

DESCRIPTION

WASHING MACHINE

TECHNICAL FIELD

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

BACKGROUND ART

[0002] PTL 1 discloses a washing machine including an automatic liquid-agent feeding device that automatically supplies a liquid agent.

[0003] The washing machine in PTL 1 includes a liquid agent tank (a tank body having an opening and accommodating the liquid agent and a tank lid that opens and closes the opening), and an automatic liquid-agent feeding device. The tank body includes packing.

Citation List

Patent Literature

[0004] PTL 1: Unexamined Japanese Patent Publication No. 2019-37356

SUMMARY OF THE INVENTION

[0005] The present disclosure provides a washing machine capable of suppressing leakage of a liquid in a liquid agent tank due to capillarity.

[0006] The washing machine according to the present disclosure includes a washing tub that accommodates laundry, a liquid agent tank that stores a liquid agent, and an automatic liquid-agent feeding device that feeds the liquid agent stored in the liquid agent tank into the washing tub. The liquid agent tank is in a substantially box shape, and includes a tank body having an opening on an upper surface in an installed state, and a tank lid having an insertion wall inserted into the opening and covering the opening. The insertion wall has an outer peripheral surface facing an upper inner peripheral surface of the tank body with the tank lid attached to the tank body, and the liquid agent tank includes a groove in a peripheral surface including at least one of the upper inner peripheral surface or the outer peripheral surface, the groove being disposed in a substantially horizontal direction in the installed state.

[0007] The washing machine according to the present disclosure is capable of suppressing leakage of a liquid in the liquid agent tank due to capillarity.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Fig. 1 is an external perspective view illustrating a configuration of a washing machine in a first exemplary embodiment, in which a lid body is closed.

Fig. 2 is an external perspective view illustrating a configuration of the washing machine with the lid body opened.

Fig. 3 is an external perspective view illustrating a configuration of a water feed unit of the washing machine and a periphery of the water feed unit, in which a detergent case, a detergent tank, and a softener tank are pulled out.

Fig. 4 is a rear view illustrating a configuration of a water feed unit of the washing machine and a periphery of the water feed unit.

Fig. 5 is an external perspective view illustrating a configuration of a detergent tank of the washing machine, in which a detergent tank lid is attached.

Fig. 6 is an external perspective view illustrating a configuration of a detergent tank of the washing machine, in which a detergent tank lid is removed.

Fig. 7 is a top view illustrating a configuration of a detergent tank of the washing machine.

Fig. 8 is an external perspective view illustrating a configuration of a detergent tank lid of the washing machine when viewed from a back surface.

Fig. 9 is a sectional view taken along line A-A, illustrating a configuration of a detergent tank of the washing machine.

Fig. 10 is a sectional view taken along line B-B, illustrating a configuration of the detergent tank of the washing machine.

Fig. 11 is a sectional view taken along line C-C, illustrating a configuration of the detergent tank of the washing machine.

Fig. 12 is a schematic sectional view illustrating a configuration of a detergent tank of a washing machine according to a second exemplary embodiment.

DESCRIPTION OF EMBODIMENT

[0009] (Underlying knowledge and the like of the present disclosure)

A conventional washing machine includes a liquid agent tank that stores a liquid agent, the liquid agent tank including a tank body and a tank lid any one of which is provided with a watertight member such as packing to prevent the liquid agent in the liquid

agent tank from leaking from between the tank body and the tank lid. Unfortunately, deterioration of the packing or the like may cause leakage of the liquid agent in the conventional washing machine.

[0010] Thus, the present disclosure provides a washing machine capable of suppressing leakage of a liquid agent from a liquid agent tank without including a watertight member such as packing and the like.

[0011] Hereinafter, an exemplary embodiment will be described in detail with reference to the accompanying drawings. Note that, the accompanying drawings and the following description are merely presented to help those skilled in the art fully understand the present disclosure, and are not intended to limit the subject matters described in the scope of claims.

[0012] (First exemplary embodiment)

Hereinafter, washing machine 100 according to the first exemplary embodiment as an example of the washing machine of the present disclosure will be described below with reference to Figs. 1 to 11.

[0013] [1-1. Configuration]

[1-1-1. Configuration of washing machine]

Figs. 1 and 2 are each an external perspective view illustrating a configuration of washing machine 100 according to the first exemplary embodiment. Fig. 1 illustrates lid body 700 closed, and Fig. 2 illustrates lid body 700 opened. The first exemplary embodiment may show a vertical direction of washing machine 100 installed as illustrated in Figs. 1 and 2 (corresponding to an installation state in the present disclosure) as an up-down direction. The first exemplary embodiment also may show one side on which operation unit 800 of washing machine 100 in Figs. 1 and 2 exists as rear, and another side opposite to the one side as front. That is, a user generally stands in front of washing machine 100 and loads laundry such as clothing into washing machine 100. The user also performs various operations for operating washing machine 100. The laundry in the present disclosure is not limited to clothing, and includes objects washable with various known washing machines, such as fabric or leather products including bedclothing, a curtain, a rug, and a shoe, or other products.

[0014] As illustrated in Figs. 1 and 2, washing machine 100 includes housing 600, lid body 700, and operation unit 800. Housing 600 includes lower housing 610 and upper housing 620. Lower housing 610 accommodates washing tub 500. Washing tub 500 is

formed in a cylindrical body opened upward, and performs a washing operation of accommodating laundry and washing the laundry. The washing operation may be performed by washing tubs in various known washing machines. The principle of the present exemplary embodiment is not limited to specific washing operation performed by washing tub 500.

[0015] Upper housing 620 is disposed above lower housing 610. Upper housing 620 is provided with loading opening 621 for laundry, loading opening 621 communicating with washing tub 500. Lid body 700 is attached to a rear part of upper housing 620, and loading opening 621 is covered with lid body 700 in an openable manner. When the user turns lid body 700 upward, washing tub 500 is exposed through loading opening 621. The user can thus load laundry into washing tub 500 through loading opening 621.

[0016] Operation unit 800 is disposed at a position located in the rear part of upper housing 620 and behind loading opening 621. The user can operate operation unit 800 to set various operations for washing tub 500. Washing machine 100 includes a controller (not illustrated) in housing 600. The controller controls the entire operation of washing machine 100, including, for example, control of water feed valve 310, detergent three-way valve 381, and softener three-way valve 382, in response to operation of the user performed on operation unit 800. The controller includes a computer system including a processor and a memory. Then, when the processor executes a program stored in the memory, the computer system functions as the controller. Although the program to be executed by the processor is here recorded in advance in the memory of the computer system, the program may be provided by being recorded in a non-transitory recording medium such as a memory card, or may be provided through a telecommunication line such as the Internet.

[0017] Water feed port 200 is provided behind operation unit 800, and water feed hose 210 is connected to water feed port 200 to allow tap water to be introduced from a faucet.

[0018] Upper housing 620 includes detergent tank 450, softener tank 480, and detergent case 400, which are accommodated in water feed unit 300 and disposed with respective front surfaces flush with each other.

[0019] Lid body 700 is configured to be partially transparent. This configuration enables the user to check the amount of residual liquid agents stored in detergent tank 450 and softener tank 480 even with lid body 700 closed by visually recognizing detergent tank residual amount display scale 450a and softener tank residual amount display scale 480a.

Although detergent tank 450 stores the liquid agent being liquid detergent and softener tank 480 stores the liquid agent being a softener, the liquid agents are not particularly distinguished and may be each referred to below as a liquid agent.

[0020] [1-1-2. Water feed unit]

Fig. 3 is an external perspective view illustrating a configuration of water feed unit 300 and the periphery of water feed unit 300, in which detergent case 400, detergent tank 450, and softener tank 480 are pulled out. Fig. 4 is a rear view illustrating a configuration of water feed unit 300 and its periphery.

[0021] As illustrated in Figs. 3 and 4, water feed unit 300 mainly includes water feed unit housing 320 formed in a substantially box shape, and water feed unit lid 340 for covering an upper surface of water feed unit housing 320.

[0022] Water feed unit housing 320 has a back surface to which water feed valve 310 is attached, water feed valve 310 being openable and closable to allow water introduced from water feed port 200 to pass therethrough. The water introduced from water feed valve 310 is introduced into water feed unit housing 320.

[0023] As described above, detergent case 400, detergent tank 450, and softener tank 480 are accommodated in water feed unit 300, and are disposed to be able to be independently pulled out.

[0024] Detergent case 400 is used for a user to feed a chemical agent in the amount required for a single operation. Detergent case 400 includes manual powder-detergent feeding part 410 for feeding powder detergent, manual liquid-detergent feeding part 420 for feeding liquid detergent, and manual softener feeding part 430 for feeding softener. Manual powder-detergent feeding part 410 and manual liquid-detergent feeding part 420 are connected to a first water passage (not illustrated) connected to water feed valve 310. Manual softener feeding part 430 is connected to a second water passage (not illustrated) connected to water feed valve 310.

[0025] Detergent tank 450 and softener tank 480 are connected to automatic liquid-agent feeding device 301. Automatic liquid-agent feeding device 301 includes detergent three-way valve 381 connected to detergent tank 450, softener three-way valve 382 connected to softener tank 480, and pump unit 390. Pump unit 390 is disposed downstream of detergent three-way valve 381 and softener three-way valve 382 to inject water and a liquid agent. Automatic liquid-agent feeding device 301 is connected to a third water passage (not illustrated) connected to water feed valve 310.

[0026] Flow-path lower part 370 is configured as a discharge part to discharge water and water containing a liquid agent to washing tub 500, the water and water containing the liquid agent flowing out from the first water passage, the second water passage, and the third water passage.

[0027] [1 -3. Detergent tank]

Hereinafter, detergent tank 450 will be described as an example of the liquid agent tank in the present disclosure. Softener tank 480 has a configuration similar to that of detergent tank 450, and thus will not be described.

[0028] Figs. 5 and 6 are each an external perspective view illustrating a configuration of detergent tank 450. Fig. 5 illustrates a state in which detergent tank lid 471 is attached, and Fig. 6 illustrates a state in which detergent tank lid 471 is removed. Fig. 7 is a top view illustrating a configuration of detergent tank 450. As illustrated in Figs. 5 to 7, detergent tank 450 includes detergent tank body 451 formed in a substantially box shape, and detergent tank lid 471. Detergent tank body 451 has an upper surface provided with detergent tank body opening 452. The substantially box shape may be a hollow shape functioning as a container capable of storing a liquid agent. Examples of the substantially box shape include various shapes such as a substantially cubic shape, a substantially prismatic shape, and a substantially cylindrical shape, other than a substantially rectangular parallelepiped shape as in detergent tank body 451 of the present exemplary embodiment.

[0029] Detergent tank lid 471 includes first claw part 479a and second claw part 479b. Detergent tank lid 471 can be attached to detergent tank body 451 by inserting first claw part 479a into the inside of the front surface of detergent tank body 451 and engaging second claw part 479b with engagement part 453 behind a back surface of detergent tank body 451. Detergent tank lid 471 is attached to detergent tank body 451 to cover detergent tank body opening 452.

[0030] Detergent tank feeding part 472 including feeding ramp 473 is disposed on a front side of detergent tank lid 471. Detergent tank feeding part 472 opens at its substantially center, and is provided at its front, right and left, and rear with respective feeding ramps 473. Feeding ramp 473 is formed inclining downward toward the opening of detergent tank feeding part 472, and guides a liquid agent (liquid detergent) to detergent tank feeding part 472 to flow down into detergent tank body 451.

[0031] Fig. 8 is an external perspective view illustrating a configuration of detergent tank lid 471 when viewed from its back surface. Figs. 9 to 11 are sectional views taken along

line A-A, line B-B, and line C-C of detergent tank 450 illustrated in Fig. 7, respectively. As illustrated in Figs. 8 to 11, detergent tank lid 471 is provided on its back side with insertion wall 474 extending downward in an installed state. Insertion wall 474 is inserted into detergent tank body opening 452. Insertion wall 474 has an outer peripheral surface serving as insertion wall outer peripheral surface 474a facing detergent tank body upper inner peripheral surface 451a in detergent tank body 451 to which detergent tank lid 471 is attached. Detergent tank body upper inner peripheral surface 451a and insertion wall outer peripheral surface 474a are defined as peripheral surfaces of detergent tank 450 in the present exemplary embodiment.

[0032] As illustrated in Figs. 8 and 9, detergent tank lid 471 is provided on its back side with center rib 477. Center rib 477 perpendicularly intersects insertion wall 474, and extends from insertion wall 474 toward the center of detergent tank lid 471. Center rib 477 is in contact with detergent tank body upper inner peripheral surface 451a in detergent tank lid 471 attached to detergent tank body 451. Center rib 477 supports insertion wall 474 from the center of detergent tank lid 471, and prevents insertion wall 474 and detergent tank body opening 452 from deforming in detergent tank body 451 to which detergent tank lid 471 is attached.

[0033] As illustrated in Figs. 8 and 10, insertion wall outer peripheral surface 474a of detergent tank lid 471 is provided with vertical rib 478 disposed in the up-down direction. Vertical rib 478 substantially perpendicularly intersects lateral rib 476 to be described later on insertion wall outer peripheral surface 474a, thereby increasing strength of insertion wall 474. The term, "substantially perpendicular", means not only being completely perpendicular but also being slightly deviated from the perpendicular, such as being perpendicular within an allowable error range in manufacturing detergent tank 450. Vertical rib 478 is in contact with detergent tank body upper inner peripheral surface 451a in detergent tank lid 471 attached to detergent tank body 451. As a result, vertical rib 478 prevents detergent tank lid 471 from rattling when detergent tank lid 471 is attached to detergent tank body 451.

[0034] As illustrated in Figs. 9 to 11, insertion wall outer peripheral surface 474a of detergent tank lid 471 is provided with groove 475 and lateral rib 476 in a substantially horizontal direction. The term, "substantially horizontality", means not only being completely horizontal but also being slightly deviated from the horizontality, such as being horizontal within an allowable error range in manufacturing detergent tank 450.

[0035] Lateral rib 476 includes first lateral rib 476a, second lateral rib 476b, and third lateral rib 476c. Third lateral rib 476c is provided on the uppermost side of lateral rib 476. Third lateral rib 476c is configured not to be in contact with detergent tank body upper inner peripheral surface 451a but to form a slight gap in detergent tank body 451 to which detergent tank lid 471 is attached. Second lateral rib 476b is located below third lateral rib 476c, and has a lower height than third lateral rib 476c. First lateral rib 476a is located below second lateral rib 476b, and has a lower height than second lateral rib 476b. That is, when detergent tank lid 471 is attached to detergent tank body 451, first lateral rib 476a of lateral rib 476 is first inserted into detergent tank body 451, first lateral rib 476a having the lowest height. Thus, the user can easily attach detergent tank lid 471 to detergent tank body 451.

[0036] Groove 475 includes first groove 475a and second groove 475b. First groove 475a is located between first lateral rib 476a and second lateral rib 476b, and second groove 475b is located between second lateral rib 476b and third lateral rib 476c.

[0037] [1-2. Operation]

Operation of washing machine 100 configured as described above according to the first exemplary embodiment will be described below.

[0038] [1-2-1. Liquid agent replenishing work of detergent tank]

The user checks the amount of residual liquid agents (liquid detergents) by looking at detergent tank residual amount display scale 450a, and performs liquid agent replenishing work when the amount of residual liquid agents is small. The user lifts a lock lever (not illustrated) below detergent tank 450 to pull out detergent tank 450 while detergent tank 450 is accommodated (in a state illustrated in Fig. 2). At this time, detergent tank 450 protrudes from a plane where front surfaces of softener tank 480 and detergent case 400 in an accommodated state are located, and side surfaces of detergent tank feeding part 472 and detergent tank body 451 are exposed to the outside. Detergent tank feeding part 472 is not provided with a dedicated lid for covering detergent tank feeding part 472, so that the user can immediately feed detergent after pulling out detergent tank 450. Detergent tank body 451 is made of a transparent material, so that the user can visually recognize a liquid level of the detergent inside detergent tank body 451 from the exposed side surface of detergent tank body.

[0039] The user feeds detergent in a commercially available container into detergent tank feeding part 472 along feeding ramp 473. When the user has a short height, the user may

overflow the detergent to front, rear, left, and right of detergent tank feeding part 472.

Detergent tank feeding part 472 according to the present exemplary embodiment causes all four sides of the front, the left and right, and the rear to be covered with feeding ramps 473, so that the user can be prevented from overflowing the detergent. Feeding ramps 473 in the present embodiment include a front part, left and right parts, and a rear part that are each inclined downward toward an opening at a substantially center. Thus, feeding ramps 473 guide the injected detergent to the opening of detergent tank feeding part 472 in any of the front part, the left and right parts, and the rear part.

[0040] When completing the liquid agent replenishing work, the user pushes detergent tank 450 toward its back surface side to allow detergent tank 450 to return to the state of Fig. 2.

[0041] [1-2-2. Washing operation when automatic feeding function is used]

During washing operation, automatic liquid-agent feeding device 301 is driven to automatically feed the liquid detergent.

[0042] Specifically, when switching between opening and closing of water feed valve 310, switching of directions of detergent three-way valve 381, and switching of operation of pump unit 390, are first performed during the washing operation, the liquid detergent in detergent tank 450 is automatically fed into washing tub 500 through the third water passage and flow-path lower part 370. After the automatic feed of the liquid detergent is completed, or at the same time of the automatic feed of the liquid detergent, water flowing out of water feed valve 310 is fed to washing tub 500 as follows. That is, the water flowing out of water feed valve 310 through the first water passage, manual powder-detergent feeding part 410, and manual liquid-detergent feeding part 420, dissolves the liquid detergent accumulated in flow-path lower part 370 and is fed to washing tub 500.

[0043] When switching between opening and closing of water feed valve 310, switching of directions of softener three-way valve 382, and switching of operation of pump unit 390, are performed in a final rinsing step, the liquid agent (softener) in softener tank 480 is automatically fed into washing tub 500 through the third water passage and flow-path lower part 370. After the automatic feeding of the softener is completed, the water flowing out of water feed valve 310 through the second water passage and manual softener feeding part 430 dissolves the softener accumulated in flow-path lower part 370 and is fed to washing tub 500.

[0044] [1-2-3. Suppression of capillarity]

When detergent tank 450 has a wide gap between detergent tank body 451 and detergent tank lid 471, a liquid agent in detergent tank 450 may leak. That is, a liquid level of the liquid agent filled in detergent tank 450 swings due to vibration or the like generated during the washing operation, and thus the liquid agent may leak from the wide gap between detergent tank body 451 and detergent tank lid 471. Thus, the gap between detergent tank body 451 and detergent tank lid 471 needs to be narrowed to prevent leakage of the liquid agent in detergent tank 450.

[0045] Detergent tank 450 is configured such that a gap between detergent tank body upper inner peripheral surface 451a and lateral rib 476 is narrowed in detergent tank body 451 to which detergent tank lid 471 is attached. This configuration enables detergent tank 450 to prevent leakage of the liquid agent in detergent tank 450.

[0046] Unfortunately, narrowing the gap between detergent tank body 451 and detergent tank lid 471 may cause capillarity to raise the liquid agent in the gap between detergent tank body 451 and detergent tank lid 471. Thus, detergent tank 450 is provided with first groove 475a between first lateral rib 476a and second lateral rib 476b, and second groove 475b between second lateral rib 476b and third lateral rib 476c. That is, detergent tank 450 has the gap between detergent tank body 451 and detergent tank lid 471, the gap being partially widened in width. This configuration enables detergent tank 450 to prevent capillarity from occurring in first groove 475a and second groove 475b. Thus, detergent tank 450 enables preventing leakage of the liquid agent in detergent tank 450 due to the capillarity while the gap between detergent tank body 451 and detergent tank lid 471 is narrowed.

[0047] [1-3. Effects]

As described above, washing machine 100 according to the first exemplary embodiment includes washing tub 500 that accommodates laundry, detergent tank 450 that stores a liquid agent, and automatic liquid-agent feeding device 301 that feeds the liquid agent stored in detergent tank 450 into washing tub 500. Detergent tank 450 includes detergent tank body 451 and detergent tank lid 471. Detergent tank body 451 is formed in a substantially box shape, and is provided in its upper surface with detergent tank body opening 452 in the installed state. Detergent tank lid 471 includes insertion wall 474 inserted into detergent tank body opening 452 to cover detergent tank body opening 452. Insertion wall outer peripheral surface 474a faces detergent tank body upper inner peripheral surface 451a in detergent tank body 451 to which detergent tank lid 471 is

attached, and detergent tank 450 includes groove 475 disposed in insertion wall outer peripheral surface 474a in a substantially horizontal direction in the installed state. Detergent tank 450 is an example of the liquid agent tank in the present disclosure, detergent tank body 451 is an example of the tank body in the present disclosure, and detergent tank lid 471 is an example of the tank lid in the present disclosure. Detergent tank body opening 452 is an example of the opening in the present disclosure. Insertion wall outer peripheral surface 474a is an example of the outer peripheral surface of the insertion wall in the present disclosure, and is an example of the peripheral surface in the present disclosure. Detergent tank body upper inner peripheral surface 451a is an example of the upper inner peripheral surface of the tank body in the present disclosure.

[0048] This configuration allows detergent tank 450 to have a relatively wide gap between detergent tank body upper inner peripheral surface 451a and insertion wall outer peripheral surface 474a in groove 475, and thus enables capillarity to be prevented. Thus, washing machine 100 according to the first exemplary embodiment can prevent leakage of liquid in detergent tank 450 due to capillarity.

[0049] As in the present exemplary embodiment, detergent tank 450 may include first lateral rib 476a and second lateral rib 476b each having a protruding shape on insertion wall outer peripheral surface 474a, and first groove 475a may be located between first lateral rib 476a and second lateral rib 476b.

[0050] This configuration enables detergent tank 450 to have a narrow gap between detergent tank body upper inner peripheral surface 451a and first lateral rib 476a, and a narrow gap between detergent tank body upper inner peripheral surface 451a and second lateral rib 476b. Thus, washing machine 100 according to the first exemplary embodiment can prevent the liquid agent in detergent tank 450 from leaking.

[0051] As in the present embodiment, first lateral rib 476a, second lateral rib 476b, and first groove 475a may be provided on or in insertion wall outer peripheral surface 474a. First lateral rib 476a may be provided below second lateral rib 476b in the installed state, and may be formed with a height lower than a height of second lateral rib 476b.

[0052] This configuration enables widening a gap between first lateral rib 476a of lateral rib 476 and detergent tank body upper inner peripheral surface 451a, first lateral rib 476a being first inserted into detergent tank body 451, when the user attaches detergent tank lid 471 to detergent tank body 451. Thus, the user can easily attach detergent tank lid 471 to detergent tank body 451.

[0053] As in the present exemplary embodiment, detergent tank lid 471 may include vertical rib 478 disposed in the up-down direction on insertion wall outer peripheral surface 474a in the installed state. Vertical rib 478 may be in contact with detergent tank body upper inner peripheral surface 451a in detergent tank lid 471 attached to detergent tank body 451.

[0054] This configuration enables vertical rib 478 to eliminate a gap between detergent tank lid 471 and detergent tank body 451. Thus, washing machine 100 according to the first exemplary embodiment enables vertical ribs 478 to prevent detergent tank lid 471 from rattling in detergent tank body 451 to which detergent tank lid 471 is attached.

[0055] As in the present exemplary embodiment, detergent tank lid 471 may include center rib 477 that intersects insertion wall 474 and extends from insertion wall 474 toward the center of detergent tank lid 471. Center rib 477 may be in contact with detergent tank body upper inner peripheral surface 451a in detergent tank lid 471 attached to detergent tank body 451.

[0056] This configuration enables center rib 477 to push and expand insertion wall 474 and detergent tank body opening 452 in detergent tank body 451 to which detergent tank lid 471 is attached. Thus, washing machine 100 according to the first exemplary embodiment enables center rib 477 to prevent deformation of insertion wall 474 and detergent tank body opening 452.

[0057] (Second exemplary embodiment)

Hereinafter, washing machine 100 according to a second exemplary embodiment as an example of the washing machine of the present disclosure will be described below with reference to Fig. 12. As described below, washing machine 100 according to the second exemplary embodiment includes detergent tank 1450 different in configuration from detergent tank 450 of washing machine 100 according to the first exemplary embodiment. Other configurations of washing machine 100 according to the second exemplary embodiment are identical to the corresponding configurations of washing machine 100 according to the first exemplary embodiment. Thus, the washing machine according to the second exemplary embodiment is herein denoted by the identical reference numeral "100".

[0058] [2-1. Configuration]

Fig. 12 is a schematic sectional view illustrating a configuration of detergent tank 1450 of washing machine 100 according to the second exemplary embodiment. Washing

machine 100 according to the second exemplary embodiment includes detergent tank 1450. Detergent tank 1450 includes detergent tank lid 1471 that is different from detergent tank lid 471 of detergent tank 450 according to the first exemplary embodiment in that insertion wall 1474 includes no lateral rib.

[0059] As illustrated in Fig. 12, detergent tank 1450 according to the second exemplary embodiment includes detergent tank body 451 and detergent tank lid 1471.

[0060] Detergent tank lid 1471 is configured to cover detergent tank body opening 452 in detergent tank body 451 to which detergent tank lid 1471 is attached. Detergent tank lid 1471 is provided on its back side with insertion wall 1474 formed extending downward. Insertion wall 1474 has an outer peripheral surface defined as insertion wall outer peripheral surface 1474a. When detergent tank lid 1471 is attached to detergent tank body 451, detergent tank body upper inner peripheral surface 451a and insertion wall outer peripheral surface 1474a face each other.

[0061] Detergent tank lid 1471 includes groove 1475 formed in insertion wall outer peripheral surface 1474a in a substantially horizontal direction. Detergent tank lid 1471 according to the second exemplary embodiment includes no lateral rib in a protruding shape on insertion wall outer peripheral surface 1474a.

[0062] [2-2. Operation]

Operation of washing machine 100 configured as described above according to the second exemplary embodiment will be described below.

[0063] [2 -2 -1. Suppression of occurrence of capillarity]

Detergent tank 1450 is configured to have a narrow gap between detergent tank body 451 and detergent tank lid 1471 to prevent leakage of a liquid agent in detergent tank 1450 due to vibration or the like during washing operation.

[0064] Unfortunately, narrowing the gap between detergent tank body 451 and detergent tank lid 1471 may cause capillarity to raise the liquid agent in the gap between detergent tank body 451 and detergent tank lid 1471. Thus, detergent tank 1450 is provided in insertion wall outer peripheral surface 1474a with groove 1475 to allow the gap between detergent tank body 451 and detergent tank lid 1471 to be partially widen in width. This configuration enables detergent tank 1450 to prevent capillarity from occurring in groove 1475. Thus, detergent tank 1450 enables preventing leakage of the liquid agent in detergent tank 1450 due to the capillarity while the gap between detergent tank body 451 and detergent tank lid 1471 is narrowed.

[0065] [2 -3. Effects]

As described above, detergent tank 1450 of washing machine 100 according to the second exemplary embodiment includes detergent tank body 451 and detergent tank lid 1471. Detergent tank body 451 is formed in a substantially box shape, and is provided in its upper surface with detergent tank body opening 452 in the installed state. Detergent tank lid 1471 includes insertion wall 1474 inserted into detergent tank body opening 452 to cover detergent tank body opening 452. Insertion wall outer peripheral surface 1474a faces detergent tank body upper inner peripheral surface 451a in detergent tank body 451 to which detergent tank lid 1471 is attached, and detergent tank 1450 includes groove 475 disposed in insertion wall outer peripheral surface 1474a in a substantially horizontal direction in the installed state. Detergent tank 1450 is an example of the liquid agent tank in the present disclosure, detergent tank body 451 is an example of the tank body in the present disclosure, and detergent tank lid 1471 is an example of the tank lid in the present disclosure. Detergent tank body opening 452 is an example of the opening in the present disclosure. Insertion wall outer peripheral surface 1474a is an example of the outer peripheral surface of the insertion wall in the present disclosure, and is an example of the peripheral surface in the present disclosure. Detergent tank body upper inner peripheral surface 451a is an example of the upper inner peripheral surface of the tank body in the present disclosure.

[0066] This configuration allows detergent tank 1450 to have a relatively wide gap between detergent tank body upper inner peripheral surface 451a and insertion wall outer peripheral surface 1474a in groove 475, and thus enables capillarity to be prevented. Thus, washing machine 100 according to the second exemplary embodiment can prevent leakage of liquid in detergent tank 1450 due to capillarity.

[0067] (Other exemplary embodiments)

As described above, the first and second exemplary embodiments have been described as examples of the technique in the present disclosure. However, the technique in the present disclosure is not limited thereto, and can also be applied to exemplary embodiments in which changes, replacements, additions, omissions, and the like have been made. Additionally, a new exemplary embodiment may be made by combining the components described in the first and second exemplary embodiments.

[0068] Thus, other exemplary embodiments will be described below.

[0069] The first and second exemplary embodiments each show washing machine 100

that is a top-loading washing machine as an example of the washing machine in the present disclosure. The washing machine in the present disclosure is not limited to the top-loading washing machine, and may be a drum type washing machine or a twin-tub washing machine.

[0070] The first and second exemplary embodiments each show detergent tank 450 and detergent tank 1450 as examples of the liquid agent tank in the present disclosure. The liquid agent tank in the present disclosure only needs to store a liquid agent in the tank, and may be softener tank 480. Softener tank 480 is similar in configuration to detergent tank 450 or detergent tank 1450, and thus softener tank 480 will be similarly described.

[0071] The first and second exemplary embodiments show groove 475 provided in insertion wall outer peripheral surface 474a and groove 1475 provided in insertion wall outer peripheral surface 1474a, respectively, as examples of the groove in the present disclosure. The groove in the present disclosure is required to be provided in at least one of the upper inner peripheral surface of the tank body in the present disclosure or the outer peripheral surface of the insertion wall of the tank lid in the present disclosure, and thus is not limited to a groove provided in the outer peripheral surface of the insertion wall in the present disclosure, such as groove 475 or groove 1475. That is, the groove in the present disclosure may be provided in the upper outer peripheral surface of the detergent tank body in the present disclosure, or may be provided in both the outer peripheral surface of the insertion wall in the present disclosure and the upper outer peripheral surface of the detergent tank body in the present disclosure. Additionally, a plurality of the grooves in the present disclosure may be provided, or only one of the grooves may be provided.

[0072] Similarly, the first lateral rib in the present disclosure and the second lateral rib in the present disclosure are each required to be provided on at least one of the upper inner peripheral surface of the tank body in the present disclosure or the outer peripheral surface of the insertion wall of the tank lid in the present disclosure.

INDUSTRIAL APPLICABILITY

[0073] The present disclosure is applicable to a washing machine including an automatic liquid-agent feeding device. Specifically, the present disclosure is applicable to a top-loading washing machine, a drum-type washing machine, and a twin-tub washing machine, for example.

REFERENCE MARKS IN THE DRAWINGS

- [0074]** 100: washing machine
200: water feed port
210: water feed hose
300: water feed unit
301: automatic liquid-agent feeding device
310: water feed valve
320: water feed unit housing
340: water feed unit lid
370: flow-path lower part
381: detergent three-way valve
382: softener three-way valve
390: pump unit
400: detergent case
410: manual powder-detergent feeding part
420: manual liquid-detergent feeding part
430: manual softener feeding part
450: detergent tank
450a: detergent tank residual amount display scale
451: detergent tank body
451a: detergent tank body upper inner peripheral surface
452: detergent tank body opening
453: engagement part
471: detergent tank lid
472: detergent tank feeding part
473: feeding ramp
474: insertion wall
474a: insertion wall outer peripheral surface
475: groove
475a: first groove
475b: second groove
476: lateral rib
476a: first lateral rib

476b: second lateral rib
476c: third lateral rib
477: center rib
478: vertical rib
479a: first claw part
479b: second claw part
480: softener tank
480a: softener tank residual amount display scale
500: washing tub
600: housing
610: lower housing
620: upper housing
621: loading opening
700: lid
800: operation unit
1450: detergent tank
1471: detergent tank lid
1474: insertion wall
1474a: insertion wall outer peripheral surface
1475: groove

CLAIMS

1. A washing machine comprising:
 - a washing tub that accommodates laundry;
 - a liquid agent tank that stores a liquid agent; and
 - an automatic liquid-agent feeding device that feeds the liquid agent stored in the liquid agent tank into the washing tub,wherein the liquid agent tank is in a substantially box shape and includes
 - a tank body including an opening on an upper surface in an installed state, and
 - a tank lid including an insertion wall inserted into the opening and covering the opening, the insertion wall including an outer peripheral surface facing an upper inner peripheral surface of the tank body with the tank lid attached to the tank body, andthe liquid agent tank includes a groove in a peripheral surface including at least one of the upper inner peripheral surface or the outer peripheral surface, the groove being disposed in a substantially horizontal direction in the installed state.
2. The washing machine according to Claim 1, wherein
 - the liquid agent tank includes a first lateral rib and a second lateral rib on the peripheral surface, and
 - the groove is located between the first lateral rib and the second lateral rib.
3. The washing machine according to Claim 2, wherein
 - the first lateral rib, the second lateral rib, and the groove are provided on or in the outer peripheral surface,
 - the first lateral rib is located below the second lateral rib in the installed state, and
 - the first lateral rib is formed having a lower height than the second lateral rib.
4. The washing machine according to Claim 3, wherein
 - the tank lid includes a vertical rib disposed on the outer peripheral surface in an up-down direction in the installed state, and
 - the vertical rib is in contact with the upper inner peripheral surface in the tank lid

attached to the tank body.

5. The washing machine according to any one of Claims 1 to 4, wherein
the tank lid includes a center rib that intersects with the insertion wall and extends
from the insertion wall toward a center of the tank lid, and
the center rib is in contact with the upper inner peripheral surface in the tank lid
attached to the tank body.