(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 434 837 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
11.03.2020 Bulletin 2020/11

(51) Int Cl.:
E03D 9/08 *(2006.01)*

(21) Application number: **18184121.4**

(22) Date of filing: **18.07.2018**

(54) SANITARY CLEANING DEVICE

SANITÄRREINIGUNGSVORRICHTUNG

DISPOSITIF DE NETTOYAGE SANITAIRE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **25.07.2017 JP 2017143916**

(43) Date of publication of application:
30.01.2019 Bulletin 2019/05

(73) Proprietor: **TOTO LTD.**
Kokurakita-ku
Kitakyushu-shi, Fukuoka 802-8601 (JP)

(72) Inventors:
- **YAMASAKI, Kota**
  Kitakyushu-shi, Fukuoka 802-8601 (JP)
- **AMEMORI, Hiroaki**
  Kitakyushu-shi, Fukuoka 802-8601 (JP)
- **SUZUKI, Kenta**
  Kitakyushu-shi, Fukuoka 802-8601 (JP)
- **SAWA, Shonosuke**
  Kitakyushu-shi, Fukuoka 802-8601 (JP)
- **SAKUMOTO, Nobutake**
  Kitakyushu-shi, Fukuoka 802-8601 (JP)

(74) Representative: **Bandpay & Greuter**
30, rue Notre-Dame des Victoires
75002 Paris (FR)

(56) References cited:
EP-A1- 3 170 940 **JP-A- H07 324 365**

EP 3 434 837 B1

Printed by Jouve, 75001 PARIS (FR)

Description

TECHNICAL FIELD

[0001] The embodiments disclosed herein relate to a sanitary cleaning device.

BACKGROUND

[0002] A conventionally known sanitary cleaning device is disposed above the body of a seat toilet and discharges water to clean a human body. By way of example only, EP 3170940 A1 discloses a shower toilet with a water heater, a water supply connection and a shower arm connection.

[0003] When such a sanitary cleaning device is used an area in which hard water (water having a hardness of 120 mg/L or higher) is used, mineral such as calcium deposits and accumulates in a water supply path in the sanitary cleaning device, which potentially leads to blockage of the water supply path. To avoid this, the water supply path is filled with acid solution of citric acid or the like, thereby removing deposition (scale) accumulated in the water supply path.

[0004] For example, Japanese Unexamined Patent Application Publication No. H07-324365 discloses a sanitary cleaning device including a dedicated tank in which acid solution is accumulated, and configured to supply the acid solution accumulated in the tank to a water supply path.

SUMMARY OF THE INVENTION

[0005] However, the above-described conventional technology can be further improved to reduce adhesion of the acid solution to a peripheral member disposed around the tank.

[0006] For example, some sanitary cleaning devices include a backflow prevention mechanism including a tank in which an air gap is formed in a water supply path to prevent backflow of foul water to a water pipe. Acid solution is provided into the tank of the backflow prevention mechanism. However, the tank of the backflow prevention mechanism has an extremely small capacity as compared to, for example, a hot-water tank provided in a hot-water accumulation sanitary cleaning device. Thus, spattering of the acid solution is likely to occur at provision of the acid solution, and the spattered acid solution potentially scatters out of the tank and adheres to a peripheral member. The adhesion of the acid solution to the peripheral member potentially degrades the peripheral member, and for this reason, it is desirable to prevent spattering of the acid solution.

[0007] It is an object of an embodiment to provide a sanitary cleaning device that can reduce adhesion of acid solution to a member disposed around a tank that accumulates the acid solution.

[0008] A sanitary cleaning device according to an embodiment includes: a nozzle configured to discharge water toward a region of a user; a water supply path through which water is supplied to the nozzle; a backflow prevention mechanism including a tank provided on the water supply path, a water inlet port that is communicated with an upstream water supply path positioned upstream of the tank on the water supply path and through which water flows into the tank, a water outlet port that is communicated with a downstream water supply path positioned downstream of the tank on the water supply path and through which water in the tank flows out to the downstream water supply path, and an overflow port that is provided to form an air gap between the overflow port and the water inlet port and through which surplus water in the tank is discharged; and a solution provision unit including a provision port through which acid solution is provided by the user, a solution supply path through which the acid solution provided through the provision port circulates, and a solution inlet port through which the acid solution flowing through the solution supply path flows into the tank. The solution supply path of the solution provision unit includes an expansion part in which a flow-path cross-sectional area increases toward the solution inlet port.

[0009] The relation of Q = V•A holds among a flow rate (Q), a flow speed (V), and a flow-path cross-sectional area (A). Accordingly, the flow speed (V) decreases as the flow-path cross-sectional area (A) increases when the flow rate (Q) is constant. Thus, since the flow-path cross-sectional area of the solution supply path increases toward the solution inlet port, the flow speed of the acid solution flowing through the solution supply path is reduced as compared to a case in which the flow-path cross-sectional area of the solution supply path is constant. This leads to reduction of the flow speed of the acid solution flowing out through the solution inlet port, thereby reducing impact at landing. This reduces spattering when the acid solution falls onto the water surface in the tank, and thus reduces adhesion of the acid solution to a peripheral member due to the spattering of the acid solution.

[0010] The solution supply path may include a first extension part communicated with the provision port and extending in a vertical direction, and a second extension part communicated with the solution inlet port and extending in a horizontal direction, and the expansion part may be provided on the second extension part.

[0011] Since the expansion part is provided on the second extension part extending in the horizontal direction on the solution supply path, the flow speed of the acid solution flowing through the solution supply path is efficiently reduced as compared to a case in which the expansion part is provided on the first extension part extending in the vertical direction.

[0012] At the second extension part, a flow path width in the horizontal direction may be larger than a flow path width in the vertical direction.

[0013] Since the second extension part extending in

the horizontal direction is formed in a flat shape, the solution provision unit has a lower height dimension. This leads to reduction of increase in the height dimension of the sanitary cleaning device.

[0014] At the expansion part of the solution supply path, both of a flow path width in the vertical direction and a flow path width in the horizontal direction may increase toward the solution inlet port.

[0015] Since not only the flow path width in the vertical direction but also the flow path width in the horizontal direction increase in this manner, the solution provision unit has a lower height dimension as compared to a case in which in which only the flow path width in the vertical direction increases.

[0016] The solution provision unit may include a funnel part having an opening area that increases toward the provision port from a downstream side of the provision port.

[0017] With this configuration, the funnel part can temporarily accumulate an excess amount of the acid solution that cannot flow through the solution provision unit, for example, when a large amount of the acid solution is provided in a short time by the user. Thus, the acid solution can be prevented from overflowing out of the solution provision unit. In addition, the increasing opening area of the provision port allows the user to easily provide the acid solution.

[0018] The funnel part may be detachably attached. Since the funnel part is detachably attached, increase in the size of the solution provision unit can be prevented.

[0019] The solution provision unit may cause the acid solution to fall at a position farther from the overflow port than a position at which water having flowed out through the water inlet port falls in the tank.

[0020] When the acid solution falls at a position as far from the overflow port as possible, the acid solution supplied into the tank is unlikely to discharge out of the tank through the overflow port as compared to a case in which the acid solution falls near the overflow port. Accordingly, for example, when the acid solution in an amount exceeding the capacity of the tank is provided while water remains in the tank, the water is discharged through the overflow port before the acid solution is discharged, which leads to reduction of unnecessary consumption of the acid solution. Since the acid solution is unlikely to be discharged through the overflow port, adhesion of the acid solution having overflowed through the overflow port to a peripheral member can be reduced.

[0021] The solution provision unit may cause the acid solution to fall at a position farther from the water outlet port than the position at which water having flowed out through the water inlet port falls in the tank.

[0022] When the acid solution falls at a position as far from the water outlet port as possible, decrease of scale removal efficiency water remains in the tank is reduced as compared to a case in which the acid solution falls near the water outlet port (to be described later in detail).

[0023] According to an embodiment, adhesion of acid solution to a member disposed around a tank that accumulates the acid solution can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

Fig. 1 is a perspective view schematically illustrating a toilet device including a sanitary cleaning device according to a first embodiment.

Fig. 2 is an explanatory diagram illustrating an exemplary configuration of the sanitary cleaning device.

Fig. 3 is a perspective view of a backflow prevention mechanism and a solution provision unit.

Fig. 4 is a schematic cross-sectional view of the backflow prevention mechanism and the solution provision unit when viewed from the back side of the sanitary cleaning device.

Fig. 5 is a perspective view of a body part of the solution provision unit.

Fig. 6 is a diagram of the body part of the solution provision unit when viewed in the direction of arrow A.

Fig. 7 is a cross-sectional view taken along line B-B in Fig. 6.

Fig. 8 is a plan view of the backflow prevention mechanism and the solution provision unit.

Fig. 9 is a cross-sectional view taken along line C-C in Fig. 8.

Fig. 10 is a flowchart illustrating the procedure of processing in a scale removal mode.

Fig. 11 is a flowchart illustrating the processing procedure of scale removal processing.

Fig. 12 is a flowchart illustrating the processing procedure of solution discharge processing.

Fig. 13 is a timing chart illustrating an exemplary operation of the sanitary cleaning device in the scale removal mode.

Fig. 14 is a perspective view of the body part of the solution provision unit according to a second embodiment.

Fig. 15 is a bottom view of the body part of the solution provision unit according to the second embodiment.

Fig. 16 is a perspective view of the body part when a cover member is removed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] Embodiments of a sanitary cleaning device disclosed in the present application will be described below in detail with the accompanying drawings. However, the present invention is not limited by the embodiments described below.

FIRST EMBODIMENT

[1. Configuration of sanitary cleaning device]

[0026] Fig. 1 is a perspective view schematically illustrating a toilet device including a sanitary cleaning device according to a first embodiment. For simplicity of description, Fig. 1 defines an X-axis direction, a Y-axis direction, and a Z-axis direction that are orthogonal to each other, and illustrates a three-dimensional orthogonal coordinate system with the positive Z-axis direction aligned with the upward direction of the vertical direction.

[0027] As illustrated in Fig. 1, a toilet device 1 includes a seat toilet bowl (hereinafter referred to as a "toilet bowl") 10 and a sanitary cleaning device 20, and is installed in a toilet room. The toilet bowl 10 is of a low-tank type configured to perform cleaning with water accumulated in a water accumulation tank 11, but not limited thereto. For example, the toilet bowl 10 may be of a flush-valve type. In the example illustrated in Fig. 1, the toilet bowl 10 is of a floor-installation type, but is not limited thereto. For example, the toilet bowl 10 may be of a wall-installation type.

[0028] The sanitary cleaning device 20 is provided above the toilet bowl 10. The sanitary cleaning device 20 includes a body part 30, a toilet lid 300, and a toilet seat (not illustrated). The toilet lid 300 and the toilet seat are each attached to the body part 30 in a freely opening and closing manner.

[0029] The body part 30 includes a case 31 and a nozzle 40. The case 31 houses, for example, the nozzle 40.

[0030] Fig. 2 is an explanatory diagram illustrating an exemplary configuration of the sanitary cleaning device 20 including the nozzle 40. As illustrated in Fig. 2, the nozzle 40 includes a plurality of discharge ports 41 through which water is discharged toward, for example, a region of a user. The following describes an example in which the nozzle 40 includes three discharge ports 41, but the number of discharge ports 41 included in the nozzle 40 may be one or two or may be four or more. In the present description, the term "water" does not necessarily mean cold water, but also includes hot water in some cases.

[0031] The nozzle 40 is movable relative to the case 31 (refer to Fig. 1). Specifically, for example, the nozzle 40 is connected with a drive source such as a motor (not illustrated). The nozzle 40 is moved, by drive of the drive source, between a position at which the nozzle 40 is extended inside of the toilet bowl 10 and a position at which the nozzle 40 is retracted and housed in the case 31. At this extended position, the nozzle 40 discharges water toward the body of the user to clean the region.

[0032] The sanitary cleaning device 20 also includes a water supply path 50, an instantaneous heat exchanger (hereinafter simply referred to as a "heat exchanger") 70, a backflow prevention mechanism 90, a control unit 200, and an operation unit 220. The nozzle 40, the water supply path 50, the heat exchanger 70, the backflow prevention mechanism 90, and the control unit 200 are disposed in the case 31.

[0033] The water supply path 50 supplies the nozzle 40 with water from a water pipe A as a water supply source. Specifically, the water supply path 50 includes an upstream water supply path 51 and a downstream water supply path 52. The upstream water supply path 51 is a flow path extending from the water pipe A to the backflow prevention mechanism 90, and the downstream water supply path 52 is a flow path extending from the backflow prevention mechanism 90 to the nozzle 40.

[0034] At a middle part of the upstream water supply path 51, a strainer 61, an electromagnetic valve 62, and a constant flow valve 63 are provided sequentially from the upstream side (in other words, the water pipe A side).

[0035] The strainer 61 removes a foreign object such as dust mixed in water supplied through the water pipe A. The electromagnetic valve 62 is a normally closed valve configured to be closed when not energized, and opens and closes the upstream water supply path 51 in accordance with a control signal from the control unit 200. The constant flow valve 63 adjusts, to a predetermined flow rate or lower, water flowing in through the water pipe A and then flows out the water.

[0036] At a middle part of the downstream water supply path 52, a pump 64, the heat exchanger 70, a strainer 65, a vacuum breaker 66, and a switching valve 67 are provided sequentially from the upstream side (in other words, the backflow prevention mechanism 90 side).

[0037] The pump 64 drives in accordance with a control signal from the control unit 200, and supplies water accumulated in a tank 91 of the backflow prevention mechanism 90 to the nozzle 40.

[0038] The heat exchanger 70 includes a heat generation body 71 such as a heater, and heats water flowing through the downstream water supply path 52 to a set temperature while maintaining the flow speed thereof.

[0039] The strainer 65 filtrates water flowing through the downstream water supply path 52. For example, the strainer 65 removes a foreign object such as scale included in water flowing through the downstream water supply path 52.

[0040] The vacuum breaker 66 causes backflow water to flow to an air open path 661, for example, when negative pressure is generated in the downstream water supply path 52, thereby preventing backflow from the nozzle 40 to the heat exchanger 70 or the like.

[0041] The switching valve 67 drives in accordance with a control signal from the control unit 200, and switches the flowing destination of water flowing through the downstream water supply path 52. For example, the switching valve 67 switches the flowing destination of water flowing through the downstream water supply path 52 to any one of the plurality of discharge ports 41 included in the nozzle 40. The switching valve 67 is connected with an electrolytic tank unit 68 configured to generate functional water. The switching valve 67 switches the flowing destination of water flowing through the down-

stream water supply path 52 to the electrolytic tank unit 68.

[0042] The electrolytic tank unit 68 includes therein an anode plate and a cathode plate. The electrolytic tank unit 68 drives in accordance with a control signal from the control unit 200 and generates water containing hypochlorous acid as functional water by electrolyzing water flowing inside. The electrolytic tank unit 68 flows out the generated functional water to a spray nozzle 681 or an alkalinity water discharge path 682. The electrolytic tank unit 68 includes a switching valve configured to switch the flowing destination of the functional water between the spray nozzle 681 and the alkalinity water discharge path 682.

[0043] The electrolytic tank unit 68 does not necessarily need to include both of the spray nozzle 681 and the alkalinity water discharge path 682, but may include only the spray nozzle 681, for example. This configuration does not require the switching valve configured to switch the flowing destination of the functional water between the spray nozzle 681 and the alkalinity water discharge path 682.

[0044] The backflow prevention mechanism 90 includes the tank 91 provided on the water supply path 50, a water inlet port 92 that is communicated with the upstream water supply path 51 and through which water flows into the tank 91, and a water outlet port 93 that is communicated with the downstream water supply path 52 and through which water in the tank 91 flows out to the downstream water supply path 52. The backflow prevention mechanism 90 includes an overflow port 94 that is provided to form an air gap between the overflow port 94 and the water inlet port 92 and through which surplus water in the tank 91 is discharged, and a float switch 95 (exemplary water level sensing unit) configured to sense the water level in the tank 91.

[0045] Water having passed through the constant flow valve 63 flows into the tank 91 through the water inlet port 92. This inflow water is accumulated in the tank 91, and flows out of the tank 91 (to the toilet bowl 10) through the overflow port 94 as surplus water when the water level thereof exceeds a full water level H1.

[0046] The overflow port 94 is provided at a position lower than the water inlet port 92. With this configuration, a space (air gap) opened to air is formed between the water inlet port 92 and the overflow port 94. Accordingly, when the water level in the tank 91 increases, water accumulated in the tank 91 is discharged out of the tank 91 through the overflow port 94 before reaching the water inlet port 92. Thus, backflow of foul water from the tank 91 to the upstream can be prevented.

[0047] The float switch 95 is disposed in the tank 91 and turned on and off by a float configured to move up and down along with fluctuation of the water level in the tank 91. Specifically, the float switch 95 outputs an ON signal to the control unit 200 when the water level in the tank 91 is equal to or higher than a predetermined high water level. When the water level in the tank 91 is equal to or lower than a predetermined low water level, the float switch 95 outputs an OFF signal to the control unit 200. The "high water level" is a predetermined water level that is higher than half of the full water level H1, and the "low water level" is a predetermined water level that is lower than half of the full water level H1. In the present embodiment, the "high water level" is set to be the full water level H1, and the "low water level" is set to be an empty water level, in other words, the water level in the tank 91 when all water that can be discharged through the water outlet port 93 is discharged from the tank 91. However, the present invention is not limited thereto, but the "high water level" may be set to be lower than the full water level H1, and the "low water level" may be set to be higher than the empty water level.

[0048] The float switch 95 is not limited to the above-described configuration. For example, the float switch 95 may include a first switch configured to output an ON signal when the water level in the tank 91 is equal to or higher than the high water level, and a second switch configured to output an ON signal when the water level in the tank 91 is equal to or lower than the low water level. In this case, the control unit 200 may detect the "high water level" when an ON signal is output from the first switch and an OFF signal is output from the second switch, and may detect the "low water level" when the ON signal is output from the second switch and the OFF signal is output from the first switch. The control unit 200 may detect the water level not to be the "high water level" nor the "low water level" when OFF signals are output from both of the first switch and the second switch.

[0049] The operation unit 220 includes, for example, an operation button and an operation knob through which the user inputs a start instruction to start cleaning of a human body and a stop instruction to stop the cleaning, and is provided at an appropriate position in the toilet room. The operation unit 220 outputs a signal indicating the start instruction input or the like by the user through the operation button or the like. The operation unit 220 may be, for example, a remote controller, but the present invention is not limited thereto. The operation unit 220 may be attached to the body part 30.

[0050] Various signals output from the float switch 95 and the operation unit 220 are input to the control unit 200. The control unit 200 controls the entire sanitary cleaning device 20. The control unit 200 includes, for example, an arithmetic processing device (not illustrated) such as a central processing unit (CPU), and a storage device (not illustrated) such as a random access memory (RAM).

[0051] The control unit 200 executes processing of controlling the electromagnetic valve 62, the heat generation body 71, the pump 64, the nozzle 40, the electrolytic tank unit 68, and any other component, based on various input signals.

[0052] In an area such as Europe, where hard water is used, mineral such as calcium deposits and becomes accumulated in the water supply path 50, which poten-

tially causes blockage of the water supply path 50. The blockage due to deposition (scale) potentially accumulates not only in the water supply path 50 but also in the tank 91, the strainer 65, the vacuum breaker 66, the nozzle 40, the spray nozzle 681, and any other component.

[0053] To avoid this, the sanitary cleaning device 20 according to the present embodiment executes scale removal processing of removing scale accumulated in the tank 91 and downstream of the tank 91 by using acid solution of citric acid or the like.

[0054] In the scale removal processing, the acid solution accumulated in the tank 91 is supplied to the downstream water supply path 52 to fill the downstream water supply path 52, the nozzle 40, and the like with the acid solution, thereby dissolving scale accumulated in the downstream water supply path 52, the nozzle 40, and the like with the acid solution. Thereafter, water is supplied to the downstream water supply path 52, the nozzle 40, and the like so that substance dissolved from the scale and the acid solution are discharged together with the water. Accordingly, the scale is removed from the downstream water supply path 52, the nozzle 40, and the like.

[0055] The scale removal processing is executed in response to an instruction to transition to a scale removal mode output from the operation unit 220 in accordance with an operation through the operation unit 220 by the user.

[0056] The sanitary cleaning device 20 includes a solution provision unit configured to supply the acid solution provided by the user to the tank 91.

[0057] Spattering of the acid solution at provision of the acid solution to the tank 91 potentially causes adhesion of the acid solution to a peripheral member disposed around the tank 91. In particular, the tank 91 of the backflow prevention mechanism 90 has an extremely small capacity as compared to a hot-water tank included in a hot-water accumulation sanitary cleaning device. Thus, when the spattering occurs, the spattered acid solution is likely to scatter out of the tank 91 and thus adhere to the peripheral member. The adhesion of the acid solution to the peripheral member potentially degrades the peripheral member, and thus it is desirable to prevent spattering of the acid solution.

[0058] In the sanitary cleaning device 20 according to the present embodiment, the solution provision unit is formed to have a shape that reduces spattering of the acid solution and thus adhesion of the acid solution to a peripheral member.

[0059] At provision of the acid solution to the tank 91, when the amount of the acid solution exceeds the full water level H1 of the tank 91, the acid solution overflows through the overflow port 94 of the tank 91 and potentially adheres to a peripheral member. Since the tank 91 has a small capacity as described above, for example, when the acid solution is provided on the tank 91 while the water level in the tank 91 is close to the full water level H1, the acid solution potentially overflows through the overflow port 94.

[0060] To avoid this, when having received the instruction to transition to the scale removal mode, the sanitary cleaning device 20 according to the present embodiment executes discharge processing of discharging water in the tank 91 before the scale removal processing, thereby reducing leakage of the acid solution through the overflow port 94 and thus adhesion of the acid solution to a peripheral member.

[2. Configuration of solution provision unit]

[0061] The following specifically describes the configuration of the solution provision unit and the content of the scale removal processing with reference to Fig. 3 and the subsequent drawings. The description will be first made on the configuration of the solution provision unit with reference to Figs. 3 to 7. Fig. 3 is a perspective view of the backflow prevention mechanism 90 and the solution provision unit. Fig. 4 is a schematic cross-sectional view of the backflow prevention mechanism 90 and the solution provision unit when viewed from the back side of the sanitary cleaning device 20.

[0062] In the present description, terms such as "horizontal" and "vertical" do not necessarily require mathematically rigorous accuracy, but effectively allow tolerance, error, and the like.

[0063] As illustrated in Fig. 3, the solution provision unit 100 includes a body part 101 and a funnel part 102. As illustrated in Fig. 4, the body part 101 is provided in the case 31 of the sanitary cleaning device 20, and the funnel part 102 is provided out of the case 31. Specifically, a recess 311 is formed on an upper surface of the case 31, and an upstream opening part 111 of the body part 101 is fixed to a bottom surface of the recess 311.

[0064] In the normal state, a lid (not illustrated) is attached to the recess 311 of the case 31 to prevent a foreign object such as dust from entering into the upstream opening part 111 of the body part 101. When the acid solution is to be provided on the tank 91, the lid (not illustrated) is removed, and the funnel part 102 is attached to the upstream opening part 111 of the body part 101.

[0065] The funnel part 102 includes a provision port 121 through which the acid solution is provided by the user. The funnel part 102 has what is called a funnel shape, the opening area of which increases from the downstream side of the provision port 121 toward the provision port 121.

[0066] With this configuration, the funnel part 102 included in the solution provision unit 100 can temporarily accumulate an excess amount of the acid solution that cannot flow through the body part 101 when a large amount of the acid solution is provided in a short time by the user. Thus, the acid solution can be prevented from overflowing out of the solution provision unit 100. In addition, the increasing opening area of the provision port 121 allows the user to easily provide the acid solution.

[0067] In the solution provision unit 100 according to the present embodiment, the funnel part 102 is detachably attached to the body part 101 (in other words, to the case 31). This configuration can prevent increase the size of the body part 30 while allowing the user to easily provide the acid solution.

[0068] The acid solution provided through the provision port 121 of the funnel part 102 by the user flows into the body part 101 through the upstream opening part 111 of the body part 101, and then flows out of the body part 101 through a downstream opening part 112 (an exemplary solution inlet port) of the body part 101. An upper opening 911 is formed in an upper part of the tank 91 so that the acid solution having flowed out through the downstream opening part 112 of the body part 101 is supplied into the tank 91 through the upper opening 911.

[0069] The solution provision unit 100 does not necessarily need to include the funnel part 102, but the upstream opening part 111 of the body part 101 may serve as a provision port of the acid solution. The upstream opening part 111 as a provision port may be formed in a funnel shape. This configuration achieves the same effect as that obtained when the funnel part 102 is provided.

[0070] Fig. 5 is a perspective view of the body part 101 of the solution provision unit 100. Fig. 6 is a diagram of the body part 101 of the solution provision unit 100 when viewed in the direction of arrow A. Fig. 7 is a cross-sectional view taken along line B-B in Fig. 6.

[0071] As illustrated in Fig. 5, the body part 101 of the solution provision unit 100 includes the upstream opening part 111, the downstream opening part 112, and a solution supply path 113. The upstream opening part 111 opens upward, and the downstream opening part 112 opens in the horizontal direction. A notch 112a is formed in a lower surface of the downstream opening part 112 so that the acid solution having flowed into the body part 101 through the upstream opening part 111 falls toward the tank 91 through the notch 112a of the downstream opening part 112.

[0072] The solution supply path 113 is a path that is formed in the body part 101 and through which the upstream opening part 111 and the downstream opening part 112 are communicated and the acid solution having flowed into through the upstream opening part 111 circulates toward the downstream opening part 112.

[0073] As illustrated in Figs. 6 and 7, the solution supply path 113 includes a first extension part 113a and a second extension part 113b. The first extension part 113a extends in the vertical direction, and is communicated with the upstream opening part 111 on the upstream side and communicated with the second extension part 113b on the downstream side. The second extension part 113b extends in the horizontal direction while expanding from the upstream side toward the downstream side, and is communicated with the first extension part 113a on the upstream side and communicated with the downstream opening part 112 on the downstream side.

[0074] As illustrated in Fig. 6, the flow path width of the second extension part 113b in the horizontal direction increases from W1 to W2 (> W1) in a direction extending from an upstream end part (on the deeper side into the sheet of Fig. 6) toward the downstream opening part 112. As illustrated in Figs. 6 and 7, the flow path width of the second extension part 113b in the vertical direction increases from W3 to W4 (> W3) in a direction extending from an upstream end part toward the downstream opening part 112.

[0075] As described above, the solution supply path 113 of the solution provision unit 100 according to the present embodiment includes an expansion part in which the cross-sectional area of the flow path (the flow-path cross-sectional area) increases toward the downstream opening part 112.

[0076] Since the flow-path cross-sectional area of the solution supply path 113 increases toward the downstream opening part 112, the flow speed of the acid solution flowing through the solution supply path 113 is reduced as compared to a case in which the flow-path cross-sectional area of the solution supply path 113 is constant. This leads to reduction of the flow speed of the acid solution flowing out through the downstream opening part 112, thereby reducing impact at landing. This reduces spattering when the acid solution falls onto the water surface in the tank 91, and thus reduces adhesion of the acid solution to a peripheral member due to spattering of the acid solution.

[0077] Since the expansion part is provided at the second extension part 113b extending in the horizontal direction on the solution supply path 113, the flow speed of the acid solution flowing through the solution supply path 113 is efficiently reduced.

[0078] The second extension part 113b as the expansion part is formed such that the flow path widths thereof in the vertical and horizontal directions both increase in the direction toward the downstream opening part 112. When not only the flow path width in the vertical direction but also the flow path width in the horizontal direction increase in this manner, the solution provision unit 100 has a lower height dimension as compared to a case in which the flow path width in the vertical direction increases. This leads to reduction of increase in the height dimension of the sanitary cleaning device 20.

[0079] In addition, the second extension part 113b of the solution provision unit 100 has what is called a flat shape in which the flow path width thereof in the horizontal direction is larger than the flow path width thereof in the vertical direction. With this shape, the height dimension of the solution provision unit 100 is further reduced, which leads to further reduction of increase in the height dimension of the sanitary cleaning device 20.

[0080] In the solution provision unit 100, the acid solution falls toward the tank 91 through the notch 112a formed in the lower surface of the downstream opening part 112. Accordingly, the amount of acid solution scattering out of the tank 91 through the downstream opening part 112 is reduced as compared to a case in which the

downstream opening part 112 includes no notch 112a. This achieves further reduction of adhesion of the acid solution to a peripheral member.

[0081] As illustrated in Fig. 7, a flow path width W5 of the second extension part 113b in the vertical direction at a connection part with the first extension part 113a is smaller than a flow path width W0 of the first extension part 113a. This configuration can reduce the momentum of the acid solution flowing out from the first extension part 113a to the second extension part 113b. This achieves further reduction of adhesion of the acid solution to a peripheral member.

[3. Position of provision of acid solution from solution provision unit to tank]

[0082] The following describes the position of provision of the acid solution from the solution provision unit 100 to the tank 91 with reference to Figs. 8 and 9. Fig. 8 is a plan view of the backflow prevention mechanism 90 and the solution provision unit 100. Fig. 9 is a cross-sectional view taken along line C-C in Fig. 8.

[0083] As illustrated in Figs. 8 and 9, the solution provision unit 100 causes the acid solution to fall at a fall position P2 that is farther from the overflow port 94 than a fall position P1 at which water having flowed out through the water inlet port 92 falls to the tank 91.

[0084] Specifically, the water inlet port 92 discharges, in the horizontal direction, water supplied through the water pipe A (refer to Fig. 2). Having discharged from the water inlet port 92, the water collides with a facing surface 912 of the tank 91, which faces to the water inlet port 92 at a constant interval, and then falls toward the inside of the tank 91.

[0085] The solution provision unit 100 causes the acid solution provided by the user to fall toward the inside of the tank 91 through the notch 112a of the downstream opening part 112. The downstream opening part 112 is positioned such that the fall position P2 is farther from the overflow port 94 than the fall position P1. In other words, the downstream opening part 112 of the solution provision unit 100 is disposed farther from the overflow port 94 than the facing surface 912 of the tank 91 in plan view.

[0086] When the acid solution falls at a position as far from the overflow port 94 as possible in this manner, the acid solution supplied into the tank 91 is unlikely to discharge out of the tank 91 through the overflow port 94 as compared to a case in which the acid solution falls near the overflow port 94. Accordingly, for example, when the acid solution in an amount exceeding the capacity of the tank 91 is provided while water remains in the tank 91, the water is discharged through the overflow port 94 before the acid solution is discharged, which leads to reduction of unnecessary consumption of the acid solution. Since the acid solution is unlikely to be discharged through the overflow port 94, adhesion of the acid solution having overflowed through the overflow port 94 to a peripheral member can be reduced.

[0087] As illustrated in Figs. 8 and 9, the solution provision unit 100 causes the acid solution to fall at a position farther from the water outlet port 93 than the fall position P1 at which water having flowed out of the water inlet port 92 falls to the tank 91. Specifically, the downstream opening part 112 is positioned such that the fall position P2 of the acid solution is farther from the water outlet port 93 than the fall position P1 of water. In other words, the downstream opening part 112 of the solution provision unit 100 is disposed at a position farther from the water outlet port 93 than the facing surface 912 of the tank 91 in plan view.

[0088] When the acid solution falls at a position as far from the water outlet port 93 as possible in this manner, decrease of scale removal efficiency when water remains in the tank 91 is reduced as compared to a case in which the acid solution falls near the water outlet port 93.

[0089] Specifically, in the scale removal processing, when the acid solution in the tank 91 is supplied to the downstream water supply path 52, the nozzle 40, and the like, any excess acid solution is discharged from the nozzle 40 to the toilet bowl 10. The acid solution discharged from the nozzle 40 is acid solution sucked out of the tank 91 through the water outlet port 93 right after start of the scale removal processing, in other words, acid solution near the water outlet port 93. If the acid solution falls near the water outlet port 93 while water remains in the tank 91, the water remaining in the tank 91 is expelled far from the water outlet port 93, whereas the acid solution is positioned near the water outlet port 93. As a result, the acid solution is potentially sucked out through the water outlet port 93 before the water is sucked out, and is unnecessarily discharged through the nozzle 40.

[0090] However, when the acid solution falls at a position far from the water outlet port 93, the water is sucked out through the water outlet port 93 and discharged through the nozzle 40 before the acid solution is sucked out and discharged, thereby preventing unnecessary consumption of the acid solution. In addition, the acid solution not diluted by the water remaining in the tank 91 and thus having a high concentration (with smallest reduction from a desired concentration) is supplied to the downstream water supply path 52, the nozzle 40, and the like. Accordingly, decrease of scale removal efficiency when water remains in the tank 91 is reduced.

[0091] In addition, since the acid solution falls at a position far from the water outlet port 93, the tank 91 is entirely filled with the acid solution. Accordingly, scale accumulated in the tank 91 can be efficiently removed.

[0092] As illustrated in Fig. 9, the tank 91 includes a first accumulation unit 913, and a second accumulation unit 914 that is communicated with the first accumulation unit 913 and deeper than the first accumulation unit 913. The water outlet port 93, the overflow port 94, and the float switch 95 (not illustrated) are disposed in the second accumulation unit 914. The upper opening 911 (refer to

Fig. 3) is provided at an upper part of the first accumulation unit 913, and the solution provision unit 100 causes the acid solution to fall in the first accumulation unit 913.

[0093] The water outlet port 93 is disposed at a position lower than a bottom surface of the first accumulation unit 913, specifically, near a bottom surface of the second accumulation unit 914. However, a slight gap is provided between the water outlet port 93 and the bottom surface of the second accumulation unit 914, and thus water or the acid solution potentially remains at a position lower than the water outlet port 93. The water level in the tank 91 in this state is referred to as an empty water level H2, and the float switch 95 senses the full water level H1 and the empty water level H2 of the tank 91.

[0094] The backflow prevention mechanism 90 is a horizontal backflow prevention mechanism, and thus the size of the sanitary cleaning device 20 can be reduced as compared to a case of a vertical backflow prevention mechanism configured to discharge water in the vertical direction. Since the backflow prevention mechanism 90 is formed integrally with the tank 91, the size of the sanitary cleaning device 20 can be further reduced.

[4. Scale removal processing]

[0095] The following describes specific operation of the scale removal processing with reference to Figs. 10 and 11. Fig. 10 is a flowchart illustrating the procedure of processing in the scale removal mode. Fig. 11 is a flowchart illustrating the processing procedure of the scale removal processing. The processing illustrated in Figs. 10 and 11 is executed by the control unit 200 controlling the pump 64, the switching valve 67, the nozzle 40, and the like included in the sanitary cleaning device 20.

[0096] As illustrated in Fig. 10, the control unit 200 determines whether the instruction to transition to the scale removal mode has been received (step S101). Specifically, when having received the instruction to transition to the scale removal mode, which is output from the operation unit 220, the control unit 200 determines that the instruction to transition to the scale removal mode is received.

[0097] The control unit 200 repeats the determination processing at step S101 until the instruction to transition to the scale removal mode is received (No at step S101). When having determined that the instruction to transition to the scale removal mode is received at step S101 (Yes at step S101), the control unit 200 executes the water discharge processing before the scale removal processing (step SI02).

[0098] In the water discharge processing, water in the tank 91 is discharged. Specifically, the control unit 200 drives the pump 64 to discharge water in the tank 91 through the nozzle 40. The control unit 200 ends the water discharge processing, for example, when a predetermined time has elapsed since start of the water discharge processing. Alternatively, the control unit 200 ends the water discharge processing when the empty water level H2 is sensed by the float switch 95.

[0099] Thereafter, the control unit 200 starts the scale removal processing (step S103). Specifically, as illustrated in Fig. 11, the control unit 200 determines whether the first provision of the acid solution is completed (step S201). Specifically, when having received a provision complete notification output from the operation unit 220, the control unit 200 determines that the first provision of the acid solution is completed. The provision complete notification is transmitted from the operation unit 220 to the control unit 200 upon operation of the operation unit 220 by the user after the provision of the acid solution to the funnel part 102 of the solution provision unit 100.

[0100] The control unit 200 repeats the determination processing at step S201 until the provision complete notification is received (No at step S201). When having determined that the provision complete notification is received at step S201 (Yes at step S201), the control unit 200 drives the pump 64 to suck the acid solution accumulated in the tank 91 out of the tank 91 and to fill the downstream water supply path 52, the nozzle 40, and the like with the acid solution (step S202). The control unit 200 ends the processing at step S202 when a predetermined time has elapsed since start of the drive of the pump 64 or when the empty water level H2 is sensed by the float switch 95.

[0101] At step S202, the control unit 200 drives the switching valve 67 to switch the flowing destination of the acid solution so that flow paths downstream of the switching valve 67, namely, flow paths to the discharge ports 41 of the nozzle 40, flow paths to the spray nozzle 681, and the alkalinity water discharge path 682 are filled with the acid solution. However, since the capacity of the tank 91 is small, it is impossible to entirely fill the downstream water supply path 52, the nozzle 40, and the like only with the acid solution provided into the tank 91 through a single provision operation to the tank 91. Thus, the sanitary cleaning device 20 according to the present embodiment performs provision of the acid solution into the tank 91 twice to entirely fill all of the downstream water supply path 52, the nozzle 40, and the like with the acid solution.

[0102] Subsequently, the control unit 200 determines whether the second provision of the acid solution is completed (step S203). Specifically, when having received the provision complete notification output from the operation unit 220 again, the control unit 200 determines that the second provision of the acid solution is completed. The control unit 200 repeats the determination processing at step S203 until the provision complete notification is received (No at step S203).

[0103] When having determined that the second provision complete notification is received at step S203 (Yes at step S203), the control unit 200 drives the pump 64 again to suck the acid solution accumulated in the tank 91 out of the tank 91 and to fill the downstream water supply path 52, the nozzle 40, and the like with the acid

solution (step S204). Accordingly, all of the downstream water supply path 52, the nozzle 40, and the like are filled with the acid solution. The control unit 200 ends the processing at step S204 when a predetermined time has elapsed since start of the drive of the pump 64 or when the empty water level H2 is sensed by the float switch 95.

[0104] In this manner, in the scale removal processing, the control unit 200 fills the downstream water supply path 52 and the nozzle 40 with the acid solution accumulated in the tank 91 by performing a plurality of times of operation of supplying, to the downstream water supply path 52, the nozzle 40, and the like, all acid solution that can be discharged through the water outlet port 93. Accordingly, all of the downstream water supply path 52, the nozzle 40, and the like are filled with the acid solution also when the tank 91 has a small capacity.

[0105] In this example, the acid solution filling processing is executed twice, but the number of times of repetition of the filling processing is determined based on the capacity of the tank 91 and the amount of acid solution necessary for filling the downstream water supply path 52, the nozzle 40, and the like, and thus is not limited to two.

[0106] Subsequently, the control unit 200 waits for a predetermined time while all of the downstream water supply path 52, the nozzle 40, and the like are filled with the acid solution (step S205). Accordingly, scale accumulated in the downstream water supply path 52, the nozzle 40, and the like is dissolved by the acid solution. In addition, scale accumulated in the tank 91 is dissolved by the acid solution.

[0107] Thereafter, the control unit 200 drives the pump 64 again to discharge the acid solution in the tank 91 through the nozzle 40 (step S206). While driving the pump 64, the control unit 200 drives the electromagnetic valve 62 to supply water into the tank 91 and to discharge the water in the tank 91 through the nozzle 40, the spray nozzle 681, and the alkalinity water discharge path 682. Accordingly, the acid solution remaining in the tank 91, the downstream water supply path 52, the nozzle 40, and the like is replaced with water. When having completed the processing at step S206, the control unit 200 completes the scale removal processing, and ends the scale removal mode.

[0108] In this manner, when having received the instruction to transition to the scale removal mode, the sanitary cleaning device 20 according to the present embodiment executes the water discharge processing of discharging water in the tank 91 before the scale removal processing.

[0109] The user can know an appropriate amount of the acid solution to be provided on the tank 91 by, for example, reading an operation manual or browsing information displayed on the operation unit 220. However, the user cannot know the amount of water accumulated in the tank 91. Thus, when an appropriate amount of the acid solution is provided on the tank 91 by the user, the acid solution potentially overflows through the overflow port 94 depending on the amount of water accumulated in the tank 91.

[0110] However, when having received the instruction to transition to the scale removal mode, the sanitary cleaning device 20 according to the present embodiment executes the water discharge processing to discharge water in the tank 91, thereby reducing leakage of the acid solution through the overflow port 94. Accordingly, the sanitary cleaning device 20 according to the present embodiment can reduce adhesion of the acid solution to a peripheral member disposed around the tank 91.

[0111] In addition, the control unit 200 executes the water discharge processing to discharge, from the tank 91, all water that can be discharged through the water outlet port 93. In other words, the control unit 200 executes the water discharge processing so that the water level in the tank 91 becomes equal to the empty water level H2. Accordingly, a larger amount of the acid solution can be accumulated in the tank 91. In addition, the acid solution can be prevented from being diluted by water remaining in the tank 91.

[0112] In this example, the water level in the tank 91 becomes equal to the empty water level H2 through the water discharge processing, but the water level after the water discharge processing does not necessarily need to be at the empty water level H2. For example, the control unit 200 may execute the water discharge processing so that the water level in the tank 91 becomes equal to a predetermined water level that is higher than the empty water level H2 and lower than the full water level H1. Accordingly, leakage of the acid solution through the overflow port 94 and dilution of the acid solution by remaining water can be reduced as compared to a case in which the water discharge processing is not executed. In addition, for example, when the user provides liquid concentrate of the acid solution while a predetermined amount of water remains in the tank 91, the acid solution diluted to a desired concentration can be obtained in the tank 91 without causing extra work for the user.

[0113] When the amount of acid solution provided by the user exceeds an appropriate amount, execution of the water discharge processing before the scale removal processing potentially fails to prevent the acid solution from overflowing through the overflow port 94. Thus, the sanitary cleaning device 20 executes solution discharge processing to more reliably reduce overflow of the acid solution through the overflow port 94.

[0114] The following describes the content of the solution discharge processing with reference to Fig. 12. Fig. 12 is a flowchart illustrating the processing procedure of the solution discharge processing.

[0115] The acid solution is potentially wrongly provided at a time not in the scale removal mode. Thus, the solution discharge processing is executed irrespective of whether the scale removal mode is activated.

[0116] As illustrated in Fig. 12, the control unit 200 determines whether the full water level H1 is sensed by the float switch 95 (step S301). The control unit 200 repeats

the processing at step S301 until the full water level H1 is sensed (No at step S301).

[0117] When having determined that the full water level H1 is sensed at step S301 (Yes at step S301), the control unit 200 drives the pump 64 (step S302) to discharge the acid solution (or water) in the tank 91 through the nozzle 40.

[0118] Subsequently, the control unit 200 determines whether the full water level H1 is canceled, in other words, whether the full water level H1 is not sensed by the float switch 95 (step S303).

[0119] When having determined that the full water level H1 is canceled at step S303 (Yes at step S303), the control unit 200 stops the pump 64 (step S304), and ends the solution discharge processing.

[0120] When the full water level H1 is not canceled at step S303 (No at step S303), the control unit 200 determines whether the pump 64 has been driven for a time exceeding a threshold (step S305). When the control unit 200 has determined that the pump 64 has been driven for a time not exceeding the threshold (No at step S305), the processing returns to step S303.

[0121] When having determined that the driven time of the pump 64 has exceeded the threshold at step S305 (Yes at step S305), the control unit 200 starts the scale removal processing described above (step SI03), and ends the solution discharge processing.

[0122] In this manner, when the full water level H1 is sensed by the float switch 95, the control unit 200 executes the solution discharge processing of discharging the acid solution in the tank 91. Accordingly, the acid solution can be more reliably prevented from overflowing through the overflow port 94.

[0123] In this example, the solution discharge processing is executed when the full water level H1 is sensed, but may be executed at least when the float switch 95 has sensed the water level in the tank 91 to be at a high water level that is higher than half of the full water level H1.

[0124] The control unit 200 executes the scale removal processing when the driven time of the pump 64 has exceeded the threshold, in other words, when the full water level H1 has been continuously maintained for a constant time in the solution discharge processing, irrespective of whether the instruction to transition to the scale removal mode has been received. Accordingly, unnecessary discharging of the acid solution can be reduced.

[0125] The control unit 200 may always execute the scale removal processing when having executed the solution discharge processing, irrespective of the driven time of the pump 64. Accordingly, the acid solution can be prevented from remaining in the tank 91 and the downstream water supply path 52.

[0126] The following describes exemplary operation of the sanitary cleaning device 20 in the scale removal mode with reference to Fig. 13. Fig. 13 is a timing chart illustrating the exemplary operation of the sanitary cleaning device 20 in the scale removal mode.

[0127] Fig. 13 illustrates, sequentially from the top, the state of the electromagnetic valve 62, the water level in the tank 91, and the drive state of the pump 64. Before transition to the scale removal mode, the electromagnetic valve 62 is closed, and the pump 64 is turned off. In this state, a predetermined amount of water is accumulated in the tank 91.

[0128] As illustrated in Fig. 13, upon transition to the scale removal mode, first, the pump 64 is driven (T1) to discharge water in the tank 91 (the water discharge processing). Thereafter, when the water level in the tank 91 becomes equal to the empty water level H2, the pump 64 stops (T2).

[0129] Subsequently, the acid solution is provided into the tank 91 by the user, and the water level in the tank 91 increases accordingly. When the water level in the tank 91 exceeds the full water level H1 (T3), the pump 64 is driven to discharge surplus acid solution out of the tank 91 (the solution discharge processing). Thereafter, when the water level in the tank 91 becomes lower than the full water level H1, the pump 64 stops (T4).

[0130] Subsequently, when the user transmits the provision complete notification by using the operation unit 220, the pump 64 is driven (T5) to fill the downstream water supply path 52, the nozzle 40, and the like with the acid solution in the tank 91. When the water level in the tank 91 becomes equal to the empty water level H2, the pump 64 stops (T6).

[0131] Subsequently, the acid solution is provided into the tank 91 by the user again, and the water level in the tank 91 increases accordingly. Thereafter, when the user transmits the provision complete notification by using the operation unit 220, the pump 64 is driven (T7) to fill the downstream water supply path 52, the nozzle 40, and the like with the acid solution in the tank 91.

[0132] Subsequently, when the water level in the tank 91 becomes equal to, for example, half of the full water level H1 (T8), the pump 64 temporarily stops. Then, after a wait for a constant time, the pump 64 is driven again (T9) to fill the downstream water supply path 52, the nozzle 40, and the like with the acid solution in the tank 91 again. Thereafter, when the water level in the tank 91 becomes equal to the empty water level H2, the pump 64 stops (T10).

[0133] Subsequently, after a wait for a constant time (T11), the electromagnetic valve 62 is opened to supply water into the tank 91, and the pump 64 is driven to discharge the water supplied into the tank 91 to the toilet bowl 10 through the downstream water supply path 52, the nozzle 40, and the like. Accordingly, the acid solution remaining in the downstream water supply path 52, the nozzle 40, and the like is discharged.

[0134] Thereafter, after a constant time has elapsed (T12), the electromagnetic valve 62 is closed and the pump 64 stops, which ends the scale removal mode.

[0135] As described above, the sanitary cleaning device 20 according to the present embodiment includes the nozzle 40, the water supply path 50, the backflow

prevention mechanism 90, and the solution provision unit 100. The nozzle 40 discharges water toward the region of the user. The water supply path 50 is a path through which water is supplied to the nozzle 40. The backflow prevention mechanism 90 includes the tank 91 provided on the water supply path 50, the water inlet port 92 that is communicated with the upstream water supply path 51 positioned upstream of the tank 91 on the water supply path 50 and through which water flows into the tank 91, the water outlet port 93 that is communicated with the downstream water supply path 52 positioned downstream of the tank 91 on the water supply path 50 and through which water in the tank 91 flows out to the downstream water supply path 52, and the overflow port 94 that is provided to form an air gap between the overflow port 94 and the water inlet port 92 and through which surplus water in the tank 91 is discharged. The solution provision unit 100 includes the provision port 121 through which the acid solution is provided by the user, the solution supply path 113 through which the acid solution provided through the provision port 121 circulates, and the downstream opening part 112 (an exemplary solution inlet port) through which the acid solution flowing through the solution supply path 113 flows into the tank 91. The solution supply path 113 of the solution provision unit 100 includes the expansion part, the flow-path cross-sectional area of which increases toward the downstream opening part 112.

[0136] The sanitary cleaning device 20 according to the present embodiment includes the nozzle 40, the water supply path 50, the backflow prevention mechanism 90, the solution provision unit 100, and the control unit 200. The nozzle 40 discharges water toward the region of the user. The water supply path 50 is a path through which water is supplied to the nozzle 40. The backflow prevention mechanism 90 includes the tank 91 provided on the water supply path 50, the water inlet port 92 that is communicated with the upstream water supply path 51 positioned upstream of the tank 91 on the water supply path 50 and through which water flows into the tank 91, the water outlet port 93 that is communicated with the downstream water supply path 52 positioned downstream of the tank 91 on the water supply path 50 and through which water in the tank 91 flows out to the downstream water supply path 52, and the overflow port 94 that is provided to form an air gap between the overflow port 94 and the water inlet port 92 and through which surplus water in the tank 91 is discharged. The solution provision unit 100 supplies the acid solution provided by the user to the tank 91. The control unit 200 executes, when having received the instruction to transition to the scale removal mode, the scale removal processing of filling the downstream water supply path 52 and the nozzle 40 with the acid solution accumulated in the tank 91 and then discharging the acid solution through the downstream water supply path 52 and the nozzle 40. When having received the instruction to transition to the scale removal mode, the control unit 200 executes the water discharge processing of discharging water in the tank 91 before the scale removal processing.

[0137] With this configuration, the sanitary cleaning device 20 according to the present embodiment can reduce adhesion of the acid solution to a peripheral member disposed around the tank 91 that accumulates acid solution.

[0138] In the above-described embodiment, the water discharge processing is executed before the scale removal processing. However, the present invention is not limited thereto. The control unit 200 may execute the scale removal processing without executing the water discharge processing when the float switch 95 has sensed the water level in the tank 91 to be lower than the low water level that is lower than half of the full water level H1. For example, the control unit 200 may omit the water discharge processing when the float switch 95 has sensed the water level in the tank 91 to be at the empty water level H2. In this manner, the scale removal processing can be started early, thereby reducing a wait time for the user.

[0139] The embodiment describes above the example in which the water level sensing unit configured to sense the water level in the tank 91 is the float switch 95, but the water level sensing unit does not necessarily need to be the float switch 95. For example, the water level sensing unit may be a water surface sensor.

SECOND EMBODIMENT

[0140] The following describes another exemplary configuration of the body part included in the solution provision unit with reference to Figs. 14 to 16. Fig. 14 is a perspective view of the body part of the solution provision unit according to a second embodiment. Fig. 15 is a bottom view of the body part of the solution provision unit according to the second embodiment. Fig. 16 is a perspective view of the body part in a state in which a cover member to be described later is removed.

[0141] As illustrated in Figs. 14 and 15, in the body part 101A according to the second embodiment, a solution supply path 113A has a downstream part extending downward, and a downstream opening part 112A in the vertical direction is provided at a downstream end part of the downstream part.

[0142] Specifically, as illustrated in Fig. 16, the solution supply path 113A of the body part 101A according to the second embodiment includes a third extension part 113c in addition to the first extension part 113a and the second extension part 113b. The third extension part 113c extends in the vertical direction, and is communicated with the second extension part 113b on the upstream side and communicated with the downstream opening part 112A on the downstream side.

[0143] The flow-path cross-sectional area of the third extension part 113c is larger than the flow-path cross-sectional area of the second extension part 113b, to which the expansion part is provided, at an upstream end

part, and is smaller than the flow-path cross-sectional area of the second extension part 113b at a downstream end part.

[0144] A cover member 114 is a part of the third extension part 113c, and detachably provided onto the body part 101A.

[0145] As described above, the body part 101A according to the second embodiment includes the third extension part 113c extending downward, and the downstream opening part 112A is provided at the downstream end part of the third extension part 113c. Accordingly, the downstream opening part 112A is disposed close to the upper opening 911 of the tank 91 as compared to the body part 101 according to the first embodiment. This configuration reduces adhesion of the acid solution having flowed out of the downstream opening part 112A to a peripheral member disposed around the tank 91.

[0146] The third extension part 113c preferably extends to, for example, the same height position as that of the upper opening 911 (refer to Fig. 3) of the tank 91 or a position lower than the upper opening 911. In other words, the downstream opening part 112A of the body part 101A is preferably disposed at the same height position as that of the upper opening 911 of the tank 91 or a position lower than the upper opening 911. This configuration more reliably reduces adhesion of the acid solution having flowed out of the downstream opening part 112A to a peripheral member disposed around the tank 91.

[0147] Further effects and modifications can be easily derived by those skilled in the art. Thus, the broader aspects of the present invention are not limited to the specific details and representative embodiments shown and described above. Accordingly, various modifications are possible without departing from the scope of the general inventive concept as defined by the appended claims.

Claims

1. A sanitary cleaning device (20) comprising:

a nozzle (40) configured to discharge water toward a region of a user;
a water supply path (50) through which water is supplied to the nozzle;
a backflow prevention mechanism (90) including a tank (91) provided on the water supply path, a water inlet port (92) that is communicated with an upstream water supply path (51) positioned upstream of the tank on the water supply path and through which water flows into the tank, and a water outlet port (93) that is communicated with a downstream water supply path (52) positioned downstream of the tank on the water supply path and through which water in the tank flows out to the downstream water supply path; and
a solution provision unit (100) including a provision port (121) through which acid solution is provided by the user, a solution supply path (113) through which the acid solution provided through the provision port circulates, and a solution inlet port (112) through which the acid solution flowing through the solution supply path flows into the tank,
characterized in that
the backflow prevention mechanism includes an overflow port (94) that is provided to form an air gap between the overflow port and the water inlet port and through which surplus water in the tank is discharged, and
the solution supply path of the solution provision unit includes an expansion part in which a flow-path cross-sectional area increases toward the solution inlet port.

2. The sanitary cleaning device according to claim 1, wherein
the solution supply path includes:

a first extension part (113a) communicated with the provision port and extending in a vertical direction, and
a second extension part (113b) communicated with the solution inlet port and extending in a horizontal direction, and

the expansion part is provided on the second extension part.

3. The sanitary cleaning device according to claim 2, wherein, at the second extension part, a flow path width in the horizontal direction is larger than a flow path width in the vertical direction.

4. The sanitary cleaning device according to claim 2 or 3, wherein, at the expansion part of the solution supply path, both of a flow path width in the vertical direction and a flow path width in the horizontal direction increase toward the solution inlet port.

5. The sanitary cleaning device according to any one of claims 1 to 4, wherein the solution provision unit includes a funnel part (102) having an opening area that increases toward the provision port from a downstream side of the provision port.

6. The sanitary cleaning device according to claim 5, wherein the funnel part is detachably attached.

7. The sanitary cleaning device according to any one of claims 1 to 6, wherein the solution provision unit causes the acid solution to fall at a position farther from the overflow port than a position at which water having flowed out through the water inlet port falls in

the tank.

8. The sanitary cleaning device according to any one of claims 1 to 7, wherein the solution provision unit causes the acid solution to fall at a position farther from the water outlet port than the position at which water having flowed out through the water inlet port falls in the tank.

Patentansprüche

1. Sanitäre Reinigungsvorrichtung (20), Folgendes umfassend:

   eine Düse (40), die dafür gestaltet ist, Wasser zu einem Bereich eines Benutzers abzulassen, einen Wasserzufuhrweg (50), durch den Wasser zur Düse geführt wird,
   einen Rückströmungs-Verhinderungsmechanismus (90), der einen Tank (91), der an dem Wasserzufuhrweg bereitgestellt ist, einen Wassereinlassanschluss (92), der in Verbindung mit einem vorgelagerten Wasserzufuhrweg (51) steht, der dem Tank an dem Wasserzufuhrweg vorgelagert ist und durch den Wasser in den Tank strömt, und einen Wasserauslassanschluss (93) beinhaltet, der in Verbindung mit einem nachgelagerten Wasserzufuhrweg (52) steht, der dem Tank an dem Wasserzufuhrweg nachgelagert ist und durch den Wasser von dem Tank zum nachgelagerten Wasserzufuhrweg ausströmt, und
   eine Lösungsbereitstellungseinheit (100), die einen Bereitstellungsanschluss (121), durch den Säurelösung von dem Benutzer bereitgestellt wird, einen Lösungszufuhrweg (113), durch den die Säurelösung zirkuliert, die durch den Bereitstellungsanschluss bereitgestellt wird, und einen Lösungseinlassanschluss (112) beinhaltet, durch den die Säurelösung, die durch den Lösungszufuhrweg strömt, in den Tank strömt,
   dadurch gekennzeichnet, dass
   der Rückströmungs-Verhinderungsmechanismus einen Überlaufanschluss (94) beinhaltet, der dafür bereitgestellt ist, einen Luftspalt zwischen dem Überlaufanschluss und dem Wassereinlassanschluss zu bilden und durch den überschüssiges Wasser in dem Tank abgelassen wird, und dass
   der Lösungszufuhrweg der Lösungsbereitstellungseinheit einen Ausdehnungsteil beinhaltet, in dem eine Strömungsweg-Querschnittsfläche hin zum Lösungseinlassanschluss zunimmt.

2. Sanitäre Reinigungsvorrichtung nach Anspruch 1, wobei der Lösungszufuhrweg Folgendes beinhaltet:

   einen ersten Erweiterungsteil (113a), der mit dem Bereitstellungsanschluss in Verbindung steht und sich in einer vertikalen Richtung erstreckt, und
   einen zweiten Erweiterungsteil (113b), der mit dem Lösungseinlassanschluss in Verbindung steht und sich in einer horizontalen Richtung erstreckt, und
   wobei der Ausdehnungsteil am zweiten Erweiterungsteil bereitgestellt ist.

3. Sanitäre Reinigungsvorrichtung nach Anspruch 2, wobei am zweiten Erweiterungsteil eine Strömungswegweite in der horizontalen Richtung größer als eine Strömungswegweite in der vertikalen Richtung ist.

4. Sanitäre Reinigungsvorrichtung nach Anspruch 2 oder 3, wobei bei dem Ausdehnungsteil des Lösungszufuhrweges sowohl eine Strömungswegweite in der vertikalen Richtung als auch eine Strömungswegweite in der horizontalen Richtung hin zum Lösungseinlassanschluss zunehmen.

5. Sanitäre Reinigungsvorrichtung nach einem der Ansprüche 1 bis 4, wobei die Lösungsbereitstellungseinheit einen Trichterteil (102) beinhaltet, der eine Öffnungsfläche aufweist, die von einer nachgelagerten Seite des Bereitstellungsanschlusses aus hin zum Bereitstellungsanschluss zunimmt.

6. Sanitäre Reinigungsvorrichtung nach Anspruch 5, wobei der Trichterteil lösbar angebracht ist.

7. Sanitäre Reinigungsvorrichtung nach einem der Ansprüche 1 bis 6, wobei die Lösungsbereitstellungseinheit bewirkt, dass die Säurelösung an eine Position fällt, die weiter vom Überlaufanschluss entfernt ist als eine Position, an der Wasser, das durch den Wassereinlassanschluss ausgelaufen ist, in den Tank fällt.

8. Sanitäre Reinigungsvorrichtung nach einem der Ansprüche 1 bis 7, wobei die Lösungsbereitstellungseinheit bewirkt, dass die Säurelösung an eine Position fällt, die weiter vom Wasserauslassanschluss entfernt ist als die Position, an der Wasser, das durch den Wassereinlassanschluss ausgelaufen ist, in den Tank fällt.

Revendications

1. Dispositif de nettoyage sanitaire (20) comprenant :

   une buse (40) configurée pour décharger de l'eau vers une région d'un utilisateur ;
   une voie d'alimentation en eau (50) par le biais

de laquelle l'eau est amenée à la buse ;
un mécanisme de prévention refoulement (90) comprenant un réservoir (91) prévu sur la voie d'alimentation en eau, un orifice d'entrée d'eau (92) qui est en communication avec une voie d'alimentation en eau amont (51) positionnée en amont du réservoir sur la voie d'alimentation en eau et par le biais duquel de l'eau s'écoule dans le réservoir, et un orifice de sortie d'eau (93) qui est en communication avec une voie d'alimentation en eau aval (52) positionnée en aval du réservoir sur la voie d'alimentation en eau et par le biais duquel de l'eau dans le réservoir sort dans la voie d'alimentation en eau aval ; et
une unité d'approvisionnement de solution (100) comprenant un orifice d'approvisionnement (121) par le biais duquel de la solution acide est fournie par l'utilisateur, une voie d'alimentation en solution (113) par le biais de laquelle la solution acide fournie par l'orifice d'approvisionnement circule, et un orifice d'entrée de solution (112) par le biais duquel la solution acide s'écoulant par la voie d'alimentation en solution s'écoule dans le réservoir,
caractérisé en ce que :

le mécanisme de prévention refoulement comprend un orifice de trop-plein (94) qui est prévu afin de former un vide d'air entre l'orifice de trop-plein et l'orifice d'entrée d'eau et par le biais duquel l'eau en excès dans le réservoir est déchargée, et
la voie d'alimentation en solution de l'unité d'approvisionnement de solution comprend une partie d'expansion dans laquelle une section transversale de voie d'écoulement augmente vers l'orifice d'entrée de solution.

2. Dispositif de nettoyage sanitaire selon la revendication 1, dans lequel :

la voie d'alimentation en solution comprend :

une première partie d'extension (113a) en communication avec l'orifice d'approvisionnement et s'étendant dans une direction verticale, et
une seconde partie d'extension (113b) en communication avec l'orifice d'entrée de solution et s'étendant dans une direction horizontale, et

la partie d'expansion est prévue sur la seconde partie d'extension.

3. Dispositif de nettoyage sanitaire selon la revendication 2, dans lequel, au niveau de la seconde partie d'extension, une largeur de voie d'écoulement dans la direction horizontale est supérieure à une largeur de voie d'écoulement dans la direction verticale.

4. Dispositif de nettoyage sanitaire selon la revendication 2 ou 3, dans lequel, au niveau de la partie d'expansion de la voie d'alimentation en solution, à la fois une largeur de voie d'écoulement dans la direction verticale et une largeur de voie d'écoulement dans la direction horizontale augmentent vers l'orifice d'entrée de solution.

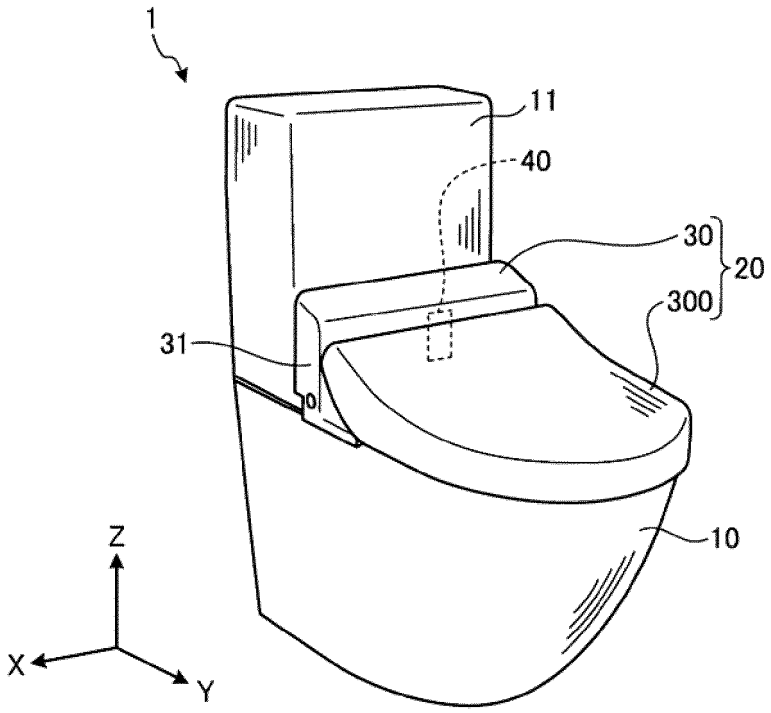
5. Dispositif de nettoyage sanitaire selon l'une quelconque des revendications 1 à 4, dans lequel l'unité d'approvisionnement de solution comprend une partie d'entonnoir (102) ayant une zone d'ouverture qui augmente vers l'orifice d'approvisionnement à partir d'un côté en aval de l'orifice d'approvisionnement.

6. Dispositif de nettoyage sanitaire selon la revendication 5, dans lequel la partie d'entonnoir est fixée de manière détachable.

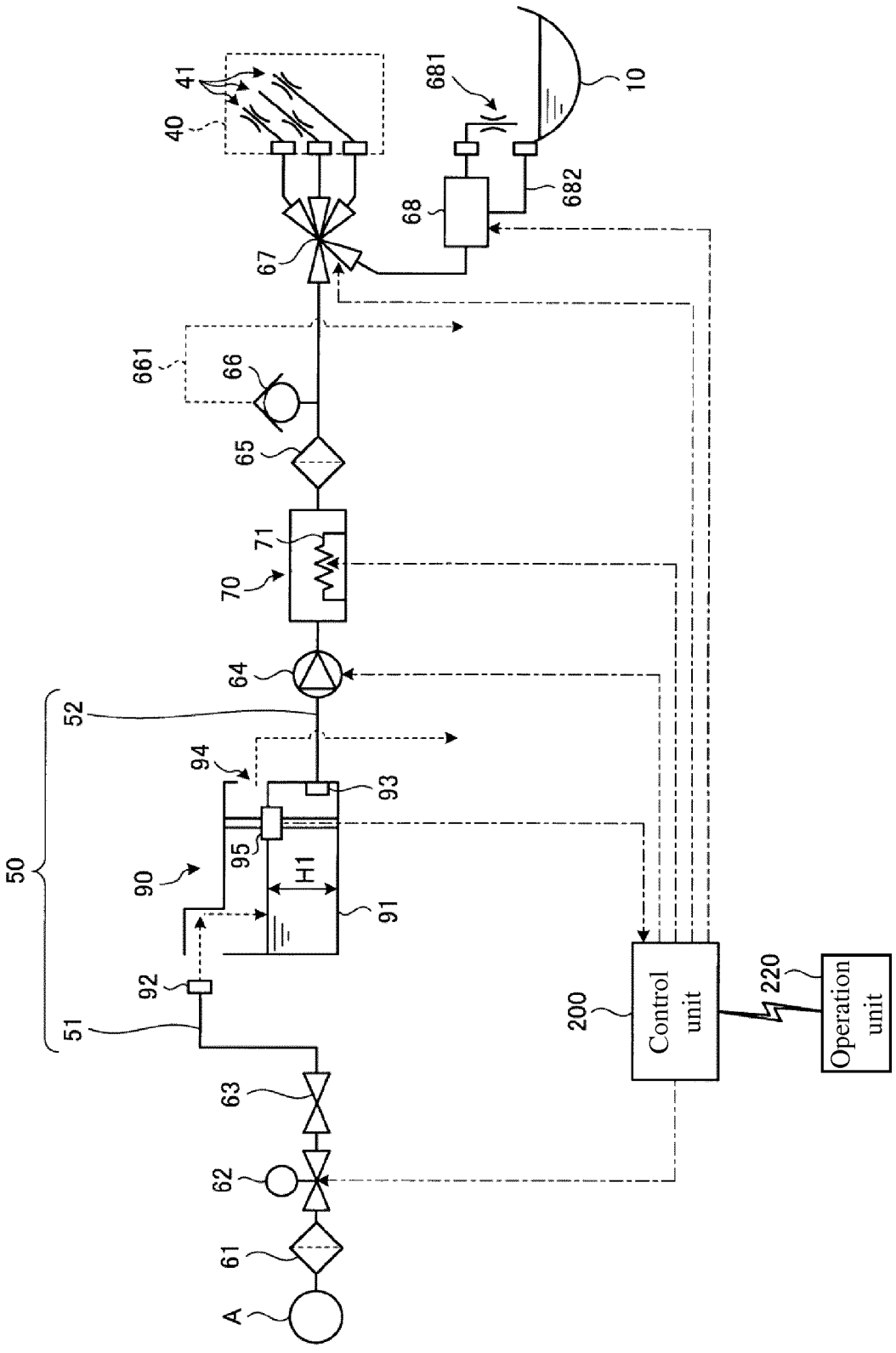
7. Dispositif de nettoyage sanitaire selon l'une quelconque des revendications 1 à 6, dans lequel l'unité d'approvisionnement de solution amène la solution acide à tomber dans une position plus éloignée de l'orifice de trop-plein qu'une position dans laquelle l'eau qui s'est écoulée par l'orifice d'entrée d'eau, tombe dans le réservoir.

8. Dispositif de nettoyage sanitaire selon l'une quelconque des revendications 1 à 7, dans lequel l'unité d'approvisionnement de solution amène la solution acide à tomber dans une position plus éloignée de l'orifice de sortie d'eau que la position à laquelle l'eau qui s'est écoulée par l'orifice d'entrée d'eau, tombe dans le réservoir.

[Fig. 1]

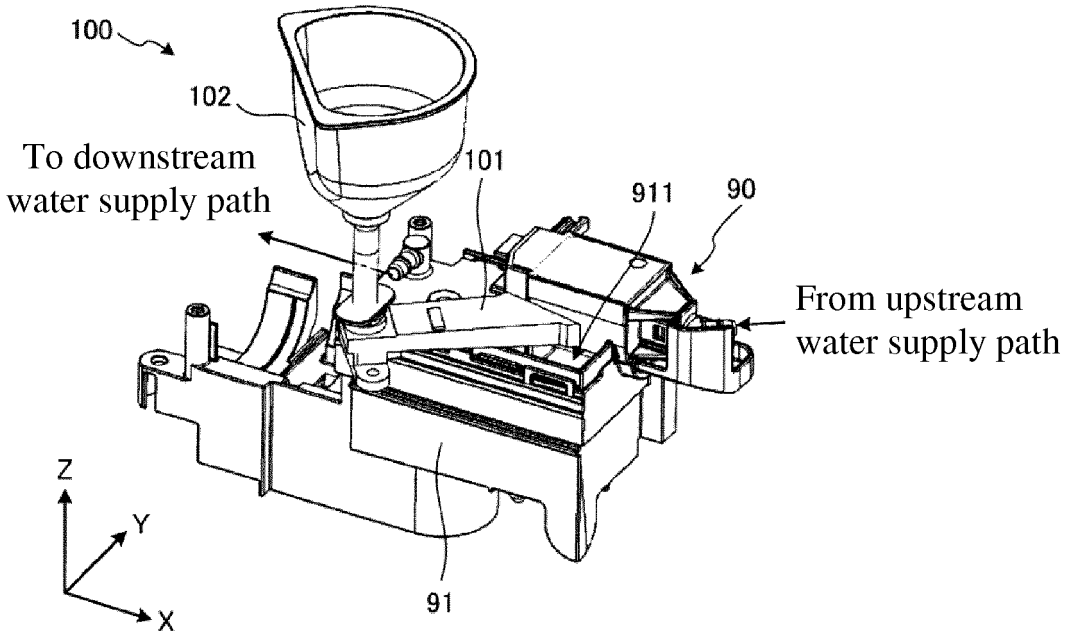


[Fig. 2]

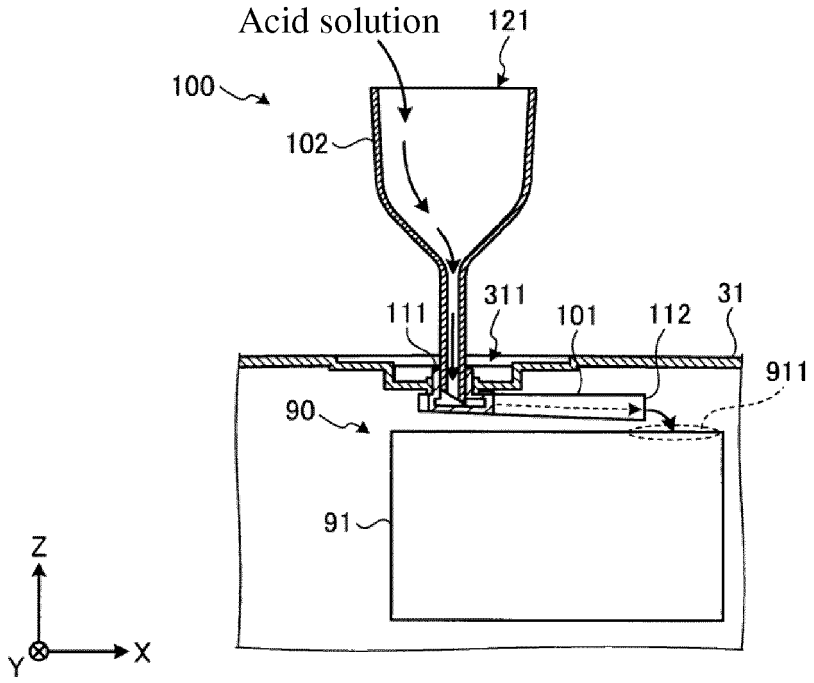

41
40
681
10
682
68
67
661
66
65
71
70
64
52
94
93
95
H1
90
91
50
92
51
63
62
61
A
200
Control unit
220
Operation unit

[Fig. 2]

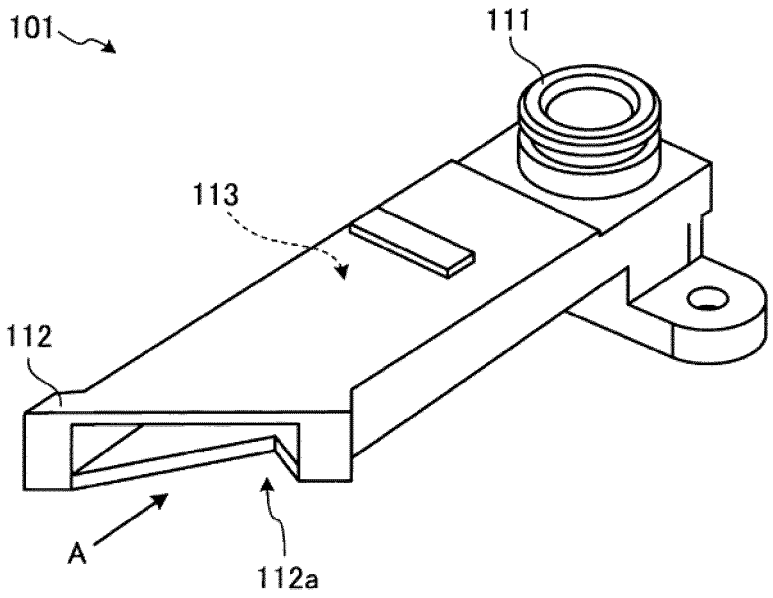
[Fig. 3]


100
102
To downstream
water supply path
101
911
90
From upstream
water supply path
Z
Y
X
91

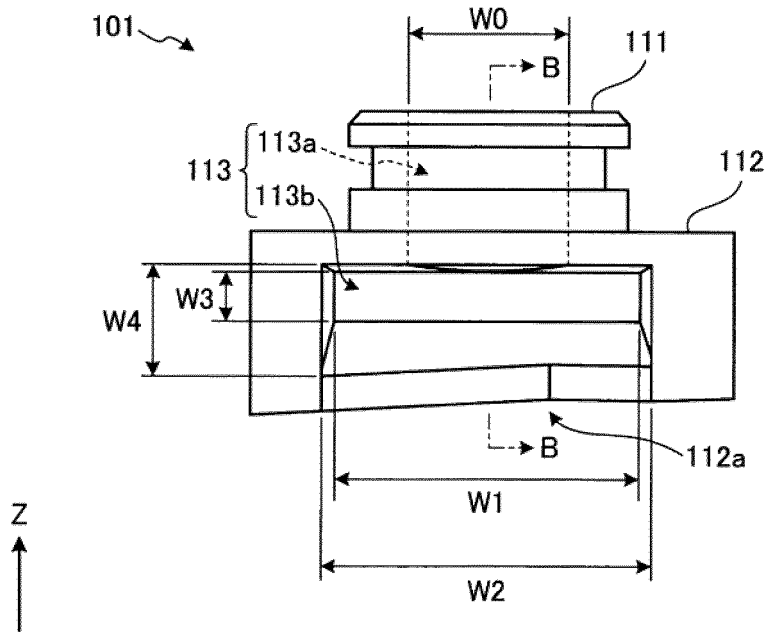
[Fig. 4]


Acid solution
121
100
102
111
311
101
112
31
911
90
91
Z
Y
X

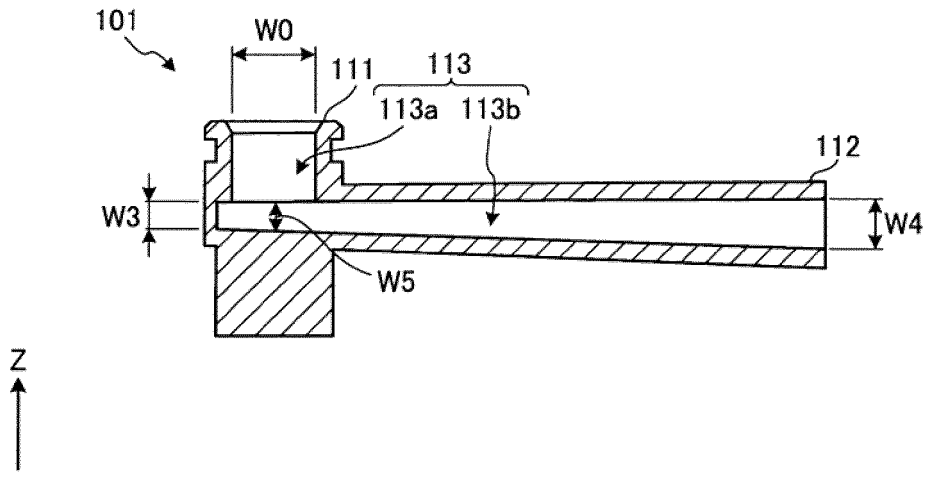
[Fig. 5]



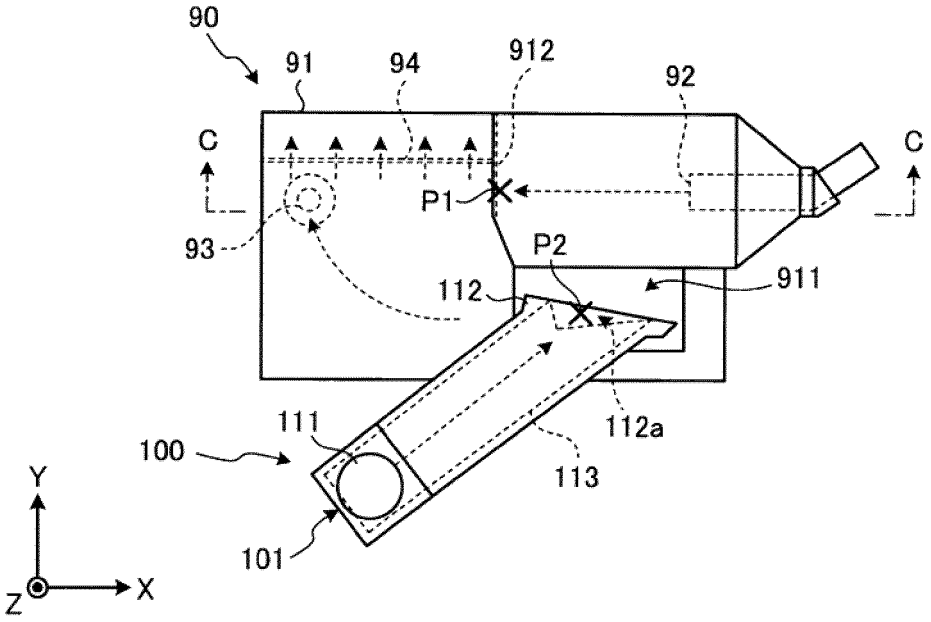
[Fig. 6]


101
W0
B
111
113
113a
113b
112
W3
W4
B
112a
W1
W2
Z

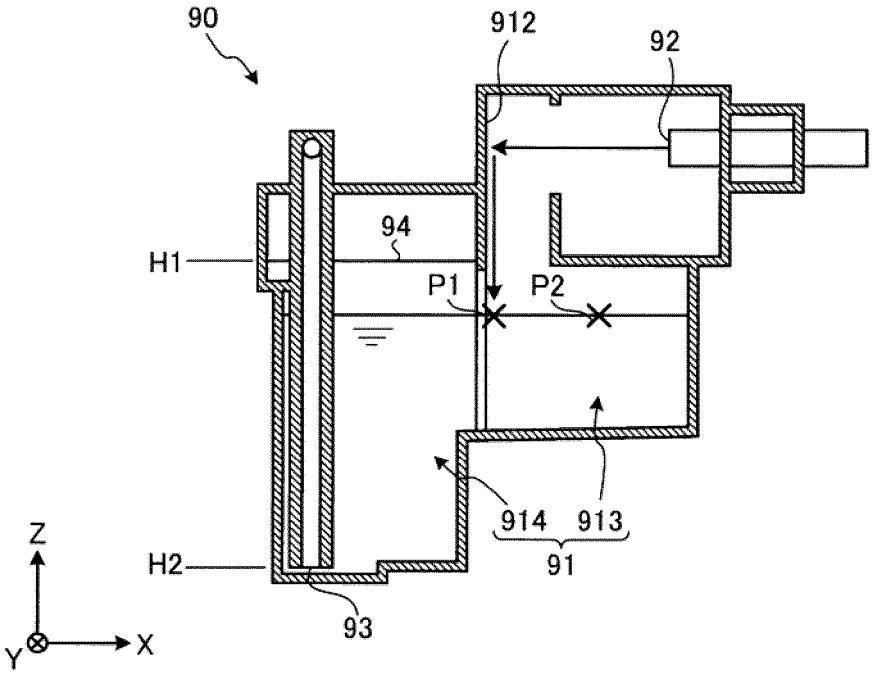
[Fig. 7]


101
W0
111
113
113a
113b
112
W3
W4
W5
Z

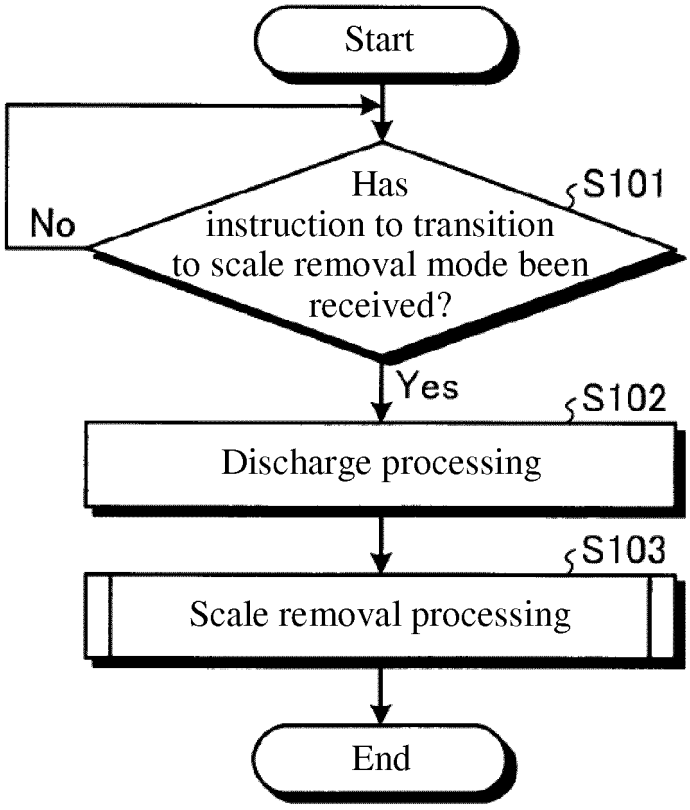
[Fig. 8]


90
91
94
912
92
C
C
P1
93
P2
911
112
112a
111
100
113
101
Y
Z
X

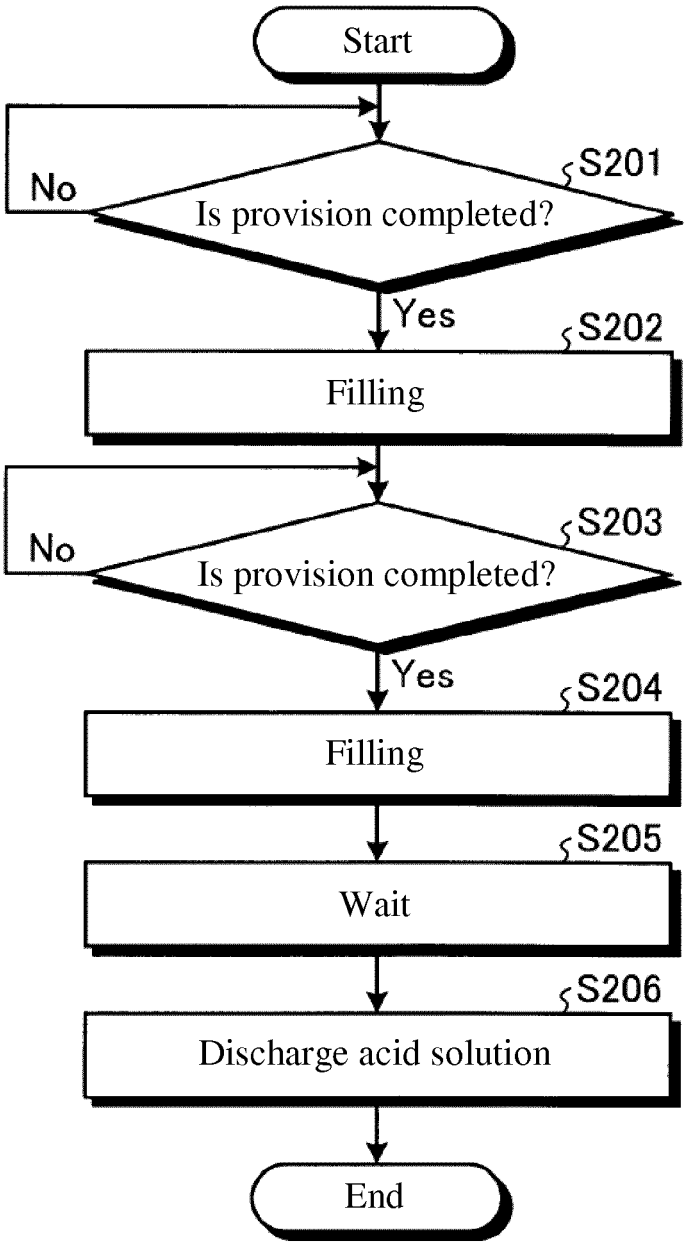
[Fig. 9]


90
912
92
94
H1
P1
P2
914
913
91
Z
H2
93
Y
X

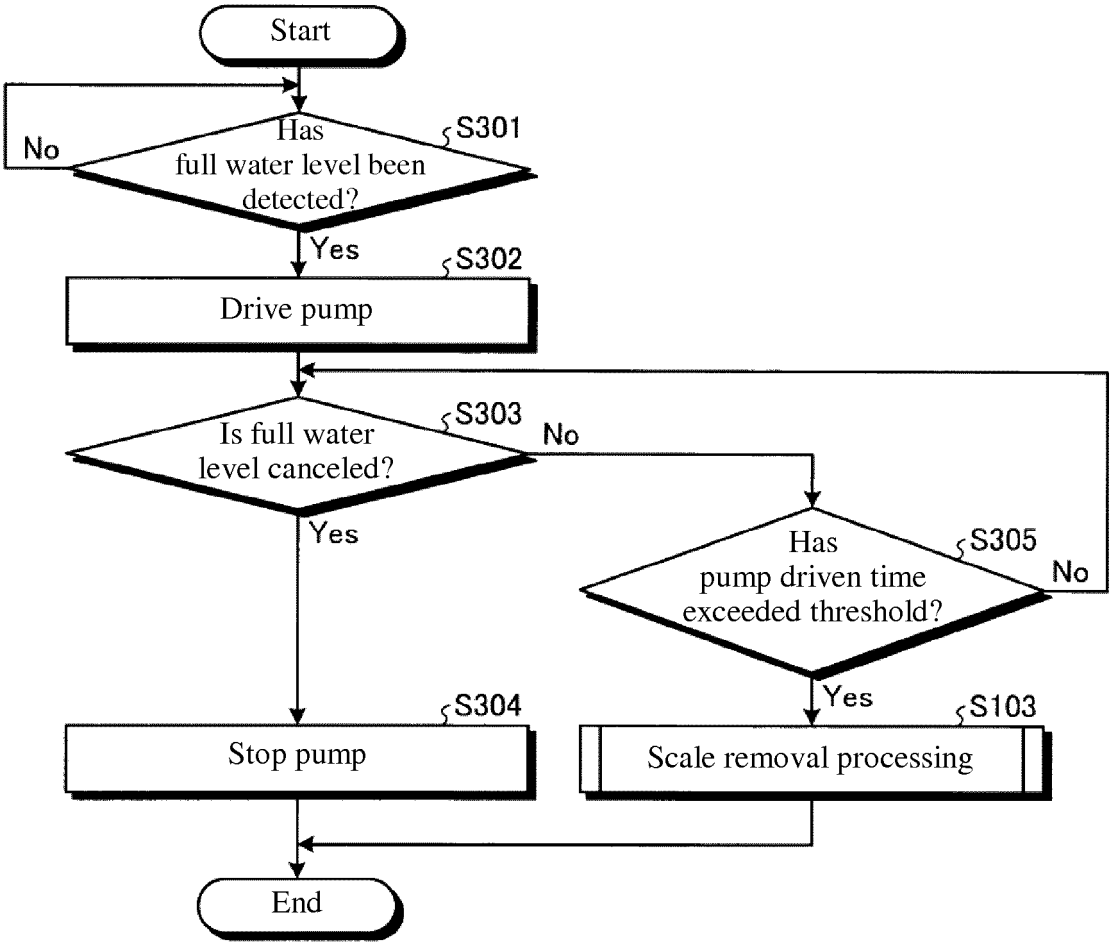
[Fig. 10]


Start
Has instruction to transition to scale removal mode been received?
S101
No
Yes
S102
Discharge processing
S103
Scale removal processing
End

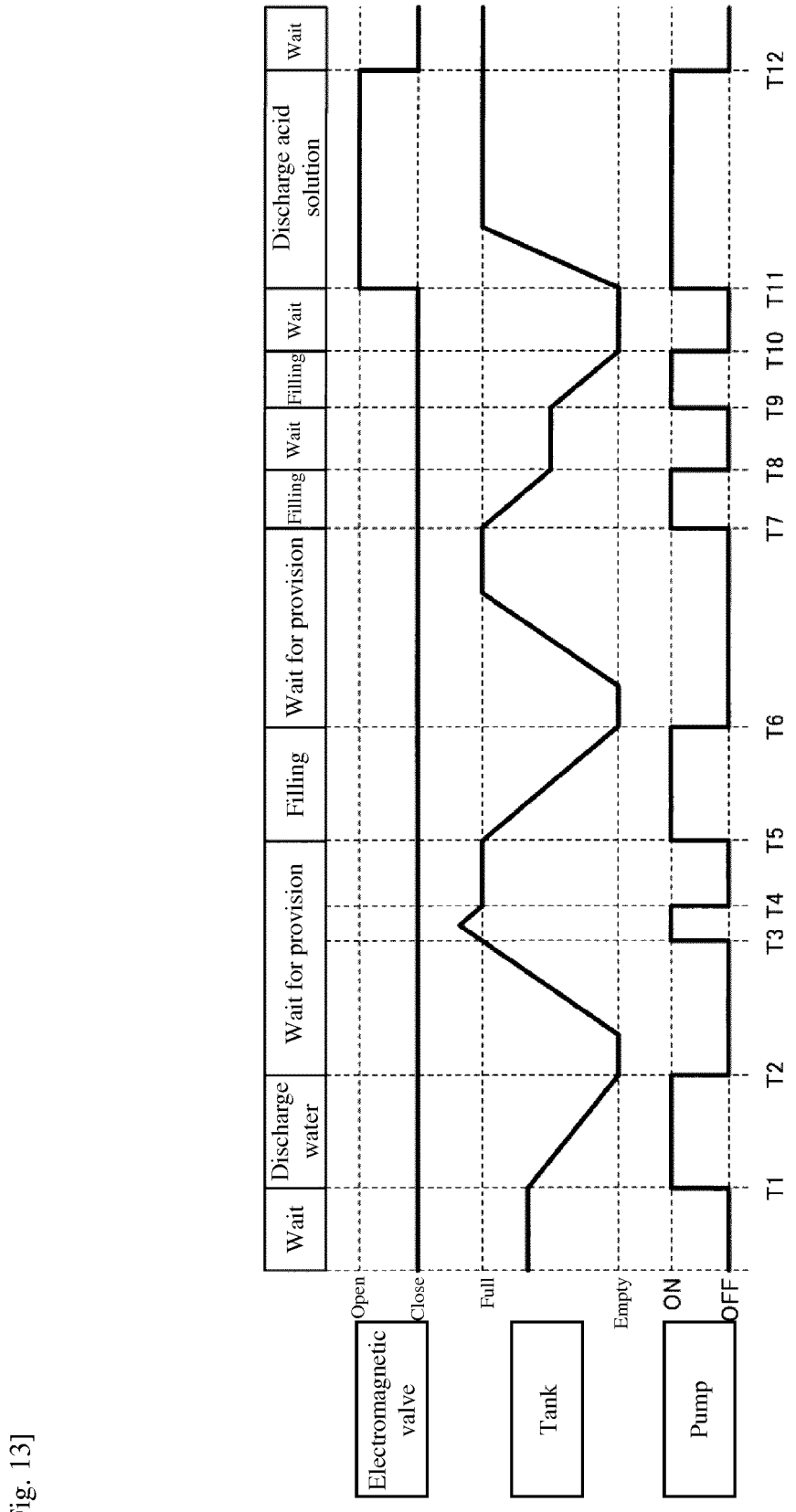
[Fig. 11]


Start
S201
No
Is provision completed?
Yes
S202
Filling
S203
No
Is provision completed?
Yes
S204
Filling
S205
Wait
S206
Discharge acid solution
End

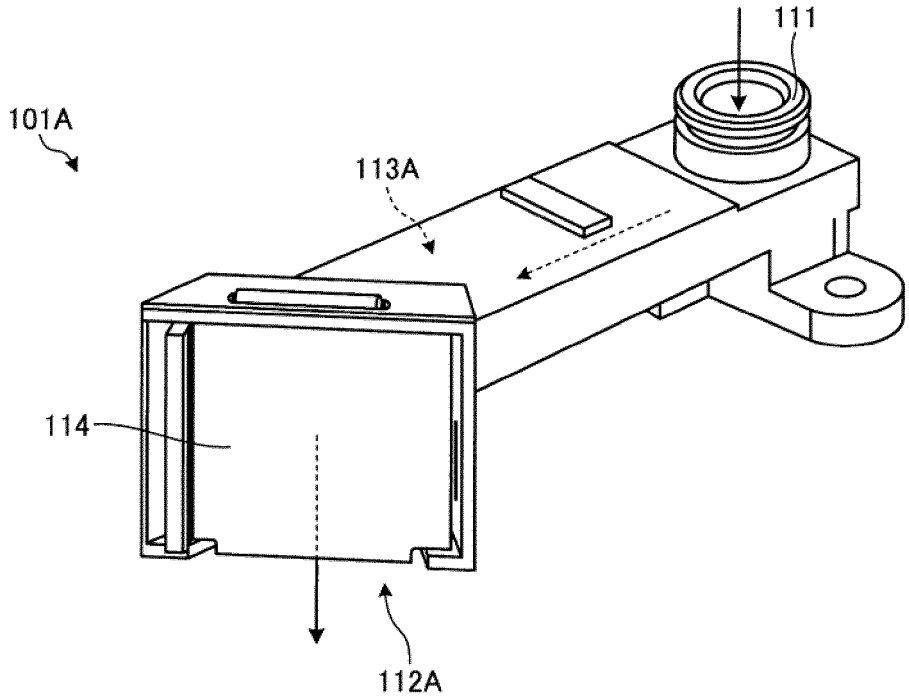
[Fig. 12]


Start
Has full water level been detected?
S301
No
Yes
S302
Drive pump
Is full water level canceled?
S303
No
Yes
Has pump driven time exceeded threshold?
S305
No
Yes
S304
Stop pump
S103
Scale removal processing
End

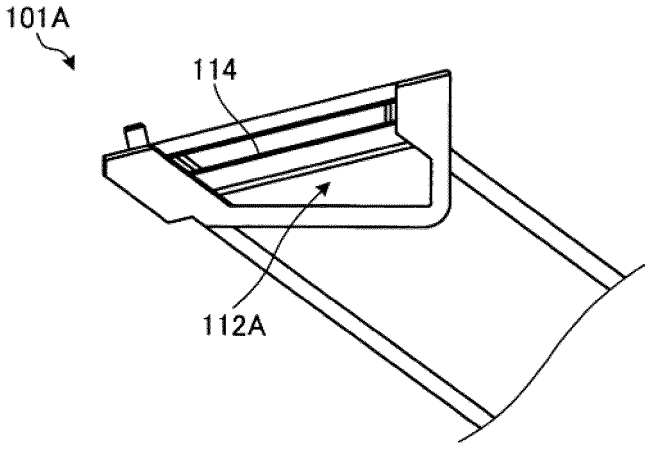
[Fig. 13]


Wait
Discharge water
Wait for provision
Filling
Wait for provision
Filling
Wait
Filling
Wait
Discharge acid solution
Wait
T1
T2
T3 T4
T5
T6
T7
T8
T9
T10
T11
T12
Open
Close
Electromagnetic valve
Full
Empty
Tank
ON
OFF
Pump

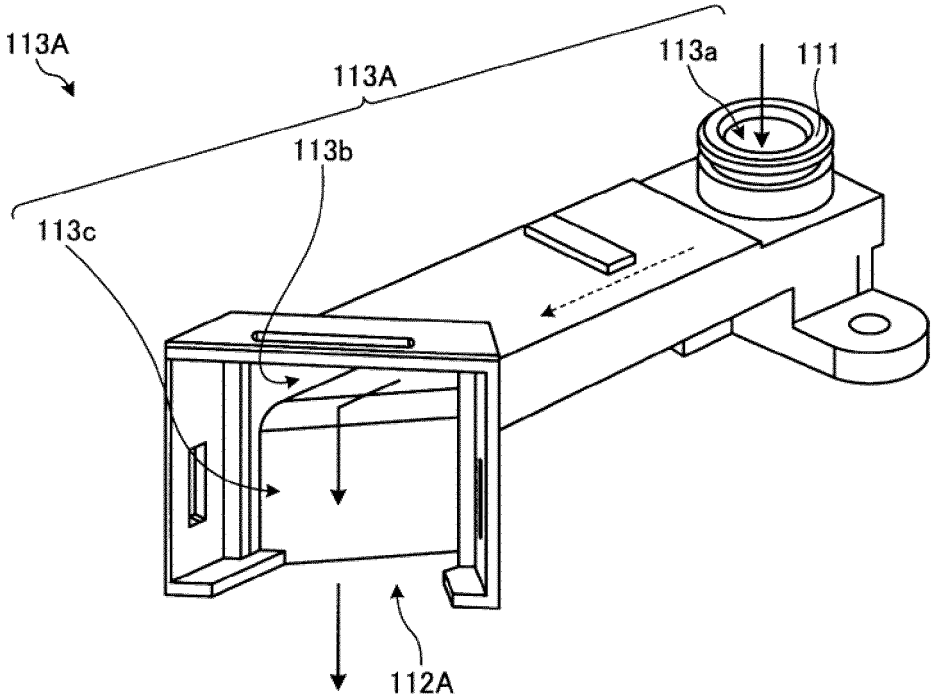
[Fig. 14]



[Fig. 15]



[Fig. 16]



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 3170940 A1 **[0002]**
- JP H07324365 B **[0004]**