

DESCRIPTION

WASHING MACHINE

5 TECHNICAL FIELD

[0001] The present disclosure relates to a washing machine.

BACKGROUND ART

[0002] PTL 1 discloses a washing machine that uses a siphon phenomenon to dispense
10 liquid detergent or softener into a washing and dewatering tank.

[0003] The washing machine according to PTL 1 includes a water tank and a detergent dispenser for dispensing liquid or liquid mixture into the water tank. The detergent dispenser includes a liquid housing, a housing lid plate, a first passage, a passage coupler, and a second passage. The liquid housing is capable of holding liquid or liquid mixture.
15 The housing lid plate covers an upper part of the liquid housing partially or entirely. The first passage has a substantially cylindrical shape, and is provided inside the liquid housing. A bottom end of the first passage opens near the bottom of the liquid housing. The passage coupler is connected to an upper end of the first passage, and has an inverted U-shape. The second passage has a substantially cylindrical shape, and has one end
20 connected to the passage coupler, has the other end that opens outwards from the bottom of the liquid housing, and is disposed outside of the first passage. A liquid dispense channel formed by the first passage, the passage coupler, and the second passage is continuous as one channel. A part of the liquid dispense channel is also formed by the housing lid plate.

Citation List

25 Patent Literature

[0004] PTL 1: Unexamined Japanese Patent Publication No. 2017-74284

SUMMARY OF THE INVENTION

[0005] The present disclosure provides a washing machine capable of suppressing
30 interruptions of the siphon phenomenon, and capable of dispensing liquid into a washing and dewatering tank reliably.

[0006] A washing machine according to the present disclosure includes: a main body; an outer tank that is supported inside the main body in a manner isolated from vibrations; a

washing and dewatering tank that is rotatably supported inside the outer tank and that holds laundry; a liquid agent case that has a substantially box shape and that is configured to supply a liquid agent dispensed inside to the outer tank or to the washing and dewatering tank; and a water filling device that is configured to fill the liquid agent case with water.

5 The washing machine further comprises a discharge channel being inside the liquid agent case, having a substantially inverted U shape, discharging an internal liquid to the outside using a siphon phenomenon, and a wall being inside the liquid agent case, being vertically elongated, and being provided between (i) a position where the water from the water filling device falls and (ii) a position of the discharge channel.

10 **[0007]** The washing machine according to the present disclosure suppresses entry of air bubbles into the discharge channel, the bubbles being formed when the water from the water filling device falls. Therefore, interruptions of the siphon phenomenon are suppressed, and the liquid can be dispensed into the washing and dewatering tank reliably.

15 BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Fig. 1 is an external perspective view of a washing machine according to a first exemplary embodiment.

Fig. 2 is an external perspective view of the washing machine according to the first exemplary embodiment with a lid opened.

20 Fig. 3 is a side sectional view of relevant parts of the washing machine according to the first exemplary embodiment.

Fig. 4 is an exploded perspective view illustrating a structure of a top cover and an agent dispenser in the washing machine according to the first exemplary embodiment.

25 Fig. 5 is an exploded perspective view of a water filling and flowing portion of the agent dispenser, in the washing machine according to the first exemplary embodiment.

Fig. 6 is an external perspective view of a liquid agent case of the agent dispenser in the washing machine according to the first exemplary embodiment.

Fig. 7 is a top view of a water filling channel of the agent dispenser in the washing machine according to the first exemplary embodiment.

30 Fig. 8 is a top view of a liquid agent case of the agent dispenser in the washing machine according to the first exemplary embodiment.

Fig. 9 is a longitudinal sectional view of the liquid agent case of the agent dispenser, in the washing machine according to the first exemplary embodiment.

DESCRIPTION OF EMBODIMENT

[0009] An exemplary embodiment will now be explained in detail with reference to some drawings. However, descriptions more in details than necessary are sometimes omitted.

5 For example, detailed descriptions of already well-known matters or redundant descriptions of substantially the same configurations may be omitted. This is to avoid unnecessary redundancy in the following description and to facilitate understanding by those skilled in the art.

[0010] Note that the accompanying drawings and the following descriptions are provided
10 to help those skilled in the art to fully understand the present disclosure and are not intended to limit the subject matter recited in the claims.

[0011] (First exemplary embodiment)

Washing machine 100 according to a first exemplary embodiment will now be explained with reference to Figs. 1 to 9.

15 **[0012]** [1-1-1. Configuration of washing machine]

Fig. 1 is an external perspective view of washing machine 100 according to the first exemplary embodiment. Fig. 2 is an external perspective view of washing machine 100 according to the first exemplary embodiment with lid 3 opened. Fig. 3 is a side sectional view of relevant parts of washing machine 100 according to the first exemplary
20 embodiment. In the present exemplary embodiment, as illustrated in Fig. 3, a vertical direction in the orientation in which washing machine 100 is installed is sometimes referred to as an up-and-down direction. In the present exemplary embodiment, the left side of washing machine 100 as illustrated in Fig. 3 is sometimes referred to as front (front side), and the right side of washing machine 100 is sometimes referred to as rear (rear
25 side).

[0013] As illustrated in Figs. 1, 2, and 3, top cover 2 is disposed on top of main body 1. Clothes loading port 7 communicating with washing and dewatering tank 6 that is rotatably provided inside outer tank 14 is formed at a substantially center of top cover 2. Outer tank 14 is supported inside main body 1, in a manner isolated from vibrations.

30 **[0014]** Lid 3 is pivotably supported on a rear part of the top surface of top cover 2, and openably covers clothes loading port 7. Liquid agent case 5 is provided on the rear side of clothes loading port 7, in a manner enabled to be pulled out.

[0015] Operation display 4 is disposed on a rear top surface of top cover 2, at a position

behind lid 3, and receives various input settings for washing operations, and also displays settings and an operation status. A controller (not illustrated) that controls the operation of the washing machine is disposed below operation display 4.

[0016] Fig. 4 is an exploded perspective view illustrating configurations of top cover 2 and agent dispenser 8 in washing machine 100 according to the first exemplary embodiment.

[0017] As illustrated in Fig. 4, agent dispenser 8 includes water filling and flowing portion 10 that includes water filling device 9 and water flowing portion 11, and liquid agent case 5 that is housed inside the water filling and flowing portion 10.

[0018] Fig. 5 is an exploded perspective view of water filling and flowing portion 10 of the agent dispenser 8, in washing machine 100 according to the first exemplary embodiment.

[0019] As illustrated in Fig. 5, water filling device 9 includes water filling device lid 13 that covers the top surface, water filling channel 12 where water flowing channel 27 is formed, water filling channel inlet port 17 that communicates with the outside of water filling channel 12, and electromagnetic water feed valve 15 that is connected to water filling channel inlet port 17 and that openably sends water. Water filling device 9 fills liquid agent case 5 with the water.

[0020] Water flowing portion 11 is formed in a manner inclined downwards toward clothes loading port 7, and the water and the agent having reached water flowing portion 11 flow down along water flowing portion 11, and are dispensed into washing and dewatering tank 6, via water flowing portion discharge port 11a.

[0021] Fig. 6 is an external perspective view of liquid agent case 5 of agent dispenser 8 in washing machine 100 according to the first exemplary embodiment.

[0022] As illustrated in Fig. 6, liquid agent case 5 has a substantially box shape, and supplies the liquid agent dispensed inside to outer tank 14 or to washing and dewatering tank 6. On an upper portion of liquid agent case 5, an engaging claw 25 and push button 24 are formed. Engaging claw 25 is configured to become engaged with a water-filling-device-side engaging portion (not illustrated) that is provided on the bottom surface of water filling device 9, and to become disengaged when push button 24 is pressed. In this manner, liquid agent case 5 is detachably housed inside the water filling and flowing portion 10.

[0023] As illustrated in Fig. 6, liquid agent case 5 includes powdery detergent dispenser

18, liquid detergent dispenser 21, and softener dispenser 22.

[0024] Fig. 7 is a top view of water filling channel 12 of agent dispenser 8 in washing machine 100 according to the first exemplary embodiment.

5 **[0025]** As illustrated in Fig. 7, water flowing channel 27 is formed in a manner branched into water flowing channel 27a for powdery detergent, water flowing channel 27b for liquid detergent, and water flowing channel 27c for softener, correspondingly to powdery detergent dispenser 18, liquid detergent dispenser 21, and softener dispenser 22 positioned thereunder.

10 **[0026]** Water flowing channel 27 is provided with a plurality of water inlet ports 28 that communicate with liquid agent case 5 provided underneath. Water flowing channel 27a for powdery detergent, water flowing channel 27b for liquid detergent, and water flowing channel 27c for softener are provided with water inlet ports 28a for powdery detergent, water inlet ports 28b for liquid detergent, and water inlet ports 28c for softener, respectively, that are some of the water inlet ports 28.

15 **[0027]** [1-1-2. Details of structure of liquid agent case]

As illustrated in Fig. 6, liquid agent case 5 has a substantially box shape having an opening facing upwards. Inside of liquid agent case 5 is partitioned in such a manner that separate compartments are formed for powdery detergent dispenser 18, liquid detergent dispenser 21, and softener dispenser 22, respectively.

20 **[0028]** Rear outer peripheral wall 18a, which is an outer peripheral wall on the rear side, of powdery detergent dispenser 18 is lower in height than side outer peripheral walls 18b provided on both sides. In this manner, the poured water, the powdery detergent, and the generated bubbles get over rear outer peripheral wall 18a, and are discharged into water flowing portion 11. On an inner bottom surface of powdery detergent dispenser 18,
25 discharge port 19 for powdery detergent opening downwards is provided. The inner bottom surface of powdery detergent dispenser 18 is formed in a manner inclined toward discharge port 19 for powdery detergent. As a result, the water, the powdery detergent, and the generated bubbles accumulating inside powdery detergent dispenser 18 flow down along the inner bottom surface, and are discharged into water flowing portion 11 via discharge
30 port 19 for powdery detergent. In powdery detergent dispenser 18, scale 20 having a step-like shape is provided. By checking the scale 20 visually, a user can determine the amount of the powdery detergent to put in.

[0029] Fig. 8 is a top view of liquid agent case 5 of agent dispenser 8 in washing machine

100 according to the first exemplary embodiment. Fig. 9 is a longitudinal sectional view of liquid agent case 5 of agent dispenser 8, in washing machine 100 according to the first exemplary embodiment.

[0030] As illustrated in Figs. 6, 8, and 9, each of liquid detergent dispenser 21 and
5 softener dispenser 22 has an inner bottom surface provided with conduit 26 and cap 23,
together forming a siphon structure. Conduit 26 is provided with, on the front side,
discharge cylindrical portion 29 communicating with the space below. As illustrated in Fig.
9, conduit 26 is covered with cap 23, together forming suction cylindrical portion 32.

Suction cylindrical portion 32 has, on the rear side, siphon inlet port 33 communicating
10 with the inside of liquid detergent dispenser 21. In the same manner, conduit 26 provided
inside the softener dispenser 22 is covered with the cap 23, together forming a suction
cylindrical portion 32. Suction cylindrical portion 32 has, on the rear side, the siphon inlet
port 33 communicating with the inside of the softener dispenser 22. Discharge cylindrical
portion 29 and suction cylindrical portion 32 communicate with each other via curved
15 upper communicating portion 34 provided in the upper portion, and suction cylindrical
portion 32, curved upper communicating portion 34, and discharge cylindrical portion 29
together form a substantially inverted U-shaped flow channel. The channel formed by
suction cylindrical portion 32, curved upper communicating portion 34, and discharge
cylindrical portion 29 will be referred to as a discharge channel. In other words, provided
20 inside of liquid agent case 5 is a discharge channel that has a substantially inverted U
shape, and via which the internal liquid is discharged to the outside by the siphon
phenomenon.

[0031] The inner bottom surfaces of the liquid detergent dispenser 21 and the softener
dispenser 22 are formed in a manner inclined downward toward conduit 26 and the cap 23,
25 and recess 30 is formed around the conduit 26 and the cap 23.

[0032] As illustrated in Figs. 6, 8, and 9, siphon inlet port 33 is surrounded by vertically
extending wall 31 on the rear side of recess 30 of liquid detergent dispenser 21. Wall 31
includes semicircular portion 31a and straight portions 31b extending from respective both
ends of the semicircular portion 31a.

30 **[0033]** In liquid detergent dispenser 21, the positions where the water falls from water
inlet ports 28b for liquid detergent include position 35a where front-side water falls, and
position 35b where rear-side water falls, so that water falls across the entire liquid
detergent dispenser 21. In other words, vertically extending wall 31 is formed between the

position where the water supplied from water filling device 9 falls, and the discharge channel.

[0034] In softener dispenser 22, the positions where the water from water inlet ports 28c for softener falls include only position 35c where front-side water falls. The rear side of the recess 30 is covered by the rear outer peripheral wall 22a of the softener dispenser 22.

[0035] [1-2. Operation]

The electromagnetic water feed valve 15 is opened at a predetermined timing in a washing operation, to send the water into water filling device 9. The water sent into water filling device 9 passes through the branched water flowing channel 27, and is discharged into liquid agent case 5. At this time, the water sent into water flowing channel 27a for powdery detergent passes through water inlet ports 28a for powdery detergent, and is sprayed into powdery detergent dispenser 18. The water sent into water flowing channel 27b for liquid detergent passes through water inlet ports 28b for liquid detergent, and is sprayed into liquid detergent dispenser 21. The water sent into water flowing channel 27c for softener passes through water inlet ports 28c for softener, and is sprayed into the softener dispenser 22.

[0036] The water sprayed into powdery detergent dispenser 18 dissolves the powdery detergent having been put in and lather part of solution, is discharged into water flowing portion 11 via discharge port 19 for powdery detergent, and dispensed into washing and dewatering tank 6.

[0037] The level of the water being sprayed into liquid detergent dispenser 21 or softener dispenser 22 gradually becomes increased, while diluting the liquid detergent or the softener. The following explanation will be provided using an example of the liquid detergent.

[0038] A water level inside liquid detergent dispenser 21 rises above siphon inlet port 33 which is a gap between an inner bottom surface of liquid detergent dispenser 21 and cap 23, and reaches an upper end of liquid detergent dispenser 21.

[0039] Generally, the viscosity of liquid detergents is much higher than that of the water, and extremely resistant to pass through the siphon inlet port 33 and the suction cylindrical portion 32. Until the liquid detergent is sufficiently diluted with the water, the siphon inlet port 33 is filled with the washing liquid with a high concentration of liquid detergent, so the flow rate of the washing liquid in the siphon inlet port 33 is low.

[0040] As the amount of water filled into liquid detergent dispenser 21 increases, the

concentration of the liquid detergent decreases, and the viscosity of the washing liquid inside siphon inlet port 33 and suction cylindrical portion 32 also decreases. As the viscosity of the washing liquid decreases, the resistance of the washing liquid passing through the siphon inlet port 33 and the suction cylindrical portion 32 decreases, and the flow rate increases. The washing liquid with a higher flow rate then pushes out the air inside the suction cylindrical portion 32 and the curved upper communicating portion 34 toward the discharge cylindrical portion 29, and the siphon phenomenon causes the liquid to start flowing continuously (hereinafter, referred to as a siphoning operation).

[0041] The siphoning operation is continued even after water filling device 9 stops supplying the water, and the washing liquid in liquid detergent dispenser 21 is sucked up and supplied into washing and dewatering tank 6. When the water level of liquid detergent dispenser 21 drops below siphon inlet port 33, the air goes into siphon inlet port 33, and the siphoning operation is ended.

[0042] As illustrated in Figs. 8 and 9, the water coming out of water inlet ports 28b for liquid detergent lands on the washing liquid at position 35a (arrow a) where front-side water on the front side of the siphon structure falls in the liquid detergent dispenser 21, and position 35b (arrow b) where rear-side water on the rear side of the siphon structure falls. The landing water collides with the washing liquid accumulated inside the liquid detergent dispenser 21, and forms air bubbles. When the air bubbles enter the siphon structure, there is a chance that a layer of the air is formed inside the upper portion of the siphon structure, and the siphoning operation is interrupted even if the water is being supplied.

[0043] By contrast, in the present disclosure, the air bubbles generated on the front side of the siphon structure in liquid detergent dispenser 21 move upward along the front and the side walls of cap 23 (arrow c). Therefore, the air bubbles generated on the front side of the siphon structure move to an upper layer of the washing liquid.

[0044] By contrast, on the rear side of the siphon structure in liquid detergent dispenser 21, siphon inlet port 33 is provided between the side wall of cap 23 and the inner bottom surface of liquid detergent dispenser 21. Therefore, the air bubbles may go inside of siphon inlet port 33. In the present disclosure, because wall 31 is formed in a manner surrounding the rear periphery of the recess 30, the air bubbles move upwards along the semicircular portion 31a of the wall 31 (arrow d). Therefore, the air bubbles generated on the rear side of the siphon structure move to an upper layer of the washing liquid. In other words, the air bubbles generated inside liquid detergent dispenser 21 move to an upper layer of the

washing liquid. The liquid that is the washing liquid enters the siphon inlet port 33 from the lower layer where the air bubbles have been removed. The washing liquid with the air bubbles removed therefrom passes across the straight portions 31b of the wall 31, flows down into the recess 30 from both sides, and is sucked into the siphon structure. As a result, it is possible to suppress entry of the air bubbles generated on the rear side of the siphon structure inside the liquid detergent dispenser 21 into the siphon inlet port 33, and to suppress interruptions of the siphoning operation due to the entry of air bubbles generated while the water is being supplied from water filling device 9.

[0045] Wall 31 includes semicircular portion 31a having the center of curvature on the side of the discharge channel. Therefore, less air bubbles are formed by the colliding water, compared with an example in which the wall has a linear shape.

[0046] [Actions and others]

A washing machine according to the present disclosure includes: main body 1; outer tank 14 supported inside main body 1 in a manner isolated from vibrations; washing and dewatering tank 6 rotatably supported inside outer tank 14 and holding laundry; liquid agent case 5 having a substantially box shape and configured to supply a liquid agent dispensed inside to outer tank 14 or to washing and dewatering tank 6; and water filling device 9 configured to pour water into liquid agent case 5. Provided inside liquid detergent dispenser 21 that is a part of the detergent case 5 is a discharge channel that includes conduit 26 and cap 23, that has a substantially inverted U shape formed by suction cylindrical portion 32, curved upper communicating portion 34, and discharge cylindrical portion 29, and that discharges the internal liquid to the outside using the siphon phenomenon. Vertically extending wall 31 is formed between the position where the water from water filling device 9 falls, and the siphon inlet port 33 that is the inlet port into the discharge channel.

[0047] As a result, entry of the air bubbles, which are formed when the water falls, into the discharge channel via siphon inlet port 33 can be suppressed.

[0048] Therefore, it is possible to suppress interruptions of the siphon phenomenon due to the entry of the air bubbles so that the chances of incomplete dispensing of the liquid from the liquid detergent dispenser 21 are reduced, and to dispense the liquid inside liquid agent case 5 into washing and dewatering tank 6, reliably.

[0049] As disclosed in the present exemplary embodiment, wall 31 may be provided as semicircular portion 31a having a substantially arc shape with the center of curvature on

the side of the siphon structure.

[0050] With this, formed air bubbles can be kept away from the siphon structure, and to suppress formation of air bubbles due to the falling water colliding with the wall.

[0051] As disclosed in the present exemplary embodiment, the siphon inlet port 33 may be provided on the side where the water from water inlet ports 28b for liquid detergent falls, and wall 31 may be disposed between the position where the water from water inlet ports 28b for liquid detergent falls, and siphon inlet port 33.

[0052] With this, it is possible to suppress the entry of air bubbles on the side where the side of siphon inlet port 33 of the siphon structure is disposed.

[0053] Therefore, because the wall 31 can be provided at a position where air bubbles are effectively kept away from the siphon inlet port 33, the liquid inside liquid agent case 5 can be dispensed reliably into washing and dewatering tank 6.

[0054] (Other exemplary embodiments)

The first exemplary embodiment has been described above as an example of the technology disclosed in the present application. However, the technology according to the present disclosure is not limited thereto.

[0055] Accordingly, another exemplary embodiment is will now be explained.

[0056] In the first exemplary embodiment, a top-loading-type washing machine has been explained as an example of the washing machine. The washing machine is not limited to a top-loading-type washing machine, as long as liquid is dispensed by the siphon structure. The washing machine may be a drum-type washing machine or a twin-tank washing machine.

[0057] In the first exemplary embodiment, wall 31 having a semicircular shape has been explained as an example of the wall. The wall is not limited to a semicircular shape, as long as the wall is formed between the position where the water from the water filling device falls, and the discharge channel. The wall may be substantially rectangular in shape, or may be a curved surface. In the first exemplary embodiment, wall 31 provided in liquid detergent dispenser 21 has been described as an example of the wall. Because the wall is intended to suppress the entry of air bubbles into the discharge channel that uses the siphon phenomenon to discharge the liquid to the outside, the wall may also be provided inside the softener dispenser.

INDUSTRIAL APPLICABILITY

[0058] The present disclosure is applicable to a device that uses a siphon structure to dispense liquid. Specifically, the present disclosure is applicable to a top-loading-type washing machine, a drum-type washing machine, and a twin-tank washing machine, for example.

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REFERENCE MARKS IN THE DRAWINGS

[0059] 1: main body

2: top cover

3: lid

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4: operation display

5: liquid agent case

6: washing and dewatering tank

7: clothes loading port

8: agent dispenser

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9: water filling device

10: water filling and flowing portion

11: water flowing portion

11a: water flowing portion discharge port

12: water filling channel

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13: water filling device lid

14: outer tank

15: electromagnetic water feed valve

17: water filling channel inlet port

18: powdery detergent dispenser

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18a: rear outer peripheral wall

18b: side outer peripheral wall

19: discharge port for powdery detergent

20: scale

21: liquid detergent dispenser

30

22: softener dispenser

22a: rear outer peripheral wall

23: cap

24: push button

	25: engaging claw
	26: conduit
	27: water flowing channel
	27a: water flowing channel for powdery detergent
5	27b: water flowing channel for liquid detergent
	27c: water flowing channel for softener
	28: water inlet port
	28a: water inlet port for powdery detergent
	28b: water inlet port for liquid detergent
10	28c: water inlet port for softener
	29: discharge cylindrical portion (discharge channel)
	30: recess
	31: wall
	31a: semicircular portion
15	31b: straight portion
	32: suction cylindrical portion (discharge channel)
	33: siphon inlet port (inlet port)
	34: curved upper communicating portion (discharge channel)
	35a, 35c: position where front-side water falls
20	35b: position where rear-side water falls

CLAIMS

1. A washing machine comprising:

a main body;

5 an outer tank that is supported inside the main body in a manner isolated from vibrations;

a washing and dewatering tank that is rotatably supported inside the outer tank;

a liquid agent case that has a substantially box shape and that supplies a liquid agent having been poured inside to the outer tank or the washing and dewatering tank; and

10 a water filling device that fills the liquid agent case with water,

wherein the washing machine further comprising:

a discharge channel being inside the liquid agent case, having a substantially inverted U shape, discharging internal liquid to outside using a siphon phenomenon; and

15 a wall being inside the liquid case, being vertically elongated and being provided between (i) a position where water from the water filling device falls and (ii) a position of the discharge channel.

2. The washing machine according to Claim 1, wherein the wall includes a

20 substantially arc-shaped portion that has a center of curvature on a side of the discharge channel.

3. The washing machine according to Claim 1 or 2, wherein

an inlet port of the discharge channel is provided on a side where water from the water filling device falls, and

25 the wall is disposed between (i) the position where the water from the water filling device falls and (ii) a position of the inlet port.