

DESCRIPTION

WASHING MACHINE

5 TECHNICAL FIELD

The present invention relates to a washing machine including a detergent dissolving device configured to supply, to a washing tub, washing preparations such as detergent and/or softener together with supplied water.

10 BACKGROUND ART

Conventional washing machines include a water pouring device accommodating a detergent case into which detergent is placed and a water pouring case connected to, for example, water service and is supplied with water (see, e.g., PTL 1).

15 As illustrated in FIG. 17, detergent container 1 rotatably incorporates agitator 2. Agitator 2 is caused to rotate by a pressure of water supplied into detergent container 1 from water supply tube 3 through water-supply connector 4. Agitator 2 agitates, by the rotation of agitator 2, detergent and water stored in detergent container 1 to dissolve the detergent in the water. A solution thus
20 obtained passes through a mesh of detergent filtering strainer 5, and then drops into liquid storage part 6 located downstream. In liquid storage part 6, undissolved fine detergent having flowed to liquid storage part 6 from detergent holding part 8 through a mesh of detergent filtering strainer 7 is mixed with the solution dropped into liquid storage part 6 so that the fine
25 detergent is dissolved in the solution. The resultant solution is caused to pass through the mesh of strainer 7 and to drop to a downstream side. The detergent solution dropped from the liquid storage part 6 flows along bottom

surface 9a of water pouring case 9 to the downstream side, so as to be fed to the washing tub.

Citation List

Patent Literature

- 5 PTL 1: Unexamined Japanese Patent Publication No. 2001-314692

SUMMARY OF THE INVENTION

Unfortunately, with the configuration of the conventional detergent dissolving device, the detergent solution may remain in the meshes of strainers
10 5 and 7 due to surface tension, and may be dried and solidified, which may cause clogging in the meshes of strainers 5 and 7. Due to the clogging, the filtering action may not work, and accordingly the detergent may remain in detergent container 1, disadvantageously. Furthermore, due to the configuration of strainers 5 and 7 making use of the filtering action, the type of
15 detergent allowed to be placed into detergent container 1 is limited to powdered detergent.

The present invention provides a washing machine including containers into which washing preparations such as powdered detergent, liquid detergent, and softener are placed and which are positioned in a single location
20 to provide enhanced convenience for a user, the washing machine being capable of suppressing or reducing leakage of the washing preparations from the containers and/or overflow of foam from the containers.

A washing machine according to the present invention includes: a body; a washing tub disposed inside the body; a detergent dissolving device
25 configured to supply water into the washing tub; and a control device for executing a washing operation including a series of steps including a washing step, a rinsing step, and a spin-drying step. The detergent dissolving device

includes a storage case including a powdered detergent container, a liquid detergent container, and a softener container. The detergent dissolving device further includes: a powdered detergent agitator disposed in the powdered detergent container; a liquid detergent agitator disposed in the liquid detergent container; siphon channels respectively formed in the liquid detergent container and the softener container; a water flow surface holding the storage case extractably and retractably; and a water pouring case configured to pour water into the storage case. The detergent dissolving device further includes: a first water channel disposed in the water pouring case and designed to pour water to the powdered detergent container; and a first water supply valve communicating with the first water channel. The detergent dissolving device further includes: a second water channel disposed in the water pouring case and designed to pour water to the powdered detergent container and the liquid detergent container; and a second water supply valve communicating with the second water channel. The detergent dissolving device further includes: a third water channel disposed in the water pouring case and designed to pour water to the softener container; and a third water supply valve communicating with the third water channel. The detergent dissolving device further includes nozzles disposed in the first, second, and third water channels and designed to supply water to the powdered detergent container, the liquid detergent container, and the softener container.

Thus, the detergent dissolving device is configured such that the softener container, into which a washing preparation is placed, as well as the powdered detergent container and the liquid detergent container are disposed together in the storage case. With this configuration, the user can place the washing preparations into these containers at a time. Consequently, it is possible to enhance convenience for the user. In addition, the powdered

detergent container and the liquid detergent container internally include the respective agitators each configured to agitate detergent and water together to dissolve the detergent in the water. Furthermore, the water channels in the water pouring case have the nozzles. With this configuration, it is possible to prevent the washing preparations from remaining undissolved in the containers, thereby making it possible to improve the reliability of the washing machine.

The washing machine according to the present invention is configured such that the liquid detergent agitator includes a rotational shaft extending horizontally, and one of the nozzles being disposed in the second water channel and being designed to supply water to the liquid detergent container supplies water toward blades of the liquid detergent agitator.

With this configuration, the user can place the washing preparations into these containers at a time, since the softener container, into which softener is placed, as well as the powdered detergent container and the liquid detergent container are disposed together in the storage case. Consequently, it is possible to enhance convenience for the user. In addition, the powdered detergent container and the liquid detergent container internally include the respective agitators each configured to agitate detergent and water together to dissolve the detergent in the water. Furthermore, the water channels in the water pouring case have the nozzles. With this configuration, it is possible to prevent the washing preparations from remaining undissolved in the containers, thereby making it possible to improve the reliability of the washing machine.

Furthermore, by the liquid detergent agitator, the liquid detergent, water, and air can be agitated together so that the liquid detergent is dissolved in the water to give a foamed washing liquid. Then, the foamed washing

liquid can be caused to flow downstream.

The washing machine according to the present invention is configured such that the powdered detergent agitator includes a rotational shaft extending vertically and blades extending radially from the rotational shaft, and one of
5 the nozzles designed to supply water to the powdered detergent container supplies water toward the blades of the powdered detergent agitator.

Since this configuration includes the storage case into which a washing preparation such as softener is placed together with powdered detergent and liquid detergent, the user can place the powdered detergent, the liquid
10 detergent, and the washing preparation into the storage case at a time. Consequently, it is possible to enhance convenience for the user. In addition, the detergent container includes the powdered detergent agitator configured to agitate detergent and water together to dissolve the detergent in the water. Furthermore, the water channels in the water pouring case have the nozzles.
15 With this configuration, it is possible to prevent the washing preparations from remaining undissolved in the container, thereby making it possible to improve the reliability of the washing machine.

The washing machine according to the present invention is configured such that the one of the nozzles designed to supply water toward the blades of
20 the powdered detergent agitator is located ahead of the powdered detergent agitator in a state where the storage case is in an accommodated state.

With this configuration, at the time when the storage case is inserted into the accommodation space after detergent is placed in the storage case, a first one of the blades of the powdered detergent agitator comes in contact with
25 the nozzle. Accordingly, while the powdered detergent agitator is rotating, the storage case moves to the accommodation space. A second one of the blades is then brought to a position at which the second one of the blades is

perpendicular to a direction in which water is poured. A distance between the second one of the blades and the nozzle is uniquely defined. Thus, even when an amount of water supplied is small under low water pressure environment, the powdered detergent agitator is caused to rotate by the pressure of the water, and agitates the detergent and the water together. This can prevent the detergent from remaining undissolved.

Incidentally, according to the configuration of the conventional detergent dissolving device including no structure for suppressing or reducing the force of water supplied into the detergent dissolving device, if water is supplied to the detergent dissolving device from which the storage case has been removed, the supplied water collides with the water flow surface and splashes. As a result, the user and/or a floor on which the washing machine is installed may get wet, disadvantageously.

The washing machine according to the present invention is configured such that the water flow surface has a bottom surface including an inner portion having a plurality of protrusions facing at least one corresponding nozzle of the nozzles.

With this configuration including the plurality of protrusions for suppressing or reducing the force of the water supplied onto the water flow surface, it is possible to prevent splashing of the water from the water flow surface even in a state where the storage case for the washing preparations has been removed. Consequently, it is possible to improve the reliability of the washing machine.

The washing machine according to the present invention is configured such that the water flow surface has a bottom surface including an inner portion having an annular recess facing at least one corresponding nozzle of the nozzles.

With this configuration including the annular recess for suppressing or reducing the force of the water supplied onto the water flow surface, it is possible to prevent splashing of the water from the water flow surface even in a state where the storage case for the washing preparations has been removed.

5 Consequently, it is possible to improve the reliability of the washing machine.

The washing machine according to the present invention is configured such that the annular recess, which is formed in the inner portion of the bottom surface of the water flow surface and which faces at least one corresponding nozzle of the nozzles, is formed in a shape including an inner recessed portion
10 surrounded by an annular protruding rib that is partly cut out.

With this configuration including the annular recess for suppressing or reducing the force of the water supplied onto the water flow surface, it is possible to prevent splashing of the water from the water flow surface even in a state where the storage case for the washing preparations has been removed.

15 Consequently, it is possible to improve the reliability of the washing machine.

The washing machine according to the present invention further includes a controller for controlling the first water supply valve, the second water supply valve, and the third water supply valve, wherein the controller alternately turns on the first water supply valve and the second water supply
20 valve when water is initially supplied in the washing step.

Thus, the user can use both of the powder detergent and the liquid detergent, since the detergent dissolving device is provided with the storage case including the powdered detergent container, the liquid detergent container, and the softener container into which powdered detergent, liquid detergent,
25 and softener are respectively placed and which are integrally molded. Consequently, it is possible to enhance convenience for the user. In addition, the powdered detergent container and the liquid detergent container internally

include the respective agitators each configured to agitate detergent and water together to dissolve the detergent in the water. With this configuration, it is possible to prevent detergent from remaining undissolved in the powdered detergent container and the liquid detergent container, thereby making it possible to improve the reliability of the washing machine.

With the above configuration, either of the powdered detergent and the liquid detergent can be used to be dissolved in the water. Meanwhile, simultaneously turning on the first and second water supply valves reduces a flow rate of the water flowing through each of the first and second water supply valves, thereby reducing the pressure of the water. This results in a reduction in rotational force of each of the agitators, thereby being likely to cause remaining of the detergent. On the other hand, with the configuration in which the controller alternately turns on the first water supply valve and the second water supply valve when water is initially supplied in the washing step, it is possible to maintain the rotational force of the agitators in the powdered detergent container and the liquid detergent container, thereby making it possible to cause all of the powdered detergent and the liquid detergent to flow out of the containers.

The washing machine according to the present invention is configured such that, at timing that is after main agitation and before water draining in each of the washing step and a final rinsing step, the controller opens the second water supply valve to introduce water into the second water pouring section.

Liquid detergent is typically higher in viscosity than water. Therefore, in low water pressure regions, it may sometimes be impossible to cause all of the liquid detergent to flow out of the container by alternately turning on the first and second water supply valves once. However, with the above

configuration, part of the liquid detergent having a high concentration is caused to flow once, and thereafter the liquid detergent diluted is caused to flow at a rush. This allows all of the liquid detergent to flow out of the container. Alternatively, the second water supply valve may be controlled to be opened to
5 introduce water into the second water pouring section at the timing that is after the main agitation and before the water draining only in the washing step or the rinsing step. Also in this case, it is possible to cause all of the liquid detergent to flow out of the container.

10 BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a side cross-sectional view of a washing machine according to an exemplary embodiment of the present invention.

FIG. 2 is an exploded perspective view of a detergent dissolving device for the washing machine according to the exemplary embodiment of the present
15 invention.

FIG. 3 is a plan view of a storage case of the washing machine according to the exemplary embodiment of the present invention.

FIG. 4 is a plan view of the storage case from which a powdered detergent agitator, a liquid detergent agitator, and caps are removed, of the
20 washing machine according to the exemplary embodiment of the present invention.

FIG. 5 is a side cross-sectional view of a powdered detergent container in the detergent dissolving device for the washing machine according to the exemplary embodiment of the present invention.

FIG. 6 is a side cross-sectional view of a liquid detergent container in the washing machine according to the exemplary embodiment of the present
25 invention.

FIG. 7 is a side cross-sectional view of a softener container in the washing machine according to the exemplary embodiment of the present invention.

FIG. 8 is a perspective plan view illustrating how powdered detergent is
5 caused to flow in the detergent dissolving device for the washing machine according to the exemplary embodiment of the present invention.

FIG. 9 is a perspective plan view illustrating how liquid detergent is caused to flow in the detergent dissolving device for the washing machine according to the exemplary embodiment of the present invention.

10 FIG. 10 is a perspective plan view illustrating how softener is caused to flow in the detergent dissolving device for the washing machine according to the exemplary embodiment of the present invention.

FIG. 11 is a front cross-sectional view of the detergent dissolving device for the washing machine according to the exemplary embodiment of the present
15 invention.

FIG. 12 is a plan view of a water flow surface of the washing machine according to the exemplary embodiment of the present invention.

FIG. 13 is a plan view of the detergent dissolving device from which the storage case is removed, for the washing machine according to the exemplary
20 embodiment of the present invention.

FIG. 14 is a plan view illustrating a positional relationship between the powdered detergent agitator and nozzles in the washing machine according to the exemplary embodiment of the present invention.

FIG. 15 is a plan view illustrating a positional relationship between the
25 powdered detergent agitator and nozzles in the washing machine according to the exemplary embodiment of the present invention.

FIG. 16 is a chart illustrating how steps in a washing operation are

performed by the washing machine according to the exemplary embodiment of the present invention.

FIG. 17 is a side sectional view of a conventional washing machine.

5 DESCRIPTION OF EMBODIMENT

An exemplary embodiment of the present invention will be described below with reference to the drawings. The exemplary embodiment should not be construed to limit the scope of the present invention.

(First exemplary embodiment)

10 FIG. 1 is a side cross-sectional view of a washing machine according to a first exemplary embodiment of the present invention.

As illustrated in FIG. 1, the washing machine includes body 11 incorporating water tub 13. Water tub 13 is supported by suspension 12 in a suspended manner for vibration proofing. Water tub 13 incorporates washing
15 tub 15. Washing tub 15 serves also as a spin-drying tub. Washing tub 15 has a side wall having a large number of water through holes 16. In addition, fluid balancer 17 is disposed in an upper portion of washing tub 15, and pulsator 18 is disposed in a center of a bottom of washing tub 15.

Rotational shaft 14 has a hollow biaxial structure for causing washing
20 tub 15 or pulsator 18 to rotate. Rotational shaft 14 also has transmission mechanism 19. Transmission mechanism 19 incorporates a gear (not shown) to reduce speed during washing, a changeover clutch (not shown) of rotational shaft 14, and a brake (not shown) to stop washing tub 15 during spin-drying.

Motor 20 is attached to a bottom of water tub 13. Motor 20 includes
25 motor-side pulley 21, via which driving power is transmitted to mechanical-side pulley 22 of transmission mechanism 19 through belt 23 to cause rotational shaft 14 to rotate.

Body 11 has an upper portion including upper frame 24. Upper frame 24 has clothes inlet 25 through which the user puts into and out laundry. Clothes inlet 25 is openably closed by lid 26. Behind upper frame 24, control device 27 is disposed. Control device 27 controls electronic parts such as motor 20 to perform a washing operation including a series of steps including a washing step, a rinsing step, and a spin-drying step. Above control device 27, operation display 28 is disposed.

FIG. 2 is an exploded perspective view of a detergent dissolving device for the washing machine according to the present exemplary embodiment.

Lower surface cover 29 illustrated in FIG. 2 is attached to a lower side of upper frame 24 to cover a rear portion of a lower surface of upper frame 24. An upper side of lower surface cover 29 has elements such as bosses attachable to electronic parts (not shown) such as a vibration detector for detecting an unbalanced state of laundry.

Lower surface cover 29 has an upper portion disposed in upper frame 24. The upper portion of lower surface cover 29 is fixedly provided with water flow surface 30 and water pouring case 31 connectable to water service. Water flow surface 30 and water pouring case 31 are disposed behind clothes inlet 25.

Between water flow surface 30 and water pouring case 31, an opening and an accommodation space communicating with the opening are formed. Storage case 32 into which the user adds a washing preparation is placed over water flow surface 30 through the opening. Storage case 32 has handle 33 fixed to a front portion of storage case 32. Storage case 32 is held extractably and retractably in a front-rear direction through the opening. As described above, the detergent dissolving device for the washing machine according to the present exemplary embodiment includes lower surface cover 29 disposed at the lowermost position, water flow surface 30 disposed above lower surface cover 29,

water pouring case 31 disposed above water flow surface 30, and storage case 32 extractably and retractably disposed in the accommodation space, which is defined by water flow surface 30 and water pouring case 31.

FIGS. 8 to 10 are perspective plan views of the detergent dissolving device for the washing machine according to the present exemplary embodiment. As illustrated in FIGS. 8 to 10, water pouring case 31 has three water channels partitioned by ribs. First water channel 31a, which is indicated by a broken line arrow in FIG. 8, includes first water supply valve 34a. Second water channel 31b, which is indicated by a broken line arrow in FIG. 9, includes second water supply valve 34b. Third water channel 31c, which is indicated by a broken line arrow in FIG. 10, includes third water supply valve 34c. First water supply valve 34a, second water supply valve 34b, and third water supply valve 34c are connected to water service (not shown), and are supplied with tap water of room temperature. A fourth water supply valve (not shown) is connected to a water heater (not shown), and is supplied with hot water.

First water supply valve 34a, second water supply valve 34b, and third water supply valve 34c of the present exemplary embodiment are three integrally-aligned valves. However, first water supply valve 34a, second water supply valve 34b, and third water supply valve 34c of the present invention are not limited to the three integrally-aligned valves. In a configuration not including the water heater, the fourth water supply valve may not be connected to anything, or the fourth water supply valve may be omitted.

FIG. 3 is a plan view of the storage case of the washing machine according to the present exemplary embodiment. FIG. 4 is a plan view of the storage case from which a powdered detergent agitator, a liquid detergent agitator, and caps are removed, of the washing machine according to the

present exemplary embodiment. FIG. 5 is a side cross-sectional view of a powdered detergent container in the detergent dissolving device for the washing machine according to the present exemplary embodiment. FIG. 6 is a side cross-sectional view of a liquid detergent storage part in the detergent
5 dissolving device for the washing machine according to the present exemplary embodiment. FIG. 7 is a side cross-sectional view of a softener container in the detergent dissolving device for the washing machine according to the present exemplary embodiment.

Storage case 32 is inclined downward toward washing tub 15 in a state
10 where storage case 32 is accommodated above water flow surface 30. Storage case 32 includes powdered detergent container 32a in which powdered detergent is held, liquid detergent container 32b in which liquid detergent is held, and softener container 32c in which softener is held. Powdered detergent container 32a includes powdered detergent agitator 35. Liquid
15 detergent container 32b includes liquid detergent agitator 36. Liquid detergent container 32b and softener container 32c include caps 37 indicating rough indications of amounts of liquid detergent and softener to be charged by the user, respectively.

Powdered detergent container 32a has projection 32e being located at a
20 center of powdered detergent container 32a and having a tubular shape. Powdered detergent agitator 35 has recess 35a. Projection 32e of powdered detergent container 32a is inserted into recess 35a of powdered detergent agitator 35. Consequently, powdered detergent agitator 35 is supported such that a rotational shaft of powdered detergent agitator 35 extends substantially
25 vertically. Powdered detergent agitator 35 has a plurality of blades 35b extending radially from a center of powdered detergent agitator 35. In the present exemplary embodiment, there is a clearance of approximately 0.1 mm

to 0.2 mm between projection 32e of powdered detergent container 32a and recess 35a of powdered detergent agitator 35. Projection 32e of powdered detergent container 32a has a plurality of holes 32f (in the present exemplary embodiment, three holes 32f) at a base of projection 32e.

5 Behind powdered detergent container 32a, mixture water container 32d in which powdered detergent and water are mixed together is disposed. Powdered detergent container 32a has peripheral wall 32g that is low in height only at a portion via which powdered detergent container 32a and mixture water container 32d communicate with each other. Mixture water container
10 32d has a plurality of holes 32h (in the present exemplary embodiment, nine holes 32h) in a center of mixture water container 32d.

Liquid detergent container 32b has a front portion in which liquid detergent agitator 36 is rotatably supported such that a rotational shaft of liquid detergent agitator 36 extends horizontally. Liquid detergent agitator 36
15 has shaft 36a. Liquid detergent container 32b has bearing part 32i that is U-shaped and is configured to support the shaft 36a of liquid detergent agitator 36. By shaft 36a and bearing part 32i, liquid detergent agitator 36 is detachably fitted to liquid detergent container 32b. Liquid detergent agitator 36 is pivotally supported by shaft 36a and bearing part 32i with shaft 36a
20 extending horizontally. Liquid detergent agitator 36 has a plurality of blades 36b arranged in parallel to shaft 36a.

Bosses 32j are disposed at centers of liquid detergent container 32b and softener container 32c. Each of bosses 32j has a tubular shape, and has a bottom with a through-hole extending longitudinally. Each of bosses 32j has
25 an outer periphery provided with ribs 32k extending longitudinally. Caps 37 respectively have recesses 33a. Recesses 33a are designed to be respectively fitted to bosses 32j via ribs 32k. Consequently, each of caps 37 is supported

such that clearance S1 is maintained between cap 37 and an upper end of an inner surface of a corresponding one of recesses 33a and clearance S2 is maintained between cap 37 and a lower end of the inner surface of the corresponding one of recesses 33a. By clearances S1 and S2, which are defined
5 by bosses 32j and recesses 33a, and the through-holes of bosses 32j, siphon channels 32l are formed, respectively. Through each of siphon channels 32l, water containing liquid detergent or softener is drained.

In a state where storage case 32 is accommodated in the accommodation space, which is defined by water pouring case 31 and water
10 flow surface 30, positions of powdered detergent agitator 35, liquid detergent agitator 36, and caps 37, each of which is attached to storage case 32, are fixed by water pouring case 31 disposed above storage case 32.

Above water pouring case 31, water pouring case lid 38 is disposed. Water pouring case 31 and water pouring case lid 38 are fixed to each other by
15 welding to provide three water channels inside water pouring case 31.

FIG. 8 is a perspective plan view of a water channel communicating with the powdered detergent container and the mixture water container in the detergent dissolving device for the washing machine according to the present exemplary embodiment. FIG. 9 is a perspective plan view of a water channel
20 communicating with the liquid detergent container and the powdered detergent container in the detergent dissolving device for the washing machine according to the present exemplary embodiment. FIG. 10 is a perspective plan view of a water channel communicating with the softener container in the detergent dissolving device for the washing machine according to the present exemplary
25 embodiment. FIG. 11 is a front cross-sectional view of the detergent dissolving device for the washing machine according to the present exemplary embodiment.

As illustrated in FIGS. 5 to 11, first water channel 31a in water pouring case 31 has nozzle 31d, which is designed to pour water toward powdered detergent agitator 35. Nozzle 31d is disposed at a location being apart from a center of powdered detergent agitator 35 and corresponding to one of blades 35b. Nozzle 31d is designed to pour water toward the one of blades 35b of powdered detergent agitator 35 in a front-to-rear direction. When storage case 32 is extracted from or retracted into the accommodation space, nozzle 31d comes in contact with one of blades 35b of powdered detergent agitator 35 to cause powdered detergent agitator 35 to rotate.

First water channel 31a in water pouring case 31 also has nozzle 31e designed to pour water to powdered detergent container 32a and nozzle 31f designed to pour water to mixture water container 32d.

Second water channel 31b in water pouring case 31 has nozzle 31g, which is located in a front portion of water pouring case 31 and is designed to pour water toward liquid detergent agitator 36. Second water channel 31b also has nozzles 31h and 31i, which are located near cap 37 of liquid detergent container 32b and are designed to pour water. Second water channel 31b also has nozzles 31j and 31k for pouring water to powdered detergent container 32a. Nozzle 31g for pouring water toward liquid detergent agitator 36 is designed to pour water to a position above one of blades 36b positioned ahead of shaft 36a.

Third water channel 31c in water pouring case 31 has nozzles 31l, 31m, which are positioned near cap 37 of softener container 32c. Third water channel 31c also has nozzles 31n, 31o, which are positioned ahead of cap 37. Third water channel also has nozzles 31p, 31q, 31r, which are positioned behind cap 37.

FIG. 12 is a plan view of the water flow surface of the washing machine according to the present exemplary embodiment. FIG. 13 is a perspective plan

view of the detergent dissolving device from which the storage case is removed, for the washing machine according to the present exemplary embodiment.

As illustrated in FIGS. 12 and 13, water flow surface 30 has a bottom surface including inner portions having a plurality of protrusions 30a and a
5 plurality of protrusions 30b facing lower portions of nozzles 31i and 31e of water pouring case 31, respectively.

The bottom surface of water flow surface 30 includes an inner portion having annular recess 30c facing a lower portion of nozzle 31h of water pouring case 31. Annular recess 30c has an inner recessed portion with an annular
10 protruding rib that is partly cut out.

The operation and effect of the washing machine having the above-mentioned configuration will be described below.

The user opens lid 26, and puts laundry into washing tub 15. Then, the user extracts storage case 32 of the detergent dissolving device through the
15 opening defined by water flow surface 30 and water pouring case 31, and places a predetermined amount of detergent into powdered detergent container 32a or liquid detergent container 32b. The user further places a predetermined amount of softener into softener container 32c, and then puts storage case 32 into the opening.

20 FIG. 14 is a plan view illustrating a positional relationship between the powdered detergent agitator and the water pouring nozzles in the washing machine according to the present exemplary embodiment. FIG. 14 shows a state where storage case 32 is accommodated in the accommodation space defined by water flow surface 30 and water pouring case 31. FIG. 15 is a plan
25 view illustrating a positional relationship between the powdered detergent agitator and the water pouring nozzles in the washing machine according to the present exemplary embodiment. Part (1) of FIG. 15 shows a state of storage

case 32 at a time when accommodation of storage case 32 into the accommodation space starts, whereas part (6) of FIG. 15 shows a state of storage case 32 at a time when the accommodation of storage case 32 is completed. Thus, FIG. 15 shows how storage case 32 transitions from the state shown in part (1) of FIG. 15 to the state shown in part (6) of FIG. 15 so as to be accommodated.

After the accommodation of storage case 32 is started (see part (1) of FIG. 15), a first one of blades 35b of powdered detergent agitator 35 comes in contact with nozzle 31d (see part (2) of FIG. 15). The contact between the first one of blades 35b of powdered detergent agitator 35 and nozzle 31d brought about by the accommodation of storage case 32 causes powdered detergent agitator 35 to rotate (see parts (2) to (6) of FIG. 15).

Thus, due to the configuration in which nozzle 31d is disposed ahead of powdered detergent agitator 35, the first one of blades 35b of powdered detergent agitator 35 comes in contact with nozzle 31d at the time when storage case 32 is inserted into the accommodation space. Accordingly, while powdered detergent agitator 35 is rotating, storage case 32 moves to the accommodation space. In the state where storage case 32 is accommodated in the accommodation space, a second one of blades 35b of powdered detergent agitator 35, which is adjacent to the first one of blades 35b being in contact with nozzle 31d and is located further from the opening than the first one of blades 35b is, is brought to a position at which the second one of blades 35b is perpendicular to a direction in which water is poured through nozzle 31d. In addition, a distance between nozzle 31d and the second one of blades 35b is uniquely defined. Thus, even when an amount of water supplied is small under low water pressure environment, powdered detergent agitator 35 is caused to rotate by the pressure of the water so that the detergent and the

water are agitated together. This prevents detergent from remaining undissolved.

Powdered detergent agitator 35 rotates to reach a position at which the second one of blades 35b of powdered detergent agitator 35 is perpendicular to
5 a discharge port of nozzle 31d, and stops at this position in the state where the accommodation of storage case 32 is completed (see FIG. 14 and part (6) of FIG. 15). In addition, in the state where the accommodation of storage case 32 is completed, a position of the storage case 32 is determined. Accordingly, a distance between the second one of blades 35b of powdered detergent agitator
10 35 and the discharge port of nozzle 31d is also fixed.

Powdered detergent agitator 35 is configured such that one of blades 35b stops at the position at which the one of blades 35b is perpendicular to the discharge port of nozzle 31d and the distance between the one of blades 35b and the discharge port of nozzle 31d is fixed. Consequently, it is possible to
15 certainly actuate powdered detergent agitator 35 such that powdered detergent agitator 35 rotates.

When storage case 32 is extracted, one of blades 35b of powdered detergent agitator 35 comes in contact with nozzle 31d, so that powdered detergent agitator 35 rotates. By the rotation of powdered detergent agitator
20 35, a foreign matter between recess 35a of powdered detergent agitator 35 and projection 32e of powdered detergent container 32a is discharged. This prevents adhesion that may otherwise be caused by the foreign matter. If powdered detergent agitator 35 is not rotating in a suitable manner, the user can judge that an abnormality related to the rotation of powdered detergent
25 agitator 35 has occurred.

Next, the user operates a start switch in operation display 28 to start the washing operation.

In response to this, control device 27 (see FIG. 1) starts the washing step. First water supply valve 34a is opened for a predetermined period of time, so that water flows into first water channel 31a partitioned by the ribs in water pouring case 31. The flow of the water is indicated by broken lines in
5 FIGS. 5 and 8. The water passing through first water channel 31a is poured toward powdered detergent agitator 35 through nozzle 31d, so as to cause powdered detergent agitator 35 to rotate.

Powdered detergent agitator 35 stops at a position at which one of blades 35b is perpendicular to the discharge port of nozzle 31d and a distance
10 between the one of blades 35b and nozzle 31d is fixed. This allows powdered detergent agitator 35 to receive the pressure of the water from nozzle 31d efficiently, thereby causing powdered detergent agitator 35 to start rotating.

By the rotation of powdered detergent agitator 35, the powdered detergent is agitated with the water in powdered detergent container 32a.

15 The water passing through first water channel 31a is poured into powdered detergent container 32a through nozzle 31e. The powdered detergent and the mixture water are stored in powdered detergent container 32a. However, the powdered detergent and the mixture water partially flow to water flow surface 30 through holes 32f (see FIG. 4). If an amount of water
20 supplied to powdered detergent container 32a exceeds the volume of powdered detergent container 32a, the water gets over peripheral wall 32g to flow into mixture water container 32d.

Since the mixture water is poured to mixture water container 32d through nozzle 31f, the mixture water is foamed in mixture water container
25 32d. The foam and the mixture water in mixture water container 32d flow to water flow surface 30 through holes 32h (see FIGS. 3 and 4) in mixture water container 32d. If an amount of the water in mixture water container 32d

exceeds the volume of mixture water container 32d, the water gets over a peripheral wall of mixture water container 32d to flow into water flow surface 30. The foam and the mixture water having flowed to water flow surface 30 are supplied to washing tub 15 through a front end of water flow surface 30.

5 After control device 27 opens first water supply valve 34a for a predetermined period of time, control device 27 opens second water supply valve 34b for a predetermined period of time to allow the water to flow into second water channel 31b partitioned by the ribs in water pouring case 31. The flow of the water is indicated by broken lines in FIGS. 6 and 9. The water
10 passing through second water channel 31b is poured toward liquid detergent agitator 36 through nozzle 31g, so as to cause liquid detergent agitator 36 to rotate in a direction causing the detergent to flow in a front-to-rear direction in storage case 32. The rotation of liquid detergent agitator 36 supplies the water and air to the liquid detergent in liquid detergent container 32b, and
15 agitates the water, air, and liquid detergent together so that the liquid detergent is dissolved in the water to give a foamed washing liquid. The foamed washing liquid is then caused to flow downstream. The water passing through second water channel 31b is poured into liquid detergent container 32b through nozzles 31h, 31i, which are respectively disposed at a position ahead of
20 cap 37 and a position behind cap 37.

 The mixture water in liquid detergent container 32b passes through siphon channel 32l, and flows out of storage case 32 to water flow surface 30. If the pouring of the water into storage case 32 is stopped, the liquid detergent water, which is the mixture of the liquid detergent and the water, remaining in
25 storage case 32 is sucked into siphon channel 32l by a siphon effect of siphon channel 32l. Consequently, almost all of the liquid detergent water flows out of storage case 32. Thus, the liquid detergent having been placed in storage

case 32 flows out of storage case 32, and does not remain in storage case 32.

The water flowing into second water channel 31b is partially poured into powdered detergent container 32a through nozzles 31j, 31k. When first water supply valve 34a is opened, the water is mixed with the powdered
5 detergent remaining in powdered detergent container 32a, and the resultant mixture flows to water flow surface 30 through holes 32f.

The foam, the liquid detergent water, and the mixture water having flowed to water flow surface 30 from storage case 32 are supplied to washing tub 15 through the front end of water flow surface 30.

10 If the water poured into washing tub 15 does not reach a predetermined water level after second water supply valve 34b has been opened for the predetermined period of time, control device 27 repeatedly performs the operation of opening first and second water supply valves 34a and 34b for the predetermined periods of time until the water in washing tub 15 reaches the
15 predetermined water level.

When the water in washing tub 15 reaches the predetermined water level, control device 27 closes first and second water supply valves 34a and 34b to stop the supply of the water. Then, control device 27 drives motor 20 to cause pulsator 18 to rotate to perform the washing step.

20 When the washing step ends, control device 27 starts the rinsing step, by which dirty washing water is drained and intermediate dewatering is performed.

In the rinsing step, third water supply valve 34c is opened, so that water flows into third water channel 31c formed by the ribs in water pouring
25 case 31. The flow of the water is indicated by broken lines in FIGS. 7 and 10. The water passing through third water channel 31c is poured into softener container 32c through nozzles 31l, 31m, 31n, 31o, 31p, 31q, 31r. Then, the

water passes through siphon channel 32l, and flows out of storage case 32 to water flow surface 30.

If the pouring of the water into storage case 32 is stopped, the softener water, which is the mixture of the softener and the water, remaining in storage case 32 is sucked into siphon channel 32l by a siphon effect of siphon channel 32l. Consequently, almost all of the softener water flows out of storage case 32. Thus, the softener having been placed in storage case 32 flows out of storage case 32, and does not remain in storage case 32.

The softener water having flowed to water flow surface 30 from storage case 32 is supplied to washing tub 15 through the front end of water flow surface 30.

When the water in washing tub 15 reaches a predetermined water level, control device 27 closes third water supply valve 34c to stop the supply of the water. Then, control device 27 drives motor 20 to cause pulsator 18 to rotate to perform the rinsing step.

If storage case 32 is removed during the water supply in, for example, the washing step or the rinsing step, the water supplied through nozzles 31d, 31e, 31f, 31g, 31h, 31i, 31j, 31k, 31l, 31m, 31n, 31o, 31p, 31q, 31r of water pouring case 31 comes in contact with the pluralities of protrusions 30a, 30b and annular recess 30c, which is partly cut out, on water flow surface 30, and is then supplied to washing tub 15 through all ends of the water flow surface.

With protrusions 30a, 30b and annular recess 30c, it is possible to prevent splashing of water from water flow surface 30 even in a state where storage case 32 has been removed. This can improve the reliability.

FIG. 16 is a chart illustrating how the steps are performed by the washing machine according to the exemplary embodiment of the present invention progress.

When water is initially supplied in the washing step, first water supply valve 34a and second water supply valve 34b are turned on alternately so that the water is introduced until the water reaches a predetermined water level (see FV1 in FIG. 16). With this configuration, the user can use either of powdered detergent and liquid detergent to be dissolved in the water. Simultaneously turning on first and second water supply valves 34a and 34b reduces a flow rate of the water flowing through each of first water supply valve 34a and second water supply valve 34b, thereby reducing the pressure of the water. This leads to a reduction in rotational force of each of the agitators, thereby being likely to cause remaining of the detergent.

In the present exemplary embodiment, first water supply valve 34a is opened for 40 seconds, and thereafter second water supply valve 34b is opened for 40 seconds. In this manner, first and second water supply valves 34a and 34b are alternately turned on repeatedly. The period of time in which each of first and second water supply valves 34a and 34b is actuated is not limited to the period of time described above. Alternatively, the period of time in which each of first and second water supply valves 34a and 34b is actuated may be set to be a minimal period of time with which the water is filled to exceed a water level causing a siphon effect even in low water pressure regions (0.01 Mpa) and/or even if fluctuations exist in the water level.

At timing that is after main agitation and before water draining in each of the washing step and the final rinsing step, second water supply valve 34b is turned on, so that water is introduced into second water channel 31b (see FV2 in FIG. 16).

Consequently, it is possible to cause all of the liquid detergent to flow out of the liquid detergent container by the siphon effect, even in a case where only one of the washing step and the rinsing step is performed. If all of the

liquid detergent is caused to flow out of the liquid detergent container at an early stage, the water accumulated in the water pouring path may leak into water pouring case 31 due to an impact such as vibrations applied after the flowing, so that the liquid detergent may remain in water pouring case 31. By
5 pouring water in the manner described in the present exemplary embodiment, it is possible to suppress or reduce the problem of the conventional techniques.

In the present exemplary embodiment, a period of time to introduce water into second water channel 31b at timing before the water draining in each of the washing step and the final rinsing step is 10 seconds. However,
10 this period of time is not limited to 10 seconds, and may be set as appropriate.

As described above, the detergent dissolving device according to the present exemplary embodiment is configured such that softener container 32c, into which softener is placed, as well as powdered detergent container 32a and liquid detergent container 32b are disposed together in storage case 32. With
15 this configuration, in a case where the user wants to use detergent and softener, the user can place the detergent and the softener into powdered detergent container 32a, liquid detergent container 32b, and softener container 32c at a time. This can enhance convenience for the user. In addition, powdered detergent container 32a and liquid detergent container 32b internally include
20 powdered detergent agitator 35 and liquid detergent agitator 36, respectively, each of which is configured to agitate detergent and water together to dissolve the detergent in the water. Furthermore, first and second water channels 31a and 31b in water pouring case 31 have nozzles 31e, 31f, 31g, 31h, 31i. With
this configuration, it is possible to prevent detergent and softener from
25 remaining undissolved in powdered detergent container 32a, thereby making it possible to improve the reliability of the washing machine.

Moreover, the detergent dissolving device according to the present

exemplary embodiment is configured such that nozzle 31d is disposed ahead of powdered detergent agitator 35. With this configuration, at the time when storage case 32 is inserted into the accommodation space after washing preparations are placed in storage case 32, a first one of blades 35b of powdered detergent agitator 35 comes in contact with nozzle 31d. Accordingly, while powdered detergent agitator 35 is rotating, storage case 32 moves to the accommodation space. A second one of blades 35b of powdered detergent agitator 35, which is adjacent to the first one of blades 35b being in contact with nozzle 31d and is located further from the opening than the first one of blades 35b is, is brought to a position at which the second one of blades 35b is perpendicular to a direction in which water is poured through nozzle 31d. Furthermore, a distance between nozzle 31d and the second one of blades 35b is uniquely defined. Thus, even when an amount of water supplied is small under low water pressure environment, powdered detergent agitator 35 is caused to rotate by the pressure of the water, and agitates the detergent and the water together. This can prevent detergent from remaining undissolved.

Moreover, in the detergent dissolving device for the washing machine according to the present exemplary embodiment, liquid detergent agitator 36 is disposed in the inner front portion of the storage case 32 such that shaft 36a, which is the rotational shaft of liquid detergent agitator 36, is supported horizontally. With this configuration, water is supplied to one of blades 36b positioned ahead of shaft 36a of liquid detergent agitator 36. By the water thus supplied, liquid detergent agitator 36 is caused to rotate. Thus, liquid detergent agitator 36 supplies the water and air to the liquid detergent and agitates the water, air, and liquid detergent together so that the liquid detergent is dissolved to give a foamed washing liquid. The foamed washing liquid is supplied to cap 37, which is disposed behind liquid detergent agitator

36 and is designed to cause a siphon phenomenon. With this configuration, it is possible to prevent liquid detergent from remaining undissolved in storage case 32 and overflow of foam from storage case 32. This can improve the reliability of the washing machine.

5 As described above, a washing machine according to a first disclosure includes: a body; a washing tub disposed inside the body; a detergent dissolving device configured to supply water into the washing tub; and a control device for performing a washing operation including a series of steps including a washing step, a rinsing step, and a spin-drying step. The detergent dissolving device
10 includes a storage case including a powdered detergent container, a liquid detergent container, and a softener container. The detergent dissolving device further includes: a powdered detergent agitator disposed in the powdered detergent container; a liquid detergent agitator disposed in the liquid detergent container; siphon channels respectively formed in the liquid detergent
15 container and the softener container; a water flow surface holding the storage case extractably and retractably; and a water pouring case configured to pour water into the storage case. The detergent dissolving device further includes: a first water channel disposed in the water pouring case and designed to pour water to the powdered detergent container; and a first water supply valve
20 communicating with the first water channel. The detergent dissolving device further includes: a second water channel disposed in the water pouring case and designed to pour water to the powdered detergent container and the liquid detergent container; and a second water supply valve communicating with the second water channel. The detergent dissolving device further includes: a
25 third water channel disposed in the water pouring case and designed to pour water to the softener container; and a third water supply valve communicating with the third water channel. The detergent dissolving device further

includes nozzles which are disposed in the first, second, and third water channels and are designed to supply water to the powdered detergent container, the liquid detergent container, and the softener container.

Thus, the detergent dissolving device is configured such that the softener container, into which a washing preparation is placed, as well as the powdered detergent container and the liquid detergent container are disposed together in the storage case. Thus, the user can place the washing preparations into these containers at a time. This can enhance convenience for the user. In addition, the powdered detergent container and the liquid detergent container internally include the respective agitators each configured to agitate detergent and water together so that the detergent is dissolved in the water. Furthermore, the water channels in the water pouring case have the nozzles. With this configuration, it is possible to prevent the washing preparations from remaining undissolved in the containers, thereby making it possible to improve the reliability of the washing machine.

A washing machine according to a second disclosure, including the configuration of the first disclosure, is configured such that the liquid detergent agitator includes a rotational shaft extending horizontally, and one of the nozzles being disposed in the second water channel and being designed to supply water to the liquid detergent container supplies water toward blades of the liquid detergent agitator.

With this configuration, in a case where the user wants to use detergent and softener, the user can place the detergent and the softener at a time, since the softener container, into which softener is placed, as well as the powdered detergent container and the liquid detergent container are disposed together in the storage case. Consequently, it is possible to enhance convenience for the user. In addition, the powdered detergent container and the liquid detergent

container internally include the respective agitators each configured to agitate detergent and water together to dissolve the detergent in the water. Furthermore, the water channels in the water pouring case have water pouring nozzles. With this configuration, it is possible to suppress or reduce undissolved detergent in the containers, thereby making it possible to improve the reliability of the washing machine.

Furthermore, by the liquid detergent agitator, the liquid detergent, water, and air can be agitated together so that the liquid detergent is dissolved in the water to give a foamed washing liquid. Then, the foamed washing liquid can be caused to flow downstream.

A washing machine according to a third disclosure, including the configuration of the first disclosure, is configured such that the powdered detergent agitator includes a rotational shaft extending vertically and blades extending radially from the rotational shaft, and one of the nozzles designed to supply water to the powdered detergent container supplies water toward the blades of the powdered detergent agitator.

Since this configuration includes the storage case into which a washing preparation such as softener is placed together with powdered detergent and liquid detergent, the user can place the powdered detergent, the liquid detergent, and the washing preparation into the storage case at a time. Consequently, it is possible to enhance convenience for the user. In addition, the detergent container includes the powdered detergent agitator configured to agitate detergent and water together to dissolve the detergent in the water. Furthermore, the water channels in the water pouring case have the nozzles. With this configuration, it is possible to prevent the washing preparations from remaining undissolved in the container, thereby making it possible to improve the reliability of the washing machine.

A washing machine according to a fourth disclosure, including the configuration of the third disclosure, is configured such that the one of the nozzles designed to supply water toward the blades of the powdered detergent agitator is located ahead of the powdered detergent agitator in a state where
5 the storage case is in an accommodated state.

With this configuration, at the time when the storage case is inserted into the accommodation space after detergent is placed in the storage case, a first one of the blades of the powdered detergent agitator comes in contact with the nozzle. Accordingly, while the powdered detergent agitator is rotating, the
10 storage case moves to the accommodation space. A second one of the blades is then brought to a position at which the second one of the blades is perpendicular to a direction in which water is poured. A distance between the second one of the blades and the nozzle is uniquely defined. Thus, even when an amount of water supplied is small under low water pressure environment,
15 the detergent agitator is caused to rotate by the pressure of the water, and agitates the detergent and the water together. This can prevent detergent from remaining undissolved.

A washing machine according to a fifth disclosure, including the configuration of the first disclosure, is configured such that the water flow
20 surface has a bottom surface including an inner portion having a plurality of protrusions facing at least one corresponding nozzle of the nozzles.

With this configuration including the plurality of protrusions for suppressing or reducing the force of the water supplied onto the water flow surface, it is possible to prevent splashing of the water from the water flow
25 surface even in a state where the storage case for the washing preparations has been removed. Consequently, it is possible to improve the reliability of the washing machine.

A washing machine according to a sixth disclosure, including the configuration of the first disclosure, is configured such that the water flow surface has a bottom surface including an inner portion having an annular recess facing at least one corresponding nozzle of the nozzles.

5 With this configuration including the annular recess for suppressing or reducing the force of the water supplied onto the water flow surface, it is possible to prevent splashing of the water from the water flow surface even in a state where the storage case for the washing preparations has been removed. Consequently, it is possible to improve the reliability of the washing machine.

10 A washing machine according to a seventh disclosure, including the configuration of the sixth disclosure, is configured such that the annular recess is formed in a shape including an inner recessed portion surrounded by an annular protruding rib that is partly cut out.

 With this configuration including the annular recess for suppressing or
15 reducing the force of the water supplied onto the water flow surface, it is possible to prevent splashing of the water from the water flow surface even in a state where the storage case for the washing preparations has been removed. Consequently, it is possible to improve the reliability of the washing machine.

 A washing machine according to an eighth disclosure, including the
20 configuration of the first disclosure, further includes a controller for controlling the first water supply valve, the second water supply valve, and the third water supply valve, wherein the controller alternately turns on the first water supply valve and the second water supply valve when water is initially supplied in the washing step.

25 Thus, the user can use both of powder detergent and liquid detergent, since the water pouring device includes the storage case including the powdered detergent container, the liquid detergent container, and the softener

container into which powdered detergent, liquid detergent, and softener are respectively placed and which are integrally molded. Consequently, it is possible to enhance convenience for the user. In addition, the powdered detergent container and the liquid detergent container internally include the
5 respective agitators each configured to agitate detergent and water together to dissolve the detergent in the water. With this configuration, it is possible to prevent detergent from remaining undissolved in the powdered detergent container and the liquid detergent container, thereby making it possible to improve the reliability of the washing machine.

10 With the above configuration, either of the powdered detergent and the liquid detergent can be used to be dissolved in the water. Meanwhile, simultaneously turning on the first and second water supply valves reduces a flow rate of the water flowing through each of the first and second water supply valves, thereby reducing pressure of the water. This results in a reduction in
15 rotational force of each of the agitators, thereby being likely to cause remaining of the detergent. On the other hand, with the configuration in which the controller alternately turns on the first water supply valve and the second water supply valve when water is initially supplied in the washing step, it is possible to maintain the rotational force of the agitators in the powdered
20 detergent container and the liquid detergent container, thereby making it possible to cause all of the powdered detergent and the liquid detergent to flow out of the containers.

A washing machine according to a ninth disclosure, including the configuration of the eighth disclosure, is configured such that, at timing that is
25 after main agitation and before water draining in each of the washing step and a final rinsing step, the controller opens the second water supply valve to introduce water into the second water pouring section.

Liquid detergent is typically higher in viscosity than water. Therefore, in low water pressure regions, it may sometimes be impossible to cause all of the liquid detergent to flow out of the container by alternately turning on the first and second water supply valves once. However, with the above
5 configuration, part of the liquid detergent having a high concentration is caused to flow once, and thereafter the liquid detergent diluted is caused to flow at a rush. This allows all of the liquid detergent to flow out of the container. Alternatively, the second water supply valve may be controlled to be opened to introduce water into the second water pouring section at the timing that is
10 after the main agitation and before the water draining only in the washing step or the rinsing step. Also in this case, it is possible to cause all of the liquid detergent to flow out of the container.

INDUSTRIAL APPLICABILITY

15 As described above, a washing machine according to the present invention includes a storage case including containers into which washing preparations are placed. With this configuration, the user can place the washing preparations into these containers at a time. Consequently, it is possible to enhance convenience for the user. In addition, the powdered
20 detergent container and the liquid detergent container internally include the respective agitators each configured to agitate detergent and water together to dissolve the detergent in the water. Furthermore, the water channels in the water pouring case have the nozzles. Therefore the washing machine according to the present invention is useful as a washing machine that can
25 prevent the washing preparations from remaining undissolved in the containers.

REFERENCE MARKS IN THE DRAWINGS

	11: body
	13: water tub
	15: washing tub
5	18: pulsator
	24: upper frame
	25: clothes inlet
	26: lid
	28: operation display
10	29: lower surface cover
	30: water flow surface
	31: water pouring case
	31a: first water channel
	31b: second water channel
15	31c: third water channel
	31d, 31e, 31f, 31g, 31h, 31i, 31j, 31k, 31l: nozzle
	32: storage case
	32a: powdered detergent container
	32b: liquid detergent container
20	32c: softener container
	32d: mixture water container
	33a: recess
	34: water supply valve
	34a: first water supply valve
25	34b: second water supply valve
	34c: third water supply valve
	35: powdered detergent agitator

	35a: recess
	35b: blade
	36: liquid detergent agitator
	36a: shaft
5	36b: blade
	37: cap
	38: water pouring case lid

CLAIMS

1. A washing machine comprising:
 - a body;
 - 5 a washing tub disposed inside the body;
 - a detergent dissolving device configured to supply water into the washing tub; and
 - a control device for performing a washing operation including a series of steps including a washing step, a rinsing step, and a spin-drying step,
 - 10 the detergent dissolving device including
 - a storage case including a powdered detergent container, a liquid detergent container, and a softener container,
 - a powdered detergent agitator disposed in the powdered detergent container,
 - 15 a liquid detergent agitator disposed in the liquid detergent container, siphon channels respectively formed in the liquid detergent container and the softener container,
 - a water flow surface holding the storage case extractably and retractably,
 - 20 a water pouring case configured to pour water into the storage case,
 - a first water channel disposed in the water pouring case and designed to pour water to the powdered detergent container,
 - a first water supply valve communicating with the first water channel,
 - a second water channel disposed in the water pouring case and
 - 25 designed to pour water to the powdered detergent container and the liquid detergent container,
 - a second water supply valve communicating with the second water

channel,

a third water channel disposed in the water pouring case and designed to pour water to the softener container,

a third water supply valve communicating with the third water channel,

5 and

nozzles which are disposed in the first, second, and third water channels and are designed to supply water to the powdered detergent container, the liquid detergent container, and the softener container.

10 2. The washing machine according to claim 1, wherein the liquid detergent agitator includes a rotational shaft extending substantially horizontally, and one of the nozzles being disposed in the second water channel and being designed to supply water to the liquid detergent container supplies water toward blades of the liquid detergent agitator.

15

3. The washing machine according to claim 1, wherein the powdered detergent agitator includes a rotational shaft extending substantially vertically and blades extending radially from the rotational shaft, and one of the nozzles designed to supply water to the powdered detergent container supplies water
20 toward the blades of the powdered detergent agitator.

4. The washing machine according to claim 3, wherein the one of the nozzles designed to supply water toward the blades of the powdered detergent agitator is located ahead of the powdered detergent agitator in a state where
25 the storage case is in an accommodated state.

5. The washing machine according to claim 1, wherein the water flow

surface has a bottom surface including an inner portion having a plurality of protrusions facing at least one corresponding nozzle of the nozzles.

6. The washing machine according to claim 1, wherein the water flow
5 surface has a bottom surface including an inner portion having an annular recess facing at least one corresponding nozzle of the nozzles.

7. The washing machine according to claim 6, wherein the annular
recess is formed in a shape including an inner recessed portion surrounded by
10 an annular protruding rib that is partly cut out.

8. The washing machine according to claim 1, further comprising a
controller for controlling the first water supply valve, the second water supply
valve, and the third water supply valve, wherein the controller alternately
15 turns on the first water supply valve and the second water supply valve when
water is initially supplied in the washing step.

9. The washing machine according to claim 8, wherein, at timing that
is after main agitation and before water draining in each of the washing step
20 and a final rinsing step, the controller opens the second water supply valve to
introduce water into the second water pouring section.