

DESCRIPTION

Title Of Invention: AUXILIARY AGENT UNIT, AND WASHING MACHINE

5 TECHNICAL FIELD

[0001] The present disclosure relates to an auxiliary agent unit and a washing machine.

BACKGROUND ART

10 [0002] Conventionally, there has been proposed a washing machine including a storage bag enclosing small pieces of silver crystal material kneaded with silver ions. The storage bag of the washing machine has a mesh shape to allow water to pass therethrough, encloses the water-soluble silver crystal material, and is attached to a water feed path of the washing machine (see, for example, Patent Literature 1).

Citation List

15 Patent Literature

[0003] PTL 1: Unexamined Japanese Patent Publication No. 2010-119633

SUMMARY OF THE INVENTION

20 [0004] The present disclosure provides an auxiliary agent unit and a washing machine that can stably impart an auxiliary action to laundry.

[0005] An auxiliary agent unit according to the present disclosure encloses a water-soluble auxiliary agent and is configured to be attachable to a washing machine, the auxiliary agent unit including a first opening through which water is introduced into the auxiliary agent unit and a second opening through which the water is drained from the
25 auxiliary agent unit. Furthermore, at least one of the first opening and the second opening is provided with a mesh structure formed in a mesh.

[0006] In addition, the washing machine according to the present disclosure includes the auxiliary agent unit described above, a detergent case provided with an auxiliary agent unit housing that detachably houses the auxiliary agent unit, and a water feeder that feeds water
30 to the auxiliary agent unit from the upper side.

[0007] The auxiliary agent unit and the washing machine according to the present disclosure can stably impart the auxiliary action to laundry.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Fig. 1 is a longitudinal sectional view of a washing machine in a first exemplary embodiment 1.

5 Fig. 2 is an exploded perspective view around an upper frame body of the washing machine in the first exemplary embodiment.

Fig. 3 is a longitudinal sectional view around a detergent case of the washing machine in the first exemplary embodiment.

Fig. 4A is a top view of a water pouring device lid of the washing machine in the first exemplary embodiment.

10 Fig. 4B is a top view of a water pouring structure of the washing machine in the first exemplary embodiment.

Fig. 4C is a top view of the detergent case of the washing machine in the first exemplary embodiment.

15 Fig. 5 is a cross sectional view showing around a silver crystal unit housing of the washing machine in the first exemplary embodiment.

Fig. 6A is an external perspective view showing around the silver crystal unit housing in a state where a silver crystal unit is removed from the washing machine in the first exemplary embodiment.

20 Fig. 6B is an external perspective view showing around the silver crystal unit housing in a state where the silver crystal unit is attached to the washing machine in the first exemplary embodiment.

Fig. 7A is an external perspective view of a storage case lid of a storage case of the washing machine in the first exemplary embodiment in a closed state.

25 Fig. 7B is an external perspective view of the storage case lid of the storage case of the washing machine in the first exemplary embodiment in an opened state.

Fig. 8A is a top view of the storage case of the washing machine in the first exemplary embodiment.

Fig. 8B is a sectional view taken along a line 8B-8B in Fig. 8A.

Fig. 8C is a sectional view taken along a line 8C-8C in Fig. 8A.

30 Fig. 9A is a top view of the silver crystal unit of the washing machine in the first exemplary embodiment.

Fig. 9B is a bottom view of the silver crystal unit of the washing machine in the first exemplary embodiment.

Fig. 9C is a sectional view taken along a line 9C-9C in Fig. 9A.

Fig. 10 is a schematic view 10 showing a flow of water flowing into the silver crystal unit in a longitudinal section around the detergent case of the washing machine in the first exemplary embodiment.

5 Fig. 11 is a schematic view showing a flow of water flowing into the silver crystal unit in a cross section around the detergent case of the washing machine in the first exemplary embodiment.

10 Fig. 12A is a sectional view taken along a line 12A-12A in Fig. 9A, showing a state where silver crystals are filled in the silver crystal unit of the washing machine in the first exemplary embodiment.

Fig. 12B is a sectional view taken along a line 12B-12B in Fig. 9A, showing a state where there is only a small amount of silver crystals remaining in the silver crystal unit of the washing machine in the first exemplary embodiment.

15 Fig. 13 is a schematic view showing a flow of water flowing into a silver crystal unit in a cross section around a detergent case of a washing machine in a second exemplary embodiment.

Fig. 14 is a sectional view of a storage case of the washing machine in the second exemplary embodiment.

20 Fig. 15 is a schematic view showing a flow of water flowing into a silver crystal unit in a cross section around a detergent case of a washing machine in a third exemplary embodiment.

DESCRIPTION OF EMBODIMENTS

25 **[0009]** Hereinafter, exemplary embodiments are described in detail with reference to the accompanying drawings. Note that the attached drawings and the following description are provided for those skilled in the art to fully understand the present disclosure, and are not intended to limit the subject matter as described in the appended claims.

[0010] (First exemplary embodiment)

30 Hereinafter, a washing machine according to a first exemplary embodiment is described with reference to Figs. 1 to 12B.

[0011] (Configuration of washing machine)

Fig. 1 is a longitudinal sectional view of a washing machine according to the first exemplary embodiment.

[0012] As shown in FIG. 1, water tank 4 for storing water during washing is provided inside washing machine body 1, and washing and dewatering tank 3 for housing clothes is rotatably provided inside water tank 4. Pulsator 5 that agitates the clothes during washing and rinsing is provided below washing and dewatering tank 3. Pulsator 5 rotates about the axis of washing and dewatering tank 3 in a rotation direction and a counter-rotation direction to agitate the clothes in washing and dewatering tank 3.

[0013] Upper frame body 2 is disposed on the upper part of washing machine body 1. Operation display 31 is provided on the rear upper part of upper frame body 2, and controller 7 is provided below operation display 31. A plurality of water feed valves 80 connected to an external water faucet (not shown) by a water feed hose (not shown) are provided inside the rear part of upper frame body 2. Water feed valves 80 are configured to make a water passage provided inside openable, and each water feed valve 80 is independently driven to open and close by an electromagnetic force.

[0014] Clothes loading port 2a for communicating washing and dewatering tank 3 with the outside is formed in the central part of upper frame body 2. Clothes loading port 2a is covered with lid body 6 in an openable and closable manner. In a state where lid body 6 is opened, a user can take laundry in and out of washing and dewatering tank 3 through clothes loading port 2a.

[0015] (Water pouring device and detergent case)

Fig. 2 is an exploded perspective view around the upper frame body of the washing machine in the first exemplary embodiment.

[0016] As shown in Fig. 2, detergent case housing 12 is disposed in the rear upper part of upper frame body 2, and detergent case 9 is detachably housed in detergent case housing 12. Above detergent case 9, there is provided water pouring device 11 that introduces tap water through water feed valve 80 described above and pours the water into detergent case 9 housed in detergent case housing 12. The water poured from water pouring device 11 into detergent case 9 passes through the inside of detergent case 9, is discharged into detergent case housing 12, and is poured into water tank 4.

[0017] Detergent case 9 has a box shape that opens upward. Grip 9d that can be gripped by a user is provided on the front side of detergent case 9. Grip 9d is made flush with clothes loading port 2a disposed in upper frame body 2 in a state where detergent case 9 is housed in detergent case housing 12.

[0018] Detergent case 9 is disposed with, in the inside thereof, powder detergent

dispenser 9a into which powder detergent is poured, liquid detergent dispenser 9b into which liquid detergent is poured, and softener dispenser 9c into which softener is poured. Silver crystal unit housing 16 to which silver crystal unit 15 is detachably attached is disposed on the rear side of softener dispenser 9c. Silver crystal unit 15 and silver crystal unit housing 16 are described later.

[0019] Fig. 3 is a longitudinal sectional view around the detergent case of the washing machine in the first exemplary embodiment. Fig. 4A is a top view of a water pouring device lid of the washing machine in the first exemplary embodiment. Fig. 4B is a top view of a water pouring structure of the washing machine in the first exemplary embodiment. Fig. 4C is a top view of the detergent case of the washing machine in the first exemplary embodiment.

[0020] As shown in Figs. 3, 4A, and 4B, water pouring device 11 includes water filling device lid 11a which is the upper surface and a water filling structure 11b which is the lower surface. Water pouring device lid 11a is provided with, as water feed ports through which water is introduced from water feed valve 80, water feed port 8a for powder detergent dispenser and water feed port 8b for liquid detergent dispenser connected to first water feed valve 81 (see Fig. 2), and water feed port 8c for softener dispenser connected to second water feed valve 82 (see Fig. 2). The water introduced from respective water feed ports flows down to water pouring structure 11b.

[0021] Water pouring structure 11b has a box shape, and has an inside thereof partitioned into small rooms so as to respectively correspond to powder detergent dispenser 9a, liquid detergent dispenser 9b, and softener dispenser 9c and silver crystal unit housing 16. The small room corresponding to softener dispenser 9c and silver crystal unit housing 16 is a common small room. Each of the small rooms are provided with a respective one of a plurality of nozzles communicating with the lower side to make water fall into detergent case 9. In the small rooms, each of powder detergent nozzle 13a, liquid detergent nozzle 13b, softener nozzle 14, and silver crystal nozzle 10 is provided to a corresponding one of powder detergent dispenser 9a, liquid detergent dispenser 9b, softener dispenser 9c, and silver crystal unit housing 16. As a result, water pouring structure 11b can independently feed water to powder detergent dispenser 9a, liquid detergent dispenser 9b, and softener dispenser 9c and silver crystal unit housing 16.

[0022] As shown in Figs. 3 and 4B, the inside of water feed valve 80 (see Fig. 2) and the small rooms are provided as water passages each having a wide width. On the other hand,

each of detergent nozzles 13, softener nozzle 14, and silver crystal nozzle 10 is provided as a hole having a small diameter. This configuration causes the flow speed to increase due to the Venturi effect when the water passes through the nozzles, and thus can increase the force of water falling into detergent case 9.

5 **[0023]** Further, silver crystal nozzle 10 includes first nozzle 10a having a large diameter and second nozzle 10b having a small diameter. First nozzle 10a and second nozzle 10b are disposed on a straight line in the front-rear direction.

10 **[0024]** As shown in Fig. 4C, powder detergent discharge port 30a that opens downward is provided at the center of powder detergent dispenser 9a, and detergent water containing the dissolved detergent is discharged downward.

15 **[0025]** Liquid detergent dispenser 9b and softener dispenser 9c are each provided with siphon structure 30b. When the liquid accumulated inside siphon structure 30b reaches a predetermined liquid level, the liquid is sucked up by the siphon phenomenon and discharged downward. That is, when a predetermined amount of water is fed from the
nozzle, the liquid detergent or softener dissolved in the water is conveyed downward by
siphon structure 30b and discharged to detergent case housing 12.

20 **[0026]** Silver crystal unit housing discharge port 30c is disposed in the inner bottom of silver crystal unit housing 16 and discharges water drained from silver crystal unit 15 downward.

20 **[0027]** (Silver crystal unit housing)

Fig. 5 is a cross sectional view showing around the silver crystal unit housing of the washing machine in the first exemplary embodiment. Fig. 6A is an external perspective view showing around the silver crystal unit housing in a state where the silver crystal unit is removed from the washing machine in the first exemplary embodiment. Fig. 6B is an
25 external perspective view showing around the silver crystal unit housing in a state where the silver crystal unit is attached to the washing machine in the first exemplary embodiment.

30 **[0028]** As shown in Figs. 5, 6A, and 6B, silver crystal unit housing 16 has a substantially box shape and is configured such that silver crystal unit 15 is detachable thereto.

30 **[0029]** On the inner peripheral wall of silver crystal unit housing 16, a plurality of inclined ribs 16c each of which extends vertically are disposed. Inclined rib 16c has a shape that protrude more toward the lower side, and smoothly guides silver crystal unit 15 when silver crystal unit 15 is inserted downward. The vertical end surface of inclined rib

16c abuts on silver crystal unit 15 in a state where silver crystal unit 15 is completely inserted into silver crystal unit housing 16. As a result, silver crystal unit 15 is held in silver crystal unit housing 16 and does not fall even when detergent case 9 is inverted.

[0030] In addition, silver crystal unit 15 is provided with hinge 22 to be described later,

5 and silver crystal unit housing 16 is provided with silver crystal unit housing side claw 16b. Hinge 22 not only functions as a hinge structure but also is configured to be engageable with silver crystal unit housing side claw 16b. When the user inserts silver crystal unit 15 into silver crystal unit housing 16, hinge 22 is engaged with silver crystal unit housing side claw 16b. As a result, silver crystal unit 15 is attached to silver crystal
10 unit housing 16.

[0031] Note that either one or both of the holding of silver crystal unit 15 by inclined rib 16c and the mounting of silver crystal unit 15 by hinge 22 may be provided.

[0032] In addition, silver crystal unit 15 has screw boss 23 (described later) protruding on one side surface, and has the entire shape that is not point-symmetric. In addition, silver
15 crystal unit housing 16 is provided with cutout 16a at a position facing screw boss 23 so as not to interfere with screw boss 23. By inserting screw boss 23 into cutout 16a, silver crystal unit 15 is positioned so as to be in a normal position (described later) with respect to silver crystal unit housing 16, that is, a correct storage position. Therefore, when silver crystal unit 15 is attached to the silver crystal unit housing by the user, silver crystal unit
20 15 can be prevented from being attached in an incorrect direction. Note that the positioning structure provided in silver crystal unit 15 may not be screw boss 23.

[0033] (Silver crystal unit)

Fig. 7A is an external perspective view of a storage case lid of a storage case of the washing machine in the first exemplary embodiment in a closed state. Fig. 7B is an
25 external perspective view of the storage case lid of the storage case of the washing machine in the first exemplary embodiment in an opened state.

[0034] Silver crystal unit 15 mainly includes silver crystals 29 (described later), storage case 18 that stores silver crystals 29, and storage case lid 19.

[0035] Silver crystals 29 are made of material in which a silver component having an
30 antibacterial action is kneaded into water-soluble diboron trioxide (B₂O₃), and are a large number of small granular pieces. Silver crystals 29 each has a large surface area and easily dissolved in water by having a granular shape. Silver crystals 29 are eluted by being immersed in water and releases antibacterial silver ions into water. Thus, silver crystals 29

serve as an auxiliary agent that generates silver ion water to impart the antibacterial action to laundry.

[0036] Storage case 18 has a box shape whose upper side is opened, and is covered with storage case lid 19. Storage case lid 19 is connected to storage case 18 by hinge 22

5 configured to be bendable.

[0037] Storage case lid 19 is provided with fitting claw projection 25 on the outer side of the side surface. Meanwhile, storage case 18 is provided with, on the inner side of the side surface near the opening, fitting claw recess 26 at a position facing fitting claw projection 25. With these configurations, in a state where storage case lid 19 is closed, fitting claw
10 projection 25 and fitting claw recess 26 are engaged with each other, and storage case lid 19 is temporarily fixed to storage case 18.

[0038] Storage case lid 19 is disposed so as to protrude laterally and has screw boss 23 extending downward. Screw boss 23 and screw seat 24 are disposed on the opposite side of hinge 22. Screw boss 23 is provided with screw hole 23a for being screwed from below. In
15 the temporarily fixed state, storage case lid 19 is fixed to storage case 18 with screw 24a at screw seat 24 and screw boss 23.

[0039] As described above, in the state where storage case lid 19 is closed, fitting claw projection 25 and fitting claw recession 26 are engaged with each other to be temporarily fixed. Therefore, when screw 24a is screwed into screw hole 23a of screw boss 23, storage
20 case lid 19 can be prevented from opening by itself. Therefore, workability at the time of enclosing silver crystals 29 in storage case 18 is good.

[0040] Fig. 8A is a top view of the storage case of the washing machine in the first exemplary embodiment. Fig. 8B is a sectional view taken along a line 8B-8B in Fig. 8A. Fig. 8C is a sectional view taken along a line 8C-8C in Fig. 8A. Fig. 9A is a top view of
25 the silver crystal unit of the washing machine in the first exemplary embodiment. Fig. 9B is a bottom view of the silver crystal unit of the washing machine in the first exemplary embodiment. Fig. 9C is a sectional view taken along a line 9C-9C in Fig. 9A.

[0041] Storage case lid 19 is provided with first opening 20 that introduces water into silver crystal unit 15, and storage case bottom surface 28 which is a bottom surface of
30 storage case 18 is provided with second opening 21 that drains the water. As a result, silver crystal unit 15 discharges silver ion water, which is generated by immersing the introduced water in silver crystals 29, downward from second opening 21.

[0042] Second opening 21 is disposed so as not to be vertically below first opening 20,

and has an opening area larger than that of first opening 20. First opening 20 is disposed on the end side of the substantially center of storage case lid 19, and partially overlaps with second opening 21.

[0043] Storage case bottom surface 28 of storage case 18 is inclined downward. As a result, silver crystals 29 inside the storage case moves downward by its own weight and easily accumulates at the lower part of the inclination.

[0044] As shown in Fig. 9C, each of first opening 20 and second opening 21 is integrally molded with water passing member 27 by insert molding such that water passing member 27 covers the opening. Water passing member 27 is made of material different from that of storage case 18 and has a mesh shape with the number of meshes of about 100. As a result, water passing member 27 allows water to pass therethrough and does not allow silver crystals 29 having the size more than or equal to a certain size to pass therethrough. In addition, each of silver crystals 29 gradually decreases in size by dissolving in water, and silver crystals 29 dissolved to a size that can pass through the meshes of water passing member 27 are not visually recognized by the user.

[0045] Operations and functions of the washing machine and the silver ion elution device configured as described above are described below.

[0046] (Washing operation)

The user opens lid body 6, puts clothes into washing and dewatering tank 3, operates operation display 31 to set an operation content, and causes controller 7 to start a washing operation. A user pours an amount of powder detergent or liquid detergent corresponding to the amount of clothes into detergent case 9.

[0047] When a washing step starts, controller 7 opens first water feed valve 81 and introduces water into water pouring device 11 via water feed port 8a for powder detergent dispenser and water feed port 8b for liquid detergent dispenser, and water pouring device 11 pours water into powder detergent dispenser 9a and liquid detergent dispenser 9b via powder detergent nozzle 13a and liquid detergent nozzle 13b of detergent nozzle 13. The detergent in detergent case 9 dissolves in water, is discharged to detergent case housing 12, and is poured into water tank 4 and washing and dewatering tank 3 together with the water. When a predetermined amount of water is fed, controller 7 closes first water feed valve 81 and causes pulsator 5 to stir clothes housed in washing and dewatering tank 3 to perform washing and stirring. When the washing step is completed, a rinsing step starts.

[0048] When the rinsing step starts, a first rinsing operation starts. Note that the first

rinsing operation may be performed a plurality of times. In the first rinsing operation, first water feed valve 81 is opened to pour water into powder detergent dispenser 9a and liquid detergent dispenser 9b, which are empty, and water not containing a softener and silver ions is supplied to water tank 4 and washing and dewatering tank 3. Subsequently, stirring of the clothes by pulsator 5 is started, and components of the detergent adhering to the clothes are washed away.

[0049] In order to cause water pouring device 11 to feed water to softener dispenser 9c and silver crystal unit housing 16, controller 7 opens second water feed valve 82 and feeds water to softener nozzle 14 and silver crystal nozzle 10. The water discharged downward from softener nozzle 14 dissolves the softener put into softener dispenser 9c, is carried by siphon structure 30b, and is discharged to detergent case housing 12. The water discharged downward from silver crystal nozzle 10 passes through silver crystal unit 15 to become silver ion water as described later, and is discharged to detergent case housing 12. The water containing softener and silver ions discharged to detergent case housing 12 is poured into water tank 4 and washing and dewatering tank 3. Subsequently, stirring of the clothes by pulsator 5 is started, and the softener and silver ions are adhered to the clothes. When the final rinsing operation is completed, the rinsing step is completed.

[0050] Because the silver ions are cations, the silver ions have a property of being easily attached to general clothing including a negatively polarized molecular structure. However, when the detergent containing an anion surfactant is simultaneously charged, an interaction acts between the silver ions and the anionic surfactant, so that the amount of silver ions attached to the clothes decreases.

[0051] On the other hand, when the softener containing a cationic surfactant is simultaneously charged as in the present exemplary embodiment, a synergistic effect is exerted, and the softener can be firmly attached to the clothes. Therefore, by causing water pouring device 11 to fill water to softener dispenser 9c and silver crystal unit housing 16, the antibacterial action by the silver ions can be efficiently obtained.

[0052] (Operation around silver crystal unit)

Fig. 10 is a schematic view showing a flow of water flowing into the silver crystal unit in a longitudinal section around the detergent case of the washing machine in the first exemplary embodiment. Fig. 11 is a schematic view showing a flow of water flowing into the silver crystal unit in a cross section around the detergent case of the washing machine in the first exemplary embodiment.

[0053] When second water feed valve 82 is opened, water is introduced into water pouring device 11. The water introduced into water pouring device 11 is discharged downward from first nozzle 10a and second nozzle 10b which are silver crystal nozzles 10, and is supplied to silver crystal unit 15 through water passing member 27.

5 [0054] As shown in Fig. 11, silver crystal nozzle 10 is provided as a hole having a small diameter. In general, the width of water flow of the water discharged from the hole gradually increases as the water moves away from the hole.

[0055] The silver crystal unit 15 is configured such that a distance between water passing member 27 and silver crystal nozzle 10 is close (about 5 mm). As a result, the water
10 discharged from silver crystal nozzle 10 reaches water passing member 27 before the width of water flow increases. The water flow having a narrow width can be efficiently supplied into silver crystal unit 15 through fine meshes of water passing member 27 without colliding with water passing member 27 and scattering to the surroundings.

[0056] As shown in Fig. 10, water poured from first nozzle 10a having a large diameter
15 and second nozzle 10b having a small diameter collides with silver crystals 29 in storage case 18 to form a turbulent flow, and wets silver crystals 29 uniformly to turn the silver crystals into silver ion water. As described above, because the whole of silver crystals 29 is uniformly exposed to water every time the water is poured, the concentration of silver ion water can be kept constant in each washing operation.

20 [0057] As shown in Fig. 11, silver crystals 29 are moved inside storage case 18 by the water flow. As a result, silver crystals 29 are uniformly in contact with water, rub against the grains of other silver crystals 29 or the inner wall of storage case 18, and quickly dissolve in water. In this manner, by filling storage case 18 with silver crystals 29 so as to have a gap between silver crystals 29, silver crystals 29 are uniformly immersed in water.

25 [0058] Further, the water introduced into silver crystal unit 15 from first opening 20 does not linearly fall, but flows down while bypassing the inside of storage case 18 and reaches second opening 21. As described above, by disposing second opening 21 not vertically below first opening 20, silver crystals 29 and water can be brought into contact with each other over a distance longer than the longitudinal dimension of storage case 18. By this
30 action, the water can be uniformly brought into contact with the whole of silver crystals 29, so that silver ion water having a high concentration can be stably generated every time the washing operation is performed.

[0059] As shown in Fig. 11, the silver ion water generated in silver crystal unit 15 is

discharged from second opening 21. In the present exemplary embodiment, by providing second opening 21 with a size larger than a size of first opening 20, the amount of water fed is suppressed from exceeding the amount of water drained, and the overflowing of the water from the upper part of silver crystal unit 15 is suppressed.

5 **[0060]** (Decrease of silver crystals and replacement of silver crystal unit)

Fig. 12A is a sectional view taken along a line 12A-12A in Fig. 9A, showing a state where silver crystals are filled in the silver crystal unit of the washing machine in the first exemplary embodiment. Fig. 12B is a sectional view taken along a line 12B-12B in Fig. 9A, showing a state where there is only a small amount of silver crystals remaining in the silver crystal unit of the washing machine in the first exemplary embodiment.

10 **[0061]** Because silver crystals 29 are water-soluble, the silver crystals gradually decrease in amount every time the washing operation is performed. As shown in Figs. 12A and 12B, because storage case bottom surface 28 of storage case 18 is inclined, a small amount of silver crystals 29 remaining is likely to be accumulated in a lower part of the inclination. In addition, as shown in Fig. 10, storage case bottom surface 28 of storage case 18 is inclined downward in a direction in which first nozzle 10a from which a large amount of water is discharged is disposed. Therefore, a small amount of remaining silver crystals 29 can be efficiently dissolved in water.

20 **[0062]** As the elution of silver ions progresses, the amount of silver crystals 29 gradually decreases, and when the amount of silver crystals 29 decreases to less than or equal to a certain level, an antibacterial effect on the laundry clothes also decreases. Therefore, the user can maintain the antibacterial performance of the washing machine by replacing silver crystal unit 15 with a new one at an appropriate timing.

25 **[0063]** Because the amount of decrease of silver crystals 29 correlates with the number of times of performing the washing operation, the recommended number of times of washing before replacing silver crystal unit 15 is experimentally obtained. In the washing machine according to the present exemplary embodiment, controller 7 counts the number of times of performing the washing operation, and when the number of times of performing the washing operation reaches the recommended number of times of washing before replacement, a light emitting diode (LED, not shown) of operation display 31 blinks. As a result, because the user can confirm the remaining amount of silver crystals 29 without visually observing the inside of silver crystal unit 15, a window configured to allow visual recognition of the inside of silver crystal unit 15 is not necessarily provided.

[0064] Further, operation display 31 may notify the remaining usable number of times of silver crystal unit 15. Accordingly, because the user can grasp the time of replacing silver crystal unit 15 early, the user can prepare silver crystal unit 15 for replacement in advance.

[0065] (Actions and others)

5 As described above, silver crystal unit 15 in the present exemplary embodiment includes first opening 20 that encloses water-soluble silver crystal 29, is configured to be attachable to the washing machine, and through which water is introduced into silver crystal unit 15, and second opening 21 through which water is drained from silver crystal unit 15, and first opening 20 and/or second opening 21 are provided with water passing
10 member 27 having a mesh shape.

[0066] With this configuration, the water can pass through silver crystal unit 15, and even silver crystals 29 having a small grain size can be prevented from leaking from second opening 21.

[0067] This allows small-sized silver crystals 29 that easily dissolve in water to be
15 adopted, and thus the silver ion water having a constant concentration can be stably generated in each washing operation.

[0068] As in the present exemplary embodiment, second opening 21 may be provided so as not to face first opening 20.

[0069] With this configuration, the water introduced from first opening 20 does not
20 linearly pass through the inside of silver crystal unit 15, but is discharged from second opening through a long distance, and the water can uniformly permeate the whole of silver crystals 29.

[0070] This allows the silver ion concentration to be kept substantially constant in each washing operation, and thus the antibacterial action can be stably obtained.

25 **[0071]** As in the present exemplary embodiment, in the direction in which silver crystal unit 15 is attached to the washing machine, first opening 20 may be provided on the upper surface of silver crystal unit 15, second opening 21 may be provided on the lower surface of silver crystal unit 15, and second opening 21 may be disposed so as to partially overlap the position where first opening 20 is projected downward.

30 **[0072]** With this configuration, even when the areas of the upper surface and the lower surface of silver crystal unit 15 are small, the water introduced from first opening 20 can pass through a long distance and be discharged from the second opening.

[0073] Therefore, even if the areas of the upper surface and the lower surface of silver

crystal unit 15 are made small, a high antibacterial action can be obtained, and thus silver crystal unit 15 can be downsized.

[0074] As in the present exemplary embodiment, the area of second opening 21 may be larger than the area of first opening 20.

5 [0075] With this configuration, the amount of water that can be discharged can be set to be larger than the amount of water that can be introduced.

[0076] Therefore, the water introduced from first opening 20 can be reliably drained from second opening 21.

10 [0077] As in the present exemplary embodiment, silver crystal unit 15 may include storage case 18 and silver crystals 29 enclosed in storage case 18, and water passing member 27 may be configured as a component separate from storage case 18.

[0078] With this configuration, because a member with fine meshes can be adopted as water passing member 27, the grain size of silver crystals 29 can be reduced.

15 [0079] As in the present exemplary embodiment, storage case bottom surface 28 of silver crystal unit 15 may be provided with second opening 21 and have an inclined shape, and second opening 21 may be provided at a position that is a lower part in the inclination of storage case bottom surface 28.

20 [0080] With this configuration, even when silver crystals 29 are consumed and the amount of silver crystals is reduced, silver crystals 29 are accumulated in the lower part of the inclination due to the inclination of storage case bottom surface 28 and the weight of the auxiliary agent.

25 [0081] As in the present exemplary embodiment, the washing machine may include silver crystal unit 15, detergent case 9 provided with silver crystal unit housing 16 that detachably houses silver crystal unit 15, and water pouring device 11 that feeds water to silver crystal unit 15 from the upper side.

[0082] With this configuration, the water containing silver ions can be filled into water tank 4 and washing and dewatering tank 3 to cause the silver ions to be attached to clothes.

[0083] Therefore, the antibacterial action can be efficiently obtained.

30 [0084] As in the present exemplary embodiment, the washing machine includes silver crystal unit 15 that encloses silver crystals 29, detergent case 9 provided with silver crystal unit housing 16 that detachably houses silver crystal unit 15, and water pouring device 11 that feeds water to detergent case 9. In addition, water pouring device 11 may include the water passage through which the water fed from second water feed valve 82 flows, and

silver crystal nozzle 10 that pours the water of the water passage into silver crystal unit 15, and the opening provided in silver crystal nozzle 10 may be narrower than the width of the water passage.

[0085] With this configuration, water fed from second water feed valve 82 can be

5 increased in water pressure through the hole of silver crystal nozzle 10, and a feed rate of water flowing into silver crystal unit 15 can be increased.

[0086] Therefore, because silver crystals 29 can be efficiently dissolved to increase the silver ion concentration, a high antibacterial effect can be obtained even with a small amount of silver crystals 29.

10 [0087] As in the present exemplary embodiment, each of silver crystals 29 may have a granular shape.

[0088] With this configuration, a rate at which silver crystals 29 are eluted into water can be increased by sliding the grains of silver crystals 29 against each other.

15 [0089] As in the present exemplary embodiment, silver crystal nozzle 10 may be provided in plural numbers.

[0090] As in the present exemplary embodiment, silver crystal nozzle 10 may include first nozzle 10a and second nozzle 10b having a smaller diameter than first nozzle 10a.

[0091] With this configuration, a difference is generated between the flow speeds and flow rates of the two water flows, enabling the turbulence to be efficiently generated.

20 [0092] As in the present exemplary embodiment, the washing machine includes silver crystal unit 15 that encloses silver crystals 29, detergent case 9 provided with silver crystal unit housing 16 that detachably houses silver crystal unit 15, and water pouring device 11 that feeds water to detergent case 9, and water filling device 11 includes silver crystal nozzle 10 that pours water to silver crystal unit 15. In addition, water passing member 27
25 having a mesh shape is provided on the upper surface of silver crystal unit 15, and silver crystal unit 15 may be housed in silver crystal unit housing 16 such that silver crystal nozzle 10 and water passing member 27 are close to each other.

[0093] With this configuration, the water discharged from silver crystal nozzle 10 can be suppressed from colliding with water passing member 27 and scattering.

30 [0094] As in the present exemplary embodiment, detergent case 9 is disposed with powder detergent dispenser 9a, liquid detergent dispenser 9b, and softener dispenser 9c, into which detergent and softener are respectively poured, and water pouring device 11 includes a water passage through which water for feeding water to silver crystal unit 15

and softener dispenser 9c passes. In addition, the water passage may be provided with silver crystal nozzle 10 and softener nozzle 14 that pours water into softener dispenser 9c, and the water passage may communicate with the lower side of water filling device 11 through silver crystal nozzle 10 and softener nozzle 14.

5 [0095] With this configuration, water can be simultaneously fed to the softener containing the cation component and silvers crystals 29 that elutes cations, and the softener and the silver crystal can be poured onto the laundry housed in water tank 4 and washing and dewatering tank 3.

[0096] Therefore, a synergistic effect due to the addition of cations acts, and the
10 components of the softener and the silver ions can be firmly attached to the clothes.

[0097] As in the present exemplary embodiment, silver crystal unit housing 16 may be disposed on the rear side of softener dispenser 9c.

[0098] With this configuration, because silver crystal unit 15 which does not need to be touched other than at the time of replacement is provided on the rear side, silver crystal
15 unit 15 does not become an obstacle when the softener is poured.

[0099] As in the present exemplary embodiment, operation display 31 may request the user to replace silver crystal unit 15 based on the number of times of washing operation.

[0100] With this configuration, the user can be notified of the time of replacement. In addition, by the replacement, the amount of cations eluted from the auxiliary agent can be
20 appropriately maintained, and stable antibacterial performance can be realized.

[0101] As in the present exemplary embodiment, operation display 31 may notify the user of the remaining usable number of times of silver crystal unit 15 based on the number of times of performing the washing operation.

[0102] With this configuration, the user can be notified of the time of replacement. In
25 addition, by the replacement, the amount of cations eluted from the auxiliary agent can be appropriately maintained, and stable antibacterial performance can be realized.

[0103] (Second exemplary embodiment)

Hereinafter, a washing machine according to a second exemplary embodiment is described with reference to Figs. 13 and 14.

30 [0104] The washing machine according to the second exemplary embodiment 2 is different from the washing machine according to the first exemplary embodiment at least in that second silver crystal unit 215 is used instead of silver crystal unit 15.

[0105] (Silver crystal unit)

Fig. 13 is a schematic view showing a flow of water flowing into the silver crystal unit in a cross section around a detergent case of the washing machine in the second exemplary embodiment.

[0106] Second storage case 218 has a box shape with the upper side covered, and is detachably attached inside second silver crystal unit housing 216. In second silver crystal unit housing 216, water passage 216a is disposed on the side of second storage case 218. Water passage 216a is disposed below silver crystal nozzle 10, and supplies water to second silver crystal unit 215 from the side.

[0107] Second storage case 218 is provided with, on the lower side surface, third opening 220 that introduces water from water passage 216a, and fourth opening 221 that is disposed at a position facing third opening 220 and discharges the water from second silver crystal unit 215. Each of third opening 220 and fourth opening 221 is formed as a plurality of holes. Second silver crystal unit housing 216 is provided with second discharge port 230 in the vicinity of fourth opening 221 to discharge the water to detergent case housing 12.

[0108] As described above, second silver crystal unit 215 according to the present exemplary embodiment is configured such that silver crystals 29 stored on the lower side inside second storage case 218 is immersed in water when the water is introduced. Silver crystals 29 on the lower side and exposed to water gradually dissolve and are discharged at each washing operation, and silver crystals 29 on the upper side are gradually lowered by their own weight. As a result, undissolved silver crystals 29 are replenished from the upper side as the number of washing operations is repeated, and silver ion water having a constant silver ion concentration can be generated. Therefore, regardless of the amount of silver crystals 29 that remains, the silver ion water can be generated at a constant silver ion concentration.

[0109] Fig. 14 is a sectional view of the storage case of the washing machine according to the second exemplary embodiment.

[0110] As illustrated in Fig. 14, third opening 220 and fourth opening 221 may be provided on the side surface of second storage case 218 so as to be higher than predetermined dimension A from the bottom surface of second storage case 218.

Accordingly, the silver ion water remains at a position lower than fourth opening 221 in second storage case 218 during each washing operation. Because the remaining silver ion water gradually dissolves silver crystals 29 in the surroundings, the silver ion water having a high concentration can be used in the next washing operation.

[0111] (Actions and others)

As described above, in the washing machine according to the present exemplary embodiment, third opening 220 that introduces water into and fourth opening 221 that discharges water from second silver crystal unit 215 are provided in the lower part of the side surface of second silver crystal unit 215.

[0112] With this configuration, the water introduced into second silver crystal unit 215 permeates silver crystals 29 on the lower side inside second storage case 218, and is discharged from fourth opening 221. As silver crystals 29 dissolve and decrease, silver crystals 29 on the upper side descends.

[0113] Therefore, because silver crystals 29 housed in second silver crystal unit 215 sequentially dissolve from the lower side, the silver ion water having a constant silver ion concentration can be always generated.

[0114] Further, as in the present exemplary embodiment, third opening 220 and fourth opening 221 may be disposed so as to be higher than predetermined height A from the bottom surface of second silver crystal unit 215.

[0115] Accordingly, the silver ion water remains at a position lower than fourth opening 221 in second storage case 218 during each washing operation. Because the remaining silver ion water gradually dissolves silver crystals 29 in the surroundings, the silver ion water having a high concentration can be used in the next washing operation.

[0116] (Third exemplary embodiment)

Hereinafter, a washing machine in a third exemplary embodiment is described with reference to Fig. 15.

[0117] The washing machine according to the third exemplary embodiment is different from the washing machine according to the first exemplary embodiment at least in that third silver crystal unit 315 is used instead of silver crystal unit 15.

[0118] (Silver crystal unit)

Fig. 15 is a schematic view showing a flow of water flowing into the silver crystal unit in a cross section around a detergent case of the washing machine in the third exemplary embodiment.

[0119] Third storage case 318 is provided with, on the lower side surface, fifth opening 320 that introduces water, and sixth opening 321 that is disposed at a position facing sixth opening 321 and drains the water from third silver crystal unit 315.

[0120] A plurality of ribs 318a is provided so as to partition the inside of third storage

case 318, the ribs being disposed to alternately extend from opposing inner surfaces of third storage case 318. As a result, the water introduced from fifth opening 320 passes through the water passage partitioned by ribs 318a, immerses silver crystals 29 in the water passage, and is discharged from sixth opening portion 321.

5 **[0121]** (Actions and others)

In the washing machine according to the present exemplary embodiment, ribs 318a are provided inside third storage case 318 so as to partition the inside of third storage case 318.

10 **[0122]** As a result, the water introduced from fifth opening 320 passes through the water passage partitioned by ribs 318a, immerses silver crystals 29 in the water passage, and is discharged from sixth opening 321.

[0123] Therefore, because silver crystals 29 on the lower side inside third storage case 318 can be uniformly wetted, the silver ion water can be generated at a constant silver ion concentration regardless of the amount of silver crystals 29 that remains.

15 **[0124]** (Other exemplary embodiments)

As described above, the first to third exemplary embodiments have been described as examples of the technique disclosed in the present application. However, the technique according to the present disclosure are not limited to this.

[0125] Accordingly, other exemplary embodiments are described below.

20 **[0126]** In the first to third exemplary embodiments, a top-loading-type washing machine has been described as an example of the washing machine. The washing machine only need to be able to wash fabric with water. Therefore, the washing machine is not limited to the top-loading-type washing machine, and may be a drum-type washing machine, a two-tub washing machine, or others.

25 **[0127]** In the first to third exemplary embodiments, the silver crystals that impart the antibacterial effect to the laundry has been described as an example of the auxiliary agent. The auxiliary agent is not limited to the silver crystals as long as the auxiliary agent is water-soluble and gives an auxiliary effect to the laundry. The auxiliary agent may impart an effect such as antibacterial, deodorization, or fragrance, or improve the effect of the
30 detergent or the softener.

INDUSTRIAL APPLICABILITY

[0128] The present disclosure is applicable to a washing machine including an

antibacterial member unit. Specifically, the present disclosure is applicable to a top-loading-type washing machine, a drum-type washing machine, a two-tub washing machine, and others.

5	REFERENCE MARKS IN THE DRAWINGS		
	[0129]	1	washing machine body
		2	upper frame body
		2a	clothes loading port
		3	washing and dewatering tank
10		4	water tank
		5	pulsator
		6	lid body
		7	controller
		8a	water feed port for powder detergent dispenser
15		8b	water feed port for liquid detergent dispenser
		8c	water feed port for softener dispenser
		9	detergent case
		9a	powder detergent dispenser
		9b	liquid detergent dispenser
20		9c	softener dispenser
		10	silver crystal nozzle (nozzle)
		10a	first nozzle (nozzle)
		10b	second nozzle (nozzle)
		11	water pouring device (water feeder)
25		11a	water pouring device lid (water feeder)
		11b	water pouring structure (water feeder)
		12	detergent case housing
		13	detergent nozzle
		13a	powder detergent nozzle
30		13b	liquid detergent nozzle
		14	softener nozzle
		15	silver crystal unit (auxiliary agent unit)
		16	silver crystal unit housing (auxiliary agent unit housing)

	16a	cutout
	16b	silver crystal unit housing side claw
	16c	inclined rib
	18	storage case
5	19	storage case lid
	20	first opening
	21	second opening
	22	hinge
	23	screw boss
10	23a	screw hole
	24	screw seat
	24a	screw
	25	fitting claw projection
	26	fitting claw recess
15	27	water passing member (mesh structure)
	28	storage case bottom surface (bottom surface)
	29	silver crystal (auxiliary agent)
	30a	powder detergent discharge port
	30b	siphon structure
20	30c	silver crystal unit housing discharge port
	31	operation display
	80	water feed valve
	81	first water feed valve
	82	second water feed valve
25	215	second silver crystal unit (auxiliary agent unit)
	216	second silver crystal unit housing (auxiliary agent unit housing)
	216a	water passage
	218	second storage case
	220	third opening
30	221	fourth opening
	230	second discharge port
	315	third silver crystal unit (auxiliary agent unit)
	318	third storage case

318a	rib
320	fifth opening
321	sixth opening

CLAIMS

1. An auxiliary agent unit enclosing an auxiliary agent that is water soluble, the auxiliary agent unit being configured to be attachable to a washing machine, the auxiliary agent unit comprising:

a first opening through which water is introduced into the auxiliary agent unit; and

a second opening through which the water is drained from the auxiliary agent unit, wherein at least one of the first opening and the second opening is provided with a mesh structure having a mesh shape.

2. The auxiliary agent unit according to Claim 1, wherein the second opening is provided at a location not facing the first opening.

3. The auxiliary agent unit according to any one of Claims 1 or 2, wherein in a direction of attaching the auxiliary agent unit to the washing machine, the first opening is provided on an upper surface of the auxiliary agent unit and the second opening is provided on a lower surface of the auxiliary agent unit, and the second opening is disposed at a location that partially overlaps a position where the first opening is projected downward.

4. The auxiliary agent unit according to any one of Claims 1 to 3, wherein the second opening has an area that is larger than an area of the first opening.

5. The auxiliary agent unit according to any one of Claims 1 to 4, further comprising:

a storage case; and

the auxiliary agent enclosed in the storage case, wherein the mesh structure is a component separate from the storage case.

6. The auxiliary agent unit according to any one of Claims 1 to 5, wherein the auxiliary agent unit has a bottom surface that is provided with the second opening and has an inclination, and the second opening is provided at a position that is a

lower part in the inclination of the bottom surface.

7. The auxiliary agent unit according to Claim 1, wherein
the auxiliary agent unit further comprises, in a lower side surface, a third opening
5 through which the water is introduced into the auxiliary agent unit and
a fourth opening through which the water is drained from the auxiliary agent unit.

8. The auxiliary agent unit according to Claim 7, wherein the third opening and
the fourth opening are disposed at positions higher than a predetermined height from a
10 bottom surface of the auxiliary agent unit.

9. The auxiliary agent unit according to any one of Claims 7 and 8, wherein the
storage case is provided with a rib in an inside of the storage case, the rib being provided to
partition the inside of the storage case.
15

10. A washing machine comprising:
the auxiliary agent unit according to any one of Claims 1 to 9;
a detergent case provided with an auxiliary agent unit housing that detachably
houses the auxiliary agent unit; and
20 a water feeder that feeds water to the auxiliary agent unit from an upper side.

11. A washing machine comprising:
an auxiliary agent unit that encloses an auxiliary agent;
a detergent case provided with an auxiliary agent unit housing that detachably
25 houses the auxiliary agent unit; and
a water feeder that feeds water to the detergent case, wherein
the water feeder includes a water passage that allows the water fed from a water
feed valve to flow, and at least one nozzle that pours the water in the water passage into the
auxiliary agent unit, and
30 the at least one nozzle is provided with an opening that has a width narrower than
a width of the water passage.

12. The auxiliary agent unit according to any one of Claims 1 to 9, wherein the

auxiliary agent has a granular shape.

13. The washing machine according to any one of Claims 10 or 11, wherein the auxiliary agent has a granular shape.

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14. The auxiliary agent unit according to Claim 12, wherein the at least one nozzle comprises a plurality of nozzles,
the plurality of nozzles are provided.

10 15. The washing machine according to any one of Claims 10, 11, or 13, wherein the at least one nozzle comprises a plurality of nozzles,
the plurality of nozzles are provided.

15 16. The auxiliary agent unit according to Claim 12, wherein the at least one nozzle includes a first nozzle and a second nozzle having a smaller diameter than the first nozzle.

17. The washing machine according to any one of Claims 10, 11, or 13, wherein the at least one nozzle includes a first nozzle and a second nozzle having a smaller
20 diameter than the first nozzle.

18. A washing machine comprising:
an auxiliary agent unit that encloses an auxiliary agent;
a detergent case provided with an auxiliary agent unit housing that detachably
25 houses the auxiliary agent unit; and
a water feeder that feeds water to the detergent case, wherein
the water feeder includes a nozzle that pours water into the auxiliary agent unit,
the auxiliary agent unit has, in an upper surface, a mesh structure having a mesh
shape, and
30 the auxiliary agent unit is housed in the auxiliary agent unit housing, the nozzle
and the mesh structure being disposed close to each other.

19. The washing machine according to Claim 18, wherein

the detergent case is provided with a dispenser having a detergent poured and a dispenser having a softener poured,

the water feeder includes a water passage that allows the water to pass, the water being fed to the auxiliary agent unit and to the dispenser having the softener poured, and
5 the water passage is provided with the nozzle and a softener nozzle that pours water into the dispenser having the softener poured, and

the water passage communicates with a lower part of the water feeder by the nozzle and the softener nozzle.

10 20. The washing machine according to Claim 19, wherein the auxiliary agent unit housing is disposed on a rear side of the dispenser having the softener poured.

21. The washing machine according to any one of Claims 10, 11, 13, or 17 to 20, wherein the washing machine prompts a user to replace the auxiliary agent unit based
15 on a number of times of performing a washing operation.

22. The washing machine according to any one of Claims 10, 11, 13, or 17 to 21, wherein the washing machine notifies the user of a remaining usable number of times of the auxiliary agent unit based on the number of times of performing the washing
20 operation.