

WASHING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to washing machines including softening-agent automatic flow-out devices.

2. Description of the Related Art

Conventional washing machine 100 including a softening-agent automatic flow-out device will be described.

Fig. 11 is a view for describing the cross-sectional structure of conventional washing machine 100.

Conventional washing machine 100 includes washing-machine outer frame 101. Washing-machine outer frame 101 suspends water receiver tub 103 with suspension rods 102. Inside water receiver tub 103, washing/dewatering tub 104 is provided so as to be rotatable for dewatering. Washing/dewatering tub 104 is provided, on its bottom portion, with pulsator 105, such that pulsator 105 is rotatable. Lower blades 106 are provided integrally with pulsator 105. Motor (driving portion) 107 drives pulsator 105 or washing/dewatering tub 104, through V belt 108 and speed reduction mechanism 109.

Lint circulation water path 110 and water-sprinkling nozzle circulation water path 111 are provided, such that they extend from pump chamber 112 around the outer periphery of lower blades 106 for pulsator 105 to upper portions of washing/dewatering tub 104.

Lint filter 113, which is attachable and detachable, and water sprinkling nozzle 114 are provided at upper portions of lint circulation water path 110 and water-sprinkling circulation water path 111, respectively. Drain valve 115 discharges

washing water in water receiver tub 103. Water feed valve 116 supplies water to the inside of water receiver tub 103. Upper frame body 117, which forms an upper portion of washing-machine outer frame 101, is provided with lid 118 such that lid 118 is openable and, further, this upper frame body 117 is provided in its front side with control portion 119. Washing/dewatering tub 104 is provided, at its upper portion, with fluid balancer 120 for alleviating vibrations during dewatering, and this fluid balancer 120 is provided with softening-agent automatic flow-out device 121 (refer to Unexamined Japanese Patent Publication No. 07-328277 or Unexamined Japanese Patent Publication No. 2007-117328, for example).

In order to ensure that tap water is supplied from water feed valve 116 to the inside of washing/dewatering tub 104 in water receiver tub 103, water feed port 116a communicating with water feed valve 116 is placed above opening portion 120a of fluid balancer 120 in washing/dewatering tub 104.

Hereinafter, there will be described the structure of softening-agent case 122 which forms a portion of softening-agent automatic flow-out device 121.

Fig. 12 is a perspective view of softening-agent automatic flow-out device 121 and its surrounding, for describing the structure of softening-agent case 122 in conventional washing machine 100. Fig. 13 is a view illustrating the cross-sectional structure of the same softening-agent automatic flow-out device 121 and its surrounding.

As illustrated in Fig. 12, softening-agent case 122 can be attached and detached to and from fluid balancer 120. Thus, a user can disengage softening-agent case 122 from fluid balancer 120 and can introduce a softening agent into softening-agent case 122. Further, fluid balancer 120 is provided with softening-agent introducing port 123, at the portion thereof where softening-agent case 122 is placed. Accordingly, the user can introduce a softening agent into softening-agent case 122 through softening-agent introducing port 123, without disengaging softening-agent case 122.

Basic operation processes with washing machine 100 include respective processes for supplying of water, washing, discharging of water, first dewatering, supplying of water, first rinsing, discharging of water, second dewatering, supplying of water, final rinsing, discharging of water and final dewatering.

There will be described the movements of the softening agent, in the respective processes.

With reference to Figs. 13 to 16, there will be described the movement of the softening agent, in conventional washing machine 100.

Fig. 14 is a cross-sectional view of softening-agent automatic flow-out device 121 when it is viewed at its upper surface, for describing the behavior of the softening agent flowing in softening-agent automatic flow-out device 121, in conventional washing machine 100. Fig. 15 and Fig. 16 are cross-sectional views for describing the movement of the softening agent in conventional washing machine 100.

As illustrated in Fig. 13 and Fig. 14, at first, the softening agent, which was introduced into softening-agent case 122 before the start of a washing process, moves to first room 148 through first movement path 147 as indicated by arrows a, due to centrifugal forces during the first dewatering process after the completion of the washing process. The softening agent which has moved to first room 148 is kept attached to outer wall 156 of first room 148, due to centrifugal forces, in the area designated by b, until the completion of the first dewatering process. During the first rinsing process after the completion of the first dewatering process, the softening agent moves to second room 150 through second movement path 149, as indicated by arrows c.

Next, as illustrated in Fig. 14 and Fig. 15, the softening agent moves to third room 152 through third movement path 151, as indicated by arrows d, due to centrifugal forces during the second dewatering process after the completion of the first rinsing process. The softening agent which has moved to third room 152 is kept attached to

outer wall 157 of third room 152, due to centrifugal forces, in the area designated by e, until the completion of the second dewatering process.

After the completion of the second dewatering process, the softening agent passes through fourth movement path 153, as indicated by arrows f (see Fig. 14). Further, as illustrated in Fig. 16, the softening agent passes through flow-out path 154 as indicated by arrows g and, thereafter, exits therefrom through softening-agent flow-out port 155 and falls downwardly between water receiver tub 103 and washing/dewatering tub 104, as indicated by arrows h.

However, the structure of conventional washing machine 100 as illustrated in Figs. 11 to 16 may have problems as follows.

At the time of the completion of the previous series of operations, washing/dewatering tub 104 is stopped at an arbitrary position. Accordingly, it is impossible to control the positions at which softening-agent automatic flow-out device 121 and softening-agent case 122, which are provided in the inner surface of fluid balancer 120, are stopped.

Fig. 17 is a view illustrating an exemplary position of softening-agent case 122 when a series of operations have completed, in conventional washing machine 100.

In the state of Fig. 17, softening-agent case 122 stays near water feed port 116a. The assumption will be made that, in this state, to-be-washed object 124 has been introduced in washing/dewatering tub 104, up to the vicinity of opening portion 120a of fluid balancer 120. It is assumed that, in this case, an operation is started, and tap water W is supplied from water feed port 116a.

Then, depending on the state of to-be-washed object 124 which has been introduced therein, as illustrated in Fig. 17, a portion of tap water W is splashed back by to-be-washed object 124 to be scattered toward softening-agent automatic flow-out device 121. Further, there may be cases of intrusions (water infiltration) of tap water W into softening-agent case 122 through softening-agent intruding port 123 in fluid

balancer 120. This may cause the softening agent in softening-agent case 122 to mix with water to reduce the concentration of the softening agent, thereby inducing the problem of impossibility of provision of predetermined performance of the softening agent during rinsing process.

SUMMARY OF THE INVENTION

Embodiments of the present invention provide predetermined performance of a softening agent during rinsing processes

According to an aspect of the present invention, there is provided a washing machine comprising: a main body; a water receiver tub placed in the main body and comprising a rotatable washing/dewatering tub, inside thereof; a pulsator placed rotatably on a bottom portion of the washing/dewatering tub; a fluid balancer provided at an upper portion of the washing/dewatering tub; a softening-agent automatic flow-out device placed in the fluid balancer and adapted to flow, therefrom, a softening agent into the water receiver tub during a rinsing process; a control portion adapted to control an operation including washing, rinsing and dewatering; a softening-agent introducing port provided in the fluid balancer and communicating with the softening-agent automatic flow-out device; a softening-agent introducing-port lid adapted to cover an opening portion of the softening-agent introducing port; and a bearing portion adapted to allow the softening-agent introducing-port lid to rotate, near the opening portion of the softening-agent introducing port.

With the washing machine according to an embodiment of the present invention, it is possible to prevent intrusions of water into the softening-agent introducing port through the softening-agent introducing-port lid, even if water comes close to intruding into the softening-agent introducing port (water infiltration), during supplying of water after the start of operations and during washing processes. This can reduce the possibility that

the softening agent in the softening-agent automatic flow-out device mixes with water to reduce the concentration of the softening agent. This can prevent degradation of predetermined performance of the softening agent, during rinsing processes.

Further, the softening-agent introducing-port lid and the bearing portion for the softening-agent introducing-port lid are placed near the opening portion of the softening-agent introducing port, which enables structuring the softening-agent case for storing the softening agent to be detachable.

Accordingly, even when the softening-agent automatic flow-out device is positioned in the rear side of the washing machine, namely below the rear surface of the opening portion of the upper frame body and, therefore, the softening-agent automatic flow-out device stays at a position which makes it hard to introduce the softening agent into the softening-agent introducing port from thereabove, a user can introduce the softening agent thereinto, by detaching and attaching the softening-agent case. This can suppress intrusions of water through the softening-agent introducing port during washing processes, while maintaining usability equivalent to that of conventional structures. This can prevent degradation of predetermined performance of the softening agent.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a view illustrating the cross-sectional structure of a washing machine according to an embodiment of the present invention.

Fig. 2 is a perspective view of a softening-agent automatic flow-out device and its surrounding at a state where a softening-agent introducing-port lid is closed, for describing the structure of a softening-agent case in the washing machine according to the embodiment of the present invention.

Fig. 3 is a perspective view of the softening-agent automatic flow-out device and its surrounding at a state where the softening-agent introducing-port lid is opened,

for describing the structure of the softening-agent case in the washing machine according to the embodiment of the present invention.

Fig. 4 is a view illustrating the cross-sectional structure of the softening-agent introducing-port lid and its surrounding, in the washing machine according to the embodiment of the present invention.

Fig. 5 is a view illustrating the cross-sectional structure of a latch portion and its surrounding, when they are viewed from the rotational center of the washing/dewatering tub, for describing the structure of the latch portion in the washing machine according to the embodiment of the present invention.

Fig. 6 is a cross-sectional view of the softening-agent automatic flow-out device when it is viewed at its upper surface, for describing the behavior of the softening agent flowing in the softening-agent automatic flow-out device, according to the embodiment of the present invention.

Fig. 7A is a cross-sectional view illustrating the behavior of the softening agent moving to a first room, according to the embodiment of the present invention.

Fig. 7B is a cross-sectional view illustrating the behavior of the softening agent moving to a third room, according to the embodiment of the present invention.

Fig. 7C is a cross-sectional view illustrating the behavior of the softening agent flowing into the water receiver tub from the softening-agent automatic flow-out device, according to the embodiment of the present invention.

Fig. 8 is a view illustrating a case where the softening-agent case is positioned near a water feed port, in the washing machine according to the embodiment of the present invention.

Fig. 9 is a view illustrating another cross-sectional structure of the softening-agent introducing-port lid, in the washing machine according to the embodiment of the present invention.

Fig. 10A is a view of the softening-agent introducing-port lid and its

surrounding, in a case where a latch hole is provided at a portion other than the outer peripheral wall of an introducing-port rib, for describing the structure of the latch hole, in the washing machine according to the embodiment of the present invention.

Fig. 10B is a view of the softening-agent introducing-port lid and its surrounding, in a case where a latch hole is provided in the vicinity of the outer peripheral wall of the introducing-port rib, for describing the structure of the latch hole in a comparative example, with respect to the embodiment of the present invention.

Fig. 11 is a view for describing the cross-sectional structure of a conventional washing machine.

Fig. 12 is a perspective view of a softening-agent automatic flow-out device and its surrounding, for describing the structure of a softening-agent case in the conventional washing machine.

Fig. 13 is a view illustrating the cross-sectional structure of the softening-agent automatic flow-out device and its surrounding, for describing the structure of the softening-agent case in the conventional washing machine.

Fig. 14 is a cross-sectional view of the softening-agent automatic flow-out device when it is viewed at its upper surface, for describing the behavior of a softening agent flowing in the softening-agent automatic flow-out device, in the conventional washing machine.

Fig. 15 is a cross-sectional view for describing the movement of the softening agent in the conventional washing machine.

Fig. 16 is a cross-sectional view for describing the movement of the softening agent in the conventional washing machine.

Fig. 17 is a view illustrating an exemplary position of the softening-agent case when a series of operations have been completed, in the conventional washing machine.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Hereinafter, embodiments of the present invention will be described, with reference to the drawings.

Fig. 1 is a view illustrating the cross-sectional structure of washing machine 50 according to an embodiment of the present invention.

Washing machine 50 includes washing-machine outer frame 1 (a main body). Washing-machine outer frame 1 suspends water receiver tub 3 with suspension rods 2. Inside water receiver tub 3, washing/dewatering tub 4 is rotatably provided. Washing/dewatering tub 4 is provided, on its bottom portion, with pulsator 5, such that pulsator 5 is rotatable. Lower blades 6 are provided integrally with pulsator 5. Motor (driving portion) 7 drives pulsator 5 or washing/dewatering tub 4, through V belt 8 and speed reduction mechanism 9.

Lint circulation water path 10 and water-sprinkling nozzle circulation water path 11 are provided, such that they extend from pump chamber 12 around the outer periphery of lower blades 6 for pulsator 5 to upper portions of washing/dewatering tub 4.

Lint filter 13, which is attachable and detachable, and water sprinkling nozzle 14 are provided at upper portions of lint circulation water path 10 and water-sprinkling circulation water path 11, respectively. Drain valve 15 discharges washing water in water receiver tub 3. Water feed valve 16 supplies water to the inside of water receiver tub 3. Upper frame body 17, which forms an upper portion of washing-machine outer frame 1, is provided with lid 18 such that it is openable and, further, this upper frame body 17 is provided in its front side with control portion 19 which controls operations including washing, rinsing and dewatering. Washing/dewatering tub 4 is provided, at its upper portion, with fluid balancer 20 for alleviating vibrations during dewatering. Near the center of fluid balancer 20, there is provided softening-agent automatic flow-out device 21 adapted to flow, therefrom, a softening agent into water receiver tub 3, during rinsing processes.

In order to ensure that tap water is supplied from water feed valve 16 to the inside of washing/dewatering tub 4 in water receiver tub 3, water feed port 16a communicating with water feed valve 16 is placed above opening portion 20a of fluid balancer 20 in washing/dewatering tub 4.

Hereinafter, there will be described the structure of softening-agent case 22 which forms a portion of softening-agent automatic flow-out device 21.

Fig. 2 is a perspective view of softening-agent automatic flow-out device 21 and its surrounding, at a state where softening-agent introducing-port lid 26 is closed, for describing the structure of softening-agent case 22 in washing machine 50 according to the embodiment of the present invention. Fig. 3 is a perspective view of them at a state where softening-agent introducing-port lid 26 is opened.

As illustrated in Fig. 2, softening-agent case 22 can be attached and detached to and from fluid balancer 20, in the direction toward the center of fluid balancer 20. Thus, a user can introduce a softening agent into softening-agent case 22, by disengaging softening-agent case 22 from fluid balancer 20.

Further, as illustrated in Fig. 3, introducing-port rib 25 is provided around softening-agent introducing port 23 which is provided in fluid balancer 20 and is communicated with softening-agent case 22. Introducing-port rib 25 includes inner peripheral wall 25d, outer peripheral wall 25b, and side walls 25c provided between inner peripheral wall 25d and outer peripheral wall 25b. Softening-agent introducing-port lid 26 is provided so as to cover softening-agent introducing port 23, in contact with upper surface 25a of introducing-port rib 25.

Near upper surface 25a of introducing-port rib 25 in fluid balancer 20, that is, near opening of softening-agent introducing port 23, there are provided bearing portions 27 for rotating softening-agent introducing-port lid 26. Bearing portions 27 are placed closer to the center of fluid balancer 20 and also in the circumferential direction.

Shaft portions 26d at the opposite ends of softening-agent introducing-port lid

26 are inserted in bearing portions 27, and softening-agent introducing-port lid 26 is structured to be rotatable in the radial direction of fluid balancer 20. If the user rotates softening-agent introducing-port lid 26 toward the center of washing-machine outer frame 1 by grasping handle portion 26a of softening-agent introducing-port lid 26, softening-agent introducing-port lid 26 opens softening-agent introducing port 23. If the user rotates softening-agent introducing-port lid 26 in the direction opposite from the direction toward the center of washing-machine outer frame 1, softening-agent introducing-port lid 26 closes softening-agent introducing port 23.

Thus, the user can introduce a softening agent into softening-agent case 22 through softening-agent introducing port 23 in fluid balancer 20, by opening softening-agent introducing-port lid 26, without disengaging softening-agent case 22.

Fig. 4 is a view illustrating the cross-sectional structure of softening-agent introducing-port lid 26 and its surrounding, in washing machine 50 according to the embodiment of the present invention.

Fluid balancer 20 is provided with rotation restriction portion 28. Rotation restriction portion 28 restricts the angle of rotation of softening-agent introducing-port lid 26, as illustrated in Fig. 2, Fig. 3 and Fig. 4. Rotation restriction portion 28 restricts softening-agent introducing-port lid 26, in such a way as to prevent softening-agent introducing-port lid 26 from rotating by 180 degrees or more, from the state where softening-agent introducing-port lid 26 closes softening-agent introducing port 23.

Accordingly, as illustrated in Fig. 4, even if softening-agent introducing-port lid 26 is rotated in the direction to the center of washing-machine outer frame 1, softening-agent introducing-port lid 26 stops at a state of being inclined toward softening-agent introducing port 23.

Further, as illustrated in Fig. 3 and Fig. 4, softening-agent introducing-port lid 26 is provided, at its outer peripheral portion 26b, with lid rib 29, such that lid rib 29 is positioned outside of introducing-port rib 25. Lid rib 29 is provided near surface 26c

which contacts with the opening portion of softening-agent introducing port 23 in softening-agent introducing-port lid 26.

Fig. 5 is a view illustrating the cross-sectional structure of a latch portion 30 and its surrounding, when they are viewed from the rotational center of the washing/dewatering tub 4, for describing the structure of latch portion 30 in washing machine 50 according to the embodiment of the present invention.

As illustrated in Fig. 3, Fig. 4 and Fig. 5, latch portion 30 is provided on surface 26c of softening-agent introducing-port lid 26 which faces to softening-agent introducing port 23. In softening-agent introducing port 23, there is provided latch hole 31 in which latch portion 30 latches. Therefore, when softening-agent introducing-port lid 26 closes softening-agent introducing port 23, latch portion 30 latches in latch hole 31, as illustrated in Fig. 5.

Washing machine 50 having the aforementioned structure will be described, with respect to operations thereof.

The user opens lid 18, then introduces to-be-washed object 24, such as clothes, into washing/dewatering tub 4, then turns on a power-supply switch placed on washing-machine outer frame 1 and, then, pushes a start button (not illustrated). Then, motor 7 (the driving portion) rotates washing/dewatering tub 4 in the normal and opposite directions, and the amount of to-be-washed object 24 is detected.

Then, an operation portion (not illustrated) displays, thereon, a required amount of a washing agent. The user introduces a washing agent to a predetermined position (which may be the inside of washing/dewatering tub 4), then opens softening-agent introducing-port lid 26 and introduces a predetermined amount of a softening agent through softening-agent introducing port 23 (the user can introduce the softening agent by disengaging softening-agent case 22). Thereafter, the user closes softening-agent introducing-port lid 26 and, further, closes lid 18, which causes a predetermined amount of tap water to be supplied into washing/dewatering tub 4 from water feed port 16a

through water feed valve 16.

After a predetermined amount of tap water has been supplied thereto, pulsator 5 is rotated in the normal and opposite directions, thereby performing a washing process for washing to-be-washed object 24.

After the completion of the washing process for a predetermined time period, the washing water in water receiver tub 3 is discharged to the outside of washing-machine outer frame 1, through drain valve 15. After the washing water has been discharged, washing/dewatering tub 4 is rotated at a higher speed (for example, 300 rpm) for performing a first dewatering process.

After the completion of the first dewatering process, tap water is supplied thereto, again, and pulsator 5 is rotated in the normal and opposite directions, thereby performing a first rinsing process for rinsing to-be-washed object 24. After the completion of the first rinsing process, the washing water in water receiver tub 3 is discharged to the outside of washing-machine outer frame 1 and, then, a second dewatering process (for example, washing/dewatering tub 4 is rotated at a higher speed with the rotational speed of washing/dewatering tub 4 being 300 rpm) is performed.

Further, tap water is supplied thereto and a final rinsing process is performed. Thereafter, the washing water in water receiver tub 3 is discharged, and a third dewatering process (for example, washing/dewatering tub 4 is rotated at a higher speed with the rotational speed of washing/dewatering tub 4 being 800 rpm) is performed.

After the third dewatering process has been performed, the operation ends.

Next, there will be described the behavior of the softening agent which flows in softening-agent automatic flow-out device 21, during this operation.

Fig. 6 is a cross-sectional view of softening-agent automatic flow-out device 21 when it is viewed at its upper surface, for describing the behavior of the softening agent flowing in softening-agent automatic flow-out device 21, according to the embodiment of the present invention. Further, Fig. 7A is a cross-sectional view illustrating the

behavior of the softening agent moving to first room 48, in softening-agent automatic flow-out device 21. Fig. 7B is a cross-sectional view illustrating the behavior of the softening agent moving to third room 52. Fig. 7C is a cross-sectional view illustrating the behavior of the softening agent flowing into water receiver tub 3 from softening-agent automatic flow-out device 21.

As illustrated in Fig. 6 and Figs. 7A to 7C, softening-agent case 22 is detachably provided, between outer wall 44 and inner wall 45 of softening-agent automatic flow-out device 21 provided in fluid balancer 20. Along therewith, from softening-agent case 22, first room 48 is provided through first movement path 47 and, further, second room 50 is provided through second movement path 49. First room 48, second movement path 49 and second room 50 have downward inclinations in their bottom surfaces, in order to facilitate the flow of the softening agent from first room 48 toward second room 50.

Further, third room 52 is provided through third movement path 51, and softening-agent flow-out port 55 is provided through fourth movement path 53 and flow-out path 54. Third room 52, fourth movement path 53 and flow-out path 54 have downward inclinations in their bottom surfaces, in order to facilitate the flow of the softening agent from third room 52 toward flow-out path 54.

There will be described the movement of the softening agent in the aforementioned structure. At first, the softening agent, which was introduced into softening-agent case 22 at the start of the washing process, moves to first room 48 through first movement path 47, beyond the wall surface of softening-agent case 22, as indicated by arrows a, due to centrifugal forces during the first dewatering process after the completion of the washing process (see Fig. 6 and Fig. 7A).

The softening agent which has moved to first room 48 is kept attached to outer wall 56 of first room 48, due to centrifugal forces, in the area designated by b, until the completion of the first dewatering process. After the completion of the first

dewatering process, namely, during the first rinsing process, the softening agent moves to second room 50 through second movement path 49, due to the inclinations provided in the bottom surfaces of first room 48, second movement path 49 and second room 50, as indicated by arrows c (see Fig. 6).

Next, the softening agent moves to third room 52 through third movement path 51 through the wall surface, as indicated by arrows d, due to centrifugal forces during the second dewatering process after the completion of the first rinsing process. The softening agent which has moved to third room 52 is kept attached to outer wall 57 of third room 52, due to centrifugal forces, in the area designated by e, until the completion of the second dewatering process (see Fig. 6 and Fig. 7B).

After the completion of the second dewatering process, namely, during the final rinsing process, the softening agent passes through fourth movement path 53, as indicated by arrows f, due to the inclinations provided in the bottom surfaces of third room 52 and fourth movement path 53. Further, the softening agent passes through flow-out path 54, as indicated by arrows g, due to the inclinations provided in the bottom surfaces of fourth movement path 53 and flow-out path 54 and, thereafter, the softening agent exits therefrom through softening-agent flow-out port 55 and falls downwardly between water receiver tub 3 and washing/dewatering tub 4, as indicated by arrows h (see Fig. 6 and Fig. 7C).

As described above, in washing machine 50 according to the present embodiment, there is provided softening-agent introducing-port lid 26 which covers softening-agent introducing port 23, above softening-agent introducing port 23 communicating with softening-agent case 22 which stores the softening agent. Accordingly, before the start of an operation and during washing processes, at a state where softening-agent introducing-port lid 26 covers softening-agent introducing port 23, even if water or the like is scattered from above softening-agent introducing port 23, it is possible to prevent the intrusion (water infiltration) of the scattered water or the like

into softening-agent case 22 through softening-agent introducing port 23.

Fig. 8 is a view illustrating a case where softening-agent case 22 is positioned near water feed port 16a, in washing machine 50 according to the embodiment of the present invention.

It will be assumed that, as illustrated in Fig. 8, softening-agent case 22 stays near water feed port 16a, at a state where to-be-washed object 24 has been introduced into washing/dewatering tub 4, up to the vicinity of opening portion 20a of fluid balancer 20. When an operation is started at this state, and tap water W is supplied from water feed port 16a, even if a portion of tap water W is scattered around softening-agent introducing port 23 due to to-be-washed object 24, it is possible to prevent tap water W from intruding into softening-agent introducing port 23 and softening-agent case 22. This can reduce the possibility that the softening agent in softening-agent case 22 mixes with water to reduce the concentration of the softening agent, thereby preventing degradation of predetermined performance of the softening agent.

Further, in washing machine 50 according to the present embodiment, as illustrated in Fig. 3 and Fig. 4, introducing-port rib 25 is provided around softening-agent introducing port 23. Therefore, even if water flows toward softening-agent introducing port 23 from the surrounding of softening-agent introducing port 23, introducing-port rib 25 blocks the water flowing toward softening-agent introducing port 23, which can prevent the intrusion of the water into softening-agent introducing port 23 in the horizontal direction of softening-agent introducing port 23. Further, when tap water W is supplied from water feed port 16a, it is possible to prevent water scattered around softening-agent introducing port 23 from intruding into softening-agent introducing port 23 in the horizontal direction, as well as from above softening-agent introducing port 23. This can further inhibit the softening agent in softening-agent case 22 from mixing with water to reduce the concentration of the

softening agent, which can further prevent the degradation of predetermined performance of the softening agent.

Further, in washing machine 50 according to the present embodiment, as illustrated in Fig. 3 and Fig. 4, softening-agent introducing-port lid 26 is provided with lid rib 29 such that lid rib 29 is placed outside introducing-port rib 25. Therefore, it is possible to block water flowing in the horizontal direction by the two ribs, which are lid rib 29 and introducing-port rib 25, thereby further preventing intrusions of water into softening-agent introducing port 23 in the horizontal direction.

Further, in cases where softening-agent introducing-port lid 26 is made of a resin, such as polypropylene, ABS, polyethylene, polycarbonate, there is the possibility of the occurrence of a gap between introducing-port rib 25 and softening-agent introducing-port lid 26, due to thermal deformations during the forming thereof, deformations during actual use, and the like. However, with washing machine 50 according to the present embodiment, the provision of lid rib 29 can increase the strength of softening-agent introducing-port lid 26 against deformations, thereby reducing the possibility of deformations of softening-agent introducing-port lid 26. This can enhance the intimate contact between softening-agent introducing-port lid 26 and upper surface 25a of introducing-port rib 25, thereby further preventing intrusions of water into softening-agent introducing port 23 in the horizontal direction.

As described above, with washing machine 50 according to the present embodiment, it is possible to further inhibit the softening agent in softening-agent case 22 from mixing with water to reduce the concentration of the softening agent, thereby further preventing degradation of predetermined performance of the softening agent.

Fig. 9 is a view illustrating another cross-sectional structure of softening-agent introducing-port lid 26, in washing machine 50 according to the embodiment of the present invention.

As illustrated in Fig. 9, softening-agent introducing-port lid 26 can be shaped

to be substantially convex in the vertically upward direction. With this structure, it is possible to make softening-agent introducing-port lid 26 have a reduced plane portion, thereby increasing the strength thereof against deformations. This can further prevent the deformation of softening-agent introducing-port lid 26. Further, this can further enhance the intimate contact between softening-agent introducing-port lid 26 and upper surface 25a of introducing-port rib 25, thereby further preventing intrusions of water into softening-agent introducing port 23 in the horizontal direction.

Further, water dropped onto the upper surface of softening-agent introducing-port lid 26 will flow down from softening-agent introducing-port lid 26, which suppresses the accumulation of dropped water on the upper surface of softening-agent introducing-port lid 26. This can reduce the possibility of existence of water near softening-agent introducing port 23, thereby reducing the possibility of intrusions of water into softening-agent introducing port 23.

Further, in washing machine 50 according to the present embodiment, as illustrated in Fig. 4 and Fig. 5, softening-agent introducing-port lid 26 is provided with latch portion 30 on its surface 26c which faces to softening-agent introducing port 23, while, in softening-agent introducing port 23, there is provided latch hole 31 in which latch portion 30 latches. Therefore, when softening-agent introducing-port lid 26 closes softening-agent introducing port 23, latch portion 30 latches in latch hole 31, which enhances the intimate contact between softening-agent introducing-port lid 26 and upper surface portion 25a of introducing-port rib 25. Further, as illustrated in Fig. 5, when latch hole 31 is formed to be a hole in the downward direction, latch hole 31 can be formed using a vertical trimming mold, as a mold for use in forming therefor, for example, which eliminates the necessity of forming softening-agent introducing-port lid 26 using a lateral slidable mold. This offers large advantages in terms of manufacturing and costs.

Further, in the event that a large amount of water flows to the vicinity of

softening-agent introducing port 23, it is possible to prevent softening-agent introducing-port lid 26 from being pushed upwardly by the water flowing thereto to be separated from introducing-port rib 25. This can reduce the amount of water which intrudes into softening-agent introducing port 23 between the surfaces of softening-agent introducing-port lid 26 and upper surface portion 25a of introducing-port rib 25 which contact with each other, thereby further reducing the possibility of intrusions of water into softening-agent introducing port 23.

Fig. 10A is a view for describing the structure of latch hole 31, in washing machine 50 according to the embodiment of the present invention. Further, Fig. 10B is a view for describing the structure of latch hole 41 in a comparative example, with respect to the embodiment of the present invention.

In the comparative example illustrated in Fig. 10B, latch hole 41 is formed in outer peripheral wall 25b of introducing-port rib 25. In this case, due to effects of centrifugal forces caused by the high-speed rotations of washing/dewatering tub 4, during the first dewatering process, the softening agent in softening-agent case 22 may flow reversely to above softening-agent introducing port 23 through latch hole 41, which induces the possibility that a predetermined amount of the softening agent can not flow through softening-agent automatic flow-out device 21, thereby making it difficult to provide predetermined performance of the softening agent.

However, in the present embodiment, as illustrated in Fig. 3, Fig. 4, Fig. 5 and Fig. 10A, latch hole 31 is formed near inner peripheral wall 25d or side walls 25c of introducing-port rib 25. This can prevent the softening agent from flowing reversely into softening-agent introducing port 23 through latch hole 31, during the first dewatering process. This allows a predetermined amount of the softening agent to flow through softening-agent automatic flow-out device 21, thereby providing predetermined performance of the softening agent.

Further, with washing machine 50 according to the present embodiment, as

illustrated in Fig. 2 and Fig. 3, there are provided bearing portions 27 for rotating softening-agent introducing-port lid 26, near upper surface 25a of introducing-port rib 25. This enables placing softening-agent introducing-port lid 26 and shaft portions 26d of softening-agent introducing-port lid 26, above softening-agent introducing port 23. This enables structuring softening-agent case 22 in softening-agent automatic flow-out device 21, such that softening-agent case 22 can be attached thereto and detached therefrom.

Accordingly, even when softening-agent automatic flow-out device 21 is positioned in the rear side of washing-machine outer frame 1, namely below rear surface 17b of opening portion 17a of upper frame body 17 as illustrated in Fig. 8 and, therefore, softening-agent automatic flow-out device 21 stays at a position which makes it hard to introduce the softening agent into softening-agent introducing port 23 from thereabove, the user can introduce the softening agent therein, by detaching and attaching softening-agent case 22. This can suppress intrusions of water through the upper surface of softening-agent introducing port 23 during washing processes, while maintaining usability equivalent to that of conventional structures.

Further, in washing machine 50 according to the present embodiment, as illustrated in Fig. 2 and Fig. 3, shaft portions 26d of softening-agent introducing-port lid 26 are placed in the side of softening-agent introducing-port lid 26 which is closer to the center of fluid balancer 20 and also in the circumferential direction and, further, there is provided rotation restriction portion 28 for restricting softening-agent introducing-port lid 26 in such a way as to prevent softening-agent introducing-port lid 26 from rotating by 180 degrees or more. Accordingly, even when softening-agent introducing-port lid 26 is opened, as illustrated in Fig. 4, softening-agent introducing-port lid 26 inclines toward softening-agent introducing port 23. Therefore, when the user introduces a softening agent into softening-agent introducing port 23, even if the user flows the softening agent onto softening-agent introducing-port lid 26, the softening agent flows

toward softening-agent introducing port 23. Accordingly, even if the user flows the softening agent onto softening-agent introducing-port lid 26, as well as into softening-agent introducing port 23, the softening agent flows into softening-agent introducing port 23, which increases the area for use in introducing the softening agent. This makes it easier to introduce the softening agent, thereby improving the usability.

Further, even if the user forgets to close softening-agent introducing-port lid 26 after intruding the softening agent into softening-agent introducing port 23, softening-agent introducing-port lid 26 can not be opened by 180 degrees or more. Further, shaft portions 26d of softening-agent introducing-port lid 26 are placed in the side of softening-agent introducing-port lid 26 which is closer to the center of fluid balancer 20 and, also, in the circumferential direction. Therefore, even if the user forgets to close softening-agent introducing-port lid 26, softening-agent introducing-port lid 26 moves to close the upper surface of softening-agent introducing port 23, when softening-agent introducing-port lid 26 experiences centrifugal forces during the first dewatering process after the washing process.

Further, as illustrated in Fig. 3 and Fig. 4, softening-agent introducing-port lid 26 is provided with lid rib 29, on outer side 26b or the inner side of its surface which contacts with softening-agent introducing port 23. Therefore, lid rib 29 forms a wall, when the softening agent is flowed onto softening-agent introducing-port lid 26. This can suppress leakage of the softening agent from softening-agent introducing-port lid 26.

As described above, according to the present invention, it is possible to provide predetermined performance of a softening agent during rinsing processes, and, therefore, the present invention is usable in applications for commercial washing machines and the like, as well as professional-use washing machines.

What is claimed is:

1. A washing machine comprising:
 - a main body;
 - a water receiver tub placed in the main body and comprising a rotatable washing/dewatering tub, inside thereof;
 - a pulsator placed rotatably on a bottom portion of the washing/dewatering tub;
 - a fluid balancer provided at an upper portion of the washing/dewatering tub;
 - a softening-agent automatic flow-out device placed in the fluid balancer and adapted to flow, therefrom, a softening agent into the water receiver tub during a rinsing process;
 - a control portion adapted to control an operation including washing, rinsing and dewatering;
 - a softening-agent introducing port provided in the fluid balancer and communicating with the softening-agent automatic flow-out device;
 - a softening-agent introducing-port lid adapted to cover an opening portion of the softening-agent introducing port; and
 - a bearing portion adapted to allow the softening-agent introducing-port lid to rotate, near the opening portion of the softening-agent introducing port.
2. The washing machine according to Claim 1, wherein
 - the bearing portion is placed in a center side of the fluid balancer and in a circumferential direction, and
 - the washing machine further comprises
 - a rotation restriction portion adapted to prevent the softening-agent introducing-port lid from rotating by 180 degrees or more.
3. The washing machine according to Claim 2, further comprises

a lid rib provided near a surface of the softening-agent introducing-port lid and adapted to contact with the opening portion of the softening-agent introducing port.