIPTION OF EMBODIMENTS

[0012]

Hereinafter, a first embodiment will be described in detail with reference to the drawings. It is to be noted that the present disclosure is not
5 limited by the accompanying drawings and the following description.

[0013]

(First Embodiment)

Hereinafter, a front-loading washing machine according to the first embodiment will be described with reference to FIG. 1 to FIG. 5.

10 [0014]

[Basic Configuration of Front-Loading Washing Machine]

FIG. 1 is an external perspective view of the front-loading washing machine according to the first embodiment. FIG. 2 is a vertical cross-sectional view of the front-loading washing machine according to the first embodiment.
15 FIG. 3 is a block circuit diagram of the front-loading washing machine according to the first embodiment.

[0015]

As illustrated in FIG. 1, door body 3 is provided in an openable and closable manner on the front side of main body housing 1, and operation unit 4
20 and display unit 5 are provided above door body 3. Door body 3 is partially see-through so that the inside is viewable, and door body 3 is arranged so as to cover access opening 7 which is opened on the front side of main body housing 1. Operation unit 4 inputs respective washing courses by a user operation. Display unit 5 is arranged adjacent to operation unit 4, and displays an input
25 result of the user operation, information that relates to the selected washing course, stages of progress during the washing course operation, and the like.

[0016]

On the front side of main body housing 1, detergent holder 6 for holding detergent and fabric conditioner is provided above door body 3 and to the side of operation unit 4 and display unit 5. Detergent holder 6 includes handle 2 which is recessed relative to main body housing 1, and is configured such that the user can put the user's hand in handle 2 and pull out detergent holder 6. Before the start of the washing operation, the user can pull out detergent holder 6 and put detergent and fabric conditioner in detergent holder 6 in advance.

[0017]

Moreover, part of a water supplier including water supply valve 25 (see FIG. 2) is exposed on the rear side of main body housing 1. Water supply valve 25 includes a plurality of valves which are capable of opening and closing two or more water paths.

[0018]

As illustrated in FIG. 2, water tub 11 is arranged in main body housing 1, and is supported in a swingable manner by damper 15 positioned below water tub 11 and spring body 16 positioned above water tub 11. Water tub 11 has a cylindrical shape with a closed end, and is arranged such that the opening of water tub 11 opposes access opening 7. Annular gasket 8 made of an elastic body such as a rubber material is provided in the gap between access opening 7 and the front portion of water tub 11 to prevent clothes and washing water from flying out from the gap.

[0019]

Rotary drum 10 has a cylindrical shape with a closed end, and is rotatably provided in water tub 11. By opening door body 3, the user is capable of loading and unloading laundry into and out of rotary drum 10 through access opening 7.

[0020]

The outer peripheral portion of rotary drum 10 includes a large number of water passage holes 14 through which the water stored in water tub 11 passes to the inside and outside rotary drum 10. Moreover, the inner wall surface of rotary drum 10 includes a plurality of baffles 13 for agitating clothes.

5 [0021]

Rotating shaft (central axis of rotation) 51 is provided at the rotation center of rotary drum 10 in the inclined direction, and the shaft direction of rotary drum 10 is inclined downward from the front side towards the rear side.

[0022]

10 Motor 12 is attached to a portion in the vicinity of the rear bottom of water tub 11 and is connected to rotating shaft 51 via belt 52. Motor 12 rotates rotary drum 10 in the forward and reverse directions via belt 52 and rotating shaft 51.

[0023]

15 Drainage path 19 has a first end connected to the lower portion of water tub 11, and a second end connected to drain valve 18. Drainage path 19 drains the washing water in water tub 11 to the outside of main body housing 1 with drain valve 18 open.

[0024]

20 The detergent dispenser includes frame body 38 which are generally box shaped, water supply member 35 connected to water supply path 50 which communicates with water supply valve 25, and detergent holder 6 which is contained in frame body 38 and can be pulled out forward. When water supply valve 25 is opened, the water supplied to water supply member 35 via
25 water supply path 50 is injected to detergent holder 6 below. The path from the detergent dispenser to water tub 11 will be described later.

[0025]

Water level detector 34 is provided in the upper portion of main body housing 1 to detect the water level in water tub 11.

[0026]

Water tub vibration detector 36 is provided on the upper portion of water tub 11, and detects the vibration of water tub 11 during the spin operation by detecting the acceleration of water tub 11 and the direction of the acceleration.

[0027]

Controller 53 is provided in the lower portion in main body housing 1. Controller 53 controls the operations of motor 12, water supply valve 25, drain valve 18, and the like based on the information from water level detector 34, water tub vibration detector 36, and the like, and controls respective processes including washing, rinsing, and spinning.

[0028]

As illustrated in FIG. 3, controller 53 is connected to power switch 33, water level detector 34, water tub vibration detector 36, fabric amount detector 37, operation unit 4, display unit 5, motor 12, drain valve 18, and water supply valve 25.

[0029]

Power switch 33 turns on and off the power supplied from a commercial power supply to main body housing 1, and is manually operated by the user.

[0030]

Fabric amount detector 37 detects the amount of laundry loaded in rotary drum 10.

[0031]

[Detergent Dispenser]

FIG. 4 is an external perspective view of the detergent holder of the

front-loading washing machine according to the first embodiment. FIG. 5 is a partially see-through perspective view of peripheral portions of a reservoir of the front-loading washing machine according to the first embodiment. In FIG. 5, detergent holder 6 is not illustrated.

5 [0032]

As illustrated in FIG. 4, detergent holder 6 includes detergent compartment 27 in which detergent is put and fabric conditioner compartment 9 in which fabric conditioner is put.

[0033]

10 As illustrated in FIG. 5, the lower portion of frame body 38 is connected to bellows-shaped water delivery member 31 which is connected to reservoir member 40. Reservoir member 40 includes reservoir 42 which is a bent portion, first discharge path 28 provided downstream of reservoir 42, divergent path opening 41 provided at a point along first discharge path 28, second
15 discharge path 29 provided downstream of first discharge path 28, and discharge connecting portion 30 which communicates with rotary drum 10 via annular gasket 8 at downstream of second discharge path 29. Water delivery member 31, reservoir 42, and first discharge path 28 form a first flow path.

[0034]

20 Reservoir member 40 is arranged such that reservoir 42 is provided at the lowest position in the attached state. Since reservoir 42 is a bent portion of reservoir member 40 having a generally V-shape, water always remains in reservoir 42. The remaining water prevents water vapor generated in the water tub, heated air, and the like from flowing into detergent holder 6.

25 [0035]

First discharge path 28 extends upward from reservoir 42. In the upper portion of first discharge path 28, divergent path opening 41 connected to

divergent path 43 to be described later is provided. Divergent path opening 41 has a diameter that is smaller than the diameter of first discharge path 28. The portion above divergent path opening 41 serves as second discharge path 29. Discharge connecting portion 30 has a generally tubular shape which
5 extends from second discharge path 29, which is the portion above first discharge path 28, toward annular gasket 8. Annular gasket 8 includes discharge outlet 81 which opposes discharge connecting portion 30. Discharge outlet 81 has a generally tubular shape extending to the interior of rotary drum 10, and is capable of discharging the passing liquid toward the rear side.
10 Second discharge path 29, discharge connecting portion 30, and discharge outlet 81 form a third flow path.

[0036]

Divergent path 43 is connected to divergent path opening 41. Divergent path 43 extends downward and is connected to telescopic hose 45.
15 The connected portion between telescopic hose 45 and divergent path 43 is engaged with the inner wall of main body housing 1 by engagement member 44. Telescopic hose 45 has a bellows shape, and is connected to the lower portion of water tub 11 in a swingable manner. As a result, telescopic hose 45 absorbs the swinging of water tub 11. Divergent path opening 41, divergent path 43,
20 and telescopic hose 45 form a second flow path. The second flow path is branched from the first flow path, and is a detour path of the third flow path.

[0037]

The operation and effects of the front-loading washing machine configured as described above will be described below.

25 [0038]

[Washing Operation]

When power switch 33 is turned on, electric power is supplied to main

body housing 1 from a commercial power supply to enable operation. The user opens door body 3 and loads laundry into rotary drum 10. The user selects a washing course by operation unit 4. For example, when the user selects “whole process” for the entire process from "washing" to "spinning" and selects
5 start of operation, the operation of main body housing 1 is started. When the front-loading washing machine according to the present embodiment starts operation, fabric amount detector 37 is driven to detect the amount of the fabric of the loaded laundry, and sequentially displays the water level, the required amounts of detergent and fabric conditioner and the required time for washing
10 on display unit 5.

[0039]

When the user pulls out detergent holder 6, detergent compartment 27 and fabric conditioner compartment 9 are exposed. The user checks display unit 5, puts the displayed required amount of detergent in detergent
15 compartment 27, and puts the displayed required amount of fabric conditioner in fabric conditioner compartment 9.

[0040]

When the user puts liquid detergent, part of the liquid detergent flows down to water delivery member 31 and reaches reservoir member 40. Since
20 water always remains in reservoir 42, the liquid detergent which has flowed down is mixed with the remaining water. When the liquid level of the mixture of the liquid detergent and water becomes higher than the position connected with divergent path 43, the mixture flows down divergent path 43 and telescopic hose 45 and is delivered to water tub 11.

25 [0041]

After that, controller 53 controls the operations of motor 12, water supply valve 25, drain valve 18, and the like, and executes respective processes

such as washing, rinsing, and spinning.

[0042]

In the washing process, controller 53 opens water supply valve 25. After the tap water supplied by water supply valve 25 passes through water
5 supply member 35, water is discharged through a predetermined outlet
opposing detergent compartment 27 of detergent holder 6.

[0043]

When powder detergent is put in detergent compartment 27, the
discharged water and the powder detergent are mixed and delivered to
10 reservoir member 40 via water delivery member 31. When liquid detergent is
put in detergent compartment 27, the discharged water and the liquid
detergent remaining in detergent compartment 27 are mixed and delivered to
reservoir member 40 via water delivery member 31. The water and the
detergent delivered to reservoir member 40 are delivered into water tub 11 and
15 rotary drum 10 as described later.

[0044]

When the water supply is completed, the washing process starts. In
the washing process, washing agitation is performed by the rotation of rotary
drum 10 to remove dirt adhered to the laundry. After a predetermined time
20 passes, the washing water is drained and the rinsing process starts.

[0045]

When the rinsing process starts, water is supplied. The tap water is
discharged through a predetermined outlet after passing through water supply
member 35, and fills fabric conditioner compartment 9. At the full water
25 level, the mixture of the water and the fabric conditioner in fabric conditioner
compartment 9 is delivered through water delivery member 31 into water tub
11 by the siphon phenomenon. Then, when water is supplied to a

predetermined water level, rinsing agitation is performed. When a predetermined time passes, the washing water is drained to the outside of main body housing 1.

[0046]

5 Next, the spin process is performed. Since discharge outlet 81 which communicates with discharge connecting portion 30 is provided in annular gasket 8, even if water tub 11 vibrates due to high speed rotation of rotary drum 10 in the spin process, influence of the vibration is less likely to be given. When the spin process ends, washing is completed.

10 [0047]

[Reservoir Member in Washing Operation]

As described above, when the user puts liquid detergent in the washing operation, part of the liquid detergent reaches reservoir member 40. Accordingly, with no divergent path 43 and telescopic hose 45 which are the
15 second flow path, the mixture of the liquid detergent and the water remaining in reservoir member 40 reaches discharge outlet 81 via first discharge path 28, second discharge path 29 and discharge connecting portion 30. Then, the user can visually recognize, through door body 3, that the liquid has been discharged through discharge outlet 81, and thus, the user may feel anxious or discomfort.
20 In addition, when liquid detergent is put with door body 3 open, the liquid detergent may leak out of main body housing 1 through access opening 7.

[0048]

In the present embodiment, the second flow path is provided as a detour path of the third flow path, so that liquid does not reach discharge outlet 81
25 when liquid detergent is put.

[0049]

Next, water is supplied to detergent compartment 27, and the mixture

of the water and the detergent flows down to reservoir member 40. When the flow rate is sufficiently small, the mixture of the water and the detergent which has reached reservoir 42 reaches water tub 11 via first discharge path 28, divergent path opening 41, divergent path 43, and telescopic hose 45.

5 [0050]

When the flow rate of the mixture of the water and the detergent exceeds the amount of water that can pass through divergent path opening 41 per unit time, or when the flow rate exceeds the maximum capacity of divergent path 43, part of the mixture flows to second discharge path 29. Subsequently,
10 the mixture is discharged into rotary drum 10 via second discharge path 29, discharge connecting portion 30, and discharge outlet 81.

[0051]

At this time, the amount of liquid passing through the path of divergent path 43 and telescopic hose 45 is smaller than the amount of liquid passing
15 through the path of second discharge path 29, discharge connecting portion 30, and discharge outlet 81. The proportion of the amount of liquid passing through the path of divergent path 43 and telescopic hose 45 in the total amount of the mixture is small. By discharging a sufficient amount of water through discharge outlet 81, it is possible to perform sufficient water supply to
20 the clothes accommodated in the front portion in rotary drum 10.

[0052]

[Effects, etc.]

As described above, the front-loading washing machine according to the present embodiment includes main body housing 1, water tub 11 supported in
25 main body housing 1 in a swingable manner, rotary drum 10 rotatably provided in water tub 11, and a detergent dispenser which supplies detergent to water tub 11 or rotary drum 10. The detergent dispenser includes detergent holder 6

in which detergent is put, a first flow path connected to detergent holder 6 and including reservoir 42 in which liquid can be stored, and a second flow path which communicates with the first flow path at downstream of and above reservoir 42 and is connected to water tub 11. The detergent dispenser further
5 includes a third flow path which communicates with the first flow path at downstream of and above the second flow path and also communicates with the interior of rotary drum 10.

[0053]

With this configuration, a small amount of liquid flows down into the
10 third flow path and reaches water tub 11, so that the liquid is not discharged into rotary drum 10 via the second flow path. Accordingly, when the user supplies detergent, it is possible to prevent the detergent put in detergent holder 6 from immediately reaching the interior of rotary drum 10.

[0054]

15 As in the present embodiment, the second flow path may include telescopic hose 45 which includes a portion connected with water tub 11 and is fixed to main body housing 1 in a swingable manner.

[0055]

With this configuration, telescopic hose 45 absorbs the swinging of
20 water tub 11 and is fixed to main body housing 1 by engagement member 44, so that the vibration is not transmitted to divergent path 43.

[0056]

(Other Embodiments)

As described above, the first embodiment has been described as an
25 example of the technique disclosed in the present application. However, the technique according to the present disclosure is not limited to such an example.

[0057]

As such, other embodiments will be described below.

[0058]

In the first embodiment, discharge outlet 81 provided in annular gasket 8 has been described as an example of the opening of the second flow path which communicates with the interior of rotary drum 10. The opening of the second flow path may be any one which communicates with the interior of rotary drum 10. Accordingly, the opening of the second flow path may be provided in a portion other than annular gasket 8.

[0059]

In the first embodiment, water delivery member 31 and reservoir member 40 have been described as an example of the first flow path including the reservoir. The shape of reservoir member 40 is not limited to the shape that bends in a generally V-shape as long as reservoir 42 is provided at the lowest position. For example, reservoir member 40 may have a generally U-shape.

[0060]

Hereinafter, other operations and effects of the front-loading washing machine according to the first embodiment will be described in detail with reference to the drawings. It is to be noted that the present disclosure is not limited by the accompanying drawings and the following description.

[0061]

[Basic Configuration of Front-Loading Washing Machine]

Although the configuration of the front-loading washing machine according to the first embodiment has already been described with reference to FIG. 1 to FIG. 5, other operations and effects of the front-loading washing machine according to the first embodiment will be described with reference to FIG. 6 to FIG. 12.

[0062]

The front-loading washing machine according to the first embodiment illustrated in FIG. 1 to FIG. 5 and the front-loading washing machine according to the first embodiment illustrated in FIG. 6 to FIG. 12 are different, for example, in installation angles of water tubs 11 and 540 and rotary drum 10 and 530. However, the characteristic configurations are the same. Accordingly, the front-loading washing machine illustrated in FIG. 1 to FIG. 12 will be described as the front-loading washing machine according to the first embodiment. However, since the effects of the front-loading washing machine according to the first embodiment illustrated in FIG. 1 to FIG. 5 and the front-loading washing machine according to the first embodiment illustrated in FIG. 6 to FIG. 12 are different, the structural elements may have different definitions or different reference numerals.

[0063]

FIG. 6 is an external perspective view of the front-loading washing machine according to the first embodiment when viewed from the front. FIG. 7 is an external perspective view of the front-loading washing machine according to the first embodiment when viewed from the rear. FIG. 8 is a vertical cross-sectional view of the front-loading washing machine according to the first embodiment.

[0064]

In FIG. 6 to FIG. 8, main body housing 200 of front-loading washing machine 100 includes front wall 210, rear wall 220 opposite to front wall 210, left wall 230 erected between front wall 210 and rear wall 220, right wall 240 opposite to left wall 230, top wall 250 surrounded by the upper edges of front wall 210, rear wall 220, left wall 230, and right wall 240, and bottom wall 260 opposite to top wall 250.

[0065]

Water supply port 410 is exposed in rear wall 220, and water supply port 410 and the water faucet (not illustrated) are connected via a hose to supply water.

5 [0066]

Door body 101 is attached to front wall 210. Door body 101 rotates between a closed position that is along front wall 210 and an open position protruding from front wall 210. Door body 101 illustrated in FIG. 1 is at the open position. When door body 101 is at the open position, access opening 511
10 defined by storage tub 510 (see FIG. 3) is exposed. At the time of washing, door body 101 is rotated to the open position, so that clothes are loaded into storage tub 510 through access opening 511.

[0067]

Storage tub 510 elastically supported in main body housing 200 in a
15 swingable manner by a vibration isolator (not illustrated) mainly includes rotary drum 530 in which clothes are loaded and water tub 540 in which rotary drum 530 is rotatably contained.

[0068]

Rotary drum 530 includes inner circumferential wall 531 which defines
20 access opening 511, inner bottom wall 532 opposite to inner circumferential wall 531, and cylindrical inner peripheral wall 533 between inner circumferential wall 531 and inner bottom wall 532.

[0069]

Water tub 540 includes outer circumferential wall 541 arranged
25 between front wall 210 and inner circumferential wall 531, outer bottom wall 542 arranged between rear wall 220 and inner bottom wall 532, and outer peripheral wall 543 which surrounds inner peripheral wall 533 between outer

circumferential wall 541 and outer bottom wall 542.

[0070]

Outer peripheral wall 543 of water tub 540 includes front peripheral wall 545 to which outer circumferential wall 541 is attached and rear peripheral wall 546 arranged between outer bottom wall 542 and front peripheral wall 545.

[0071]

Motor 520 includes main body 521 which generates driving force and drive shaft 522 which transmits the driving force to rotary drum 530. Drive shaft 522 penetrates outer bottom wall 542 and is connected to inner bottom wall 532. FIG. 8 illustrates rotation axis RX of rotary drum 530 defined by motor 520. Foam generator 450 to be described later is arranged above rotation axis RX.

[0072]

FIG. 9 is a block circuit diagram of the front-loading washing machine according to a second embodiment. FIG. 10 is a partially see-through top view of the front-loading washing machine according to the second embodiment.

[0073]

In FIG. 9, the solid arrows indicate the flow of water, the dashed arrows indicate the flow of air, and the dashed dotted arrows indicate the transmission path of a control signal.

[0074]

In FIG. 9 and FIG. 10, washing machine 100 includes main body housing 200, controller 300, water supply device 400, washing device 500, and dryer 600.

[0075]

Main body housing 200 internally houses controller 300, water supply

device 400, washing device 500, and dryer 600. Controller 300 controls water supply device 400, washing device 500, and dryer 600, and sequentially controls a washing process for washing clothes, a rinsing process for rinsing the clothes, a spin process for spinning the clothes, and a drying process for drying the
5 clothes.

[0076]

(Washing Device)

Washing device 500 includes storage tub 510 including rotary drum 530 and water tub 540 for accommodating clothes, and motor 520 for driving
10 storage tub 510. Motor 520 rotates rotary drum 530 of storage tub 510 under the control of controller 300.

[0077]

In the washing process, rotary drum 530 agitates clothes in liquid containing detergent. As a result, the clothes are properly washed.

15 [0078]

In the rinsing process, rotary drum 530 agitates the clothes in water having a detergent concentration lower than that in the washing process. In addition, in the rinsing process, water supply to storage tub 510 and drainage from storage tub 510 are repeated. As a result, the detergent is properly
20 removed from the clothes.

[0079]

In the spin process, rotary drum 530 removes water from the clothes with centrifugal force. As a result, the drying of the clothes is facilitated.

[0080]

25 In the drying process, dry air is supplied into water tub 540 of storage tub 510. Since the humidity of the dry air is low and the temperature of the dry air is high, the clothes are properly dried in storage tub 510. Rotary drum

530 agitates the clothes while the dry air is being supplied. As a result, the clothes are properly dried.

[0081]

(Water Supply Device)

5 Water supply device 400 supplies water to storage tub 510 in the washing process and the rinsing process described above.

[0082]

Water supply device 400 includes water supply port 410 connected to the faucet, water supply valve 420, and detergent holder 460 including
10 detergent compartment 430 in which detergent is put and fabric conditioner compartment 440 in which liquid fabric conditioner is put. The front to back of detergent holder 460 corresponds to the lengthwise direction of detergent holder 460. Detergent holder 460 can be freely pulled out from the front side of main body housing 200 so that detergent and liquid fabric conditioner can be
15 put in. Water supply device 400 further includes first water supply path 421, second water supply path 422, third water supply path 423, and foam generator 450. Foam generator 450 will be described in detail with reference to FIG. 11 and subsequent drawings.

[0083]

20 The water supplied to water supply port 410 is delivered to water supply valve 420.

[0084]

Water supply valve 420 has a multi-valve configuration in which two or more water paths can be opened and closed. Accordingly, water supply valve
25 420 is capable of switching between first water supply path 421 through which water is supplied to storage tub 510 via detergent compartment 430, second water supply path 422 through which water is supplied to storage tub 510 via

liquid fabric conditioner compartment 440, and third water supply path 423 through which water is directly delivered to foam generator 450.

[0085]

When water supply valve 420 opens first water supply path 421 in the
 5 washing process, water flows into detergent compartment 430 in which detergent has been put, so that the water and the detergent are mixed. The mixture of the water and the detergent flows into rotary drum 530.

[0086]

When water supply valve 420 opens second water supply path 422 in
 10 the rinsing process, water flows into liquid fabric conditioner compartment 440 in which liquid fabric conditioner has been put, so that the water and the liquid fabric conditioner are mixed. The mixture of the water and the liquid fabric conditioner then flows into storage tub 510.

[0087]

15 First water supply path 421 is used in the rinsing process, for example, when detergent has not been put in detergent compartment 430. As a result, water is directly supplied to storage tub 510 via detergent compartment 430. Furthermore, second water supply path 422 may be used in the washing process, for example, when the liquid fabric conditioner has not been put in
 20 liquid fabric conditioner compartment 440.

[0088]

(Dryer)

Dryer 600 includes air filter 610 which receives moist air delivered from storage tub 510 via intake duct 650, heat exchanger 620 which causes heat
 25 exchange between heat and the air which has passed through air filter 610, and blower fan 630 which sends warm air which have passed through heat exchanger 620 and from which moisture has been removed to storage tub 510

via air supply duct 660. Air filter 610 removes lint from the air delivered from storage tub 510. Accordingly, the purified air flows into heat exchanger 620.

[0089]

(Detergent Dispenser)

5 FIG. 11 is a vertical cross-sectional view of an upper half of the front-loading washing machine according to the first embodiment. FIG. 12 is a partially see-through cross-sectional view of the foam generator of the front-loading washing machine according to the first embodiment when viewed from the front.

10 [0090]

 In FIG. 11 and FIG. 12, foam generator 450 is a device which generates foam. The washing liquid which has turned into foam and increased in volume in foam generator 450 is delivered to storage tub 510, permeating through all the clothes. When the washing liquid contacts and permeates the clothes, the
15 foam turns into foam films and covers the clothes. Since the foam films contain a high concentration of surfactant, dirt on the clothes can be efficiently removed.

[0091]

 Foam generator 450 is attached to front peripheral wall 545 of water
20 tub 540 at a position below detergent holder 460 and above axis of rotation RX of rotary drum 530. Foam generator housing 451 has partition wall 456, so that foam generator 450 has a generally U-shape.

[0092]

 The upper face of foam generator housing 451 of foam generator 450 is
25 connected to inlet 453 which communicates with first water supply path 421 and second water supply path 422 via detergent compartment 430 and liquid fabric conditioner compartment 440 of detergent holder 460, and is further

connected to ejection hole 455 which is one end of third water supply path 423.

[0093]

Foam generation chamber 452 is partitioned by partition wall 456 at the lowermost portion of foam generator housing 451. Outlet 454 is provided
5 opposite to inlet 453 with partition wall 456 disposed between outlet 454 and inlet 453. The bottom surface of foam generation chamber 452 is inclined upward toward outlet 454, and outlet 454 is provided on an extension line of the bottom of foam generation chamber 452. Tip A of partition wall 456 is positioned lower than outlet 454 (storage line).

10 [0094]

Foam generation chamber 452 stores the detergent put in detergent compartment 430 and flowed into foam generation chamber 452 together with the water. When water is ejected at a high flow velocity through ejection hole 455 via third water supply path 423 and collides with the liquid surface of the
15 stored detergent liquid, much detergent foam is generated. The detergent foam then flows into storage tub 510 through outlet 454 together with the water with a high flow velocity.

[0095]

Here, by partitioning the interior of foam generator housing 451 by
20 partition wall 456, the area of the flow path in foam generation chamber 452 is reduced, so that the flow velocity of the water from ejection hole 455 can be increased, and much more detergent foam can be generated.

[0096]

In addition, steam or odor existing in storage tub 510 may flow
25 backward through foam generator 450, and leak out of detergent compartment 430. Foam generation chamber 452 prevents backward flow of the steam or odor with water seal. By providing partition wall 456 to reduce the area of the

flow path in foam generation chamber 452 as in the present embodiment, the amount of water required for water seal of the flow path can be reduced. As a result, water seal of foam generation chamber 452 can be reliably achieved with a small amount of water.

5 [0097]

Moreover, in foam generator housing 451, bypass outlet 427 is provided upstream of outlet 454 and above and downstream of the detergent liquid stored in the bottom of foam generation chamber 452, and bypass path 425 is connected to bypass outlet 427.

10 [0098]

The other end of bypass path 425 is connected to water tub 540 in a swingable manner to absorb the vibration transmitted from storage tub 510. When the mixture of the water and the detergent stored through inlet 453 exceeds the storage line, the mixture overflows through bypass outlet 427 into water tub 540 via bypass path 425 and telescopic hose 426.

[0099]

Detergent holder 460, inlet 453, foam generator 450, bypass path 425, and telescopic hose 426 serve as a detergent dispenser which supplies water containing detergent to storage tub 510.

20 [0100]

(Washing Operation)

The operation and effects of the front-loading washing machine configured as described above will be described below.

[0101]

25 The user pulls out detergent holder 460 before operation, and puts liquid detergent for washing in detergent compartment 430. The liquid detergent gradually flows down to foam generator 450 through inlet 453, and

accumulates in foam generation chamber 452 positioned the lowest. Foam generation chamber 452 is designed to collect liquid detergent up to the storage line. When a larger amount of liquid detergent which exceeds the storage line is put, the detergent flows through bypass outlet 427 into water tub 540 via
5 bypass path 425 and telescopic hose 426.

[0102]

After the start of the operation, water supply valve 420 is driven, so that water is supplied to detergent compartment 430 via first water supply path 421. Water flows down to foam generator 450 through inlet 453 of foam
10 generator 450 while washing off the liquid detergent remaining in detergent compartment 430 and the subsequent path.

[0103]

When powder detergent is put in detergent compartment 430, the mixture of the powder detergent and water flows into foam generation chamber
15 452 of foam generator 450 through inlet 453. The mixture overflowing foam generation chamber 452 flows through bypass outlet into water tub 540 via bypass path 425 and telescopic hose 426.

[0104]

Subsequently, water supply valve 420 is opened, and water at a high
20 flow velocity is ejected through ejection hole 455 via third water supply path 423. The water ejected through ejection hole 455 vigorously collides with the water surface of the mixture of the detergent and the water stored in foam generation chamber 452, agitates the detergent liquid, takes in air, and generates detergent foam. The generated detergent foam flows towards
25 outlet 454 of foam generator 450, and is supplied to the clothes in rotary drum 530 of storage tub 510 through outlet 454.

[0105]

The detergent foam generated in foam generator 450 is directly supplied into rotary drum 530 through outlet 454 above foam generator 450. As a result, the detergent foam quickly permeates the entire clothes, and the surfactant that concentrates in the foam adsorbs and floats the dirt, so that the cleaning performance can be exhibited, for example, in such a manner that even stubborn dirt can be removed cleanly.

[0106]

When water is supplied into rotary drum 530 to a predetermined water level, motor 520 is driven, rotary drum 530 is rotated to perform a washing agitation, and much detergent foam acts on the clothes, exhibiting high cleaning effects.

[0107]

Next, in the first rinsing process, water supply valve 420 opens first water supply path 421 after the drainage and intermediate spinning, and water is supplied to water tub 540 through detergent compartment 430 with no detergent left and foam generator 450. When the water is supplied to a predetermined water level, motor 520 is driven and rotary drum 530 is rotated to perform a rinsing agitation.

[0108]

In the final rinsing process, when water supply valve 420 opens second water supply path 422 after the drainage and intermediate spinning, water is supplied to liquid fabric conditioner compartment 440 of detergent holder 460 in which the liquid fabric conditioner has been put in advance, and the water and the liquid fabric conditioner are mixed. Then, the mixture of the water and liquid fabric conditioner flows into water tub 540. When water is supplied to a predetermined water level in rotary drum 530, motor 520 is driven and rotary drum 530 is rotated, so that rinsing agitation is performed while giving

the effects of the liquid fabric conditioner to the clothes.

[0109]

After the rinsing agitation is completed and water is drained, the final spin process is performed, and then the drying process is performed as required.

5 [0110]

Here, the washing water remaining in foam generator 450 at the end of the rinsing process flows into bypass path 425 or stays in foam generation chamber 452 without flowing into bypass path 425, depending on the magnitude of the vibration of water tub 540 in the spin process. Accordingly, during the spin process, washing water does not flow into water tub 540 through outlet 454 and wet the clothes that are being spun.

[0111]

Moreover, in the spin process and the drying process, water seal of foam generation chamber 452 is achieved with the water remained after the rinsing process, exhibiting a trap effect. This prevents the odor that exists in storage tub 510 from flowing backward and leaking out of detergent compartment 430 through foam generator 450.

[0112]

(Effects, etc.)

20 As described above, the front-loading washing machine according to the present embodiment includes main body housing 200, water tub 540 which is supported in main body housing 200 in a swingable manner and in a vibration isolation manner, rotary drum 530 which is rotatably contained in water tub 540 and accommodates laundry, a motor which rotates rotary drum 530, a detergent dispenser which supplies detergent to water tub 540 or rotary drum 25 530, and water supply device 400 which supplies water to the detergent dispenser. The detergent dispenser includes detergent compartment 430 in

which detergent is put, foam generation chamber 452 which is provided below detergent compartment 430 and in which the detergent flowed down from detergent compartment 430 is stored, and ejection hole 455 which is provided above foam generation chamber 452 and through which the water supplied
5 from water supply device 400 falls onto the liquid surface of foam generation chamber 452.

[0113]

With this configuration, in foam generator 450 which is part of the detergent dispenser, the detergent liquid stored in foam generation chamber
10 452 and water collide with each other, so that foam is generated. Accordingly, it is possible to realize a device which generates foam with a simple configuration, without, for example, providing a path dedicated to foam generation.

[0114]

15 As in the present embodiment, water supply device 400 may include a first water supply path which is connected to detergent compartment 430 and through which water flows down to foam generation chamber 452 via detergent compartment 430, and third water supply path 423 connected to ejection hole 455.

20 [0115]

Accordingly, water can be supplied to the washing liquid stored in foam generation chamber 452 by third water supply path 423 provided separately from the first water supply path.

[0116]

25 As in the present embodiment, the detergent dispenser may include foam generator 450 having a generally U-shape, and foam generation chamber 452 may serve as a lower portion of foam generator 450.

[0117]

With this configuration, the size of foam generator 450 can be reduced, so that the space can be saved for the detergent dispenser.

[0118]

5 As in the present embodiment, the detergent dispenser may include, at downstream of foam generation chamber 452, bypass path 425 connecting foam generator 450 and the water tub, and a discharge path which is provided downstream of and above the connected portion between foam generator 450 and bypass path 425 and which places foam generator 450 and the storage tub
10 to be in communication with each other.

[0119]

With this configuration, the detergent liquid which has exceeded the storage line is delivered to water tub 540 via bypass path 425. Accordingly, it is possible to prevent overflow of foam generation chamber 452.

15 [0120]

(Second Embodiment)

FIG. 13 is a partially see-through cross-sectional view of a foam generator of a front-loading washing machine according to a second embodiment when viewed from the front.

20 [0121]

Since respective elements other than the shape added to the foam generator are the same as those in the first embodiment illustrated in FIG. 6 to FIG. 12, the same reference numerals are given to the same elements, and the description thereof is omitted.

25 [0122]

(Guide Wall)

In FIG. 13, guide wall 457 is provided so as to cover bypass outlet 427

which is a connection port to bypass path 425.

[0123]

Guide wall 457 has a generally semicircular shape, includes opening 428 which is opened in a generally semicircular shape only on outlet 454 side
5 that is on the downstream side, and communicates with bypass outlet 427.

[0124]

The operation and effects of the front-loading washing machine configured as described above will be described below.

[0125]

10 In the washing process, in a state where a mixture of liquid detergent or powder detergent and water is stored in foam generation chamber 452, when water supply valve 420 is opened and water is ejected at a high flow velocity through ejection hole 455 of foam generator 450 via third water supply path 423, the discharged water vigorously collides with the liquid surface of the stored
15 mixture of the detergent and the water and agitates the detergent liquid, so that air is taken into the liquid in the form of foam. Accordingly, detergent foam is generated. The generated detergent foam flows along guide wall 457, flows towards outlet 454 of foam generator 450 without flowing to bypass path 425 through bypass outlet 427, and is supplied to the clothes in rotary drum
20 530 of storage tub 510 through outlet 454.

[0126]

(Effects, etc.)

As described above, foam generator 450 according to the present embodiment includes a guide wall which covers the upstream side at bypass
25 outlet 427 which is an opening portion which communicates with bypass path 425.

[0127]

Accordingly, the generated detergent foam is guided by guide wall 457, and flows towards outlet 454 of foam generator 450 without flowing out through bypass outlet 427. As a result, it is possible to prevent the detergent foam from flowing out through bypass path 425, and to efficiently generate the
5 detergent foam.

[0128]

(Other Embodiments)

As described above, the first embodiment and the second embodiment have been described as examples of the technique disclosed in the present
10 application. However, the technique according to the present disclosure is not limited to such examples.

[0129]

As such, other embodiments will be described below.

[0130]

15 In the first embodiment and the second embodiment, the front-loading washing machine has been described as an example of the washing machine. The washing machine may be any washing machine that uses detergent. Accordingly, the washing machine is not limited to the front-loading washing machine, but may be a vertical type (top-loading) washing machine or a
20 twin-tub washing machine.

[0131]

In the first embodiment and the second embodiment, foam generator 450 has been described as an example of the foam generator. Since the foam generator is only required to include a reservoir, the shape of the foam
25 generator is not limited to the shape of foam generator 450, but may be a shape extending upward from foam generation chamber 452 as illustrated in FIG. 14. FIG. 14 is a partially see-through cross-sectional view of a foam generator of a

front-loading washing machine according to another embodiment when viewed from the front.

[0132]

In the first embodiment and the second embodiment, the shapes in FIG. 12 and FIG. 13 have been described as examples of a generally U-shaped foam generator. The generally U-shape is not limited to the shapes illustrated in FIG. 12 and FIG. 13, but may be, for example, a V-shape, a U-shape, a folded shape, or a shape including any one of them.

[0133]

In the first embodiment and the second embodiment, outlet 454 provided as part of foam generator housing 451 has been described as an example of the flow path. The flow path is only required to be a path which establishes communication between the reservoir and the rotary drum, and is not limited to the one provided as part of foam generator housing 451. The flow path may be a separate component connected to the foam generator. The flow path does not have to be directly connected to the rotary drum. For example, the flow path may be connected to a window gasket which provides water seal of the front portion of the storage tub. By providing part of the window gasket as a flow path, the detergent foam can be efficiently spread over the clothes accommodated in the rotary drum from above. In addition, the window gasket is often made of an elastic material such as rubber, and absorbs the vibration of the storage tub. By connecting the flow path to the window gasket, it is possible to prevent vibration from being transmitted to the foam generator, so that a rigid material having no elasticity can be used for the foam generator.

INDUSTRIAL APPLICABILITY

[0134]

The present disclosure is applicable to front-loading washing machines in which detergent is put. Specifically, the present disclosure is applicable to front-loading washing machines.

5 [0135]

In addition, the present disclosure is applicable to washing machines which perform a washing operation with detergent. Specifically, the present disclosure is applicable to vertical (top-loading) washing machines, front-loading washing machines, twin-tub washing machines, and the like.

10

REFERENCE MARKS IN THE DRAWINGS

[0136]

- | | | |
|----|---------|--|
| | 1, 200 | main body housing |
| | 3, 101 | door body |
| 15 | 6, 460 | detergent holder |
| | 7, 511 | access opening |
| | 9 | fabric conditioner compartment |
| | 10, 530 | rotary drum |
| | 11, 540 | water tub |
| 20 | 12, 520 | motor |
| | 25, 420 | water supply valve |
| | 27 | detergent compartment |
| | 28 | first discharge path (first flow path) |
| | 29 | second discharge path (third flow path) |
| 25 | 30 | discharge connecting portion (third flow path) |
| | 31 | water delivery member (first flow path) |
| | 35 | water supply member |

	38	frame body
	40	reservoir member
	41	divergent path opening (second flow path)
	42	reservoir (first flow path)
5	43	divergent path (second flow path)
	44	engagement member
	45	telescopic hose (second flow path)
	53, 300	controller
	81	discharge outlet (third flow path)
10	400	water supply device
	421	first water supply path
	423	third water supply path
	425	bypass path
	427	bypass outlet
15	428	opening
	430	detergent compartment
	440	fabric conditioner compartment
	450	foam generator
	451	foam generator housing
20	452	foam generation chamber (reservoir)
	453	inlet
	454	outlet
	455	ejection hole
	456	partition wall
25	457	guide wall
	510	storage tub
	545	front peripheral wall

CLAIMS

1. A front-loading washing machine, comprising:
 - a main body housing;
 - a water tub which is supported in the main body housing and is
 - 5 swingable in the main body housing;
 - a rotary drum which is rotationally provided in the water tub; and
 - a detergent dispenser which supplies detergent to at least one of the
 - water tub and the rotary drum,
 - wherein the detergent dispenser includes:
 - 10 a detergent holder in which the detergent is put;
 - a first flow path connected to the detergent holder and including
 - a reservoir in which liquid is stored;
 - a second flow path which communicates with the first flow path
 - at downstream of and above the reservoir, the second flow path being connected
 - 15 to the water tub; and
 - a third flow path which communicates with the first flow path
 - at downstream of and above the second flow path, and communicates with an
 - interior of the rotary drum.
- 20 2. The front-loading washing machine according to claim 1,
 - wherein the second flow path includes a hose portion including a
 - portion connected with the water tub, the hose portion being fixed to the main
 - body housing in a swingable manner.
- 25 3. A washing machine, comprising:
 - a main body housing;
 - a water tub which is elastically supported in the main body and is

swingable in the main body;

a rotary drum which is rotatably contained in the water tub and accommodates laundry;

a motor which rotates the rotary drum;

5 a detergent dispenser which supplies detergent to the water tub or the rotary drum; and

a water supply device which supplies water to the detergent dispenser, wherein the detergent dispenser includes:

a detergent holder in which the detergent is put;

10 a reservoir in which the detergent flowed down from the detergent holder is stored, the reservoir being provided below the detergent holder; and

an ejection hole which is provided above the reservoir and through which the water supplied from the water supply device falls onto a
15 liquid surface in the reservoir.

4. The washing machine according to claim 3,

wherein the water supply device includes:

a first water supply path which is connected to the detergent
20 holder and through which water flows down to the reservoir via the detergent holder; and

a third water supply path connected to the ejection hole.

5. The washing machine according to any one of claims 3 and 4,

25 wherein the detergent dispenser includes a foam generator having a generally U-shape, and

the reservoir serves as a lower portion of the foam generator.

6. The washing machine according to claim 5,
wherein the detergent dispenser includes:

5 a bypass path which connects the foam generator and the water
tub at downstream of the reservoir; and

a discharge path which is provided downstream of and above a
connected portion between the foam generator and the bypass path and places
the foam generator and the rotary drum to be in communication with each
other.

10

7. The washing machine according to claim 6,

wherein the foam generator includes an opening portion which
communicates with the bypass path, and includes a guide wall at the opening
portion, the guide wall covering an upstream side of the opening portion.

15