

DESCRIPTION

WASHING MACHINE

5 TECHNICAL FIELD

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

BACKGROUND ART

[0002] Patent Literature (PTL) 1 discloses a washing machine using a plurality of relay
10 components through which paths from a water supply valve to an automatic liquid-agent feeding device are connected.

[0003] The washing machine in PTL 1 includes the water supply valve that supplies water to a washing tub, a liquid-agent tank that stores a liquid agent therein, and the automatic liquid-agent feeding device that feeds the liquid agent stored in the liquid-agent
15 tank into the washing tub. The paths between the water supply valve and the automatic liquid-agent feeding device are connected by interposing hoses and resin components therebetween.

Citation List

Patent Literature

20 **[0004]** PTL 1: Unexamined Japanese Patent Publication No. 2019-181023

SUMMARY OF THE INVENTION

[0005] The present disclosure provides a washing machine that can supply water with a stable flow rate to an automatic liquid-agent feeding device, and that can achieve an
25 increase in volume of a liquid-agent tank in a limited space.

[0006] A washing machine in the present disclosure includes a housing, a washing tub, a water supply unit, a liquid-agent tank, and an automatic liquid-agent feeding device. The washing tub is provided inside the housing, and is configured to contain laundry. The water supply unit is disposed inside the housing, and supplies water to the washing tub. The
30 liquid-agent tank stores a liquid agent therein. The automatic liquid-agent feeding device feeds the liquid agent stored in the liquid-agent tank to the washing tub. The water supply unit is formed in a box shape to house the liquid-agent tank therein. In the water supply unit, a water guiding path is formed to allow water introduced from the water supply valve

to flow therethrough. The automatic liquid-agent feeding device is attached on an outer peripheral surface of the water supply unit, and is connected to the water guiding path.

[0007] A washing machine in the present disclosure is a washing machine configured to allow laundry to be loaded from a top side of a housing into the inside thereof in an installation state. The washing machine includes a lower housing part, a washing tub, an upper housing part, a water supply unit, a liquid-agent tank, and an automatic liquid-agent feeding device. The lower housing part is included in the housing. The washing tub is provided inside the lower housing part, and is formed in a bottomed cylindrical shape opened upward. The upper housing part is included in the housing, and is disposed on top of the lower housing part. In the upper housing part, a loading opening for the laundry is formed, and communicates with the washing tub. The water supply unit is disposed in a rear portion of the upper housing part, and supplies water to the washing tub. The liquid-agent tank stores a liquid agent therein. The automatic liquid-agent feeding device feeds the liquid agent stored in the liquid-agent tank to the washing tub. The water supply unit includes a tank reception part opened toward the loading opening and housing the liquid-agent tank, and a water guiding path configured as an inner structure of the water supply unit and configured to cause water introduced from a water supply valve to flow therethrough. The automatic liquid-agent feeding device is attached on a rear side of the water supply unit, and is directly connected to the water guiding path.

[0008] A washing machine in the present disclosure can supply water with a stable flow rate to an automatic liquid-agent feeding device, and can achieve an increase in volume of a liquid-agent tank in a limited space.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Fig. 1 is an external perspective view illustrating a configuration of a washing machine in a first exemplary embodiment, the view illustrating a state in which a lid of the washing machine is closed.

Fig. 2 is an external perspective view illustrating a configuration of the washing machine in the first exemplary embodiment, the view illustrating a state in which the lid of the washing machine is opened.

Fig. 3 is an external perspective view illustrating a configuration of a water supply unit and the periphery of the water supply unit of the washing machine in the first exemplary embodiment, the view illustrating a state in which a detergent case, a detergent

tank, and a softener tank are pulled out.

Fig. 4 is a rear view illustrating a configuration of the water supply unit and the periphery of the water supply unit of the washing machine in the first exemplary embodiment.

5 Fig. 5 is an exploded perspective view illustrating a configuration of the water supply unit and the periphery of the water supply unit of the washing machine in the first exemplary embodiment.

Fig. 6 is a top view illustrating a configuration of the water supply unit and the periphery of the water supply unit of the washing machine in the first exemplary
10 embodiment, the view illustrating a state in which a flow-path lid is removed.

Fig. 7 is a top view for illustrating parts to be taken as cross sections, the view illustrating the water supply unit and the periphery of the water supply unit of the washing machine in the first exemplary embodiment, the view further illustrating a state in which the flow-path lid is removed while the detergent case, the detergent tank, and the softener
15 tank are detached.

Fig. 8 is a cross-sectional view of the water supply unit and the periphery of the water supply unit illustrated in Fig. 7, the view being taken along line F-F in Fig. 7.

Fig. 9 is a top view illustrating a configuration of the water supply unit and the periphery of the water supply unit of the washing machine in the first exemplary
20 embodiment, the view illustrating a state in which the flow-path lid is removed while the detergent case, the detergent tank, and the softener tank are pulled out.

Fig. 10 is a cross-sectional view of the water supply unit and the periphery of the water supply unit illustrated in Fig. 7, the view being taken along line B-B in Fig. 7.

Fig. 11 is a cross-sectional view of the water supply unit and the periphery of the water supply unit illustrated in Fig. 7, the view being taken along line E-E in Fig. 7.
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Fig. 12 is a cross-sectional view of the water supply unit and the periphery of the water supply unit illustrated in Fig. 7, the view being taken along line C-C in Fig. 7.

Fig. 13 is a cross-sectional view of the water supply unit and the periphery of the water supply unit illustrated in Fig. 7, the view being taken along line A-A in Fig. 7.

30 Fig. 14 is a cross-sectional view of the water supply unit and the periphery of the water supply unit illustrated in Fig. 7, the view being taken along line D-D in Fig. 7.

Fig. 15 is an external front view illustrating a configuration of the water supply unit of the washing machine in the first exemplary embodiment, the view illustrating a

state in which the detergent case, the detergent tank, and the softener tank are detached.

DESCRIPTION OF EMBODIMENTS

[0010] Hereinafter, a washing machine in each exemplary embodiment, as one example
5 of a washing machine in the present disclosure, will be described in detail with reference to the drawings. Note that the accompanying drawings and the following description are only presented to help those skilled in the art fully understand the present disclosure, and are not intended to limit the subject matters described in the claims.

[0011] (First exemplary embodiment)

10 Hereinafter, washing machine 100 in a first exemplary embodiment will be described with reference to Figs. 1 to 15.

[0012] [1-1. Configuration]

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

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

30 **[0013]** As illustrated in Figs. 1 and 2, washing machine 100 includes housing 600, lid 700, and operation unit 800, and is a so-called top loader washing machine allowing laundry to be loaded into housing 600 from a top side of housing 600, in the installation state. Housing 600 includes lower housing part 610 and upper housing part 620. Lower

housing part 610 houses washing tub 500. Washing tub 500 is a cylindrical body whose top is opened (that is, washing tub 500 has a bottomed cylindrical shape). Washing tub 500 performs washing operation of washing laundry while washing tub 500 contains the laundry. The washing operation may be operation performed by respective washing tubs in various known washing machines. The principle of the present exemplary embodiment is not limited to the specific washing operation performed by washing tub 500.

[0014] Upper housing part 620 is disposed on top of lower housing part 610. Loading opening 621 for laundry is formed in upper housing part 620, and communicates with washing tub 500. Lid 700 is attached to a rear portion of upper housing part 620, and loading opening 621 is covered with lid 700 in an openable manner. When the user pivotally lifts up lid 700, washing tub 500 is exposed through loading opening 621. The user can thus load laundry into washing tub 500 through loading opening 621.

[0015] Operation unit 800 is disposed at a position located in the rear portion of upper housing part 620 and located on the rear side of loading opening 621. The user can operate operation unit 800 to set various operations for washing tub 500. Note that washing machine 100 includes a control device (not illustrated) in housing 600. The control device controls the entire operation of washing machine 100, including, for example, control of water supply valve 310 and three-way valve 380, in response to the operation of operation unit 800 performed by the user. The control device includes a computer system having a processor and a memory. The processor executes a program stored in the memory to cause the computer system to function as the control device. As described above, the program executed by the processor here is recorded in advance in the memory of the computer system. The program may alternatively be provided by being recorded in a non-transitory recording medium such as a memory card, or may be provided through a telecommunication line such as the Internet.

[0016] Water supply port 200 is provided at the rear side of operation unit 800. Water supply hose 210 is connected to water supply port 200 to allow introduction of tap water from a faucet.

[0017] Water supply unit 300 is disposed in the rear portion of upper housing part 620 (that is, the inside of housing 600), and supplies water to washing tub 500. As illustrated in Fig. 2, detergent tank 450, softener tank 460, and detergent case 400 are disposed while front sides thereof are flush with one another, in a state where detergent tank 450, softener tank 460, and detergent case 400 are housed in water supply unit 300. Detergent case 400

is an example of an agent feeding device in the present disclosure that is configured to allow feeding of a single dose of an agent.

[0018] Fig. 3 is an external perspective view illustrating a configuration of water supply unit 300 and the periphery of water supply unit 300, the view illustrating a state in which detergent case 400, detergent tank 450, and softener tank 460 are pulled out. As illustrated in Fig. 3, each of detergent tank 450 and softener tank 460 is configured to be capable of storing a liquid agent in an amount capable of performing multiple operations. That is, each of detergent tank 450 and softener tank 460 is an example of a liquid-agent tank in the present disclosure that stores a liquid agent therein. Detergent tank 450 stores detergent therein, and softener tank 460 stores softener therein. In detergent tank 450, detergent tank feeding part 451 is formed, to which detergent to be stored is poured. In softener tank 460, softener tank feeding part 461 is formed, to which softener to be stored is poured. Each of detergent tank feeding part 451 and softener tank feeding part 461 has an opened top to allow a liquid agent to be poured. Detergent tank residual amount display scale 450a is provided in detergent tank 450, and softener tank residual amount display scale 460a is provided in softener tank 460. Each of detergent tank residual amount display scale 450a and softener tank residual amount display scale 460a is formed of a transparent material. The user can thus visually check the residual amount of a liquid agent.

[0019] Detergent case 400 is used for allowing the user to feed an agent in an amount of being necessary for a single operation. In detergent case 400, manual powder-detergent feeding part 410 for feeding of powder detergent, manual liquid-detergent feeding part 420 for feeding of liquid detergent, and manual softener feeding part 430 for feeding of softener are provided.

[0020] Lid 700 is partially transparent. This configuration allows the user to visually recognize detergent tank residual amount display scale 450a and softener tank residual amount display scale 460a, and check the residual amount of liquid agents stored in detergent tank 450 and softener tank 460, even when lid 700 is closed.

[0021] [1-1-2. Water supply unit]

Fig. 4 is a rear view illustrating a configuration of water supply unit 300 and the periphery of water supply unit 300. Fig. 5 is an exploded perspective view illustrating a configuration of water supply unit 300 and the periphery of water supply unit 300. As illustrated in Fig. 5, water supply unit 300 mainly includes water supply unit housing 320, flow-path lid 340, and flow-path lower part 370. Water supply unit housing 320 is formed

in a box shape. With flow-path lid 340, the top side of water supply unit housing 320 is covered. Flow-path lower part 370 is attached to the lower bottom of water supply unit housing 320.

[0022] As illustrated in Figs. 3 and 4, water supply valve 310 is attached on a left part of water supply unit housing 320, as viewed from the rear side thereof. Water supply valve 310 allows water introduced from water supply port 200 to pass therethrough in an openable and closable manner. In a state where water supply valve 310 is opened, water introduced from water supply valve 310 is sequentially introduced into water supply unit housing 320.

[0023] Bathwater pump 314 is disposed on a rear central part of water supply unit housing 320. Bathwater pump 314 sucks water from the outside of washing machine 100 through a hose (not illustrated). Bathwater pump 314 is fixed to flow-path lid 340 by screwing. Bathwater pump 314 is directly connected to first water guiding path 321, to be described later, through bathwater-pump-targeting water inlet ports 333. Bathwater pump 314 can start suction and discharge operation by being supplied with water from first water guiding path 321.

[0024] As illustrated in Fig. 5, water supply unit housing 320 is formed in a box shape that opens frontward. Water supply unit housing 320 includes tank reception part 360 and detergent case reception part 350, as inner spaces. That is, water supply unit 300 is formed in a box shape to house detergent tank 450 and softener tank 460 therein. Tank reception part 360 is opened toward loading opening 621. Tank reception part 360 houses detergent tank 450 and softener tank 460, and detergent case reception part 350 houses detergent case 400, to allow detergent tank 450, softener tank 460, and detergent case 400 to be pulled out independently of one another.

[0025] Detergent case flow-path part 330 is disposed as the top side of detergent case reception part 350. In detergent case flow-path part 330, first water guiding path 321 and second water guiding path 322, which will be described later, are formed. That is, water supply unit 300 includes detergent case flow-path part 330. Note that detergent case flow-path part 330 is an example of an agent-feeding-device-targeting water feeding part in the present disclosure, which feeds water into the agent feeding device in the present disclosure housed below.

[0026] As illustrated in Figs. 3 and 4, automatic liquid-agent feeding device 301 is attached on the rear side (a right part when viewed from the rear side) of water supply unit

housing 320 (that is, water supply unit 300). Automatic liquid-agent feeding device 301 feeds respective liquid agents stored in detergent tank 450 and softener tank 460 to washing tub 500. Automatic liquid-agent feeding device 301 will be described later.

[0027] [1-1-3. Water guiding paths]

As illustrated in Figs. 4 and 5, water supply valve 310 includes three on-off valves, that is, first water introduction cylinder 311, second water introduction cylinder 312, and third water introduction cylinder 313. Water supply valve 310 is configured to be capable of independently opening and closing each of the on-off valves.

[0028] Fig. 6 is a top view illustrating a configuration of water supply unit 300 and the periphery of water supply unit 300, the view illustrating a state in which flow-path lid 340 is removed. Fig. 7 is a top view for illustrating parts to be taken as cross sections, the view illustrating water supply unit 300 and the periphery of water supply unit 300, the view illustrating a state in which flow-path lid 340 is removed while detergent case 400, detergent tank 450, and softener tank 460 are detached. Fig. 8 is a cross-sectional view of water supply unit 300 and the periphery of water supply unit 300 illustrated in Fig. 7, the view being taken along line F-F in Fig. 7. Fig. 9 is a top view illustrating a configuration of water supply unit 300 and the periphery of water supply unit 300, the view illustrating a state in which flow-path lid 340 is removed while detergent case 400, detergent tank 450, and softener tank 460 are pulled out. Fig. 10 is a cross-sectional view of water supply unit 300 and the periphery of water supply unit 300 illustrated in Fig. 7, the view being taken along line B-B in Fig. 7.

[0029] As illustrated in Figs. 6 to 10, in water supply unit housing 320 (that is, water supply unit 300), first water guiding path 321, second water guiding path 322, and third water guiding path 323 are formed, each of which is an example of a water guiding path, according to the present disclosure, allowing water introduced from water supply valve 310 to flow therethrough. First water guiding path 321, second water guiding path 322, and third water guiding path 323 are directly connected to water supply valve 310. First water guiding path 321, second water guiding path 322, and third water guiding path 323 are formed by being subjected to a ramification to independently communicate with first water introduction cylinder 311, second water introduction cylinder 312, and third water introduction cylinder 313, respectively. That is, first water introduction cylinder 311 communicates with first water guiding path 321, second water introduction cylinder 312 communicates with second water guiding path 322, and third water introduction cylinder

313 communicates with third water guiding path 323.

[0030] [1-1-4. Detergent case, first water guiding path, and second water guiding path]

As illustrated in Figs. 3 and 6 to 9, first water guiding path 321 is configured to guide water supplied from first water introduction cylinder 311 to detergent case flow-path part 330, and second water guiding path 322 is configured to guide water supplied from second water introduction cylinder 312 to detergent case flow-path part 330, to allow the water to be fed into detergent case 400 located below.

[0031] Inside detergent case 400, as described above, manual powder-detergent feeding part 410, manual liquid-detergent feeding part 420, and manual softener feeding part 430 are provided, each of which is configured to allow the user to feed a corresponding one of the agents.

[0032] In first water guiding path 321, powder-detergent-targeting water inlet ports 331 and liquid-detergent-targeting water inlet ports 332 are provided. Each powder-detergent-targeting water inlet port 331 is formed above manual powder-detergent feeding part 410, and allows communication between the upper side and the lower side of powder-detergent-targeting water inlet port 331. Each liquid-detergent-targeting water inlet port 332 is formed above manual liquid-detergent feeding part 420, and allows communication between the upper side and lower side of liquid-detergent-targeting water inlet port 332. In second water guiding path 322, softener-targeting water inlet ports 334 are provided. Each softener-targeting water inlet port 334 is formed above manual softener feeding part 430, and allows communication between the upper side and lower side of softener-targeting water inlet port 334.

[0033] In each of manual powder-detergent feeding part 410, manual liquid-detergent feeding part 420, and manual softener feeding part 430, a discharge port (not illustrated) is provided, which discharges a liquid including water and an agent accumulated in the inside to the lower part. The liquid discharged from the discharge port falls to flow-path lower part 370. Flow-path lower part 370 is configured as an example of a discharge part in the present disclosure. Flow-path lower part 370 is formed as the bottom of water supply unit 300, and discharges the liquid including water and an agent to washing tub 500.

[0034] As described above, first water guiding path 321 passes through each of powder-detergent-targeting water inlet ports 331, liquid-detergent-targeting water inlet ports 332, and bathwater-pump-targeting water inlet ports 333 of detergent case flow-path part 330, from the outlet of first water introduction cylinder 311. First water guiding path 321 is a

flow path thereafter leading to flow-path lower part 370 through each of the discharge port of manual powder-detergent feeding part 410 and the discharge port of manual liquid-detergent feeding part 420. Second water guiding path 322 is a flow path from the outlet of second water introduction cylinder 312 to flow-path lower part 370 through softener-targeting water inlet ports 334 of detergent case flow-path part 330 and the discharge port of manual softener feeding part 430. Third water guiding path 323 is a flow path from the outlet of third water introduction cylinder 313 to cleaning path water conduction port 324 to be described later. That is, third water guiding path 323 includes cleaning path water conduction port 324.

10 **[0035]** [1-1-5. Detergent tank, automatic feeding device, and third water guiding path]

Fig. 11 is a cross-sectional view of water supply unit 300 and the periphery of water supply unit 300 illustrated in Fig. 7, the view being taken along line E-E in Fig. 7. Fig. 12 is a cross-sectional view of water supply unit 300 and the periphery of water supply unit 300 illustrated in Fig. 7, the view being taken along line C-C in Fig. 7. Fig. 13 is a cross-sectional view of water supply unit 300 and the periphery of water supply unit 300 illustrated in Fig. 7, the view being taken along line A-A in Fig. 7. Fig. 14 is a cross-sectional view of water supply unit 300 and the periphery of water supply unit 300 illustrated in Fig. 7, the view being taken along line D-D in Fig. 7. Fig. 15 is an external front view illustrating a configuration of water supply unit 300 of washing machine 100, the view illustrating a state in which detergent case 400, detergent tank 450, and softener tank 460 are detached.

[0036] As illustrated in Figs. 6 and 10 to 15, third water guiding path 323 is formed in a substantially horizontal direction along and substantially across the rear side of water supply unit housing 320. Third water guiding path 323 opens rearward at cleaning path water conduction port 324 (see Fig. 11). That is, cleaning path water conduction port 324 is formed on the rear side of water supply unit 300. Cleaning path water conduction port 324 is connected to in-automatic-feeding-device path 325 to be described later (see Fig. 13). Cleaning path water conduction port 324 allows third water guiding path 323 and automatic liquid-agent feeding device 301 to communicate with each other. That is, automatic liquid-agent feeding device 301 is directly connected to third water guiding path 323. Automatic liquid-agent feeding device 301 is disposed on the rear side of tank reception part 360. As described later, automatic liquid-agent feeding device 301 is connected to detergent tank 450 and softener tank 460, which are housed in tank reception

part 360. That is, automatic liquid-agent feeding device 301 is attached on the rear side of water supply unit 300 to allow cleaning path water conduction port 324 and in-automatic-feeding-device path 325 to be connected to each other.

[0037] As illustrated in Fig. 9, detergent tank insertion port 302 is provided on the rear side of detergent tank 450. Inside detergent tank insertion port 302, a detergent tank check valve (not illustrated) is provided, which is opened by being pushed. Similarly, softener tank insertion port 303, and a softener tank check valve (not illustrated), opened by being pushed, are provided on the rear side of softener tank 460. Detergent tank 450 is configured to allow supply of liquid detergent by, in a state where detergent tank 450 is attached to tank reception part 360, inserting automatic detergent feeding insertion port 452, to be described later, into detergent tank insertion port 302 to cause the detergent tank check valve to be opened. Similarly, softener tank 460 is configured to allow supply of softener by, in a state where softener tank 460 is attached to tank reception part 360, inserting automatic softener feeding insertion port 462, to be described later, into softener tank insertion port 303 to cause the softener tank check valve to be opened.

[0038] Automatic detergent feeding connection 360a and automatic softener feeding connection 360b are provided on the inner rear side of tank reception part 360. Automatic detergent feeding connection 360a and automatic softener feeding connection 360b are configured to respectively surround automatic detergent feeding insertion port 452 and automatic softener feeding insertion port 462 of automatic liquid-agent feeding device 301.

[0039] Automatic liquid-agent feeding device 301 includes automatic detergent feeding insertion port 452 and automatic softener feeding insertion port 462, three-way valve 380, pump unit 390, and in-automatic-feeding-device path 325 (see Figs. 4, 9, and 13). Three-way valve 380 switches paths of liquid detergent, softener, and water. Pump unit 390 sucks and discharges the respective liquid agents stored in detergent tank 450 and softener tank 460. In-automatic-feeding-device path 325 connects three-way valve 380 and pump unit 390, and introduces each liquid agent into pump unit 390.

[0040] As illustrated in Fig. 9, automatic detergent feeding insertion port 452 and automatic softener feeding insertion port 462 are formed to protrude frontward. In a state where detergent tank 450 and softener tank 460 are housed in tank reception part 360, automatic detergent feeding insertion port 452 is connected to detergent tank 450, and automatic softener feeding insertion port 462 is connected to softener tank 460.

[0041] Three-way valve 380 includes detergent-targeting three-way valve 381 and

softener-targeting three-way valve 382, each of which is configured to be controllable in an independently openable and closable manner. Detergent-targeting three-way valve 381 is disposed to communicate with automatic detergent feeding insertion port 452. Softener-targeting three-way valve 382 is disposed to communicate with automatic softener feeding insertion port 462. As illustrated in Fig. 13, the downstream side of three-way valve 380 is connected to pump unit 390 through in-automatic-feeding-device path 325. As described above, three-way valve 380 is connected to in-automatic-feeding-device path 325, automatic detergent feeding insertion port 452, automatic softener feeding insertion port 462, and pump unit 390. Washing machine 100 can control flows of detergent, softener, and water by opening and closing detergent-targeting three-way valve 381 and softener-targeting three-way valve 382.

[0042] Pump unit 390 includes in-pump flow path 391, cylinder 397, and piston 395. In-pump flow path 391 is provided between pump unit inlet 392a and pump unit outlet 392b. Cylinder 397 is provided in the middle of in-pump flow path 391. Piston 395 is caused to move vertically by a rotary drive force of a motor (not illustrated).

[0043] Inlet check valve 393 is provided at pump unit inlet 392a, and outlet check valve 394 is provided at pump unit outlet 392b.

[0044] Inlet check valve 393 is configured to be opened by a negative pressure action of piston 395, and outlet check valve 394 is configured to be opened by a positive pressure action of piston 395.

[0045] In-automatic-feeding-device path 325 is connected to flow-path lower part 370 through outlet port 326, on the downstream side of pump unit 390.

[0046] [1-2. Operation]

Operation of washing machine 100 configured as described above will be described below.

[0047] [1-2-1. Water flows in washing operation when automatic feeding function is used]

In Figs. 6, 8, and 10 to 15, a flow of water supplied from first water introduction cylinder 311 is defined as X, a flow of water supplied from second water introduction cylinder 312 is defined as Y, and a flow of water supplied from third water introduction cylinder 313 is defined as Z.

[0048] At the time of starting washing operation, automatic liquid-agent feeding device 301 is driven, and automatic feeding of liquid detergent is performed. Specifically, first, in

a state where third water introduction cylinder 313 is closed, detergent-targeting three-way valve 381, which is a part of three-way valve 380, is opened. This brings a path between detergent tank 450 and pump unit 390 into a communication state. Pump unit 390 causes piston 395 to move vertically by rotating the motor. Pump unit 390 then sucks an appropriate amount of liquid detergent from pump unit inlet 392a, and discharges the liquid detergent through pump unit outlet 392b.

[0049] Next, path cleaning is performed to wash away the detergent in three-way valve 380 and pump unit 390. Detergent-targeting three-way valve 381 is closed, and the path between detergent tank 450 and pump unit 390 is blocked. The path from third water introduction cylinder 313 to automatic liquid-agent feeding device 301 is brought into a communication state. Subsequently, third water introduction cylinder 313 of water supply valve 310 is opened. As illustrated as water flow Z, water having been introduced from third water introduction cylinder 313 passes through third water guiding path 323, and reaches in-automatic-feeding-device path 325 through cleaning path water conduction port 324. In-pump flow path 391 is then filled with this water (see Figs. 11 and 13). Pump unit 390 causes piston 395 to move vertically by rotating the motor. Pump unit 390 then ejects the water with which in-pump flow path 391 is filled through pump unit outlet 392b, to wash away the liquid detergent and a foreign substance present in in-pump flow path 391. The water flowing out of in-automatic-feeding-device path 325 flows down to flow-path lower part 370 through outlet port 326, and is fed into washing tub 500 from flow-path lower part 370 (see Fig. 14).

[0050] In this manner, washing machine 100 performs path cleaning after the feeding of the liquid detergent, in the automatic feeding of the liquid detergent. This path cleaning reduces mixing of the remaining detergent and softener to be fed in the final rinsing process, and thus further reduces precipitation of a foreign substance generated when the detergent and the softener are mixed.

[0051] After the automatic feeding of the liquid detergent is completed, or simultaneously with the automatic feeding of the liquid detergent, first water introduction cylinder 311 is opened to cause water to be supplied to first water guiding path 321 (see Fig. 8). As illustrated as water flow X, the water having been introduced into first water guiding path 321 passes through each of powder-detergent-targeting water inlet ports 331, liquid-detergent-targeting water inlet ports 332, and bathwater-pump-targeting water inlet ports 333. The water having passed through powder-detergent-targeting water inlet ports 331,

the water having passed through liquid-detergent-targeting water inlet ports 332, and the water having passed through bathwater-pump-targeting water inlet ports 333 are then respectively fed into manual powder-detergent feeding part 410, manual liquid-detergent feeding part 420, and bathwater pump 314 (see Figs. 6, 9, and 15). The water having been
5 fed into manual powder-detergent feeding part 410 and the water having been fed into manual liquid-detergent feeding part 420 flow down to flow-path lower part 370 through the discharge ports, and then dissolve the liquid detergent accumulated in flow-path lower part 370 and are fed into washing tub 500.

[0052] In the final rinsing process, softener-targeting three-way valve 382, which is a part
10 of three-way valve 380, is opened. This brings a path between softener tank 460 and pump unit 390 into a communication state. Pump unit 390 causes piston 395 to move vertically by rotating the motor. Pump unit 390 then sucks an appropriate amount of softener from pump unit inlet 392a, and discharges the softener through pump unit outlet 392b.

[0053] Next, softener-targeting three-way valve 382 is closed, and the path between
15 softener tank 460 and pump unit 390 is blocked. The path from third water introduction cylinder 313 to automatic liquid-agent feeding device 301 is brought into a communication state. Third water introduction cylinder 313 is thereafter opened, and path cleaning is performed to wash away the detergent in three-way valve 380 and pump unit 390.

[0054] In this manner, washing machine 100 also performs path cleaning after the
20 feeding of the softener. This path cleaning reduces mixing of the remaining softener and detergent to be fed in the next washing operation, and thus further reduces precipitation of a foreign substance generated when the detergent and the softener are mixed.

[0055] An appropriate amount of softener is discharged from pump unit outlet 392b, and
flows into water supply unit housing 320 and then flows to flow-path lower part 370.

Thereafter, second water introduction cylinder 312 is opened, and water is supplied to
25 second water guiding path 322 (see Fig. 8). As illustrated as water flow Y, the water having been introduced into second water guiding path 322 passes through softener-targeting water inlet ports 334, and is fed into manual softener feeding part 430. The water having been fed into manual softener feeding part 430 then flows down from the discharge
30 port of manual softener feeding part 430 to flow-path lower part 370. The water dissolves the softener accumulated in flow-path lower part 370, and is fed into washing tub 500 (see Figs. 6, 9, and 15).

[0056] [1-3. Actions and others]

As described above, washing machine 100 in the first exemplary embodiment includes housing 600, washing tub 500, water supply unit 300, detergent tank 450, softener tank 460, and automatic liquid-agent feeding device 301. Washing tub 500 is provided inside housing 600, and is configured to contain laundry. Water supply unit 300 is disposed inside housing 600, and supplies water to washing tub 500. Each of detergent tank 450 and softener tank 460 stores a liquid agent therein. Automatic liquid-agent feeding device 301 feeds the respective liquid agents stored in detergent tank 450 and softener tank 460 to washing tub 500. Water supply unit housing 320 of water supply unit 300 is formed in a box shape to house detergent tank 450 and softener tank 460 therein. In water supply unit 300, first water guiding path 321, second water guiding path 322, and third water guiding path 323 are formed, each of which allows the water introduced from water supply valve 310 to flow therethrough. Automatic liquid-agent feeding device 301 is attached on the outer peripheral surface on the rear side of water supply unit housing 320, and is connected to third water guiding path 323.

[0057] As described above, in washing machine 100 in the first exemplary embodiment, first water guiding path 321, second water guiding path 322, and third water guiding path 323 are integrally formed with water supply unit 300. Third water guiding path 323 is directly connected to automatic liquid-agent feeding device 301 while no relay component or the like is interposed therebetween.

[0058] Washing machine 100 in the first exemplary embodiment can thus supply water with a stable flow rate to automatic liquid-agent feeding device 301, and can achieve an increase in volume of detergent tank 450 and softener tank 460 in a limited space.

[0059] Although not particularly illustrated and described, washing machine 100 in the first exemplary embodiment may further include an outer tub rotatably enclosing washing tub 500, and water supply unit 300 may be disposed inside housing 600 to supply water to washing tub 500 or the outer tub.

[0060] As in the present exemplary embodiment, automatic liquid-agent feeding device 301 of washing machine 100 may include pump unit 390 that sucks and discharges the respective liquid agents stored in detergent tank 450 and softener tank 460, and in-automatic-feeding-device path 325 that introduces each liquid agent into pump unit 390. Third water guiding path 323 may include cleaning path water conduction port 324 that is formed on the rear side of water supply unit housing 320. Automatic liquid-agent feeding device 301 may be attached to the rear side of water supply unit housing 320 to allow

cleaning path water conduction port 324 and in-automatic-feeding-device path 325 to be connected to each other.

[0061] With this configuration, third water guiding path 323, which is a path dedicated to automatic liquid-agent feeding device 301, is provided in washing machine 100. It is thus possible to stably supply water into automatic liquid-agent feeding device 301 even when the entire amount of water supply is small in terms of the flow rate.

[0062] As in the present exemplary embodiment, washing machine 100 may include detergent case 400 that is housed in water supply unit 300, and that is configured to allow feeding of a single dose of an agent. Water supply unit 300 may include detergent case flow-path part 330 configured to allow water to be fed into detergent case 400 housed below, and flow-path lower part 370 configured as a discharge part that is formed as the bottom of water supply unit 300 and that discharges water and an agent to washing tub 500. Then, each of detergent case 400 and automatic liquid-agent feeding device 301 may cause the water and the agent therein to flow out to flow-path lower part 370.

[0063] As in the present exemplary embodiment, washing machine 100 is a washing machine allowing laundry to be loaded into housing 600 from the top side of housing 600, in the installation state. Washing machine 100 includes lower housing part 610, washing tub 500, upper housing part 620, water supply unit 300, detergent tank 450, softener tank 460, and automatic liquid-agent feeding device 301. Lower housing part 610 is included in housing 600. Washing tub 500 is provided inside lower housing part 610, and is formed in a bottomed cylindrical shape opened upward. Upper housing part 620 is included in housing 600, and is disposed on top of lower housing part 610. Loading opening 621 for laundry, which communicates with washing tub 500, is formed in upper housing part 620. Water supply unit 300 is disposed in the rear portion of upper housing part 620, and supplies water to washing tub 500. Each of detergent tank 450 and softener tank 460 stores a liquid agent therein. Automatic liquid-agent feeding device 301 feeds the respective liquid agents stored in detergent tank 450 and softener tank 460 to washing tub 500. Water supply unit 300 includes tank reception part 360, first water guiding path 321, second water guiding path 322, and third water guiding path 323. Tank reception part 360 is opened toward loading opening 621, and houses detergent tank 450 and softener tank 460. Each of first water guiding path 321, second water guiding path 322, and third water guiding path 323 is configured as an inner structure of water supply unit 300, and allows the water introduced from water supply valve 310 to flow therethrough. Automatic liquid-

agent feeding device 301 is attached on the rear side of water supply unit 300, and is directly connected to third water guiding path 323.

[0064] With this configuration, washing machine 100, which is a top loader washing machine, can supply water with a stable flow rate to automatic liquid-agent feeding device 301. Washing machine 100 can also reduce the risk of water leakage by minimizing connection points. Washing machine 100 can further achieve an increase in volume of detergent tank 450 and softener tank 460 in a limited space.

[0065] A conventional washing machine requires a plurality of relay components such as hoses and resin components, for a flow path configuration connecting a water supply valve and an automatic liquid-agent feeding device (for example, PTL 1). Accordingly, this configuration complicates calculation of a flow rate in water supplied from the water supply valve to the automatic liquid-agent feeding device, and makes it difficult to supply water with a stable flow rate.

[0066] In washing machine 100 in the present exemplary embodiment, only third water guiding path 323, disposed in water supply unit 300, is used as a flow path configuration connecting water supply valve 310 and automatic liquid-agent feeding device 301. That is, in washing machine 100 in the present exemplary embodiment, water supply unit 300 is directly connected to water supply valve 310, and first water guiding path 321, second water guiding path 322, and third water guiding path 323, each of which allows the water introduced from water supply valve 310 to flow therethrough, are formed in water supply unit 300. In washing machine 100 in the present exemplary embodiment, automatic liquid-agent feeding device 301 is directly connected to third water guiding path 323. That is, washing machine 100 in the present exemplary embodiment does not have a configuration in which water supply valve 310 and automatic liquid-agent feeding device 301 are connected through a relay component such as a hose.

[0067] This facilitates calculation of a flow rate in water supplied from water supply valve 310 to automatic liquid-agent feeding device 301. Washing machine 100 in the present exemplary embodiment can thus supply water with a stable flow rate. Washing machine 100 in the present exemplary embodiment can therefore reduce clogging of a foreign substance in the automatic liquid-agent feeding device occurring when the amount of water supply is small.

[0068] The water guiding paths in the present exemplary embodiment are configured as parts of water supply unit 300 formed in a box shape. First water guiding path 321 and

second water guiding path 322 are disposed on the top side of water supply unit 300, and third water guiding path 323 is disposed on the rear side of water supply unit 300.

[0069] With this configuration, washing machine 100 in the present exemplary embodiment avoids losing, due to bulky relay components, a space inside the washing machine, and also avoids losing an inner space provided for housing detergent tank 450, softener tank 460, and detergent case 400.

[0070] In washing machine 100 in the present exemplary embodiment, water supply unit 300 provided for supplying water to automatic liquid-agent feeding device 301 can be thus configured in a space-saving manner. Washing machine 100 in the present exemplary embodiment can achieve an increase in volume of detergent tank 450 and softener tank 460 in a limited space inside washing machine 100. In washing machine 100 in the present exemplary embodiment, each of the water guiding paths (first water guiding path 321, second water guiding path 322, and third water guiding path 323) is configured with a minimized space. With this configuration, washing machine 100 in the present exemplary embodiment can have a layout that allows tank reception part 360 and detergent case reception part 350 to be collectively provided on the same plane, thereby enabling a layout increasing usability for a user.

[0071] In washing machine 100 in the present exemplary embodiment, third water guiding path 323 is directly connected to automatic liquid-agent feeding device 301 without detergent case 400 interposed therebetween.

[0072] With this configuration, washing machine 100 in the present exemplary embodiment can reduce a decrease in the flow rate in third water guiding path 323 before water reaches automatic liquid-agent feeding device 301, and thus can supply an appropriate flow rate of water to automatic liquid-agent feeding device 301.

[0073] (Second exemplary embodiment)

[2-1. Configuration]

A washing machine in a second exemplary embodiment is different from washing machine 100 in the first exemplary embodiment in that a water supply valve in the second exemplary embodiment including two on-off valves is used, instead of using water supply valve 310 including the three on-off valves, that is, first water introduction cylinder 311, second water introduction cylinder 312, and third water introduction cylinder 313.

[0074] The water supply valve in the second exemplary embodiment includes, as the on-off valves thereof, a first water introduction cylinder in the second exemplary embodiment

and a second water introduction cylinder in the second exemplary embodiment. Each of the first water introduction cylinder in the second exemplary embodiment and the second water introduction cylinder in the second exemplary embodiment is controlled to be independently opened and closed.

5 **[0075]** A water guiding path connected to the first water introduction cylinder in the second exemplary embodiment ramifies into a first water guiding path in the second exemplary embodiment and a third water guiding path in the second exemplary embodiment. The first water guiding path in the second exemplary embodiment is provided for supplying water to bathwater pump 314, manual powder-detergent feeding
10 part 410, and manual liquid-detergent feeding part 420. The third water guiding path in the second exemplary embodiment is provided for supplying water to automatic liquid-agent feeding device 301.

[0076] The second water introduction cylinder in the second exemplary embodiment is connected to a second water guiding path in the second exemplary embodiment. The
15 second water guiding path in the second exemplary embodiment is provided for supplying water to manual softener feeding part 430. The second water guiding path in the second exemplary embodiment is connected to the second water introduction cylinder in the second exemplary embodiment. The second water guiding path in the second exemplary embodiment thus allows water to pass at a timing different from the timing of the first
20 water guiding path in the second exemplary embodiment and the third water guiding path in the second exemplary embodiment, which are connected to the first water introduction cylinder in the second exemplary embodiment.

[0077] [2-2. Actions and others]

As described above, the washing machine in the second exemplary embodiment
25 includes bathwater pump 314 that sucks water from the outside of the washing machine in the second exemplary embodiment and that supplies the sucked water to washing tub 500, and detergent case 400 that is housed in water supply unit 300 and that is configured to allow feeding of a single dose of an agent. A water guiding path in the second exemplary embodiment is connected to the water supply valve in the second exemplary embodiment,
30 and is formed in a ramifying manner to supply water to each of bathwater pump 314, detergent case 400, and automatic liquid-agent feeding device 301. Specifically, the water guiding path in the second exemplary embodiment is connected to the first water introduction cylinder in the second exemplary embodiment, and ramifies into the first

water guiding path in the second exemplary embodiment and the third water guiding path in the second exemplary embodiment. The first water guiding path in the second exemplary embodiment supplies water to bathwater pump 314 and detergent case 400. The third water guiding path in the second exemplary embodiment supplies water to automatic liquid-agent feeding device 301.

[0078] As described above, the first water guiding path in the second exemplary embodiment and the third water guiding path in the second exemplary embodiment are formed as a continuously formed component in which the flow path corresponding to each of bathwater pump 314, manual powder-detergent feeding part 410, and manual liquid-detergent feeding part 420 is formed by being subjected to a ramification. With this configuration, the washing machine in the second exemplary embodiment can adjust a flow rate, in a cross-sectional area ratio, of the water supplied to each flow path by changing the cross-sectional area of the flow path corresponding to each of bathwater pump 314, manual powder-detergent feeding part 410, and manual liquid-detergent feeding part 420.

[0079] The washing machine in the second exemplary embodiment can therefore easily adjust the supply amount of water flowing through each flow path corresponding to one or ones of bathwater pump 314, detergent case 400, and automatic liquid-agent feeding device 301, for each flow path.

[0080] (Other exemplary embodiments)

As described above, each of the first exemplary embodiment and the second exemplary embodiment has been described to exemplify the technique in the present disclosure. The technique in the present disclosure is not, however, limited thereto.

[0081] Hereinafter, other exemplary embodiments are thus exemplified.

[0082] In each of the first exemplary embodiment and the second exemplary embodiment, the description has been made by using a top loader washing machine as an example of the washing machine in the present disclosure. The washing machine in the present disclosure is not limited to the top loader washing machine, and may be a drum type washing machine or a twin-tub washing machine.

[0083] In the first exemplary embodiment, water supply valve 310 including first water introduction cylinder 311, second water introduction cylinder 312, and third water introduction cylinder 313, each of which is independently openable and closable, has been described as an example of the water supply valve in the present disclosure. In the second

exemplary embodiment, the water supply valve in the second exemplary embodiment including the two on-off valves has been described as an example of the water supply valve in the present disclosure. The configuration of the water supply valve in the present disclosure is not limited to each of the configuration of water supply valve 310 and the configuration of the water supply valve in the second exemplary embodiment because the water supply valve in the present disclosure is only required to introduce water into the water guiding path. The water supply valve in the present disclosure may be configured, for example, to supply water introduced from second water introduction cylinder 312 or the second water introduction cylinder in the second exemplary embodiment to automatic liquid-agent feeding device 301. The configuration of the water supply valve in the present disclosure is not limited to the configuration including two or three on-off valves, and may be a configuration including one on-off valve or a configuration including four or more on-off valves.

[0084] Through the first exemplary embodiment and the second exemplary embodiment, automatic liquid-agent feeding device 301 and third water guiding path 323, provided on the rear side of water supply unit 300, have been described, as respective examples of the automatic liquid-agent feeding device in the present disclosure and the cleaning path in the present disclosure, attached on the outer peripheral surface of the water supply unit in the present disclosure. The outer peripheral surface of the water supply unit in the present disclosure is not limited to the rear side of the water supply unit in the present disclosure, and may be any of the top side, the bottom side, the right side, the left side, the front side, and the rear side of the water supply unit in the present disclosure.

[0085] The water supply unit in the present disclosure is formed in a box shape to house the liquid-agent tank in the present disclosure therein. The shape of the water supply unit is not limited to a substantially rectangular parallelepiped shape or a substantially cubic shape. The water supply unit may have a substantially polygonal cross section, or a rounded cross section such as a circular cross section or an elliptical cross section.

INDUSTRIAL APPLICABILITY

[0086] The present disclosure is applicable to a washing machine including an automatic liquid-agent feeding device. Specifically, the present disclosure is applicable to a top loader washing machine, a drum type washing machine, a twin-tub washing machine, and the like.

REFERENCE MARKS IN THE DRAWINGS

5	[0087]	100	washing machine
		200	water supply port
		210	water supply hose
		300	water supply unit
		301	automatic liquid-agent feeding device
10		302	detergent tank insertion port
		303	softener tank insertion port
		310	water supply valve
		311	first water introduction cylinder
		312	second water introduction cylinder
15		313	third water introduction cylinder
		314	bathwater pump
		320	water supply unit housing
		321	first water guiding path
		322	second water guiding path
20		323	third water guiding path
		324	cleaning path water conduction port
		325	in-automatic-feeding-device path
		326	outlet port
		330	detergent case flow-path part
25		331	powder-detergent-targeting water inlet port
		332	liquid-detergent-targeting water inlet port
		333	bathwater-pump-targeting water inlet port
		334	softener-targeting water inlet port
		340	flow-path lid
30		350	detergent case reception part
		360	tank reception part
		360a	automatic detergent feeding connection
		360b	automatic softener feeding connection
		370	flow-path lower part
		380	three-way valve

	381	detergent-targeting three-way valve
	382	softener-targeting three-way valve
	390	pump unit
	391	in-pump flow path
5	392a	pump unit inlet
	392b	pump unit outlet
	393	inlet check valve
	394	outlet check valve
	395	piston
10	397	cylinder
	400	detergent case
	410	manual powder-detergent feeding part
	420	manual liquid-detergent feeding part
	430	manual softener feeding part
15	450	detergent tank
	450a	detergent tank residual amount display scale
	451	detergent tank feeding part
	452	automatic detergent feeding insertion port
	460	softener tank
20	460a	softener tank residual amount display scale
	461	softener tank feeding part
	462	automatic softener feeding insertion port
	500	washing tub
	600	housing
25	610	lower housing part
	620	upper housing part
	621	loading opening
	700	lid
	800	operation unit
30	X	water flow
	Y	water flow
	Z	water flow

CLAIMS

1. A washing machine comprising:

a housing;

5 a washing tub disposed inside the housing, the washing tub being configured to contain laundry;

a water supply unit disposed inside the housing, the water supply unit being configured to supply water to the washing tub;

a liquid-agent tank configured to store a liquid agent in the liquid-agent tank; and

10 an automatic liquid-agent feeding device configured to feed the liquid agent stored in the liquid-agent tank to the washing tub,

wherein

the water supply unit has a box shape and houses the liquid-agent tank in the water supply unit, and the water supply unit includes a water guiding path configured to
15 cause water introduced from a water supply valve to flow through the water guiding path, and

the automatic liquid-agent feeding device is disposed on an outer peripheral surface of the water supply unit, and is connected to the water guiding path.

20 2. The washing machine according to Claim 1, wherein

the automatic liquid-agent feeding device includes

a pump unit configured to suck and discharge the liquid agent stored in the liquid-agent tank, and

25 an in-automatic-feeding-device path configured to introduce a liquid agent into the pump unit,

the water guiding path includes a cleaning flow path disposed on the outer peripheral surface of the water supply unit, and

the automatic liquid-agent feeding device is disposed on the outer peripheral surface of the water supply unit to cause the cleaning flow path and the in-automatic-
30 feeding-device path to be connected to each other.

3. The washing machine according to Claim 1, further comprising:

a bathwater pump configured to suck water from an outside of the washing

machine and supply the sucked water to the washing tub; and

an agent feeding device housed in the water supply unit, the agent feeding device being configured to allow feeding of a single dose of an agent, wherein the water guiding path is connected to the water supply valve, and the water guiding path ramifies and is configured to supply water to each of the bathwater pump, the agent feeding device, and the automatic liquid-agent feeding device.

4. The washing machine according to Claim 1, further comprising an agent feeding device housed in the water supply unit, the agent feeding device being configured to allow feeding of a single dose of an agent,

wherein

the water supply unit includes

an agent-feeding-device-targeting water feeding part configured to feed water into the agent feeding device housed below the agent-feeding-device-targeting water feeding part, and

a discharge part configured as a bottom of the water supply unit, the discharge part being configured to discharge water and an agent to the washing tub, and

the agent feeding device is configured to cause water and an agent inside the agent feeding device to flow out to the discharge part, and the automatic liquid-agent feeding device is configured to cause water and an agent inside the automatic liquid-agent feeding device to flow out to the discharge part.

5. A washing machine configured to cause laundry to be loaded from a top side of a housing into an inside of the housing in an installation state, the washing machine comprising:

a lower housing part included in the housing;

a washing tub disposed inside the lower housing part, the washing tub having a bottomed cylindrical shape opened upward;

an upper housing part included in the housing and disposed on top of the lower housing part, the upper housing part including a loading opening for the laundry, the loading opening communicating with the washing tub;

a water supply unit disposed in a rear portion of the upper housing part, the water supply unit being configured to supply water to the washing tub;

a liquid-agent tank configured to store a liquid agent in the liquid-agent tank; and
an automatic liquid-agent feeding device configured to feed the liquid agent stored
in the liquid-agent tank to the washing tub,

wherein

5 the water supply unit includes

a tank reception part opened toward the loading opening and housing the
liquid-agent tank, and

a water guiding path configured as an inner structure of the water supply
unit, the water guiding path being configured to cause water introduced from a water
10 supply valve to flow through the water guiding path, and

the automatic liquid-agent feeding device is disposed on a rear side of the water
supply unit, and is directly connected to the water guiding path.