

WASHING MACHINE

BACKGROUND

1. Technical Field

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

2. Description of the Related Art

[0002] Patent Literature 1 discloses a washing machine including a liquid washing agent feeding device configured to automatically feed an appropriate amount of a liquid washing agent.

[0003] The washing machine disclosed in Patent Literature 1 includes: the liquid washing agent feeding device; a tank configured to store the liquid washing agent in amounts allowing washing operation to be performed a plural number of times; and a case configured to accommodate the tank. The tank is configured such that, when moved in the vertical direction, the tank can be removed from or attached to the case.

Citation List

[0004] Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2019-181023

SUMMARY

[0005] The present disclosure provides a washing machine configured to more easily refilling a liquid agent tank for storing a liquid agent with the liquid agent and thereby substantially prevent contamination around the liquid agent tank.

[0006] The washing machine according to the present disclosure includes a washing tub, a liquid agent tank, a liquid agent automatic feeding device, and a liquid agent tank accommodation unit. The washing tub is configured to accommodate the laundry. The liquid agent tank is configured to store a liquid, and includes an opening in a top face of the liquid agent tank when the liquid agent tank is in an installed state. The liquid agent automatic feeding device is configured to feed the liquid stored in the liquid agent tank into the washing tub. The liquid agent tank accommodation unit is configured to accommodate the liquid agent tank and connect the liquid agent tank to the liquid agent automatic feeding device. Furthermore, the liquid agent tank is configured to be attachable to and removable from the liquid agent automatic feeding device, and is engaged with the liquid

agent tank accommodation unit at a first position at which the opening is opened outward.

[0007] The washing machine according to the present disclosure makes it possible to more easily refill the liquid agent tank for storing a liquid agent with the liquid agent and thereby substantially prevent contamination around the liquid agent tank.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is an external perspective view of the configuration of a washing machine in Embodiment 1 in a state in which a lid of the washing machine is closed.

FIG. 2 is an external perspective view of the configuration of the washing machine in Embodiment 1 in a state in which the lid of the washing machine is opened.

FIG. 3 is an external perspective view of the configuration of a water supply unit of the washing machine and its surroundings in Embodiment 1 in a state in which a detergent case, a detergent tank, and a softening agent tank are drawn out.

FIG. 4 is a back view of the configuration of the water supply unit of the washing machine and its surroundings in Embodiment 1.

FIG. 5 is an exploded perspective view of the configuration of the water supply unit of the washing machine and its surroundings in Embodiment 1.

FIG. 6 is a top view of the configuration of the water supply unit of the washing machine and its surroundings in Embodiment 1, except a flow-path lid unit.

FIG. 7 is a top view of the water supply unit of the washing machine and its surroundings in Embodiment 1, except the flow-path lid unit, in a state in which the detergent case, the detergent tank, and the softening agent tank are removed.

FIG. 8 is a cross-sectional view of the water supply unit and its surroundings, taken along line F-F in FIG. 7.

FIG. 9 is a top view of the water supply unit of the washing machine and its surroundings in Embodiment 1, except the flow-path lid unit, in a state in which the detergent case, the detergent tank, and the softening agent tank are drawn out.

FIG. 10 is a cross-sectional view of the water supply unit and its surroundings, taken along line B-B in FIG. 7.

FIG. 11 is a cross-sectional view of the water supply unit and its surroundings, taken along line E-E in FIG. 7.

FIG. 12 is a cross-sectional view of the water supply unit and its surroundings, taken along line C-C in FIG. 7.

FIG. 13 is a cross-sectional view of the water supply unit and its surroundings,

taken along line A-A in FIG. 7.

FIG. 14 is a cross-sectional view of the water supply unit and its surroundings, taken along line D-D in FIG. 7.

FIG. 15 is an external front view of the water supply unit of the washing machine in Embodiment 1 in a state in which the detergent case, the detergent tank, and the softening agent tank are removed.

FIG. 16 is an external perspective view of the configuration of the detergent tank of the washing machine in Embodiment 1.

FIG. 17A is a cross-sectional top view of the water supply unit of the washing machine and its surroundings in Embodiment 1, except the flow-path lid unit, in a state in which the detergent tank is accommodated.

FIG. 17B is a cross-sectional top view of the water supply unit of the washing machine and its surroundings in Embodiment 1, except the flow-path lid unit, in a state in which the detergent tank is drawn out.

FIG. 18 is a cross-sectional view of the water supply unit and its surroundings, taken along line G-G in FIG. 17A.

FIG. 19 is a cross-sectional view of the water supply unit and its surroundings, taken along line K-K in FIG. 17B.

FIG. 20 is a cross-sectional view of the water supply unit and its surroundings, taken along line H-H in FIG. 17A.

FIG. 21 is a cross-sectional view of the water supply unit and its surroundings, taken along line J-J in FIG. 17B.

FIG. 22 is a top view of the configuration of a flow-path lower unit of the washing machine in Embodiment 1.

FIG. 23 is an external perspective view of the configuration of a washing machine in Embodiment 2 in a state in which a lid of the washing machine is closed.

FIG. 24 is an external perspective view of the configuration of the washing machine in Embodiment 2 in a state in which the lid of the washing machine is opened.

FIG. 25 is an external perspective view of the configuration of a water supply unit of the washing machine and its surroundings in Embodiment 2 in a state in which a detergent case, a detergent tank, and a softening agent tank are drawn out.

FIG. 26 is a back view of the configuration of the water supply unit of the washing machine and its surroundings in Embodiment 2.

FIG. 27 is an exploded perspective view of the configuration of the water supply

unit of the washing machine and its surroundings in Embodiment 2.

FIG. 28 is a top view of the configuration of the water supply unit of the washing machine and its surroundings in Embodiment 2, except a flow-path lid unit.

FIG. 29 is a top view of the water supply unit of the washing machine and its surroundings in Embodiment 2, except the flow-path lid unit, in a state in which the detergent case, the detergent tank, and the softening agent tank are removed.

FIG. 30 is a cross-sectional view of the water supply unit and its surroundings, taken along line Q-Q in FIG. 29.

FIG. 31 is a top view of the water supply unit of the washing machine and its surroundings in Embodiment 2, except the flow-path lid unit, in a state in which the detergent case, the detergent tank, and the softening agent tank are drawn out.

FIG. 32 is a cross-sectional view of the water supply unit and its surroundings, taken along line M-M in FIG. 29.

FIG. 33 is a cross-sectional view of the water supply unit and its surroundings, taken along line P-P in FIG. 29.

FIG. 34 is a cross-sectional view of the water supply unit and its surroundings, taken along line N-N in FIG. 29.

FIG. 35 is a cross-sectional view of the water supply unit and its surroundings, taken along line L-L in FIG. 29.

FIG. 36 is a cross-sectional view of the water supply unit and its surroundings, taken along line O-O in FIG. 29.

FIG. 37 is an external front view of the water supply unit of the washing machine in Embodiment 2 in a state in which the detergent case, the detergent tank, and the softening agent tank are removed.

FIG. 38 is an external perspective view of the configuration of the detergent tank of the washing machine in Embodiment 2.

FIG. 39A is a cross-sectional top view of the water supply unit of the washing machine and its surroundings in Embodiment 2, except the flow-path lid unit, in a state in which the detergent tank is accommodated.

FIG. 39B is a cross-sectional top view of the water supply unit of the washing machine and its surroundings in Embodiment 2, except the flow-path lid unit, in a state in which the detergent tank is drawn out.

FIG. 40 is a cross-sectional view of the water supply unit and its surroundings, taken along line R-R in FIG. 39A.

FIG. 41 is a cross-sectional view of the water supply unit and its surroundings, taken along line U-U in FIG. 39B.

FIG. 42 is a cross-sectional view of the water supply unit and its surroundings, taken along line S-S in FIG. 39A.

FIG. 43 is a cross-sectional view of the water supply unit and its surroundings, taken along line T-T in FIG. 39B.

FIG. 44 is a top view of the configuration of a flow-path lower unit of the washing machine in Embodiment 2.

DETAILED DESCRIPTIONS

[0009] Hereinafter, Embodiment 1 will be described in detail with reference to the drawings. The accompanying drawings and the following descriptions are provided to help those skilled in the art fully understand the present disclosure, and do not intend to thereby restrict the subject matter recited in the claims.

[0010] (Embodiment 1)

Hereinafter, washing machine 100 in Embodiment 1 will be described using FIG. 1 to FIG. 22.

[0011] [1-1. Configuration]

[1-1-1. Configuration of Washing Machine]

FIG. 1 is an external perspective view of the configuration of washing machine 100 in Embodiment 1 in a state in which lid 700 is closed. FIG. 2 is an external perspective view of the configuration of washing machine 100 in a state in which lid 700 is opened. Note that, in Embodiment 1, the vertical direction in a state in which washing machine 100 is installed (corresponding to an installed state in the present disclosure) as illustrated in FIG. 1 and FIG. 2 is sometimes referred to as a top-and-bottom direction. Furthermore, in Embodiment 1, a side on which operation unit 800 of washing machine 100 is present in FIG. 1 and FIG. 2 is sometimes referred to as a rear side, meanwhile a side opposing the rear side is sometimes referred to as a front side. That is, typically, a user stands in front of washing machine 100 and puts the laundry, such as clothes, into washing machine 100, and performs various types of operations for operating washing machine 100. Note that the laundry in the present disclosure is not limited to clothes, but may be, for example, fabrics and leather products, such as bedclothes, curtains, carpeting, and shoes, and other various known washing-machine washables.

[0012] As illustrated in FIG. 1 and FIG. 2, washing machine 100 includes casing 600, lid

700, and operation unit 800, and is what is called a top-loading washing machine that allows the laundry to be put into casing 600 from above when washing machine 100 is in the installed state. Casing 600 includes lower casing 610 and upper casing 620. Lower casing 610 is configured to accommodate washing tub 500. Washing tub 500 is in the shape of an open-top cylinder (in other words, in the shape of a cylinder with a bottom) and configured to accommodate the laundry and perform a washing operation for washing the laundry. The washing operation may be an operation performed by a washing tub of any type of various known washing machines. The principle of Embodiment 1 is not limited to a specific washing operation performed by washing tub 500.

[0013] Upper casing 620 is disposed above lower casing 610. In upper casing 620, loading opening 621 for the laundry is formed to communicate with washing tub 500. Lid 700 is attached to a rear portion of upper casing 620 and configured to cover loading opening 621 in an openable and closable manner. When the user rotates lid 700 upward, washing tub 500 is exposed through loading opening 621. The user can put the laundry into washing tub 500 from loading opening 621.

[0014] In a rear portion of upper casing 620, operation unit 800 is disposed at a position behind loading opening 621. The user can operate operation unit 800 to set various types of operations of washing tub 500. Note that washing machine 100 includes a controller, not illustrated, in casing 600 to control, for example, water supply valve 310 and three-way valve 380 and furthermore the operation of the whole of washing machine 100, in response to the operation of operation unit 800 by the user. The controller includes a computer system including a processor and a memory. When the processor executes a program stored in the memory, the computer system functions as a controller. Here, there was described that the program to be performed by the processor is beforehand recorded in the memory of the computer system, but the program may be recorded in a non-transitory recording medium, such as a memory card, and provided, or may be provided via a telecommunication line, such as the Internet.

[0015] Water supply port 200 is provided behind operation unit 800. Water supply hose 210 is connected to water supply port 200 so as to introduce tap water from a tap.

[0016] As illustrated in FIG. 2, detergent tank 450, softening agent tank 460, and detergent case 400 are disposed so that, when detergent tank 450, softening agent tank 460, and detergent case 400 are accommodated in water supply unit 300, their front faces are flush with each other.

[0017] FIG. 3 is an external perspective view of the configuration of water supply unit

300 and its surroundings in a state in which detergent case 400, detergent tank 450, and softening agent tank 460 are drawn out. As illustrated in FIG. 3, detergent tank 450 and softening agent tank 460 are configured to be capable of storing a liquid in amounts allowing two or more operations. Specifically, detergent tank 450 and softening agent tank 460 store a liquid detergent and a softening agent, respectively. Detergent tank 450 includes detergent tank feeding unit 451 through which the liquid detergent to be stored is poured, meanwhile softening agent tank 460 includes softening agent tank feeding unit 461 through which the softening agent to be stored is poured. The top face of each of detergent tank feeding unit 451 and softening agent tank feeding unit 461 is open so that a liquid can be poured.

[0018] Detergent tank 450 and softening agent tank 460 include detergent tank residual amount scale 450a and softening agent tank residual amount scale 460a, respectively. Detergent tank residual amount scale 450a and softening agent tank residual amount scale 460a are each formed of a transparent material, so that the user can visually check the residual amount of a liquid.

[0019] In contrast, detergent case 400 is to be used in order that the user feeds an agent in amounts necessary for one operation. Detergent case 400 includes: powder detergent manual feeding unit 410 into which a powder detergent is fed; liquid detergent manual feeding unit 420 into which a liquid detergent is fed; and softening agent manual feeding unit 430 into which a softening agent is fed.

[0020] Lid 700 is configured to be partially transparent. With this configuration, even when lid 700 is in the closed state, the user can visually read detergent tank residual amount scale 450a and softening agent tank residual amount scale 460a to check the residual amount of a liquid stored in detergent tank 450 and the residual amount of a liquid stored in softening agent tank 460.

[0021] [1-1-2. Water Supply Unit]

FIG. 4 is a back view of the configuration of water supply unit 300 and its surroundings. FIG. 5 is an exploded perspective view of the configuration of water supply unit 300 and its surroundings. As illustrated in FIG. 5, water supply unit 300 includes: water supply unit casing 320 being approximately box-shaped; flow-path lid unit 340 configured to cover the top face of water supply unit casing 320; and flow-path lower unit 370 attached to the bottom of water supply unit casing 320.

[0022] As illustrated in FIG. 3 and FIG. 4, water supply valve 310 configured to be openable and closable to allow the passage of water introduced from water supply port 200

is attached to the left side of water supply unit casing 320 when seen from the back face thereof. With water supply valve 310 open, water introduced via water supply valve 310 is introduced into water supply unit casing 320.

[0023] At the center of the back face of water supply unit casing 320, bath pump 314 configured to suck water via a hose (not illustrated) from the outside of washing machine 100 is provided. Bath pump 314 is fixed to flow-path lid unit 340 with a screw, and directly connected to the later-described first water conveyance path 321 via bath pump-specific water feed port 333. When water is supplied from first water conveyance path 321, bath pump 314 can start suction and discharge operations.

[0024] As illustrated in FIG. 5 and FIG. 6, water supply unit casing 320 is in the shape of a box open forward. Water supply unit casing 320 includes detergent tank accommodation unit 360, softening agent tank accommodation unit 365, and detergent case accommodation unit 350, each serving as an interior space. Detergent tank accommodation unit 360, softening agent tank accommodation unit 365, and detergent case accommodation unit 350 independently drawably accommodate detergent tank 450, softening agent tank 460, and detergent case 400, respectively. Detergent tank accommodation unit 360 includes the later-described detergent tank accommodation unit hook 361 and the later-described stopper 368. Note that the shape of water supply unit casing 320 illustrated in FIG. 5 and FIG. 6 is merely an example, and water supply unit casing 320 is in any shape of a box so as to accommodate detergent tank 450, softening agent tank 460, and detergent case 400 in water supply unit casing 320. Furthermore, the shapes of detergent tank accommodation unit 360 and softening agent tank accommodation unit 365 illustrated in FIG. 5 and FIG. 6 are also merely examples. Detergent tank accommodation unit 360 and softening agent tank accommodation unit 365 is in a box shape open toward loading opening 621, and the box shape is any shape as long as detergent tank accommodation unit 360 and softening agent tank accommodation unit 365 can accommodate detergent tank 450 and softening agent tank 460, respectively. In other words, the shapes of water supply unit casing 320, detergent tank accommodation unit 360, and softening agent tank accommodation unit 365 are neither limited to an approximately rectangular parallelepiped shape nor an approximately cubic shape, and may be a rounded shape having an approximately polygonal cross section or a circular or elliptical cross section.

[0025] Detergent case flow-path unit 330 is provided to serve as the top face of detergent case accommodation unit 350. In detergent case flow-path unit 330, the later-described

first water conveyance path 321 and the later-described second water conveyance path 322 are formed.

[0026] As illustrated in FIG. 3 and FIG. 4, liquid agent automatic feeding device 301 is attached to the right side of water supply unit casing 320 when seen from the back face thereof. Liquid agent automatic feeding device 301 will be described later.

[0027] [1-1-3. Water Conveyance Path]

As illustrated in FIG. 4 and FIG. 5, water supply valve 310 includes three opening-and-closing valves, namely, first water conveyance pipe 311, second water conveyance pipe 312, and third water conveyance pipe 313, and is capable of independently opening and closing the three opening-and-closing valves.

[0028] FIG. 6 is a top view of the configuration of water supply unit 300 and its surroundings, except flow-path lid unit 340. FIG. 7 is a top view of water supply unit 300 and its surroundings, except flow-path lid unit 340, in a state in which detergent case 400, detergent tank 450, and softening agent tank 460 are removed. FIG. 8 is a cross-sectional view of water supply unit 300 and its surroundings, taken along line F-F in FIG. 7. FIG. 9 is a top view of water supply unit 300 and its surroundings, except flow-path lid unit 340, in a state in which detergent case 400, detergent tank 450, and softening agent tank 460 are drawn out. FIG. 10 is a cross-sectional view of water supply unit 300 and its surroundings, taken along line B-B in FIG. 7.

[0029] As illustrated in FIG. 6 to FIG. 10, a water conveyance path allowing water introduced via water supply valve 310 to flow therethrough is formed in water supply unit casing 320 and directly connected to water supply valve 310. The water conveyance path is branched so that the resulting branch paths independently communicate with first water conveyance pipe 311, second water conveyance pipe 312, and third water conveyance pipe 313, respectively. A path of the branch paths that communicates with first water conveyance pipe 311 is defined as first water conveyance path 321, a path thereof communicating with second water conveyance pipe 312 is defined as second water conveyance path 322, and a path thereof communicating with third water conveyance pipe 313 is defined as third water conveyance path 323.

[0030] [1-1-4. Detergent Case, First Water Conveyance Path, Second Water Conveyance Path]

As illustrated in FIG. 3 and FIG. 6 to FIG. 9, first water conveyance path 321 and second water conveyance path 322 are configured to guide water supplied from first water conveyance pipe 311 and second water conveyance pipe 312 to detergent case flow-path

unit 330 and feed the water into detergent case 400 positioned below.

[0031] As described above, powder detergent manual feeding unit 410, liquid detergent manual feeding unit 420, and softening agent manual feeding unit 430 are provided inside detergent case 400 and configured to allow the user to feed a powder detergent , a liquid detergent , and a softening agent, respectively.

[0032] First water conveyance path 321 includes: powder detergent-specific water feed port 331 formed in order to make the upper and lower sides communicate with each other above powder detergent manual feeding unit 410; and liquid detergent-specific water feed port 332 formed in order to make the upper and lower sides communicate with each other above liquid detergent manual feeding unit 420. Second water conveyance path 322 includes softening agent-specific water feed port 334 formed in order to make the upper and lower sides communicate with each other above softening agent manual feeding unit 430.

[0033] Each of powder detergent manual feeding unit 410, liquid detergent manual feeding unit 420, and softening agent manual feeding unit 430 includes an exhaust port (not illustrated) configured to discharge a liquid having gathered inside. The liquid discharged from the exhaust port falls down to flow-path lower unit 370. Flow-path lower unit 370 is configured as a discharge unit to discharge the liquid to washing tub 500.

[0034] [1-1-5. Automatic Feeding Device, Third Water Conveyance Path]

FIG. 11 is a cross-sectional view of water supply unit 300 and its surroundings, taken along line E-E in FIG. 7. FIG. 12 is a cross-sectional view of water supply unit 300 and its surroundings, taken along line C-C in FIG. 7. FIG. 13 is a cross-sectional view of water supply unit 300 and its surroundings, taken along line A-A in FIG. 7. FIG. 14 is a cross-sectional view of water supply unit 300 and its surroundings, taken along line D-D in FIG. 7. FIG. 15 is an external front view of the configuration of water supply unit 300 in a state in which detergent case 400, detergent tank 450, and softening agent tank 460 are removed.

[0035] As illustrated in FIG. 6 and FIG. 10 to FIG. 15, third water conveyance path 323 is formed along the back face of water supply unit casing 320 in the approximately horizontal direction, and is open toward the back face side at washing path water port 324. Washing path water port 324 is connected to the later-described in-automatic-feeding-device path 325, and causes third water conveyance path 323 to communicate with liquid agent automatic feeding device 301. Liquid agent automatic feeding device 301 is disposed on the back face side of detergent tank accommodation unit 360 and softening

agent tank accommodation unit 365. Furthermore, as described later, liquid agent automatic feeding device 301 is connected to both detergent tank 450 accommodated in detergent tank accommodation unit 360 and softening agent tank 460 accommodated in softening agent tank accommodation unit 365. In other words, detergent tank accommodation unit 360 accommodates detergent tank 450 and connects detergent tank 450 to liquid agent automatic feeding device 301, meanwhile softening agent tank accommodation unit 365 accommodates softening agent tank 460 and connects softening agent tank 460 to liquid agent automatic feeding device 301.

[0036] As illustrated in FIG. 9, detergent tank entry 302 is provided on the back face side of detergent tank 450, and detergent tank check valve 302a (see FIG. 20) configured to be opened when pushed is provided inside detergent tank entry 302. Similarly, softening agent tank entry 303 and a softening agent tank check valve (not illustrated) configured to be opened when pushed are provided on the back face side of softening agent tank 460. Detergent tank 450 is configured such that, in a state in which detergent tank 450 is installed in detergent tank accommodation unit 360, the later-described detergent automatic feed entry 452 is inserted into detergent tank entry 302 and thereby detergent tank check valve 302a is opened to allow the supply of a liquid detergent. Similarly, softening agent tank 460 is configured such that, in a state in which softening agent tank 460 is installed in softening agent tank accommodation unit 365, the later-described softening agent automatic feed entry 462 is inserted into softening agent tank entry 303 and thereby the softening agent tank check valve is opened to allow the supply of a softening agent.

[0037] Detergent automatic feeding-specific connection unit 360a and softening agent automatic feeding-specific connection unit 365a are provided in the inner back faces of detergent tank accommodation unit 360 and softening agent tank accommodation unit 365, respectively. Detergent automatic feeding-specific connection unit 360a and softening agent automatic feeding-specific connection unit 365a are configured to surround detergent automatic feed entry 452 and softening agent automatic feed entry 462 of liquid agent automatic feeding device 301, respectively.

[0038] Liquid agent automatic feeding device 301 includes detergent automatic feed entry 452, softening agent automatic feed entry 462, three-way valve 380, pump unit 390, and in-automatic-feeding-device path 325. Three-way valve 380 is configured to switch between paths for a liquid detergent, a softening agent, and water. Pump unit 390 is configured to suck in and discharge a liquid. In-automatic-feeding-device path 325

connects three-way valve 380 to pump unit 390. Note that, in Embodiment 1, detergent tank accommodation unit 360 and softening agent tank accommodation unit 365 are not included in the configuration of liquid agent automatic feeding device 301, but may be included in the configuration of liquid agent automatic feeding device 301. In other words, liquid agent automatic feeding device 301 may be in the shape of a box open toward loading opening 621, and include detergent automatic feed entry 452, softening agent automatic feed entry 462, detergent tank accommodation unit 360, and softening agent tank accommodation unit 365. The shape of liquid agent automatic feeding device 301 including detergent tank accommodation unit 360 and softening agent tank accommodation unit 365 may be any box shape as long as liquid agent automatic feeding device 301 can accommodate detergent tank 450 and softening agent tank 460. In other words, the shape of liquid agent automatic feeding device 301 is neither limited to an approximately rectangular parallelepiped shape nor an approximately cubic shape, and may be a rounded shape having an approximately polygonal cross section or a circular or elliptical cross section. Note that liquid agent automatic feeding device 301 may be configured to include at least one of detergent tank accommodation unit 360 and softening agent tank accommodation unit 365.

[0039] As illustrated in FIG. 9, detergent automatic feed entry 452 and softening agent automatic feed entry 462 are formed to project forward. In a state in which detergent tank 450 and softening agent tank 460 are accommodated in detergent tank accommodation unit 360 and softening agent tank accommodation unit 365, respectively, detergent automatic feed entry 452 and softening agent automatic feed entry 462 are connected to detergent tank 450 and softening agent tank 460, respectively.

[0040] Three-way valve 380 includes detergent three-way valve 381 and softening agent three-way valve 382, each being configured to be independently openable and closable. Detergent three-way valve 381 is disposed to communicate with washing path water port 324, detergent automatic feed entry 452, and softening agent three-way valve 382. Softening agent three-way valve 382 is disposed to communicate with detergent three-way valve 381, softening agent automatic feed entry 462, and in-automatic-feeding-device path 325. As illustrated in FIG. 13, a portion on the downstream side of three-way valve 380 is connected to pump unit 390 via in-automatic-feeding-device path 325. Thus, three-way valve 380 is connected to in-automatic-feeding-device path 325, detergent automatic feed entry 452, softening agent automatic feed entry 462, and pump unit 390. Washing machine 100 can control the flow of a detergent, a softening agent, and water by opening

and closing detergent three-way valve 381 and softening agent three-way valve 382.

[0041] Pump unit 390 includes in-pump flow path 391, cylinder 397, and piston 395. In-pump flow path 391 is disposed between pump unit inlet 392a and pump unit outlet 392b. Cylinder 397 is disposed in the middle of in-pump flow path 391. Piston 395 is configured to move up and down with a rotational driving force of a motor (not illustrated).

[0042] Inlet check valve 393 is provided in pump unit inlet 392a, meanwhile outlet check valve 394 is provided in pump unit outlet 392b.

[0043] Inlet check valve 393 is configured to be opened by a negative-pressure operation of piston 395, meanwhile outlet check valve 394 is configured to be opened by a positive-pressure operation of piston 395.

[0044] On the downstream side of pump unit 390, in-automatic-feeding-device path 325 is connected to flow-path lower unit 370 via washing path outlet 326.

[0045] [1-1-6. Detergent Tank, Tank Accommodation Unit]

Hereinafter, detergent tank 450 will be described as an example of the liquid agent tank. Softening agent tank 460 has the same configuration as that of detergent tank 450.

[0046] FIG. 16 is an external perspective view of the configuration of detergent tank 450. As illustrated in FIG. 16, detergent tank 450 includes: detergent tank casing 456 in the shape of a box; and detergent tank feeding unit 451 disposed above detergent tank casing 456.

[0047] Detergent tank feeding unit 451 has an opening at the approximate center thereof. Feeding incline unit 464 is provided in the front portion, the right-and-left side portion, and the rear portion of detergent tank feeding unit 451. Feeding incline unit 464 is inclined downward toward the opening of detergent tank feeding unit 451, and is configured to guide a liquid agent to detergent tank feeding unit 451 and cause the liquid agent to flow downward into detergent tank casing 456.

[0048] FIG. 17A is a cross-sectional top view of water supply unit 300 and its surroundings, except flow-path lid unit 340, in a state in which detergent tank 450 is accommodated. FIG. 17B is a cross-sectional top view of water supply unit 300 and its surroundings, except flow-path lid unit 340, in a state in which detergent tank 450 is drawn out. FIG. 18 is a cross-sectional view of water supply unit 300 and its surroundings, taken along line G-G in FIG. 17A. FIG. 19 is a cross-sectional view of water supply unit 300 and its surroundings, taken along line K-K in FIG. 17B. FIG. 20 is a cross-sectional view of water supply unit 300 and its surroundings, taken along line H-H in FIG. 17A. FIG. 21 is a cross-sectional view of water supply unit 300 and its surroundings, taken along line J-J

in FIG. 17B.

[0049] As illustrated in FIG. 18, lock lever 454 is provided on the bottom of detergent tank casing 456. In a state in which detergent tank 450 is accommodated in detergent tank accommodation unit 360, lock lever 454 is engaged with detergent tank accommodation unit hook 361 provided in the inner bottom face of detergent tank accommodation unit 360. Lock lever grip unit 454a is provided at a front-side end of lock lever 454. Lock lever grip unit 454a is disposed in the vicinity of detergent tank casing grip unit 456a formed by extending a front lower portion of detergent tank casing 456.

[0050] As illustrated in FIG. 18 to FIG. 21, filter 470 configured to filter a liquid is provided inside detergent tank casing 456 on the back face side of detergent tank casing 456. Filter 470 is approximately rectangular-shaped to come into contact with an inner side wall of detergent tank casing 456 and is inclined downward from the back face to the front.

[0051] Spring mechanism 455 is provided at the approximate center of a lower portion in the back face of detergent tank casing 456. Spring mechanism 455 includes spring 455a disposed at a position below filter 470. Spring 455a is configured to bias detergent tank casing 456 toward the front. Detergent tank accommodation unit contact face 362 is provided behind spring mechanism 455. Detergent tank accommodation unit contact face 362 is configured to come into contact with spring mechanism 455 to cause spring 455a to stand still in a compressed state. Note that detergent tank entry 302 is disposed on the side of spring mechanism 455.

[0052] Flow-path lid unit 340 constitutes the top face of detergent tank accommodation unit 360. Flow-path lid unit 340 is configured to cover the upper portion of detergent tank feeding unit 451 and functions as a lid to substantially prevent contamination with a foreign substance from detergent tank feeding unit 451.

[0053] As illustrated in FIG. 18 and FIG. 19, stopper 368 is provided in a front portion in the inner top face of detergent tank accommodation unit 360. Stopper 368 is configured to be engageable with tank projection 457 provided in the top face of detergent tank 450.

[0054] As illustrated in FIG. 20 and FIG. 21, drop port 364 communicating with flow-path lower unit 370 is formed in the inner bottom face of detergent tank accommodation unit 360. Drop port 364 is disposed at a position below detergent tank entry 302 in a state in which detergent tank 450 is accommodated in detergent tank accommodation unit 360. Storage unit 363 is provided in the inner bottom face of detergent tank accommodation unit 360. Storage unit 363 is configured to serve as a recess capable of storing a liquid and also

as a gap that separates the bottom face of detergent tank 450 from the inner bottom face of detergent tank accommodation unit 360.

[0055] [1-1-7. Flow-Path Lower Unit]

FIG. 22 is a top view of the configuration of flow-path lower unit 370. As illustrated in FIG. 21 and FIG. 22, flow-path lower unit 370 includes first flow-path lower unit path 372, washing path 319, second flow-path lower unit path 373, and flow-path lower unit discharge port 371. First flow-path lower unit path 372 communicates with washing path outflow port 326. Washing path 319 is disposed below drop port 364. Second flow-path lower unit path 373 allows a liquid discharged from detergent case 400 to pass therethrough.

[0056] Washing path 319 includes: washing path inlet 318 configured to introduce a liquid from first flow-path lower unit path 372; and washing path outlet 374 configured to allow the liquid to flow out to first flow-path lower unit path 372. Washing path inlet 318 is disposed at a position upstream of a drop point of a liquid dropping from drop port 364, meanwhile washing path outlet 374 is disposed at a position downstream of the drop point of the liquid dropping from drop port 364. Washing path inlet 318 is configured to have an area smaller than the flow path cross-sectional area of first flow-path lower unit path 372, and therefore the amount of water passing through washing path 319 is comparatively small. Thus, washing machine 100 can substantially prevent water passing through washing path 319 from overflowing upward from drop port 364 and then entering detergent tank accommodation unit 360.

[0057] First flow-path lower unit path 372 communicates with second flow-path lower unit path 373 at junction 375. Flow-path lower unit discharge port 371 is disposed downstream of junction 375 and is open downward so as to drop a liquid into washing tub 500.

[0058] [1-2. Operation]

The operation of washing machine 100 configured as described above will be explained below.

[0059] [1-2-1. Work for Refilling Detergent Tank with Liquid Agent]

The user checks the residual amount of a detergent by reading detergent tank residual amount scale 450a, and, when the residual amount of the detergent is small, liquid agent refilling work is conducted. Hereinafter, a position of detergent tank 450 when stopper 368 is engaged with tank projection 457 serving as an example of a first engagement unit in the present disclosure is defined as position P (in a state illustrated in

FIG. 17B and FIG. 19) (an example of a first position in the present disclosure). In other words, position P is a position at which detergent tank feeding unit 451 serving as an example of the opening in the present disclosure is opened outward.

[0060] At a position (an example of a second position in the present disclosure) at which detergent tank 450 is accommodated in detergent tank accommodation unit 360, detergent automatic feed entry 452 is inserted into detergent tank entry 302. Furthermore, at this position, detergent tank 450 is fixed to detergent tank accommodation unit 360 by the engagement of lock lever 454 as an example of a second engagement unit in the present disclosure with detergent tank accommodation unit hook 361. That is, at the second position, detergent tank 450 communicates with liquid agent automatic feeding device 301 and is engaged with detergent tank accommodation unit 360. In other words, detergent tank 450 is engaged with detergent tank accommodation unit 360 in a state in which detergent tank 450 is connected to detergent automatic feed entry 452. Although spring mechanism 455 has an elastic force enough to bias detergent tank 450 toward the front, spring mechanism 455 stands still when lock lever 454 is engaged with detergent tank accommodation unit hook 361.

[0061] When the user holds lock lever grip unit 454a and detergent tank casing grip unit 456a and lifts up lock lever 454, the engagement of lock lever 454 with detergent tank accommodation unit hook 361 is canceled. When the engagement of lock lever 454 with detergent tank accommodation unit hook 361 is canceled, detergent tank 450 is pushed out forward by an elastic force of spring mechanism 455. Detergent tank 450 may move to position P with the elastic force of spring mechanism 455 or may stand still behind position P. The user may draw out stationary detergent tank 450 to position P.

[0062] When detergent tank 450 reaches position P, stopper 368 comes into contact with tank projection 457, whereby detergent tank 450 is hooked to detergent tank accommodation unit 360. Thus, stopper 368 substantially prevents detergent tank 450 from falling into washing tub 500.

[0063] When detergent tank 450 is located at position P, detergent tank 450 projects from a flat face in which the front faces of softening agent tank 460 and detergent case 400 in the accommodated state are located, meanwhile tank-side faces 459 of detergent tank feeding unit 451 and detergent tank casing 456 are exposed outside. A lid specifically designed to cover detergent tank feeding unit 451 is not provided in detergent tank feeding unit 451, and therefore the user can feed a detergent immediately after drawing out detergent tank 450. Since detergent tank casing 456 is formed of a transparent material,

the user can visually check the liquid level of a detergent stored inside, from tank side-face 459 of exposed detergent tank casing 456. Note that, in FIG. 16, only tank side-face 459 on the right-hand side of detergent tank casing 456 is illustrated, but, the user can visually check the liquid level of the detergent stored inside, also from tank side-face 459 exposed on the left-hand side. Furthermore, in Embodiment 1, a description was given in which the entirety of detergent tank casing 456 is formed of the transparent material, but a part of detergent tank casing 456, for example, only at least detergent tank residual amount scale 450a and tank side-face 459 may be formed of the transparent material.

[0064] The user feed a commercial detergent contained in a container into detergent tank feeding unit 451 along feeding incline unit 464. When the user is short, the user bears a risk of spilling the detergent on the front, rear, right, or left side of detergent tank feeding unit 451. All sides, namely, the front, right, left, and rear sides of detergent tank feeding unit 451 in Embodiment 1 are covered with feeding incline unit 464, whereby the user can be substantially prevented from spilling the detergent. Furthermore, the front side, the right-and-left side, and the rear side of feeding incline unit 464 in Embodiment 1 are each inclined downward toward the opening disposed at the approximate center. Thus, on any side of the front, the right-and-left, and the rear sides of feeding incline unit 464, the poured detergent is guided to the opening of detergent tank feeding unit 451.

[0065] [1-2-2. Liquid Leakage at Joint between Detergent Tank and Liquid agent automatic feeding device]

When detergent tank 450 is drawn toward the front, detergent automatic feed entry 452 is drawn out of detergent tank entry 302 and detergent tank check valve 302a is closed, and as a result, some detergent is left inside detergent tank entry 302. If the detergent is left as it is, the remaining detergent would run down from detergent tank entry 302 and drop into detergent tank accommodation unit 360. As described above, in washing machine 100, when detergent tank 450 is drawn toward the front, there is a risk of the occurrence of a liquid leakage at a joint between detergent tank 450 and liquid agent automatic feeding device 301 and the contamination of detergent tank accommodation unit 360.

[0066] Detergent tank accommodation unit 360 in Embodiment 1 includes drop port 364 and storage unit 363. Thus, a detergent having flown backward from detergent tank entry 302 is stored in storage unit 363, and therefore, the detergent does not adhere to the bottom face of detergent tank 450, and hence detergent tank accommodation unit 360 is not contaminated. When the amount of the detergent stored in storage unit 363 exceeds a

predetermined amount, the excessive detergent is discharged downward from drop port 364, the detergent drops into washing path 319 formed in flow-path lower unit 370.

[0067] Furthermore, when detergent automatic feed entry 452 is drawn out of detergent tank entry 302, the detergent remains also in detergent automatic feed entry 452. The remaining liquid agent passes through drop port 364 and reaches washing path 319 formed in flow-path lower unit 370.

[0068] The detergent having reached washing path 319 is dissolved in water passing through washing path 319, and fed into washing tub 500 to be used for washing operation. The flow of water in flow-path lower unit 370 will be described later.

[0069] If washing machine 100 is configured to supply water to the inside of detergent tank accommodation unit 360 to wash away the detergent, there is a risk of the outflow of water from the opening on the front face side of detergent tank accommodation unit 360. In contrast, washing machine 100 in Embodiment 1 includes drop port 364 and storage unit 363, whereby it is not necessary to supply water to the inside of detergent tank accommodation unit 360 to wash away the detergent. In other words, washing machine 100 in Embodiment 1 can substantially prevent detergent tank accommodation unit 360 from being contaminated due to liquid leakages from detergent automatic feed entry 452 and detergent tank entry 302.

[0070] [1-2-3. Water Flow in Washing Operation during Use of Automatic Feeding Function]

In FIG. 6, FIG. 8 and FIG. 10 to FIG. 15, the flow of water supplied from first water conveyance pipe 311 is defined as X, the flow of water supplied from second water conveyance pipe 312 is defined as Y, and the flow of water supplied from third water conveyance pipe 313 is defined as Z.

[0071] Before the start of washing operation, liquid agent automatic feeding device 301 is driven to automatically feed a liquid detergent. Specifically, first, in a state in which third water conveyance pipe 313 is closed, detergent three-way valve 381, which is a part of three-way valve 380, is opened, whereby detergent tank 450 communicates with pump unit 390 by means of a path. By rotating a motor, pump unit 390 causes piston 395 to move up and down, and thereby sucks in an appropriate amount of the liquid detergent from pump unit inlet 392a and discharges the liquid detergent from pump unit outlet 392b.

[0072] Next, path washing for washing away the detergent remaining in three-way valve 380 and pump unit 390 is performed. Detergent three-way valve 381 is closed, whereby the path between detergent tank 450 and pump unit 390 is blocked, and, at the same time,

third water conveyance pipe 313 communicates with liquid agent automatic feeding device 301 by means of a path. Subsequently, third water conveyance pipe 313 of water supply valve 310 is opened. In like manner with water flow Z, water introduced from third water conveyance pipe 313 passes through third water conveyance path 323 and reaches in-automatic-feeding-device path 325 via washing path water port 324, whereby in-pump flow path 391 is filled with water (see FIG. 11 and FIG. 13). By rotating the motor, pump unit 390 causes piston 395 to move up and down and thereby spouts the filled water from pump unit outlet 392b, whereby the liquid detergent and foreign substances present in in-pump flow path 391 are washed away. Water having flown out from in-automatic-feeding-device path 325 flows down into flow-path lower unit 370 via washing path outflow port 326 and is then fed into washing tub 500 from flow-path lower unit 370 (see FIG. 14).

[0073] As described above, in the liquid detergent automatic feeding operation, washing machine 100 performs the path washing after the feeding of a liquid detergent. The path washing substantially prevents the mixing of the remaining detergent and a softening agent to be fed during a final rinsing step and thereby substantially prevents the precipitation of a foreign substance caused by the mixing of the detergent and the softening agent.

[0074] As illustrated in FIG. 22, water having passed through washing path outflow port 326 flows into first flow-path lower unit path 372. A part of the water having flown into first flow-path lower unit path 372 flows into washing path 319 from washing path inlet 318 to wash away the liquid detergent or softening agent adhering to washing path 319. The water having passed through washing path 319 passes through washing path outlet 374 and enters first flow-path lower unit path 372. The water having passed through first flow-path lower unit path 372 enters second flow-path lower unit path 373 at junction 375 and is fed into washing tub 500 from flow-path lower unit discharge port 371.

[0075] After the completion of the automatic feeding of the liquid detergent, or simultaneously with the automatic feeding of the liquid detergent, first water conveyance pipe 311 is opened to cause the supply of water to first water conveyance path 321 (see FIG. 8). In like manner with water flow X, water having been introduced into first water conveyance path 321 passes through powder detergent-specific water feed port 331, liquid detergent-specific water feed port 332, and bath pump-specific water feed port 333. Then, water having passed through powder detergent-specific water feed port 331, liquid detergent-specific water feed port 332, and bath pump-specific water feed port 333 is poured into powder detergent manual feeding unit 410, liquid detergent manual feeding unit 420, and bath pump 314 (see FIG. 6, FIG. 9, and FIG. 15). Water having been poured

into powder detergent manual feeding unit 410 and liquid detergent manual feeding unit 420 flows down into flow-path lower unit 370 through the discharge port, whereby the liquid detergent having gathered in flow-path lower unit 370 is dissolved in the water and the resultant solution is fed into washing tub 500.

[0076] In the final rinsing step, softening agent three-way valve 382 as a part of three-way valve 380 is opened, whereby softening agent tank 460 communicates with pump unit 390 by means of a path. By rotating the motor, pump unit 390 causes piston 395 to move up and down, and thereby sucks in an appropriate amount of the softening agent from pump unit inlet 392a and discharges the softening agent from pump unit outlet 392b.

[0077] Next, softening agent three-way valve 382 is closed, whereby the path between softening agent tank 460 and pump unit 390 is blocked, and third water conveyance pipe 313 communicates with liquid agent automatic feeding device 301 by means of a path. After that, third water conveyance pipe 313 is opened, whereby path washing is performed to wash away the detergent remaining in three-way valve 380 and pump unit 390.

[0078] As described above, washing machine 100 performs the path washing also after the feeding of the softening agent. This path washing substantially prevents the mixing of the remaining softening agent and a detergent to be fed in the next washing operation and thereby substantially prevents the precipitation of a foreign substance caused by the mixing of the detergent and the softening agent.

[0079] An appropriate amount of the softening agents is discharged from pump unit outlet 392b and flows into flow-path lower unit 370 inside water supply unit casing 320, and then, second water conveyance pipe 312 is opened, whereby water is supplied to second water conveyance path 322 (see FIG. 8). In like manner with water flow Y, water having been introduced into second water conveyance path 322 passes through softening agent-specific water feed port 334 and is poured into softening agent manual feeding unit 430. Then, water having been poured into softening agent manual feeding unit 430 flows down into flow-path lower unit 370 from the discharge port of softening agent manual feeding unit 430, whereby the softening agent having gathered in flow-path lower unit 370 is dissolved in the water and the resultant solution is fed into washing tub 500 (see FIG. 6, FIG. 9, and FIG. 15).

[0080] [1-3. Effects]

As described above, washing machine 100 in Embodiment 1 includes: washing tub 500; detergent tank 450 or softening agent tank 460; liquid agent automatic feeding device 301; and detergent tank accommodation unit 360 or softening agent tank

accommodation unit 365. Washing tub 500 is configured to accommodate the laundry. Detergent tank 450 or softening agent tank 460 is an example of the liquid agent tank in the present disclosure, and is configured to store a liquid and includes detergent tank feeding unit 451 or softening agent tank feeding unit 461, as an example of the opening in the present disclosure, disposed in the top face of detergent tank 450 or softening agent tank 460 in the installed state. Liquid agent automatic feeding device 301 is configured to feed the liquid stored in detergent tank 450 or softening agent tank 460 into washing tub 500. Detergent tank accommodation unit 360 or softening agent tank accommodation unit 365 is an example of the liquid agent tank accommodation unit in the present disclosure, and is configured to accommodate detergent tank 450 or softening agent tank 460 and connect detergent tank 450 or softening agent tank 460 to liquid agent automatic feeding device 301. Detergent tank 450 or softening agent tank 460 is configured to be attachable to and detachable from liquid agent automatic feeding device 301. Furthermore, detergent tank 450 or softening agent tank 460 is engaged with detergent tank accommodation unit 360 or softening agent tank accommodation unit 365 at position P (an example of the first position in the present disclosure) at which detergent tank feeding unit 451 or softening agent tank feeding unit 461 is opened outward.

[0081] Thus, in a state in which detergent tank 450 or softening agent tank 460 is held by detergent tank accommodation unit 360 or softening agent tank accommodation unit 365, the user can pour a liquid agent into detergent tank feeding unit 451 or softening agent tank feeding unit 461.

[0082] Therefore, the user can easily refill detergent tank 450 or softening agent tank 460 with a liquid detergent or a softening agent. As a result, washing machine 100 can substantially prevent the surroundings of detergent tank 450 or softening agent tank 460 from being contaminated with the liquid detergent or the softening agent.

[0083] As in the case of washing machine 100 in Embodiment 1, at a position (an example of the second position in the present disclosure) at which detergent tank 450 or softening agent tank 460 is accommodated in detergent tank accommodation unit 360 or softening agent tank accommodation unit 365, detergent tank 450 or softening agent tank 460 may be configured as follows. In other words, detergent tank 450 or softening agent tank 460 may be configured to communicate with liquid agent automatic feeding device 301 and be engaged with detergent tank accommodation unit 360 or softening agent tank accommodation unit 365.

[0084] Thus, in a state of being accommodated in detergent tank accommodation unit 360

or softening agent tank accommodation unit 365, detergent tank 450 or softening agent tank 460 supplies the liquid detergent or the softening agent to liquid agent automatic feeding device 301.

[0085] On the other hand, in a state of being drawn toward the front, detergent tank 450 or softening agent tank 460 does not supply the liquid detergent or the softening agent to liquid agent automatic feeding device 301.

[0086] Thus, washing machine 100 can substantially prevent the liquid stored in detergent tank 450 or softening agent tank 460 from flowing to the outside in a state in which detergent tank 450 or softening agent tank 460 is drawn out.

[0087] As in the case of washing machine 100 in the present embodiment, liquid agent automatic feeding device 301 may include: detergent automatic feed entry 452 or softening agent automatic feed entry 462; and flow-path lower unit 370. Detergent automatic feed entry 452 or softening agent automatic feed entry 462 is an example of the connection unit in the present disclosure, and is connected to detergent tank 450 or softening agent tank 460 and configured to cause the inside of detergent tank 450 or softening agent tank 460 to communicate with liquid agent automatic feeding device 301. Flow-path lower unit 370 is an example of a liquid supply path in the present disclosure, and is disposed below detergent tank accommodation unit 360 or softening agent tank accommodation unit 365 and configured to supply a liquid to washing tub 500. Then, in the inner bottom face of detergent tank accommodation unit 360 or softening agent tank accommodation unit 365, drop port 364 configured to communicate with flow-path lower unit 370 may be formed below detergent automatic feed entry 452 or softening agent automatic feed entry 462.

[0088] Thus, a liquid detergent or a softening agent having leaked from detergent automatic feed entry 452 or softening agent automatic feed entry 462 drops through drop port 364, into washing path 319 provided in flow-path lower unit 370 and fed into washing tub 500 through washing path 319.

[0089] Thus, washing machine 100 can substantially prevent detergent tank accommodation unit 360 or softening agent tank accommodation unit 365 from being contaminated due to the adhesion of the liquid detergent or the softening agent having leaked from detergent automatic feed entry 452 or softening agent automatic feed entry 462.

[0090] As in the case of washing machine 100 in Embodiment 1, storage unit 363 configured to store a predetermined amount of a liquid and cause the excessive liquid in amounts exceeding the predetermined amount to drop into drop port 364 may be formed in

the inner bottom face of detergent tank accommodation unit 360 or softening agent tank accommodation unit 365.

[0091] Thus, storage unit 363 functions as a gap between detergent tank 450 or softening agent tank 460 and detergent tank accommodation unit 360 or softening agent tank accommodation unit 365. Thus, washing machine 100 can make it possible that the liquid detergent or the softening agent is less prone to adhere to the bottom face of detergent tank 450 or softening agent tank 460.

[0092] As in the case of washing machine 100 in Embodiment 1, detergent tank 450 or softening agent tank 460 may include detergent tank entry 302 or softening agent tank entry 303 connected to detergent automatic feed entry 452 or softening agent automatic feed entry 462. Storage unit 363 may be formed from drop port 364 to a position below detergent tank entry 302 or softening agent tank entry 303 in a state in which detergent tank 450 or softening agent tank 460 is hooked at position P. Detergent tank entry 302 or softening agent tank entry 303 is an example of a tank-side connection unit in the present disclosure.

[0093] Thus, washing machine 100 can cause storage unit 363 to receive the liquid detergent or the softening agent having leaked from detergent tank entry 302 or softening agent tank entry 303 and cause the liquid detergent or the softening agent to drop into drop port 364.

[0094] As in the case of washing machine 100 in Embodiment 1, detergent tank 450 or softening agent tank 460 may be formed of a transparent material, and, in a state in which detergent tank 450 or softening agent tank 460 is drawn to position P, tank side face 459 as an example of a side face in the present disclosure may be exposed.

[0095] Thus, the user can visually check the inside of detergent tank 450 or softening agent tank 460 through exposed tank side face 459 in a state in which detergent tank 450 or softening agent tank 460 is drawn out.

[0096] As in the case of washing machine 100 in Embodiment 1, detergent tank 450 or softening agent tank 460 may include: detergent tank entry 302 or softening agent tank entry 303; and detergent tank check valve 302a or softening agent tank check valve. Detergent tank entry 302 or softening agent tank entry 303 is an example of a tank-side connection unit in the present disclosure. Detergent tank check valve 302a or softening agent tank check valve is an example of the opening-and-closing valve in the present disclosure, and is disposed inside detergent tank entry 302 or softening agent tank entry 303. Liquid agent automatic feeding device 301 may include detergent automatic feed

entry 452 or softening agent automatic feed entry 462 connected to detergent tank entry 302 or softening agent tank entry 303 when detergent tank 450 or softening agent tank 460 is located at the second position. Detergent tank check valve 302a or softening agent tank check valve may be opened in a state in which detergent tank entry 302 or softening agent tank entry 303 is connected to detergent automatic feed entry 452 or softening agent automatic feed entry 462.

[0097] Thus, washing machine 100 can surely supply the detergent or the softening agent to liquid agent automatic feeding device 301 in a state in which detergent tank entry 302 or softening agent tank entry 303 is connected to liquid agent automatic feeding device 301.

[0098] Washing machine 100 in Embodiment 1 is a washing machine that allows the laundry to be put into casing 600 from above when washing machine 100 is in the installed state. Washing machine 100 in Embodiment 1 includes lower casing 610, washing tub 500, upper casing 620, detergent tank 450 or softening agent tank 460, and liquid agent automatic feeding device 301. Lower casing 610 is a constituent of casing 600. Washing tub 500 is disposed inside lower casing 610 and is in the shape of an open-top cylinder with a bottom. Upper casing 620 is a constituent of casing 600, and is disposed above lower casing 610 and includes loading opening 621 communicating with washing tub 500. Detergent tank 450 or softening agent tank 460 is an example of the liquid agent tank in the present disclosure, and is configured to store a liquid. In the upper face of detergent tank 450 or softening agent tank 460, detergent tank feeding unit 451 or softening agent tank feeding unit 461 as an example of the opening in the present disclosure is provided. Liquid agent automatic feeding device 301 is configured to feed the liquid stored in detergent tank 450 or softening agent tank 460 into washing tub 500. Furthermore, liquid agent automatic feeding device 301 is in the shape of a box open toward loading opening 621, and includes: detergent tank accommodation unit 360 or softening agent tank accommodation unit 365; and detergent automatic feed entry 452 or softening agent automatic feed entry 462. Detergent tank accommodation unit 360 or softening agent tank accommodation unit 365 is an example of the liquid agent tank accommodation unit in the present disclosure and is configured to accommodate detergent tank 450 or softening agent tank 460. Detergent automatic feed entry 452 or softening agent automatic feed entry 462 is an example of the connection unit in the present disclosure and is configured to be detachably connected to detergent tank 450 or softening agent tank 460. Detergent tank 450 or softening agent tank 460 includes tank projection 457 and lock lever 454. Tank projection 457 is an example of the first engagement unit in the present disclosure, and is

engaged with stopper 368 at position P at which detergent tank feeding unit 451 or softening agent tank feeding unit 461 is opened outward. Lock lever 454 is an example of the second engagement unit in the present disclosure, and is engaged with detergent tank accommodation unit hook 361 in a state in which lock lever 454 is connected to detergent automatic feed entry 452 or softening agent automatic feed entry 462.

[0099] Thus, detergent tank 450 or softening agent tank 460 stands still in a state of projecting toward loading opening 621, so that detergent tank feeding unit 451 or softening agent tank feeding unit 461 is exposed outside.

[0100] Thus, the user can easily pour the liquid detergent or the softening agent from the front, right, or left side of detergent tank feeding unit 451 or softening agent tank feeding unit 461. As a result, washing machine 100 can substantially prevent the surroundings of detergent tank 450 or softening agent tank 460 from being contaminated with the liquid detergent or the softening agent.

[0101] Note that, in [1-3. Effects], a description was given in which washing machine 100 includes detergent tank 450 or softening agent tank 460 as an example of the liquid agent tank of the washing machine in the present disclosure. However, examples of the configuration of the washing machine in the present disclosure include a configuration including both detergent tank 450 and softening agent tank 460. The same goes for the following configurations. That is, the same goes for detergent tank accommodation unit 360 or softening agent tank accommodation unit 365 as an example of the liquid agent tank accommodation unit in the present disclosure, and also goes for detergent tank feeding unit 451 or softening agent tank feeding unit 461 as an example of the opening in the present disclosure. Furthermore, the same also goes for detergent automatic feed entry 452 or softening agent automatic feed entry 462 as an example of the connection unit in the present disclosure, and also goes for detergent tank entry 302 or softening agent tank entry 303 as an example of the tank-side connection unit in the present disclosure. Furthermore, the same also goes for detergent tank check valve 302a or the softening agent tank check valve as an example of the opening-and-closing valve in the present disclosure.

[0102] (Modification of Embodiment 1)

Embodiment 1 was described above to illustrate the technology of the present disclosure. However, the technology of the present disclosure is not limited by Embodiment 1.

[0103] Then, a modification of Embodiment 1 will be illustrated below.

[0104] In Embodiment 1, washing machine 100, which was a top-loading washing

machine, was described 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, but may be a front-loading washing machine or a twin-tub washing machine.

[0105] In Embodiment 1, drop port 364 being open downward was described as an example of a drop port in the present disclosure that substantially prevents the liquid agent tank in the present disclosure from being contaminated due to a liquid leakage at the connection unit in the present disclosure. The drop port in the present disclosure beneficially includes a means for discharging the leaking liquid agent to the outside, and therefore the drop port is not limited to drop port 364 being open downward. For example, the drop port in the present disclosure may be a groove disposed below the connection unit in the present disclosure. The groove may be configured to communicate with the liquid supply path in the present disclosure on the downstream side and allow water to be supplied to the inside of the groove. Thus, the liquid having dropped downward due to the liquid leakage is discharged to the liquid supply path in the present disclosure by water flowing through the inside of the groove, and fed into the washing tub in the present disclosure.

[0106] (Embodiment 2)

The present disclosure relates to a washing machine.

[0107] Patent Literature 1 discloses a washing machine including a liquid washing agent feeding device configured to automatically feed an appropriate amount of a liquid washing agent.

[0108] The washing machine disclosed in Patent Literature 1 includes: the liquid washing agent feeding device; a tank configured to store the liquid washing agent allowing washing operation to be performed a plural number of times; and a case configured to accommodate the tank. The tank is configured such that, when moved in the vertical direction, the tank can be detached from or attached to the case.

[0109] The present disclosure provides a washing machine allowing a liquid agent tank to be highly reliably installed in a liquid agent automatic feeding device.

[0110] The washing machine in the present disclosure includes: a washing tub configured to accommodate the laundry; a liquid agent tank configured to store a liquid; a liquid agent tank accommodation unit being in the shape of a box and configured to accommodate the liquid agent tank; and a liquid agent automatic feeding device configured to feed the liquid stored in the liquid agent tank into the washing tub. The liquid agent tank is connected to the liquid agent automatic feeding device at a second position at which the liquid agent

tank is accommodated in the liquid agent tank accommodation unit, and is fixed to the liquid agent tank accommodation unit by a lock unit, and is hooked to the liquid agent tank accommodation unit at a first position forward of the second position in a state in which the fixation by the lock unit is released.

[0111] The washing machine in the present disclosure allows the liquid agent automatic feeding device to be highly reliably connected to the liquid agent tank.

[0112] Hereinafter, Embodiment 2 will be described in detail with reference to the drawings. The accompanying drawings and the following descriptions are provided to help those skilled in the art fully understand the present disclosure, and do not intend to thereby restrict the subject matter recited in the claims.

[0113] Hereinafter, washing machine 1100 in Embodiment 2 will be described using FIG. 23 to FIG. 44.

[0114] [2-1. Configuration]

[2-1-1. Configuration of Washing Machine]

FIG. 23 is an external perspective view of the configuration of washing machine 1100 in Embodiment 2 in a state in which lid 1700 is closed. FIG. 24 is an external perspective view of the configuration of washing machine 1100 in a state in which lid 1700 is opened. Note that, in Embodiment 2, the vertical direction in a state in which washing machine 1100 is installed (corresponding to the installed state in the present disclosure) as illustrated in FIG. 23 and FIG. 24 is sometimes referred to as a top-and-bottom direction. Furthermore, in Embodiment 2, a side on which operation unit 1800 of washing machine 1100 is present in FIG. 23 and FIG. 24 is sometimes referred to as a rear side, meanwhile a side opposing the rear side is sometimes referred to as a front side. That is, typically, a user stands in front of washing machine 1100 and puts the laundry, such as clothes, into washing machine 1100, and performs various types of operations for operating washing machine 1100. Note that the laundry in the present disclosure is not limited to clothes, but may be, for example, fabrics and leather products, such as bedclothes, curtains, carpeting, and shoes, and other various known washing-machine washables.

[0115] As illustrated in FIG. 23 and FIG. 24, washing machine 1100 includes casing 1600, lid 1700, and operation unit 1800, and is what is called a top-loading washing machine that allows the laundry to be put into casing 1600 from above when washing machine 1100 is in the installed state. Casing 1600 includes lower casing 1610 and upper casing 1620. Lower casing 1610 is configured to accommodate washing tub 1500.

Washing tub 1500 is in the shape of an open-top cylinder (in other words, in the shape of a

cylinder with a bottom) and configured to accommodate the laundry and perform a washing operation for washing the laundry. The washing operation may be an operation performed by a washing tub of any type of various known washing machines. The principle of Embodiment 2 is not limited to a specific washing operation performed by washing tub 1500.

[0116] Upper casing 1620 is disposed above lower casing 1610. In upper casing 1620, loading opening 1621 for the laundry is formed to communicate with washing tub 1500. Lid 1700 is attached to a rear portion of upper casing 1620 and configured to cover loading opening 1621 in an openable and closable manner. When the user rotates lid 1700 upward, washing tub 1500 is exposed through loading opening 1621. The user can put the laundry into washing tub 1500 from loading opening 1621.

[0117] In a rear portion of upper casing 1620, operation unit 1800 is disposed at a position behind loading opening 1621. The user can operate operation unit 1800 to set various types of operations of washing tub 1500. Note that washing machine 1100 includes a controller, not illustrated, in casing 1600 to control, for example, water supply valve 1310 and three-way valve 1380 and furthermore the operation of the whole of washing machine 1100, in response to the operation of operation unit 1800 by the user. The controller includes a computer system including a processor and a memory. When the processor executes a program stored in the memory, the computer system functions as a controller. Here, there was described that the program to be performed by the processor is beforehand recorded in the memory of the computer system, but the program may be recorded in a non-transitory recording medium, such as a memory card, and provided, or may be provided via a telecommunication line, such as the Internet.

[0118] Water supply port 1200 is provided behind operation unit 1800. Water supply hose 1210 is connected to water supply port 1200 so as to introduce tap water from a tap.

[0119] As illustrated in FIG. 24, detergent tank 1450, softening agent tank 1460, and detergent case 1400 are disposed so that, when detergent tank 1450, softening agent tank 1460, and detergent case 1400 are accommodated in water supply unit 1300, their front faces are flush with each other.

[0120] FIG. 25 is an external perspective view of the configuration of water supply unit 1300 and its surroundings in a state in which detergent case 1400, detergent tank 1450, and softening agent tank 1460 are drawn out. As illustrated in FIG. 25, detergent tank 1450 and softening agent tank 1460 are configured to be capable of storing a liquid in amounts allowing two or more operations. Specifically, detergent tank 1450 and softening agent

tank 1460 store a liquid detergent and a softening agent, respectively. Detergent tank 1450 includes detergent tank feeding unit 1451 through which the liquid detergent to be stored is poured, meanwhile softening agent tank 1460 includes softening agent tank feeding unit 1461 through which the softening agent to be stored is poured. The top face of each of detergent tank feeding unit 1451 and softening agent tank feeding unit 1461 is open so that a liquid can be poured.

[0121] Detergent tank 1450 and softening agent tank 1460 include detergent tank residual amount scale 1450a and softening agent tank residual amount scale 1460a, respectively. Detergent tank residual amount scale 1450a and softening agent tank residual amount scale 1460a are each formed of a transparent material, so that the user can visually check the residual amount of a liquid.

[0122] In contrast, detergent case 1400 is to be used in order that the user feeds an agent in amounts necessary for one operation. Detergent case 1400 includes: powder detergent manual feeding unit 1410 into which a powder detergent is fed; liquid detergent manual feeding unit 1420 into which a liquid detergent is fed; and softening agent manual feeding unit 1430 into which a softening agent is fed.

[0123] Lid 1700 is configured to be partially transparent. With this configuration, even when lid 1700 is in the closed state, the user can visually read detergent tank residual amount scale 1450a and softening agent tank residual amount scale 1460a to check the residual amount of a liquid stored in detergent tank 1450 and the residual amount of a liquid stored in softening agent tank 1460.

[0124] [2-1-2. Water Supply Unit]

FIG. 26 is a back view of the configuration of water supply unit 1300 and its surroundings. FIG. 27 is an exploded perspective view of the configuration of water supply unit 1300 and its surroundings. As illustrated in FIG. 27, water supply unit 1300 includes: water supply unit casing 1320; flow-path lid unit 1340; and flow-path lower unit 1370. Water supply unit casing 1320 is approximately box shaped. Flow-path lid unit 1340 is configured to cover the top face of water supply unit casing 1320. Flow-path lower unit 1370 is attached to the bottom of water supply unit casing 1320.

[0125] As illustrated in FIG. 25 and FIG. 26, water supply valve 1310 configured to be openable and closable to allow the passage of water introduced from water supply port 1200 is attached to the left side of water supply unit casing 1320 when seen from the back face thereof. With water supply valve 1310 open, water introduced via water supply valve 1310 is introduced into water supply unit casing 1320.

[0126] At the center of the back face of water supply unit casing 1320, bath pump 1314 configured to suck water via a hose (not illustrated) from the outside of washing machine 1100 is provided. Bath pump 1314 is fixed to flow-path lid unit 1340 with a screw, and directly connected to the later-described first water conveyance path 1321 via bath pump-specific water feed port 1333. When water is supplied from first water conveyance path 1321, bath pump 1314 can start suction and discharge operations.

[0127] As illustrated in FIG. 27 and FIG. 28, water supply unit casing 1320 is in the shape of a box open forward. Water supply unit casing 1320 includes detergent tank accommodation unit 1360, softening agent tank accommodation unit 1365, and detergent case accommodation unit 1350, each serving as an interior space. Detergent tank accommodation unit 1360, softening agent tank accommodation unit 1365, and detergent case accommodation unit 1350 independently drawably accommodate detergent tank 1450, softening agent tank 1460, and detergent case 1400, respectively. Detergent tank accommodation unit 1360 includes the later-described detergent tank accommodation unit hook 1361 and the later-described stopper 1368. Detergent tank 1450 includes the later-described lock lever 1454.

[0128] Note that the shape of water supply unit casing 1320 illustrated in FIG. 27 and FIG. 28 is merely an example, and water supply unit casing 1320 is in any shape of a box so as to accommodate detergent tank 1450, softening agent tank 1460, and detergent case 1400. Furthermore, the shapes of detergent tank accommodation unit 1360 and softening agent tank accommodation unit 1365 illustrated in FIG. 27 and FIG. 28 are also merely examples. Detergent tank accommodation unit 1360 and softening agent tank accommodation unit 1365 are in the shape of a box opened toward loading opening 1621. Detergent tank accommodation unit 1360 and softening agent tank accommodation unit 1365 may be in any box shape long as detergent tank accommodation unit 1360 and softening agent tank accommodation unit 1365 can accommodate detergent tank 1450 and softening agent tank 1460, respectively. In other words, the shapes of water supply unit casing 1320, detergent tank accommodation unit 1360, and softening agent tank accommodation unit 1365 are neither limited to an approximately rectangular parallelepiped shape nor an approximately cubic shape, and may be a rounded shape having an approximately polygonal cross section or a circular or elliptical cross section.

[0129] Detergent case flow-path unit 1330 is provided to serve as the top face of detergent case accommodation unit 350. In detergent case flow-path unit 1330, the later-described first water conveyance path 1321 and the later-described second water

conveyance path 1322 are formed.

[0130] As illustrated in FIG. 25 and FIG. 26, liquid agent automatic feeding device 1301 is attached to the right side of water supply unit casing 1320 when seen from the back face thereof. Liquid agent automatic feeding device 1301 will be described later.

[0131] [2-1-3. Water Conveyance Path]

As illustrated in FIG. 26 and FIG. 27, water supply valve 1310 includes three opening-and-closing valves, namely, first water conveyance pipe 1311, second water conveyance pipe 1312, and third water conveyance pipe 1313, and is capable of independently opening and closing the three opening-and-closing valves.

[0132] FIG. 28 is a top view of the configuration of water supply unit 1300 and its surroundings, except which flow-path lid unit 1340. FIG. 29 is a top view of water supply unit 1300 and its surroundings, except flow-path lid unit 1340, in a state in which detergent case 1400, detergent tank 1450, and softening agent tank 1460 are removed. FIG. 30 is a cross-sectional view of water supply unit 1300 and its surroundings, taken along line F-F in FIG. 29. FIG. 31 is a top view of water supply unit 1300 and its surroundings, except flow-path lid unit 1340, in a state in which detergent case 1400, detergent tank 1450, and softening agent tank 1460 are drawn out. FIG. 32 is a cross-sectional view of water supply unit 1300 and its surroundings, taken along line B-B in FIG. 29.

[0133] As illustrated in FIG. 28 to FIG. 32, a water conveyance path allowing water introduced via water supply valve 1310 to flow therethrough is formed in water supply unit casing 1320 and directly connected to water supply valve 1310. The water conveyance path is branched so that the resulting branch paths independently communicate with first water conveyance pipe 1311, second water conveyance pipe 1312, and third water conveyance pipe 1313, respectively. A path of the branch paths that communicates with first water conveyance pipe 1311 is defined as first water conveyance path 1321, a path thereof communicating with second water conveyance pipe 1312 is defined as second water conveyance path 1322, and a path thereof communicating with third water conveyance pipe 1313 is defined as third water conveyance path 1323.

[0134] [2-1-4. Detergent Case, First Water Conveyance Path, Second Water Conveyance Path]

As illustrated in FIG. 25 and FIG. 28 to FIG. 31, first water conveyance path 1321 and second water conveyance path 1322 are configured to guide water supplied from first water conveyance pipe 1311 and second water conveyance pipe 1312 to detergent case flow-path unit 1330 and feed the water into detergent case 1400 positioned below.

[0135] As described above, powder detergent manual feeding unit 1410, liquid detergent manual feeding unit 1420, and softening agent manual feeding unit 1430 are provided inside detergent case 1400 and configured to allow the user to feed a powder detergent, a liquid detergent, and a softening agent, respectively.

[0136] First water conveyance path 1321 includes: powder detergent-specific water feed port 1331 formed in order to make the upper and lower sides communicate with each other above powder detergent manual feeding unit 1410; and liquid detergent-specific water feed port 1332 formed in order to make the upper and lower sides communicate with each other above liquid detergent manual feeding unit 1420. Second water conveyance path 1322 includes softening agent-specific water feed port 1334 formed in order to make the upper and lower sides communicate with each other above softening agent manual feeding unit 1430.

[0137] Each of powder detergent manual feeding unit 1410, liquid detergent manual feeding unit 1420, and softening agent manual feeding unit 1430 includes an exhaust port (not illustrated) configured to discharge a liquid having gathered inside. The liquid discharged from the exhaust port falls down to flow-path lower unit 1370. Flow-path lower unit 1370 is configured as a discharge unit to discharge the liquid to washing tub 1500.

[0138] [2-1-5. Automatic Feeding Device, Third Water Conveyance Path]

FIG. 33 is a cross-sectional view of water supply unit 1300 and its surroundings, taken along line E-E in FIG. 29. FIG. 34 is a cross-sectional view of water supply unit 1300 and its surroundings, taken along line C-C in FIG. 29. FIG. 35 is a cross-sectional view of water supply unit 1300 and its surroundings, taken along line A-A in FIG. 29. FIG. 36 is a cross-sectional view of water supply unit 1300 and its surroundings, taken along line D-D in FIG. 29. FIG. 37 is an external front view of the configuration of water supply unit 1300 in a state in which detergent case 1400, detergent tank 1450, and softening agent tank 1460 are removed.

[0139] As illustrated in FIG. 28 and FIG. 32 to FIG. 37, third water conveyance path 1323 is formed along the back face of water supply unit casing 1320 in the approximately horizontal direction, and is open toward the back face side at washing path water port 1324. Washing path water port 1324 is connected to the later-described in-automatic-feeding-device path 1325 and causes third water conveyance path 1323 to communicate with liquid agent automatic feeding device 1301. Liquid agent automatic feeding device 1301 is disposed on the back face side of detergent tank accommodation unit 1360 and softening

agent tank accommodation unit 1365. Furthermore, as described later, liquid agent automatic feeding device 1301 is connected to both detergent tank 1450 accommodated in detergent tank accommodation unit 1360 and softening agent tank 1460 accommodated in softening agent tank accommodation unit 1365. In other words, detergent tank accommodation unit 1360 accommodates detergent tank 1450 and connects detergent tank 1450 to liquid agent automatic feeding device 1301, meanwhile softening agent tank accommodation unit 1365 accommodates softening agent tank 1460 and connects softening agent tank 1460 to liquid agent automatic feeding device 1301.

[0140] As illustrated in FIG. 31, detergent tank entry 1302 is provided on the back face side of detergent tank 1450, and detergent tank check valve 1302a (see FIG. 42) configured to be opened when pushed is provided inside detergent tank entry 1302. Similarly, softening agent tank entry 1303 and a softening agent tank check valve (not illustrated) configured to be opened when pushed are provided on the back face side of softening agent tank 1460. Detergent tank 1450 is configured such that, in a state in which detergent tank 1450 is installed in detergent tank accommodation unit 1360, the later-described detergent automatic feed entry 1452 is inserted into detergent tank entry 1302 and thereby detergent tank check valve 1302a is opened to allow a liquid detergent to be supplied. Similarly, softening agent tank 1460 is configured such that, in a state in which softening agent tank 1460 is installed in softening agent tank accommodation unit 1365, the later-described softening agent automatic feed entry 1462 is inserted into softening agent tank entry 303 and thereby the softening agent tank check valve is opened to allow a softening agent to be supplied.

[0141] Detergent automatic feeding-specific connection unit 1360a and softening agent automatic feeding-specific connection unit 1365a are provided in the inner back faces of detergent tank accommodation unit 1360 and softening agent tank accommodation unit 1365, respectively. Detergent automatic feeding-specific connection unit 1360a and softening agent automatic feeding-specific connection unit 1365a are configured to surround detergent automatic feed entry 1452 and softening agent automatic feed entry 1462 of liquid agent automatic feeding device 1301, respectively.

[0142] Liquid agent automatic feeding device 1301 includes detergent automatic feed entry 1452, softening agent automatic feed entry 1462, three-way valve 1380, pump unit 1390, and in-automatic-feeding-device path 1325. Three-way valve 1380 is configured to switch between paths for a liquid detergent, a softening agent, and water. Pump unit 1390 is configured to suck in and discharge a liquid. In-automatic-feeding-device path 1325

connects three-way valve 1380 to pump unit 1390. Note that, in Embodiment 2, detergent tank accommodation unit 1360 and softening agent tank accommodation unit 1365 are not included in the configuration of liquid agent automatic feeding device 1301, but may be included in the configuration of liquid agent automatic feeding device 1301. In other words, liquid agent automatic feeding device 1301 may be in the shape of a box open toward loading opening 1621, and include detergent automatic feed entry 1452, softening agent automatic feed entry 1462, detergent tank accommodation unit 1360, and softening agent tank accommodation unit 1365. The shape of liquid agent automatic feeding device 1301 including detergent tank accommodation unit 1360 and softening agent tank accommodation unit 1365 may be any box shape as long as liquid agent automatic feeding device 1301 can accommodate detergent tank 1450 and softening agent tank 1460. In other words, the shape of liquid agent automatic feeding device 1301 is neither limited to an approximately rectangular parallelepiped shape nor an approximately cubic shape, and may be a rounded shape having an approximately polygonal cross section or a circular or elliptical cross section. Note that liquid agent automatic feeding device 1301 may be configured to include at least one of detergent tank accommodation unit 1360 and softening agent tank accommodation unit 1365.

[0143] As illustrated in FIG. 31, detergent automatic feed entry 1452 and softening agent automatic feed entry 1462 are formed to project forward. In a state in which detergent tank 1450 is accommodated in detergent tank accommodation unit 1360, detergent automatic feed entry 1452 is connected to detergent tank 1450. Furthermore, in a state in which softening agent tank 1460 is accommodated in softening agent tank accommodation unit 1365, softening agent automatic feed entry 1462 is connected to softening agent tank 1460.

[0144] Three-way valve 1380 includes detergent three-way valve 1381 and softening agent three-way valve 1382, each being configured to be independently openable and closable. Detergent three-way valve 1381 is disposed to communicate with washing path water port 1324, detergent automatic feed entry 1452, and softening agent three-way valve 1382. Softening agent three-way valve 1382 is disposed to communicate with detergent three-way valve 1381, softening agent automatic feed entry 1462, and in-automatic-feeding-device path 1325. As illustrated in FIG. 35, a portion on the downstream side of three-way valve 1380 is connected to pump unit 1390 via in-automatic-feeding-device path 1325. Thus, three-way valve 1380 is connected to in-automatic-feeding-device path 1325, detergent automatic feed entry 1452, softening agent automatic feed entry 1462, and pump unit 1390. Washing machine 1100 can control the flow of a detergent, a softening agent,

and water by opening and closing detergent three-way valve 1381 and softening agent three-way valve 1382.

[0145] Pump unit 1390 includes in-pump flow path 1391, cylinder 1397, and piston 1395. In-pump flow path 1391 is disposed between pump unit inlet 1392a and pump unit outlet 1392b. Cylinder 1397 is disposed in the middle of in-pump flow path 1391. Piston 1395 is configured to move up and down with a rotational driving force of a motor (not illustrated).

[0146] Inlet check valve 1393 is provided in pump unit inlet 1392a, meanwhile outlet check valve 1394 is provided in pump unit outlet 1392b.

[0147] Inlet check valve 1393 is configured to be opened by a negative-pressure operation of piston 1395, meanwhile outlet check valve 1394 is configured to be opened by a positive-pressure operation of piston 1395.

[0148] On the downstream side of pump unit 1390, in-automatic-feeding-device path 1325 is connected to flow-path lower unit 1370 via washing path outlet 1326.

[0149] [2-1-6. Detergent Tank, Tank Accommodation Unit]

Hereinafter, detergent tank 1450 will be described as an example of the liquid agent tank. Softening agent tank 1460 has the same configuration as that of detergent tank 1450.

[0150] FIG. 38 is an external perspective view of the configuration of detergent tank 1450. As illustrated in FIG. 38, detergent tank 1450 includes: detergent tank casing 1456 in the shape of a box; and detergent tank feeding unit 1451 disposed above detergent tank casing 1456.

[0151] Detergent tank feeding unit 1451 has an opening at the approximate center thereof. Feeding incline unit 1464 is provided in the front portion, the right-and-left side portion, and the rear portion of detergent tank feeding unit 1451. Feeding incline unit 1464 is inclined downward toward the opening of detergent tank feeding unit 1451, and is configured to guide a liquid agent to detergent tank feeding unit 1451 and cause the liquid agent to flow downward into detergent tank casing 1456.

[0152] FIG. 39A is a cross-sectional top view of water supply unit 1300 and its surroundings, except flow-path lid unit 1340, in a state in which detergent tank 1450 is accommodated. FIG. 39B is a cross-sectional top view of water supply unit 1300 and its surroundings, except flow-path lid unit 1340, in a state in which detergent tank 1450 is drawn out. FIG. 40 is a cross-sectional view of water supply unit 1300 and its surroundings, taken along line R-R in FIG. 39A. FIG. 41 is a cross-sectional view of water

supply unit 1300 and its surroundings, taken along line U-U in FIG. 39B. FIG. 42 is a cross-sectional view of water supply unit 1300 and its surroundings, taken along line S-S in FIG. 39A. FIG. 43 is a cross-sectional view of water supply unit 1300 and its surroundings, taken along line T-T in FIG. 39B.

[0153] As illustrated in FIG. 40, lock lever 1454 is provided on the bottom of detergent tank casing 1456. In a state in which detergent tank 1450 is accommodated in detergent tank accommodation unit 1360, lock lever 1454 is engaged with detergent tank accommodation unit hook 1361 provided in the inner bottom face of detergent tank accommodation unit 1360. Lock lever grip unit 1454a is provided at a front-side end of lock lever 1454. Lock lever grip unit 1454a is disposed in the vicinity of detergent tank casing grip unit 1456a formed by extending a front lower portion of detergent tank casing 1456. In other words, lock lever grip unit 1454a serving as an end of lock lever 1454 is disposed in the vicinity of detergent tank casing grip unit 1456a that makes it possible to grip detergent tank 1450.

[0154] As illustrated in FIG. 40 to FIG. 43, filter 1470 configured to filter a liquid is provided inside detergent tank casing 1456 on the back face side of detergent tank casing 1456. Filter 1470 has an approximately rectangular shape so as to come into contact with an inner side wall of detergent tank casing 1456 and is inclined downward from the back face to the front.

[0155] Spring mechanism 1455 is provided at the approximate center of a lower portion in the back face of detergent tank casing 1456. Spring mechanism 1455 includes spring 1455a disposed at a position below filter 1470. Spring 1455a is configured to bias detergent tank casing 1456 toward the front. Detergent tank accommodation unit contact face 1362 is provided behind spring mechanism 1455. Detergent tank accommodation unit contact face 1362 is configured to come into contact with spring mechanism 1455 to cause spring 1455a to stand still in a compressed state. Note that detergent tank entry 1302 is disposed on the side of spring mechanism 1455. As illustrated in FIG. 40 and FIG. 41, lock lever 1454 and detergent tank accommodation unit hook 1361 are disposed in the vicinity of a line of action of the bias force of spring mechanism 1455. In FIG. 40, the line of action of the bias force of spring mechanism 1455 is a line extending forward (extending from right and left in FIG. 40) in the direction that draws detergent tank 1450, through a point of action being a point at which spring mechanism 1455 comes into contact with detergent tank accommodation unit contact face 1362.

[0156] Flow-path lid unit 1340 constitutes the top face of detergent tank accommodation

unit 1360. Flow-path lid unit 1340 is configured to cover the upper portion of detergent tank feeding unit 1451 and functions as a lid to substantially prevent contamination with a foreign substance from detergent tank feeding unit 1451.

[0157] As illustrated in FIG. 40 and FIG. 41, stopper 1368 is provided in a front portion in the inner top face of detergent tank accommodation unit 1360. Stopper 1368 is configured to be engageable with tank projection 1457 provided in the top face of detergent tank 1450.

[0158] As illustrated in FIG. 42 and FIG. 42, drop port 1364 communicating with flow-path lower unit 1370 is formed in the inner bottom face of detergent tank accommodation unit 1360. Drop port 1364 is disposed at a position below detergent tank entry 1302 in a state in which detergent tank 1450 is accommodated in detergent tank accommodation unit 1360. Storage unit 1363 is provided in the inner bottom face of detergent tank accommodation unit 1360. Storage unit 1363 is configured to serve as a recess capable of storing a liquid and also as a gap that separates the bottom face of detergent tank 1450 from the inner bottom face of detergent tank accommodation unit 1360.

[0159] [2-1-7. Flow-Path Lower Unit]

FIG. 44 is a top view of the configuration of flow-path lower unit 1370. As illustrated in FIG. 43 and FIG. 44, flow-path lower unit 1370 includes first flow-path lower unit path 1372, washing path 1319, second flow-path lower unit path 1373, and flow-path lower unit discharge port 1371. First flow-path lower unit path 1372 communicates with washing path outflow port 1326. Washing path 319 is disposed below drop port 1364. Second flow-path lower unit path 1373 allows a liquid discharged from detergent case 1400 to pass therethrough.

[0160] Washing path 1319 includes: washing path inlet 1318 configured to introduce a liquid from first flow-path lower unit path 1372; and washing path outlet 1374 configured to allow the liquid to flow out to first flow-path lower unit path 1372. Washing path inlet 1318 is disposed at a position upstream of a drop point of a liquid dropping from drop port 1364, meanwhile washing path outlet 1374 is disposed at a position downstream of the drop point of the liquid dropping from drop port 1364. Washing path inlet 1318 is configured to have an area smaller than the flow path cross-sectional area of first flow-path lower unit path 1372, and therefore the amount of water passing through washing path 1319 is comparatively small. Thus, washing machine 1100 can substantially prevent water passing through washing path 1319 from overflowing upward from drop port 1364 and then entering detergent tank accommodation unit 1360.

[0161] First flow-path lower unit path 1372 communicates with second flow-path lower unit path 1373 at junction 1375. Flow-path lower unit discharge port 1371 is disposed downstream of junction 1375 and is open downward so as to drop a liquid into washing tub 1500.

[0162] [2-2. Operation]

The operation of washing machine 1100 configured as described above will be explained below.

[0163] [2-2-1. Work for Refilling Detergent Tank with Liquid Agent]

The user checks the residual amount of a detergent by reading detergent tank residual amount scale 1450a, and, when the residual amount of the detergent is small, a work for refilling the liquid agent is conducted. Hereinafter, a position of detergent tank 1450 when stopper 1368 is engaged with tank projection 1457 is defined as position P1 (in a state illustrated in FIG. 39B and FIG. 41) (an example of the first position in the present disclosure). In other words, position P1 is a position located forward of the later-described accommodation position.

[0164] At the position (an example of the second position in the present disclosure) at which detergent tank 1450 is accommodated in detergent tank accommodation unit 1360, detergent automatic feed entry 1452 is inserted into detergent tank entry 1302.

Furthermore, at this accommodation position, detergent tank 1450 is fixed to detergent tank accommodation unit 1360 by the engagement of lock lever 1454 with detergent tank accommodation unit hook 1361. Note that a combination of lock lever 1454 and detergent tank accommodation unit hook 1361 is an example of the lock unit in the present disclosure. Detergent tank accommodation unit hook 1361 is an example of the engagement unit in the present disclosure, and is provided in detergent tank accommodation unit 1360. Furthermore, lock lever 1454 is an example of the lever in the present disclosure, and is provided in detergent tank 1450 and configured to be engageable with detergent tank accommodation unit hook 1361. That is, at the accommodation position at which detergent tank 1450 is accommodated in detergent tank accommodation unit 1360, detergent tank 1450 is connected to liquid agent automatic feeding device 1301, and is engaged with detergent tank accommodation unit 1360 by lock lever 1454 and detergent tank accommodation unit hook 1361. Although spring mechanism 1455 has an elastic force enough to bias detergent tank 1450 toward the front, spring mechanism 1455 stands still when lock lever 1454 is engaged with detergent tank accommodation unit hook 1361.

[0165] When the user holds lock lever grip unit 1454a and detergent tank casing grip unit 1456a and lifts up lock lever 1454, the engagement of lock lever 1454 with detergent tank accommodation unit hook 1361 is canceled. When the engagement of lock lever 1454 with detergent tank accommodation unit hook 1361 is canceled, detergent tank 1450 is pushed out forward by an elastic force of spring mechanism 1455. Detergent tank 1450 may move to position P1 with the elastic force of spring mechanism 1455 or may stand still behind position P1. That is, spring mechanism 1455 as an example of a biasing unit in the present disclosure biases detergent tank 1450 toward position P1. The user may draw out stationary detergent tank 1450 to position P1.

[0166] When detergent tank 1450 reaches position P1, stopper 1368 comes into contact with tank projection 1457, whereby detergent tank 1450 is hooked to detergent tank accommodation unit 1360. Thus, stopper 1368 substantially prevents detergent tank 1450 from falling into washing tub 1500.

[0167] When detergent tank 1450 is located at position P1, detergent tank 1450 projects from a flat face in which the front faces of softening agent tank 1460 and detergent case 1400 in the accommodated state are located. At this time, tank-side face 1459 of detergent tank feeding unit 1451 and detergent tank casing 1456 is exposed outside. A lid specifically designed to cover detergent tank feeding unit 1451 is not provided in detergent tank feeding unit 1451, and therefore the user can feed a detergent immediately after drawing out detergent tank 1450. Since detergent tank casing 1456 is formed of a transparent material, the user can visually check the liquid level of the detergent stored inside, from tank side-face 1459 of exposed detergent tank casing 1456. Note that, in FIG. 38, only tank side-face 1459 on the right-hand side of detergent tank casing 1456 is illustrated, but the user can visually check the liquid level of the detergent stored inside, also from tank side-face 1459 exposed on the left-hand side. Furthermore, in Embodiment 2, a description was given in which the entirety of detergent tank casing 1456 is formed of the transparent material, but only a part of detergent tank casing 1456, for example, at least detergent tank residual amount scale 1450a and tank side-face 1459 may be formed of the transparent material.

[0168] The user feed a commercial detergent contained in a container into detergent tank feeding unit 1451 along feeding incline unit 1464. When the user is short, the user bears a risk of spilling the detergent on the front, rear, right, or left side of detergent tank feeding unit 1451. All sides, namely, the front, right, left, and rear sides of detergent tank feeding unit 1451 in Embodiment 2 are covered with feeding incline unit 1464, whereby the user

can be substantially prevented from spilling the detergent. Furthermore, the front side, the right-and-left side, and the rear side of feeding incline unit 1464 in Embodiment 2 are each inclined downward toward the opening disposed at the approximate center. Thus, on any side of the front, the right-and-left, and the rear sides of feeding incline unit 1464, the poured detergent is guided to the opening of detergent tank feeding unit 1451.

[0169] When the work for refilling the liquid agent is completed, the user pushes detergent tank 1450 toward the back face side so that detergent tank 1450 is accommodated in detergent tank accommodation unit 1360. In a state in which detergent automatic feed entry 1452 is completely inserted into detergent tank entry 1302, detergent tank 1450 is fixed to detergent tank accommodation unit 1360 by the engagement of lock lever 1454 with detergent tank accommodation unit hook 1361. In the case where the user stops pushing detergent tank 1450 toward the back face side before completing the insertion of detergent automatic feed entry 1452 into detergent tank entry 1302, the following occurs. That is, detergent tank 1450 is pushed out forward with an elastic force of spring mechanism 1455, and thereby projects from a flat face in which the front faces of softening agent tank 1460 and detergent case 1400 in the accommodated state are positioned. Thus, the user recognizes that the connection between detergent tank entry 1302 and detergent automatic feed entry 1452 is not completed, whereby liquid agent automatic feeding device 1301 can be prevented from being used in a state in which detergent tank 1450 is not correctly installed.

[0170] [2-2-2. Water Flow in Washing Operation during Use of Automatic Feeding Function]

In FIG. 28, FIG. 30 and FIG. 32 to FIG. 37, the flow of water supplied from first water conveyance pipe 1311 is defined as X1, the flow of water supplied from second water conveyance pipe 1312 is defined as Y1, and the flow of water supplied from third water conveyance pipe 1313 is defined as Z1.

[0171] Before the start of washing operation, liquid agent automatic feeding device 301 is driven to automatically feed a liquid detergent. Specifically, first, in a state in which third water conveyance pipe 1313 is closed, detergent three-way valve 1381, which is a part of three-way valve 1380, is opened, whereby detergent tank 1450 communicates with pump unit 1390 by means of a path. By rotating a motor, pump unit 1390 causes piston 1395 to move up and down, and thereby sucks in an appropriate amount of the liquid detergent from pump unit inlet 1392a and discharges the liquid detergent from pump unit outlet 1392b.

[0172] Next, path washing for washing away the detergent remaining in three-way valve 1380 and pump unit 1390 is performed. Detergent three-way valve 1381 is closed, whereby the path between detergent tank 1450 and pump unit 1390 is blocked, and, at the same time, third water conveyance pipe 1313 communicates with liquid agent automatic feeding device 1301 by means of a path. Subsequently, third water conveyance pipe 1313 of water supply valve 1310 is opened. In like manner with water flow Z1, water introduced from third water conveyance pipe 1313 passes through third water conveyance path 1323 and reaches in-automatic-feeding-device path 1325 via washing path water port 1324, whereby in-pump flow path 1391 is filled with water (see FIG. 33 and FIG. 35). By rotating the motor, pump unit 1390 causes piston 1395 to move up and down and thereby spouts the filled water from pump unit outlet 1392b, whereby the liquid detergent and foreign substances present in in-pump flow path 1391 are washed away. Water having flown out from in-automatic-feeding-device path 1325 flows down into flow-path lower unit 1370 via washing path outflow port 1326 and is then fed into washing tub 1500 from flow-path lower unit 1370 (see FIG. 36).

[0173] As described above, in the liquid detergent automatic feeding operation, washing machine 1100 performs the path washing after the feeding of a liquid detergent. The path washing substantially prevents the mixing of the remaining detergent and a softening agent to be fed during a final rinsing step and thereby substantially prevents the precipitation of a foreign substance caused by the mixing of the detergent and the softening agent.

[0174] As illustrated in FIG. 44, water having passed through washing path outflow port 1326 flows into first flow-path lower unit path 1372. A part of the water having flown into first flow-path lower unit path 1372 flows into washing path 1319 from washing path inlet 1318 to wash away the liquid detergent or softening agent adhering to washing path 1319. The water having passed through washing path 1319 passes through washing path outlet 1374 and enters first flow-path lower unit path 1372. The water having passed through first flow-path lower unit path 1372 enters second flow-path lower unit path 1373 at junction 1375 and is fed into washing tub 1500 from flow-path lower unit discharge port 1371.

[0175] After the completion of the automatic feeding of the liquid detergent, or simultaneously with the automatic feeding of the liquid detergent, first water conveyance pipe 1311 is opened to cause the supply of water to first water conveyance path 1321 (see FIG. 30). In like manner with water flow X1, water having been introduced into first water conveyance path 1321 passes through powder detergent-specific water feed port 1331,

liquid detergent-specific water feed port 1332, and bath pump-specific water feed port 1333. Then, water having passed through powder detergent-specific water feed port 1331, liquid detergent-specific water feed port 1332, and bath pump-specific water feed port 1333 is poured into powder detergent manual feeding unit 1410, liquid detergent manual feeding unit 1420, and bath pump 1314 (see FIG. 28, FIG. 31, and FIG. 37). Water having been poured into powder detergent manual feeding unit 1410 and liquid detergent manual feeding unit 1420 flows down into flow-path lower unit 1370 through the discharge port, whereby the liquid detergent having gathered in flow-path lower unit 1370 is dissolved in the water and the resultant solution is fed into washing tub 1500.

[0176] In the final rinsing step, softening agent three-way valve 1382 as a part of three-way valve 1380 is opened, whereby softening agent tank 1460 communicates with pump unit 1390 by means of a path. By rotating the motor, pump unit 1390 causes piston 1395 to move up and down, and thereby sucks in an appropriate amount of the softening agent from pump unit inlet 1392a and discharges the softening agent from pump unit outlet 1392b.

[0177] Next, softening agent three-way valve 1382 is closed, whereby the path between softening agent tank 1460 and pump unit 1390 is blocked, and third water conveyance pipe 1313 communicates with liquid agent automatic feeding device 1301 by means of a path. After that, third water conveyance pipe 1313 is opened, whereby path washing is performed to wash away the detergent remaining in three-way valve 1380 and pump unit 1390.

[0178] As described above, washing machine 1100 performs the path washing also after the feeding of the softening agent. This path washing substantially prevents the mixing of the remaining softening agent and a detergent to be fed in the next washing operation and thereby substantially prevents the precipitation of a foreign substance caused by the mixing of the detergent and the softening agent.

[0179] An appropriate amount of the softening agents is discharged from pump unit outlet 1392b and flows into flow-path lower unit 1370 inside water supply unit casing 1320, and then, second water conveyance pipe 1312 is opened, whereby water is supplied to second water conveyance path 1322 (see FIG. 30). In like manner with water flow Y1, water having been introduced into second water conveyance path 1322 passes through softening agent-specific water feed port 1334 and is poured into softening agent manual feeding unit 1430. Then, water having been poured into softening agent manual feeding unit 1430 flows down into flow-path lower unit 1370 from the discharge port of softening

agent manual feeding unit 1430, and thus the softening agent having gathered in flow-path lower unit 1370 is dissolved in the water and the resultant solution is fed into washing tub 1500 (see FIG. 28, FIG. 31, and FIG. 37).

[0180] [2-3. Effects]

As described above, washing machine 1100 in Embodiment 2 includes: washing tub 1500; detergent tank 1450 or softening agent tank 1460; detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365; and liquid agent automatic feeding device 1301. Washing tub 1500 is configured to accommodate the laundry. Detergent tank 1450 or softening agent tank 1460 is an example of the liquid agent tank in the present disclosure, and is configured to store a liquid. Detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365 is an example of the liquid agent tank accommodation unit in the present disclosure, and is in the shape of a box and configured to accommodate detergent tank 1450 or softening agent tank 1460. Liquid agent automatic feeding device 1301 is configured to feed a liquid stored in detergent tank 1450 or softening agent tank 1460 into washing tub 1500. At the accommodation position (as an example of the second position in the present disclosure) at which detergent tank 1450 or softening agent tank 1460 is accommodated in detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365, detergent tank 1450 or softening agent tank 1460 is connected to liquid agent automatic feeding device 1301. Furthermore, at the accommodation position, detergent tank 1450 or softening agent tank 1460 is fixed to detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365 by a combination of lock lever 1454 and detergent tank accommodation unit hook 1361 which are an example of the lock unit in the present disclosure. Furthermore, detergent tank 1450 or softening agent tank 1460 is hooked to detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365 at position P1 located forward of the accommodation position, in a state in which the fixation by lock lever 1454 and detergent tank accommodation unit hook 1361 is released. Position P1 is an example of the first position in the present disclosure.

[0181] Thus, detergent tank 1450 or softening agent tank 1460 accommodated at the accommodation position in detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365 is fixed in a state of being connected to liquid agent automatic feeding device 1301. Furthermore, detergent tank 1450 or softening agent tank 1460 having been drawn to position P1 is held by detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365.

[0182] Therefore, the user can safely draw out detergent tank 1450 or softening agent tank 1460 from detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365. Furthermore, washing machine 1100 can surely connect liquid agent automatic feeding device 1301 to detergent tank 1450 or softening agent tank 1460. That is, washing machine 1100 can highly reliably connect liquid agent automatic feeding device 1301 to detergent tank 1450 or softening agent tank 1460.

[0183] As in the case of washing machine 1100 in Embodiment 2, spring mechanism 1455, as an example of the biasing unit in the present disclosure, configured to bias detergent tank 1450 or softening agent tank 1460 toward position P1 may be provided in detergent tank 1450 or softening agent tank 1460.

[0184] Thus, when the fixing by lock lever 1454 and detergent tank accommodation unit hook 1361 is released, detergent tank 1450 or softening agent tank 1460 is biased by spring mechanism 1455 toward position P1.

[0185] Therefore, the user can easily draw out detergent tank 1450 or softening agent tank 1460 to position P1.

[0186] Washing machine 1100 in Embodiment 2 may include a combination of detergent tank accommodation unit hook 1361 and lock lever 1454 as an example of the lock unit in the present disclosure. Detergent tank accommodation unit hook 1361 is an example of the engagement unit in the present disclosure, and is provided in detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365. Lock lever 1454 is an example of the lever in the present disclosure, and is provided in detergent tank 1450 or softening agent tank 1460 and configured to be engageable with detergent tank accommodation unit hook 1361.

[0187] Thus, detergent tank 1450 or softening agent tank 1460 drawn to position P1 is held by detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365.

[0188] Therefore, detergent tank 1450 or softening agent tank 1460 is hooked to detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365 by the engagement of lock lever 1454 with detergent tank accommodation unit hook 1361, and thereby can be strongly connected to detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365.

[0189] As in the case of washing machine 1100 in Embodiment 2, lock lever 1454 and detergent tank accommodation unit hook 1361 may be disposed in the vicinity of a line of action of the elastic force of spring mechanism 1455.

[0190] Thus, when the fixing by lock lever 1454 and detergent tank accommodation unit hook 1361 is released, detergent tank 1450 or softening agent tank 1460 is biased in the drawing direction.

[0191] Therefore, when the user releases the fixing by lock lever 1454 and detergent tank accommodation unit hook 1361, the user can smoothly draw out detergent tank 1450 or softening agent tank 1460. Furthermore, detergent tank 1450 or softening agent tank 1460 can be substantially prevented from being inclined due to the biasing of spring mechanism 1455 in a state in which detergent tank 1450 or softening agent tank 1460 is accommodated in detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365.

[0192] As in the case of washing machine 1100 in Embodiment 2, lock lever 1454 and spring mechanism 1455 may be disposed on a virtual line, which is a center line that is parallel to the attachment-and-detachment direction and splits detergent tank 1450 or softening agent tank 1460 to the right and the left.

[0193] Thus, when the fixing by lock lever 1454 and detergent tank accommodation unit hook 1361 is released, detergent tank 1450 or softening agent tank 1460 is biased in the drawing direction, and therefore a rotation moment does not occur.

[0194] Therefore, when the user releases the fixing by lock lever 1454 and detergent tank accommodation unit hook 1361, the user can smoothly draw out detergent tank 1450 or softening agent tank 1460. Furthermore, when the user installs detergent tank 1450 or softening agent tank 1460, detergent tank 1450 or softening agent tank 1460 can be prevented from being inclined due to the biasing of spring mechanism 1455 and thereby not being correctly accommodated.

[0195] As in the case of washing machine 1100 in Embodiment 2, detergent tank 1450 or softening agent tank 1460 may include detergent tank casing grip unit 1456a, as an example of a grip unit in the present disclosure, that makes it possible to grip detergent tank 1450 or softening agent tank 1460. Lock lever grip unit 1454a as an example of an end of the lever in the present disclosure may be disposed in the vicinity of detergent tank casing grip unit 1456a.

[0196] Thus, the user can hold detergent tank casing grip unit 1456a and also hold lock lever grip unit 1454a, and thereby operate lock lever 1454.

[0197] Therefore, the user can release the fixing by lock lever 1454 and detergent tank accommodation unit hook 1361 and draw out detergent tank 1450 or softening agent tank 1460 in one operation.

[0198] As in the case of washing machine 1100 in Embodiment 2, detergent tank 1450 or softening agent tank 1460 may include: spring mechanism 1455; detergent tank entry 1302 or softening agent tank entry 1303; and detergent tank check valve 1302a or softening agent tank check valve. Spring mechanism 1455 is provided in the bottom of detergent tank 1450 or softening agent tank 1460. Detergent tank entry 1302 or softening agent tank entry 1303 is an example of a tank-side connection unit in the present disclosure, and is provided in the bottom of detergent tank 1450 or softening agent tank 1460 and connected to liquid agent automatic feeding device 1301. Detergent tank check valve 1302a or softening agent tank check valve is an example of the opening-and-closing valve in the present disclosure. Detergent tank check valve 1302a or softening agent tank check valve is provided inside detergent tank entry 1302 or softening agent tank entry 1303, and is configured to be opened only when detergent tank entry 1302 or softening agent tank entry 1303 is connected to liquid agent automatic feeding device 1301. Detergent tank entry 1302 or softening agent tank entry 1303 may be disposed on the side of spring mechanism 1455.

[0199] Thus, washing machine 1100 allows spring mechanism 1455 and detergent tank entry 1302 or softening agent tank entry 1303 to be provided in the bottom of detergent tank 1450 or softening agent tank 1460.

[0200] As in the case of washing machine 1100 in Embodiment 2, detergent tank 1450 and softening agent tank 1460 may be included and detergent tank entry 1302 of detergent tank 1450 may be disposed in the vicinity of softening agent tank entry 1303 of softening agent tank 1460.

[0201] Thus, even in the case where, like detergent tank 1450 and softening agent tank 1460, two liquid agent tanks are disposed to be adjacent to each other, washing machine 1100 allows liquid agent automatic feeding device 1301 to be more compact.

[0202] Washing machine 1100 in Embodiment 2 is a washing machine that allows the laundry to be put into casing 1600 from above when washing machine 1100 is in the installed state. Washing machine 1100 in Embodiment 2 includes lower casing 1610, washing tub 1500, upper casing 1620, detergent tank 1450 or softening agent tank 1460, and liquid agent automatic feeding device 1301. Lower casing 1610 is a constituent of casing 1600. Washing tub 1500 is disposed inside lower casing 1610 and is in the shape of an open-top cylinder with a bottom. Upper casing 1620 is a constituent of casing 1600, and is disposed above lower casing 1610 and includes loading opening 1621 for the laundry, loading opening 1621 communicating with washing tub 1500. Detergent tank

1450 or softening agent tank 1460 is an example of the liquid agent tank in the present disclosure, and is configured to store a liquid inside. Liquid agent automatic feeding device 1301 is configured to feed the liquid stored in detergent tank 1450 or softening agent tank 1460 into washing tub 1500. Liquid agent automatic feeding device 1301 is in the shape of a box open toward loading opening 1621, and includes: detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365; and detergent automatic feed entry 1452 or softening agent automatic feed entry 1462. Detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365 is an example of the liquid agent tank accommodation unit in the present disclosure and is configured to accommodate detergent tank 1450 or softening agent tank 1460. Detergent automatic feed entry 1452 or softening agent automatic feed entry 1462 is an example of the connection unit in the present disclosure and is configured to be detachably connected to detergent tank 1450 or softening agent tank 1460. Detergent tank 1450 or softening agent tank 1460 includes lock lever 1454 configured to be engaged with detergent tank accommodation unit hook 1361 in a state in which detergent tank 1450 or softening agent tank 1460 is connected to detergent automatic feed entry 1452 or softening agent automatic feed entry 1462.

[0203] Thus, washing machine 1100 can surely connect liquid agent automatic feeding device 1301 to detergent tank 1450 or softening agent tank 1460. That is, washing machine 1100 can highly reliably connect liquid agent automatic feeding device 1301 to detergent tank 1450 or softening agent tank 1460.

[0204] Note that, in [2-3. Effects], there was described that washing machine 1100 includes detergent tank 1450 or softening agent tank 1460 as an example of the liquid agent tank of the washing machine in the present disclosure. However, examples of the configuration of the washing machine in the present disclosure include a configuration in which both detergent tank 1450 and softening agent tank 1460 are included. The same goes for the following configurations. That is, the same goes for detergent tank accommodation unit 1360 or softening agent tank accommodation unit 1365 as an example of the liquid agent tank accommodation unit in the present disclosure, and also goes for detergent tank feeding unit 1451 or softening agent tank feeding unit 1461 as an example of the opening in the present disclosure. Furthermore, the same also goes for detergent automatic feed entry 1452 or softening agent automatic feed entry 1462 as an example of the connection unit in the present disclosure, and also goes for detergent tank entry 1302 or softening agent tank entry 1303 as an example of the tank-side connection unit in the

present disclosure. Furthermore, the same also goes for detergent tank check valve 1302a or the softening agent tank check valve as an example of the opening-and-closing valve in the present disclosure.

[0205] (Modification of Embodiment 2)

Embodiment 2 was described above to illustrate the technology of the present disclosure. However, the technology of the present disclosure is not limited by Embodiment 2.

[0206] Then, a modification of Embodiment 2 will be illustrated below.

[0207] In Embodiment 2, washing machine 1100 as a top-loading washing machine was described 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, but may be a front-loading washing machine or a twin-tub washing machine.

[0208] In Embodiment 2, spring mechanism 1455 provided in detergent tank 1450 (detergent tank casing 1456) was described as an example of the biasing unit in the present disclosure. The biasing unit in the present disclosure beneficially biases the liquid agent tank in the present disclosure toward the first position, and therefore, spring mechanism 1455 may not be provided in detergent tank 1450 (detergent tank casing 1456). Spring mechanism 1455 may be provided in detergent tank accommodation unit 1360. In other words, the biasing unit in the present disclosure is beneficially provided in the liquid agent tank in the present disclosure or the liquid agent tank accommodation unit in the present disclosure.

[0209] In Embodiment 2, spring mechanism 1455 provided in the lower portion in the back face of detergent tank casing 1456 was described as an example of the biasing unit in the present disclosure. The biasing unit in the present disclosure is beneficially disposed on the approximate center line in the attachment-and-detachment direction, and therefore, spring mechanism 1455 may not be provided in the lower portion in the back face of detergent tank casing 1456, but may be provided in an upper portion in the back face of detergent tank casing 1456. In other words, the biasing unit in the present disclosure may not be provided in a lower portion in the back face of the liquid agent tank, but may be provided in an upper portion in the back face thereof. Furthermore, in the case where spring mechanism 1455 is provided in the upper portion in the back face of detergent tank casing 1456, lock lever grip unit 1454a is beneficially provided in an upper portion in the front face of detergent tank casing 1456. In other words, in the case where the biasing unit in the present disclosure is provided in the upper portion in the back face of the liquid

agent tank in the present disclosure, an end of the lever in the present disclosure is beneficially provided in an upper portion in the front face of the liquid agent tank in the present disclosure.

[0210] In Embodiment 2, lock lever 1454 provided in detergent tank 1450 and softening agent tank 1460 was described as an example of the biasing unit in the present disclosure. The lever in the present disclosure is beneficially provided to be engageable with the engagement unit in the present disclosure, and therefore, may not be provided at a position closer to the liquid agent tank in the present disclosure, but may be provided at a position closer to the liquid agent tank accommodation unit in the present disclosure.

[0211] In Embodiment 2, detergent tank entry 1302 and softening agent tank entry 1303 disposed on the side of spring mechanism 1455 were described as examples of the tank-side connection unit in the present disclosure. The tank-side connection unit in the present disclosure may not be disposed on the side of the biasing unit in the present disclosure, but is beneficially disposed so that the tank-side connection units in the present disclosure of a plurality of the liquid agent tanks in the present disclosure are located closer to each other.

[0212] For example, in the case where two liquid agent tanks in the present disclosure are disposed in upper and lower portions, respectively, the tank-side connection unit in the present disclosure of the liquid agent tank in the present disclosure disposed in the upper portion is provided in the lower portion of the back face of the liquid agent tank in the present disclosure. On the other hand, the tank-side connection unit in the present disclosure of the liquid agent tank in the present disclosure disposed in the lower portion is provided in the upper portion of the back face of the liquid agent tank in the present disclosure.

[0213] In the case of four liquid agent tanks in the present disclosure, adjacent two of the four being disposed at an upper position and other adjacent two of the four are disposed at a lower position, tank-side connection units in the present disclosure of the two adjacent liquid agent tanks in the present disclosure disposed at the upper position are provided in the lower portion of the back face of the liquid agent tank in the present disclosure. On the other hand, tank-side connection units in the present disclosure of the two adjacent liquid agent tanks in the present disclosure disposed at the lower position are provided at the upper position of the back face of the liquid agent tank in the present disclosure. In this case, the tank-side connection units in the present disclosure of the two adjacent liquid agent tanks are beneficially disposed in such a manner that the tank-side connection units in the present disclosure are located closer to each other. Like Embodiment 2, in the case

where two adjacent detergent tank 1450 and softening agent tank 1460 are included and detergent tank casing grip unit 1456a and spring mechanism 1455 are provided at the lower center of detergent tank 1450, the following arrangement is preferred. That is, an arrangement in which detergent tank entry 1302 is disposed on the side of spring mechanism 1455 is preferred. As for softening agent tank 1460, the same arrangement is preferred.

[0214] That is, in the case where the washing machine in the present disclosure includes two adjacent liquid agent tanks in the present disclosure, when the grip unit of the liquid agent tank in the present disclosure and the biasing unit in the present disclosure are provided at the lower center of the liquid agent tank in the present disclosure, the following arrangement is preferred. That is, an arrangement in which the tank-side connection unit in the present disclosure is disposed on the side of the biasing unit in the present disclosure is preferred.

INDUSTRIAL APPLICABILITY

[0215] The present disclosure is applicable to a washing machine including a liquid agent automatic feeding device. Specifically, the present disclosure is applicable to, for example, a top-loading washing machine, a front-loading washing machine, and a twin-tub washing machine.

REFERENCE MARKS IN THE DRAWINGS

[0216] 100...washing machine
200...water supply port
210...water supply hose
300...water supply unit
301...liquid agent automatic feeding device
302...detergent tank entry (tank-side connection unit)
302a...detergent tank check valve (opening-and-closing valve)
303...softening agent tank entry (tank-side connection unit)
310...water supply valve
311...first water conveyance pipe
312...second water conveyance pipe
313...third water conveyance pipe
314...bath pump

318...washing path inlet
 319...washing path
 320...water supply unit casing
 321...first water conveyance path
 322...second water conveyance path
 323...third water conveyance path
 324...washing path water port
 325...in-automatic-feeding-device path
 326...washing path outflow port
 330...detergent case flow-path unit
 331...powder detergent-specific water feed port
 332...liquid detergent-specific water feed port
 333...bath pump-specific water feed port
 334...softening agent-specific water feed port
 340...flow-path lid unit
 350...detergent case accommodation unit
 360...detergent tank accommodation unit (liquid agent tank accommodation unit)
 360a...detergent automatic feeding-specific connection unit
 361...detergent tank accommodation unit hook
 362...detergent tank accommodation unit contact face
 363...storage unit
 364...drop port
 365...softening agent tank accommodation unit (liquid agent tank accommodation
 unit)
 365a...softening agent automatic feeding-specific connection unit
 368...stopper
 370...flow-path lower unit (liquid supply path)
 371...flow-path lower unit discharge port
 372...first flow-path lower unit path
 373...second flow-path lower unit path
 374...washing path outlet
 375...junction
 380...three-way valve
 381...detergent three-way valve

382...softening agent three-way valve
390...pump unit
391...in-pump flow path
392a...pump unit inlet
392b...pump unit outlet
393...inlet check valve
394...outlet check valve
395...piston
397...cylinder
400...detergent case
410...powder detergent manual feeding unit
420...liquid detergent manual feeding unit
430...softening agent manual feeding unit
450...detergent tank (liquid agent tank)
450a...detergent tank residual amount scale
451...detergent tank feeding unit (opening)
452...detergent automatic feed entry (connection unit)
454...lock lever (second engagement unit)
454a...lock lever grip unit
455...spring mechanism
455a...spring
456...detergent tank casing
456a...detergent tank casing grip unit
457...tank projection (first engagement unit)
459...tank side-face (side face)
460...softening agent tank (liquid agent tank)
460a...softening agent tank residual amount scale
461...softening agent tank feeding unit (opening)
462...softening agent automatic feed entry (connection unit)
464...feeding incline unit
470...filter
500...washing tub
600...casing
610...lower casing

620...upper casing
621...loading opening
700...lid
800...operation unit
1100...washing machine
1200...water supply port
1210...water supply hose
1300...water supply unit
1301...liquid agent automatic feeding device
1302...detergent tank entry (tank connection unit)
1302a...detergent tank check valve (opening-and-closing valve)
1303...softening agent tank entry (tank connection unit)
1310...water supply valve
1311...first water conveyance pipe
1312...second water conveyance pipe
1313...third water conveyance pipe
1314...bath pump
1318...washing path inlet
1319...washing path
1320...water supply unit casing
1321...first water conveyance path
1322...second water conveyance path
1323...third water conveyance path
1324...washing path water port
1325...in-automatic-feeding-device path
1326...washing path outflow port
1330...detergent case flow-path unit
1331...powder detergent-specific water feed port
1332...liquid detergent-specific water feed port
1333...bath pump-specific water feed port
1334...softening agent-specific water feed port
1340...flow-path lid unit
1350...detergent case accommodation unit
1360...detergent tank accommodation unit (liquid agent tank accommodation

unit)

- 1360a...detergent automatic feeding-specific connection unit
- 1361...detergent tank accommodation unit hook (lock unit) (engagement unit)
- 1362...detergent tank accommodation unit contact face
- 1363...storage unit
- 1364...drop port
- 1365...softening agent tank accommodation unit (liquid agent tank

accommodation unit)

- 1365a...softening agent automatic feeding-specific connection unit
- 1368...stopper
- 1370...flow-path lower unit
- 1371...flow-path lower unit discharge port
- 1372...first flow-path lower unit path
- 1373...second flow-path lower unit path
- 1374...washing path outlet
- 1375...junction
- 1380...three-way valve
- 1381...detergent three-way valve
- 1382...softening agent three-way valve
- 1390...pump unit
- 1391...in-pump flow path
- 1392a...pump unit inlet
- 1392b...pump unit outlet
- 1393...inlet check valve
- 1394...outlet check valve
- 1395...piston
- 1397...cylinder
- 1400...detergent case
- 1410...powder detergent manual feeding unit
- 1420...liquid detergent manual feeding unit
- 1430...softening agent manual feeding unit
- 1450...detergent tank (liquid agent tank)
- 1450a...detergent tank residual amount scale
- 1451...detergent tank feeding unit (opening)

1452...detergent automatic feed entry (connection unit)
1454...lock lever (lock unit) (lever)
1454a...lock lever grip unit (end of lever)
1455...spring mechanism (biasing unit)
1455a...spring
1456...detergent tank casing
1456a...detergent tank casing grip unit (grip unit)
1457...tank projection
1459...tank side-face
1460...softening agent tank (liquid agent tank)
1460a...softening agent tank residual amount scale
1461...softening agent tank feeding unit (opening)
1462...softening agent automatic feed entry (connection unit)
1464...feeding incline unit
1470...filter
1500...washing tub
1600...casing
1610...lower casing
1620...upper casing
1621...loading opening
1700...lid
1800...operation unit
X...water flow
X1...water flow
Y...water flow
Y1...water flow
Z...water flow
Z1...water flow

WHAT IS CLAIMED IS:

1. A washing machine, comprising:
 - a washing tub configured to accommodate laundry;
 - a liquid agent tank configured to store a liquid and including an opening, the opening being provided in an upper face of the liquid agent tank in an installed state of the liquid agent tank;
 - a liquid agent automatic feeding device configured to feed the liquid from the liquid agent tank into the washing tub; and
 - a liquid agent tank accommodation unit configured to accommodate the liquid agent tank and connect the liquid agent tank to the liquid agent automatic feeding device;wherein the liquid agent tank is
 - configured to be attachable to and detachable from the liquid agent automatic feeding device, and
 - engaged with the liquid agent tank accommodation unit at a first position at which the opening is open outward.
2. The washing machine according to claim 1, wherein,
 - at a second position at which the liquid agent tank is accommodated in the liquid agent tank accommodation unit, the liquid agent tank is configured to communicate with the liquid agent automatic feeding device and be engaged with the liquid agent tank accommodation unit.
3. The washing machine according to claim 1 or 2, wherein
 - the liquid agent automatic feeding device includes:
 - a connection unit connected to the liquid agent tank and configured to cause an inside of the liquid agent tank to communicate with the liquid agent automatic feeding device; and
 - a liquid supply path disposed below the liquid agent tank accommodation unit, the liquid supply path being a path through which the liquid to the washing tub, and,
 - in an inner bottom face of the liquid agent tank accommodation unit, a drop port communicating with the liquid supply path is formed below the connection unit.
4. The washing machine according to claim 3, wherein,

in the inner bottom face of the liquid agent tank accommodation unit,
a storage unit is formed, the storage unit being configured to store a predetermined amount of the liquid, and drop the liquid into the drop port when an amount of the liquid exceeds the predetermined amount.

5. The washing machine according to claim 4, wherein
the liquid agent tank includes a tank-side connection unit connected to the connection unit, and

the storage unit is formed to extend from the drop port to a position below the tank-side connection unit in a state in which the liquid agent tank is hooked at the first position.

6. The washing machine according to any one of claims 1 to 5, wherein
the liquid agent tank is formed of a transparent material, and
a side face of the liquid agent tank is exposed in a state in which the liquid agent tank is drawn to the first position.

7. The washing machine according to claim 2, wherein
the liquid agent tank includes:
a tank-side connection unit; and
an opening-and-closing valve disposed inside the tank-side connection unit,

the liquid agent automatic feeding device includes a connection unit configured to be connected to the tank-side connection unit when the liquid agent tank is located at the second position, and

the opening-and-closing valve is opened in a state in which the tank-side connection unit is connected to the connection unit.

8. A washing machine that allows laundry to be put into a casing from a top portion of the casing when the washing machine is in an installed state, the washing machine comprising:

a lower casing being a constituent of the casing;

a washing tub disposed inside the lower casing and formed in a shape of a cylinder with a bottom, the cylinder being open toward the top portion;

an upper casing being a constituent of the casing, disposed in an upper portion of the lower casing, and including a loading opening for the laundry, the loading opening communicating with the washing tub;

a liquid agent tank configured to store the liquid and including an opening in an upper face of the liquid agent tank; and

a liquid agent automatic feeding device configured to feed the liquid stored in the liquid agent tank into the washing tub,

wherein the liquid agent automatic feeding device

is formed in a shape of a box open toward the loading opening, and

includes:

a liquid agent tank accommodation unit configured to accommodate the liquid agent tank; and

a connection unit configured to be detachably connected to the liquid agent tank,

wherein the liquid agent tank includes:

a first engagement unit configured to be engaged with the liquid agent tank accommodation unit at a position at which the opening is open outward; and

a second engagement unit configured to be engaged with the liquid agent tank accommodation unit in a state in which the liquid agent tank is connected to the connection unit.

9. A washing machine, comprising:

a washing tub configured to accommodate laundry;

a liquid agent tank configured to store a liquid;

a liquid agent tank accommodation unit formed in a box shape and configured to accommodate the liquid agent tank; and

a liquid agent automatic feeding device configured to feed the liquid stored in the liquid agent tank into the washing tub,

wherein, at a second position at which the liquid agent tank is accommodated in the liquid agent tank accommodation unit, the liquid agent tank is connected to the liquid agent automatic feeding device and fixed to the liquid agent tank accommodation unit by a lock unit, and,

in a state in which fixing by the lock unit is released, the liquid agent tank is hooked to the liquid agent tank accommodation unit at a first position forward of the

second position.

10. The washing machine according to claim 9, wherein
the liquid agent tank or the liquid agent tank accommodation unit includes a
biasing unit configured to bias the liquid agent tank toward the first position.

11. The washing machine according to claim 10, wherein
the lock unit includes:
an engagement unit disposed in the liquid agent tank accommodation
unit; and
a lever disposed in the liquid agent tank and configured to be engageable
with the engagement unit.

12. The washing machine according to claim 10 or 11, wherein
the lock unit is disposed in a vicinity of a line of action of a bias force of the
biasing unit.

13. The washing machine according to claim 11, wherein
the lever and the biasing unit are disposed on a center line, the center line being
parallel to an attachment-and-detachment direction and splitting the liquid agent tank into
two.

14. The washing machine according to claim 11 or 13, wherein
the liquid agent tank includes a grip unit, the grip unit allowing the liquid agent
tank to be gripped, and
an end of the lever is disposed in a vicinity of the grip unit.

15. The washing machine according to any one of claims 10 to 14, wherein
the liquid agent tank includes:
the biasing unit disposed in a bottom of the liquid agent tank;
a tank connection unit disposed in the bottom of the liquid agent tank and
connected to the liquid agent automatic feeding device; and
an opening-and-closing valve disposed inside the tank connection unit
and configured to be opened only when the tank connection unit is connected to the liquid

agent automatic feeding device, and

the tank connection unit is disposed on a side of the biasing unit.

16. The washing machine according to claim 15, wherein
the liquid agent tank includes two liquid agent tanks, and
tank connection units of the two liquid agent tanks are disposed closer to each other.

17. A washing machine that allows laundry to be put into a casing from a top portion of the casing when the washing machine is in an installed state, the washing machine comprising:

a lower casing being a constituent of the casing;

a washing tub disposed inside the lower casing and formed in a shape of a cylinder with a bottom, the cylinder being open toward the top portion;

an upper casing

being a constituent of the casing,

disposed in an upper portion of the lower casing, and

including a loading opening for the laundry, the loading opening communicating with the washing tub;

a liquid agent tank configured to store the liquid; and

a liquid agent automatic feeding device configured to feed the liquid stored in the liquid agent tank into the washing tub,

wherein the liquid agent automatic feeding device

is formed in a shape of a box open toward the loading opening, and

includes:

a liquid agent tank accommodation unit configured to accommodate the liquid agent tank; and

a connection unit configured to be detachably connected to the liquid agent tank,

wherein the liquid agent tank includes a lever, the lever being configured to be engaged with the liquid agent tank accommodation unit in a state in which the liquid agent tank is connected to the connection unit.