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(71) Applicant: **Toto Ltd.**
Kitakyushu-shi, Fukuoka 802-8601 (JP)

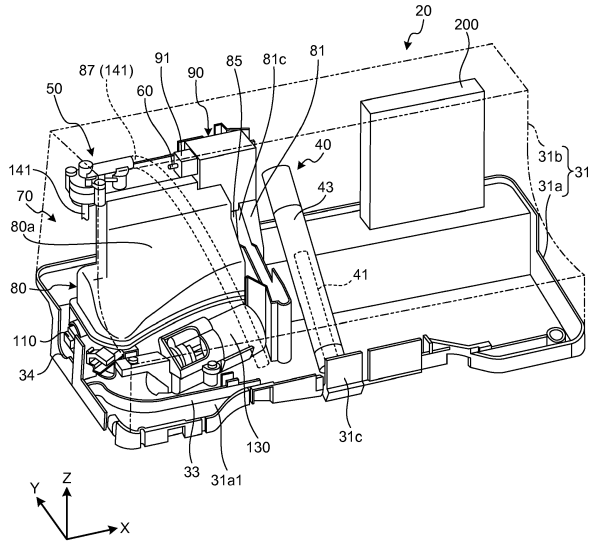
(72) Inventors:
- **IDE, Mizuki**
  Kitakyushu-shi, Fukuoka 802-8601 (JP)
- **TAIRA, Kensaku**
  Kitakyushu-shi, Fukuoka 802-8601 (JP)
- **HARADA, Shoji**
  Kitakyushu-shi, Fukuoka 802-8601 (JP)
- **FUKUZATO, Shintaro**
  Kitakyushu-shi, Fukuoka 802-8601 (JP)
- **YAMAKAWA, Takeshi**
  Kitakyushu-shi, Fukuoka 802-8601 (JP)

(74) Representative: **Takeuchi, Maya et al**
Fédit-Loriot
38, avenue Hoche
75008 Paris (FR)

(54) **SANITARY WASHING APPARATUS**

(57) A sanitary washing apparatus (20) includes a nozzle (41), a water passage (50), a tank (80), a backflow prevention mechanism (90), a pump (30), a case (31), and a strainer (110). The water passage communicates with the nozzle and a water supply pipe (A). The tank is disposed on the water passage and provided with a heating element (71) inside thereof. The backflow prevention mechanism is disposed on the water passage and upstream of the tank. The backflow prevention mechanism includes an air gap (94a) communicating with an atmosphere, thereby preventing backflow of water. The pump is disposed downstream of the tank. The case houses the tank, the nozzle, the pump, and the backflow prevention mechanism. The strainer is detachably mounted on the tank such that attachment and/or detachment work of the strainer is conducted through an opening (34) of the case.

FIG.3



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Description

FIELD

[0001] An embodiment of the disclosure relates to a sanitary washing apparatus.

BACKGROUND

[0002] Conventionally, a sanitary washing apparatus has been known that is disposed on top of a western style toilet body and washes a human body with discharged water.

[0003] To the sanitary washing apparatus, a backflow prevention mechanism may be attached. The backflow prevention mechanism serves to prevent the backflow of sewage through a flow passage, and to thereby prevent the contamination of the water in the piping. The backflow prevention mechanism may include an air gap which is a space communicating with the atmosphere and disposed at such a position as to split up the flow passage.

[0004] A standard for the backflow prevention mechanism is clearly defined in each of the European countries, and the product in these countries has to meet the standard. In most of the European countries, tap water is hard water, which is known to produce a precipitate (hereinafter "scale") such as calcium carbonate when heated.

[0005] In one known sanitary washing apparatus, a tank with a heating function is disposed at a downstream side of the backflow prevention mechanism so as to heat the water stored therein (see, for example, Japanese Laid-Open Patent Application No. 2010-090621).

[0006] However, when the hardness of the water is high, the scale readily accumulates in the tank that heats water stored therein. Then, when the scale flows to a downstream side, flow passage clogging may be caused.

[0007] It is an object of an aspect of an embodiment to provide a sanitary washing apparatus that can readily discharge scale in a tank.

SUMMARY

[0008] A sanitary washing apparatus according to an aspect of an embodiment includes a nozzle, a water passage, a tank, a backflow prevention mechanism, a pump, a case, and a strainer. The nozzle is configured to discharge water toward a private part of a user. The water passage is configured to communicate with the nozzle and a water supply pipe. The tank is disposed on the water passage. The tank is provided with a heating element inside thereof and configured to store water therein. The tank is configured to supply water to the nozzle. The backflow prevention mechanism is disposed on the water passage and upstream of the tank. The backflow prevention mechanism includes an air gap communicating with an atmosphere, thereby preventing backflow of water. The pump is disposed downstream of the tank and supplies water stored in the tank to the nozzle. The case houses the tank, the nozzle, the pump, and the backflow prevention mechanism. The case has an opening. The strainer is detachably mounted on the tank such that attachment and/or detachment work of the strainer is conducted through the opening of the case. The strainer filters water that flows from the tank to the pump.

[0009] According to an aspect of an embodiment as described above, a sanitary washing apparatus includes a tank, a discharge nozzle, a pump, a backflow prevention mechanism, a case, and a strainer. The tank is provided with a heating element inside thereof and stores water therein. The discharge nozzle discharges water in the tank toward a private part of a user. The pump is disposed on a downstream side of the tank and supplies water stored in the tank to the discharge nozzle. The backflow prevention mechanism has an air gap disposed on an upstream side of the tank and at a site where a flow passage is divided by an atmosphere open space. The case houses the tank, the discharge nozzle, the pump, and the backflow prevention mechanism. The strainer is attachable to and detachable from the tank through an opening of the case and filters water that flows from the tank to the pump.

[0010] Thereby, it is possible to detach a strainer from a tank without detaching a case, and hence, scale accumulated in the tank can readily be discharged to an outside thereof.

[0011] The tank includes a water drain hole that discharges water stored therein. The strainer is attached to or detached from the water drain hole. Thereby, a strainer is detached from a water drain hole so that scale in a tank can be discharged reliably.

[0012] The strainer includes a head, a shaft with a diameter less than that of the head, and an engagement part that is disposed on the shaft on a side of the head and engages with the water drain hole. The tank includes a flexible cover that has one end communicating with the water drain hole and a cylindrical shape having an aperture at a lower side of a peripheral surface thereof and contacts, from an outside thereof, the head at a position where the head of the strainer in a case where engagement of the engagement part with the water drain hole is released plugs the other end.

[0013] Thereby, water that flows out of a tank can be prevented from scattering from a side of the other end as a strainer is detached from a water drain hole.

[0014] The case includes, on a bottom surface thereof, a water drainage channel that guides, to a bowl of a toilet, water that flows out of the water drain hole. Thereby, water that flows out of a water drain hole can be discharged to a bowl of a toilet.

[0015] The water drain hole is provided in such a manner that at least a portion of an aperture thereof in the tank is disposed under the heating element. Thereby, water in a tank flows so as to go around a periphery of a heating element and is discharged to a water drain hole while scale closer to the heating element is involved therein, and hence, scale in the tank can be discharged

efficiently.

[0016] According to an aspect of an embodiment, scale in a tank of a sanitary washing apparatus can readily be discharged.

BRIEF DESCRIPTION OF DRAWINGS

[0017] A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. 1 is a perspective view that schematically illustrates a toilet apparatus with a sanitary washing apparatus according to an embodiment;
FIG. 2 is an illustration diagram that illustrates an example of a configuration of a sanitary washing apparatus;
FIG. 3 is a perspective view of a sanitary washing apparatus;
FIG. 4 is a front view that enlarges and illustrates a neighborhood of a heat exchanger;
FIG. 5 is a plan view that enlarges and illustrates a neighborhood of a heat exchanger;
FIG. 6 is a cross-sectional view of FIG. 5 along a line VI-VI;
FIG. 7 is a diagram that enlarges and illustrates a neighborhood of a backflow prevention mechanism;
FIG. 8 is a cross-sectional view of FIG. 5 along a line VIII-VIII;
FIG. 9 is a cross-sectional view of FIG. 4 along a line IX-IX;
FIG. 10 is a perspective view of a strainer;
FIG. 11 is a perspective view of a cover;
FIG. 12A is a cross-sectional view of FIG. 6 along a line XII-XII;
FIG. 12B is a diagram that illustrates a position of a strainer in a case where water drainage is executed;
FIG. 12C is a diagram that illustrates a strainer in a detached state;
FIG. 13 is a cross-sectional view of FIG. 5 along a line XIII-XIII;
FIG. 14 is a timing chart that illustrates an example of steps of a process for a sanitary washing apparatus according to an embodiment;
FIG. 15A is an illustration diagram (part 1) that illustrates a state of water in a tank;
FIG. 15B is an illustration diagram (part 2) that illustrates a state of water in a tank;
FIG. 15C is an illustration diagram (part 3) that illustrates a state of water in a tank;
FIG. 15D is an illustration diagram (part 4) that illustrates a state of water in a tank;
FIG. 15E is an illustration diagram (part 5) that illustrates a state of water in a tank;
FIG. 15F is an illustration diagram (part 6) that illustrates a state of water in a tank;
FIG. 15G is an illustration diagram (part 7) that illustrates a state of water in a tank.

DESCRIPTION OF EMBODIMENT

[0018] Hereinafter, an embodiment of a sanitary washing apparatus will be described in detail, with reference to the accompanying drawings. This invention is not limited to an embodiment described below.

1. Configuration of Sanitary Washing Apparatus

[0019] FIG. 1 is a perspective view that schematically illustrates a toilet apparatus with a sanitary washing apparatus according to an embodiment. For readily understanding the description, FIG. 1 illustrate a three-dimensional orthogonal coordinate system where a direction of an X-axis, a direction of a Y-axis, and a direction of a Z-axis that are orthogonal to one another are defined and a positive direction of the Z-axis is a vertically upward direction. Such an orthogonal coordinate system may also be illustrated in other drawings to be used for an explanation described below.

[0020] As illustrated in FIG. 1, a toilet apparatus 1 includes a western style toilet (that will be described as a "toilet" below) 10 and a sanitary washing apparatus 20, and is installed in a toilet room. The toilet 10 is of a low tank type that executes washing with water stored in a water storage tank 11, and is not limited thereto but may be, for example, of a flush valve type. The toilet 10 illustrated in Fig. 1 is floor-mounted type. However, the toilet 10 is not limited thereto but may be of a wall-mounted type or the like.

[0021] The sanitary washing apparatus 20 is disposed on top of the toilet 10. The sanitary washing apparatus 20 includes a body part 30, a toilet lid 300, and a non-illustrated toilet seat. Both the toilet lid 300 and the toilet seat are mounted on the body part 30 so as to be openable and closable.

[0022] The body part 30 includes a case 31 and a nozzle unit 40. The case 31 houses the nozzle unit 40 and the like. A detailed configuration of the case 31 will be described later.

[0023] FIG. 2 is an illustration diagram that illustrates an example of a configuration of the sanitary washing apparatus 20 that includes the nozzle unit 40. As illustrated in FIG. 2, the nozzle unit 40 includes a discharge nozzle 41 that discharges water toward a private part or the like of a user. In the present specification, "water" does not necessarily mean cold water and may include hot water.

[0024] The discharge nozzle 41 has a discharge hole 42 that is an opening at a tip thereof. The discharge nozzle 41 is configured to be movable back and forth with respect to the case 31 (see FIG. 1). For example, a non-illustrated driving source such as a motor is connected to the discharge nozzle 41. By driving such a driving

source, the discharge nozzle 41 is moved back and forth between a position where the discharge nozzle 41 has been moved forth into a bowl 12 of the toilet 10 and a position where the discharge nozzle 41 has been moved back into, and is housed, in the case 31. At such a position where the discharge nozzle 41 has been moved forth, the discharge nozzle 41 discharges water toward a body of a user to wash a private part thereof.

[0025] The sanitary washing apparatus 20 further includes a water supply part (or water passage) 50, a control part 200, a seating sensor 210, and an operation part 220. The water supply part 50, the control part 200, and the seating sensor 210 as mentioned above are disposed in the body part 30.

[0026] The water supply part 50 supplies water from a water supply pipe A that is a water supply source to the nozzle unit 40. Specifically, the water supply part 50 includes a first flow passage 60, a hot water storage type heat exchanger 70 (that will be described as a "heat exchanger 70" below), and a second flow passage 100.

[0027] The first flow passage 60 is a flow passage from the water supply pipe A to a backflow prevention mechanism 90. The backflow prevention mechanism 90 will be described in more detail below. The second flow passage 100 is a flow passage from a tank 80 to the discharge nozzle 41 of the nozzle unit 40. The heat exchanger 70 includes the tank 80 and stores water supplied from the water supply pipe A through the first flow passage 60. Water stored in the tank 80 is heated to produce hot water and such produced hot water is supplied to the nozzle unit 40 through the second flow passage 100.

[0028] Meanwhile, a backflow prevention mechanism needs to be attached to the sanitary washing apparatus 20 in order to prevent sewage from flowing backward on the first flow passage 60 or the like and thereby contaminating the water supply pipe A. Such a backflow prevention mechanism is a mechanism that forms an atmosphere open space that is a space that is open to an atmosphere (air gap) in the middle of a flow passage from the water supply pipe A to the nozzle unit 40 to divide the flow passage.

[0029] In a conventional technique, an open-type tank is separately disposed on an upstream side of a tank of a heat exchanger and such an open-type tank is provided with a vertical-type backflow prevention mechanism that spouts water in a vertical direction. Water stored in such an open-type tank is pumped to such a tank of a heat exchanger by a pump disposed on a downstream side of the open-type tank and subsequently supplied to a nozzle unit.

[0030] However, the above-mentioned vertical-type backflow prevention mechanism is large in a height direction to secure a space thereof, and hence, there is room for improvement from the viewpoint of downsizing of a sanitary washing apparatus. In regard to a sanitary washing apparatus in a conventional technique, a size of such an apparatus may be increased by a space for installation of such an open-type tank.

[0031] The above-mentioned open-type tank is configured to be constantly in a full water state in order to prevent a pump from idling, and to discard, to a bowl of a toilet, excess water that is higher than a predetermined water level in the open-type tank. Hence, in a conventional technique, there is also room for improvement from the viewpoint of water saving.

[0032] The sanitary washing apparatus 20 according to the present embodiment is configured in such a manner that it is possible to attain downsizing thereof and water saving.

[0033] As mentioned above, water stored in the tank 80 of the sanitary washing apparatus 20 according to the present embodiment is heated to produce hot water. Herein, in a case where stored water, that is, water supplied from the water supply pipe A is, for example, hard water that contains a lot of calcium ions or magnesium ions, scale is readily produced by heating so that the scale may accumulate in the tank 80. As such scale flows to the second flow passage 100, the discharge nozzle 41, or the like, on a downstream side of the tank 80, flow passage clogging may be caused thereby.

[0034] The sanitary washing apparatus 20 according to the present embodiment is configured in such a manner that it is possible to readily discharge scale in the tank 80.

[0035] In the sanitary washing apparatus 20, it is preferable to take out hot water produced in the tank 80 efficiently. That is, for example, in a case where a backflow prevention mechanism is configured to be disposed in the tank 80, as hot water in the tank 80 is used to wash a user, a water level in the tank 80 is gradually lowered and cold water is supplied from the water supply pipe A.

[0036] The sanitary washing apparatus 20 according to the present embodiment is configured in such a manner that it is possible to take out heated water from the tank 80 efficiently. Hereinafter, a configuration of the sanitary washing apparatus 20 will be described in detail.

[0037] As illustrated in FIG. 2, a strainer for water supply 61, an electromagnetic valve 62, and a constant flow valve 63 are disposed on the first flow passage 60 in this order from an upstream side thereof. The strainer for water supply 61 eliminates a foreign substance such as a contaminant that is incorporated in water supplied from the water supply pipe A. The electromagnetic valve 62 is a normally-closed-type valve that is in a closed state at time of no energization thereof, and opens or closes the first flow passage 60 depending on a control signal from the control part 200. The constant flow valve 63 regulates water that flows from the water supply pipe A so as to drain a predetermined flow rate or less thereof.

[0038] The heat exchanger 70 includes the above-mentioned tank 80 and the backflow prevention mechanism 90 disposed on an upstream side of the tank 80. The tank 80 and the backflow prevention mechanism 90 are formed integrally, and this will be described later.

[0039] The tank 80 is provided with a heating element 71, a float switch 72, a thermistor 73, and a bimetal 74.

The heating element 71 is disposed closer to a bottom surface 80b inside the tank 80. The heating element 71 is energized depending on a control signal from the control part 200 to generate heat so that water stored in the tank 80 is heated. For example, a sheath heater can be used for the heating element 71 that is not limited thereto but may be another kind of a heating device such as, for example, a ceramic heater.

[0040] The float switch 72 is disposed at a predetermined position closer to a top of the tank 80, and in a case where a water level in the tank 80 is elevated to a predetermined level or higher, a non-illustrated float rises to output a predetermined signal. That is, the float switch 72 has a function of detecting a water level of water stored in the tank 80. In the present embodiment, the float switch 72 outputs an ON signal in a case where a water level in the tank 80 is a predetermined level or higher, and the float switch 72 will be described later by using FIG. 14.

[0041] The thermistor 73 and the bimetal 74 are installed inside the tank 80. Positions of installation of the thermistor 73 and the bimetal 74 will be described later.

[0042] The thermistor 73 detects temperature of water in the tank 80 and outputs a signal that indicates detected temperature. The bimetal 74 is interposed in an energization circuit (not-illustrated) for the heating element 71. The bimetal 74 opens a contact in an energization circuit in a case where temperature of water in the tank 80 is higher than a predetermined level, so that energization of the heating element 71 is blocked. Such a predetermined temperature can be set arbitrary, and it is preferable to set, for example, a value enabling to detect an excessive temperature rise of water in the tank.

[0043] Thereby, the bimetal 74 functions as a safety device that prevents water in the tank 80 from being excessively heated by the heating element 71. In a case where temperature of water in the tank 80 after blocking energization is lower than a predetermined level, the bimetal 74 may be configured in such a manner that the above-mentioned contact is automatically restored or closed to restart heating by the heating element 71.

[0044] In the sanitary washing apparatus 20, a strainer 110 is interposed between the tank 80 and the second flow passage 100. A pump 130 is disposed on the second flow passage 100. The strainer 110 filters water that flows from the tank 80 to the pump 130. Specifically, the strainer 110 eliminates a foreign substance such as scale that is contained in water that flows out of the tank 80. The strainer 110 is configured to be attachable to and detachable from the tank 80, and this will be described later.

[0045] The pump 130 is disposed on a downstream side of the tank 80 and the strainer 110. The pump 130 is driven in response to a control signal from the control part 200 and supplies water stored in the tank 80 to the discharge nozzle 41.

[0046] A vacuum breaker 140 is connected to the second flow passage 100 at a position on a downstream side of the tank 80 and an upstream side of the discharge nozzle 41. An atmosphere open channel 141 that is a channel with one end that is open to an atmosphere is connected to the vacuum breaker 140. By the vacuum breaker 140 that is thus configured, for example, a backward flow from the discharge nozzle 41 to the heat exchanger 70 or the like can be prevented from being produced in a case where a negative pressure is produced on the second flow passage 100.

[0047] A pipe diameter of the second flow passage 100 is set to be greater than a diameter of the discharge hole 42 of the discharge nozzle 41. Thus, scale clogging can be prevented by increasing a pipe diameter of a flow passage that leads to the discharge nozzle 41 from the tank 80.

[0048] The seating sensor 210 is disposed at, for example, an appropriate position of the case 31 (see FIG. 1) and detects that a user sits on a toilet seat. The seating sensor 210 outputs a predetermined signal that indicates seating in a case where the seating is detected. For example, a light-projecting-and-receiving-type distance sensor can be used for the seating sensor 210.

[0049] The seating sensor 210 is not limited to the above-mentioned distance sensor and another kind of sensor such as, for example, a load sensor that detects a load of a user that acts on a toilet seat may be used. The seating sensor 210 is not necessarily required to be disposed in the case 31 and may be disposed on, for example, a wall surface or the like of a toilet room. In the present embodiment, the seating sensor 210 outputs an ON signal in a case where seating of a user is detected, and the seating sensor 210 will be described later by using FIG. 14.

[0050] The operation part 220 includes an operation button, an operation knob, or the like, such that a user inputs a start instruction for starting washing of a human body or a stop instruction for stopping such washing, and is disposed at an appropriate position in a toilet room. The operation part 220 outputs a signal that indicates a start instruction or the like that is input by a user through the operation button or the like. For example, a remote controller can be used for the operation part 220 that is not limited thereto and may be mounted on the body part 30.

[0051] Various signals that are output from the float switch 72, the thermistor 73, the seating sensor 210, and the operation part 220 as mentioned above are input to the control part 200. The control part 200 controls the entirety of the sanitary washing apparatus 20, and includes, for example, a non-illustrated arithmetic processing unit such as a Central Processing Unit (CPU) and a non-illustrated storage device such as Random Access Memory (RAM).

[0052] The control part 200 executes a process for controlling the electromagnetic valve 62, the heating element 71, the pump 130, the nozzle unit 40, and the like, based on various input signals, and a content of such a process will be described in detail later. A reference symbol in FIG. 2 that has not been described will be described by using another drawing, and the reference symbol is pro-

vided in FIG. 2 to correspond to such another drawing.

2. Specific Configuration of Sanitary Washing Apparatus

[0053] Next, the above-mentioned sanitary washing apparatus 20 will be described in more detail with reference to FIG. 3 and subsequent figures. FIG. 3 is a perspective view of the sanitary washing apparatus 20. Any view in FIG. 3 and subsequent figures that illustrate a configuration of the sanitary washing apparatus 20 is a schematic diagram.

[0054] As illustrated in FIG. 3, the case 31 of the sanitary washing apparatus 20 contains various components such as the tank 80 of the heat exchanger 70, the backflow prevention mechanism 90, the discharge nozzle 41, the pump 130, and the control part 200.

[0055] The case 31 includes a case plate 31 a and a case cover 31 b. The case plate 31 a (that will be referred to as a "plate 31a" below) includes a plate-shaped bottom surface 31a1 and is mounted on top of the toilet 10 (see FIG. 1). The plate 31 a is formed into a shape with a longitudinal direction along an X-axis and a transverse direction along a Y-axis in a top view. Various components such as the tank 80 are disposed on the plate 31 a.

[0056] The case cover 31 b is configured to be attachable to and detachable from the plate 31 a and mounted so as to cover tops of various components disposed on the plate 31 a. In FIG. 3, for convenience of understanding, the case cover 31 b is indicated by an imaginary line so that an inside of the case 31 is indicated transparently.

[0057] Herein, positions of various components disposed in the case 31 will be described. The nozzle unit 40 that includes the discharge nozzle 41 is disposed at a central part 31 c of the case 31. FIG. 3 illustrates a state where the discharge nozzle 41 is housed in a cylindrical housing case 43.

[0058] In an internal space of the case 31, the tank 80, the pump 130, and the like are disposed side by side on a left side of the discharge nozzle 41. In the present specification, a term that represents a direction such as a "left side" or a "right side" means a "left side" or a "right side" when the bowl 12 is disposed at a front side in a top view of the sanitary washing apparatus 20 in a state where it is mounted on the toilet 10. Specifically, a negative direction of an X-axis will be referred to as a "left side" and a positive direction of the X-axis will be referred to as a "right side". A negative direction of a Y-axis will be referred to as a "front side" and a positive direction of the Y-axis will be referred to as a "back side".

[0059] In the case 31, an electronic component such as the control part 200 is disposed on a right side of the discharge nozzle 41. Thus, an internal space of the case 31 is divided into left and right regions by the discharge nozzle 41 as a boundary, where the water supply part 50 that includes the tank 80 and the like is disposed in one region and an electronic component such as the control part 200 is disposed in the other region. Thereby, for example, a water droplet produced in the water supply part 50 or the like can be prevented from readily scattering toward an electronic component.

[0060] In the above-mentioned other region, a deodorization unit or the like is also disposed, where illustration thereof is omitted in FIG. 3. Positions of various disposed components illustrated in FIG. 3 or the like are merely illustrations and not limiting.

3. Configurations of Tank and Backflow Prevention Mechanism

[0061] Next, configurations of the tank 80 of the heat exchanger 70 and the backflow prevention mechanism 90 will be further described in detail. FIG. 4 is a front view that enlarges and illustrates a neighborhood of the heat exchanger 70 illustrated in FIG. 3 and FIG. 5 is a plan view that enlarges and illustrates a neighborhood of the heat exchanger 70 illustrated in FIG. 3. FIG. 4 and FIG. 5 illustrate a state where the case cover 31 b is removed from the plate 31 a.

[0062] As illustrated in FIG. 4 and FIG. 5, the backflow prevention mechanism 90 is disposed on top of the tank 80. The backflow prevention mechanism 90 is disposed on an upper right portion of the tank 80, in other words, on a side of the discharge nozzle 41 on top of the tank 80. As described above, the backflow prevention mechanism 90 is disposed on top of the tank 80 and not limited thereto, and the backflow prevention mechanism 90 may be disposed at, for example, an upper position that separates from the tank 80 by a predetermined distance.

[0063] FIG. 6 is a cross-sectional view of FIG. 5 along a line VI-VI. FIG. 6 omits illustration of the plate 31 a. As illustrated in FIG. 6, the backflow prevention mechanism 90 includes a spout port 91, a water-receiving port 92, and a water drain port 93.

[0064] FIG. 7 is a diagram that enlarges and illustrates a neighborhood of the backflow prevention mechanism 90 illustrated in FIG. 6. As illustrated in FIG. 7, the spout port 91 is disposed at an end 60a of the first flow passage 60 communicating with the water supply pipe A (see FIG. 2). The spout port 91 spouts water supplied from the water supply pipe A in a horizontal direction (for example, a positive direction of an X-axis).

[0065] In FIG. 7, water spouted from the spout port 91 is indicated by an arrow of broken line D1. In the present specification, a term of "horizontal", "vertical", or the like does not necessarily need mathematically strict precision and a substantial tolerance or error or the like is permitted.

[0066] The water-receiving port 92 is an aperture that is disposed to be opposed to the spout port 91 through an atmosphere open space 94 that is a space that is open to an atmosphere. The water-receiving port 92 receives water spouted from the spout port 91. Water received by the water-receiving port 92 flows into the tank 80. In an example illustrated in FIG. 7, the water-receiving port 92 is formed in such a manner that an aperture plane thereof is vertical, is not limited thereto, and may be formed, for

example, in such a manner that such an aperture plane is inclined.

[0067] Thus, the backflow prevention mechanism 90 according to the present embodiment is a horizontal-type backflow prevention mechanism that spouts water toward the atmosphere open space 94 in a horizontal direction, and has an air gap 94a (see FIG. 6) disposed at a site B where a flow passage is divided by the atmosphere open space 94.

[0068] A distance C1 from the spout port 91 to the water-receiving port 92 in the space 94 is set at a value that meets a standard defined in a country or place where the sanitary washing apparatus 20 is installed, and set at, for example, 20 mm or greater.

[0069] The water drain port 93 discharges water remaining in the space 94, for example, outside of the backflow prevention mechanism 90. The water drain port 93 is an aperture disposed under the space 94 that is present between the spout port 91 and the water-receiving port 92. As illustrated by an arrow of dashed-dotted line D21 in FIG. 7, the water drain port 93 receives and discharges a portion of water spouted from the spout port 91, for example, water with insufficient water force so as not to be received by the water-receiving port 92, in other words, water that does not reach the water-receiving port 92 but remains in the space 94.

[0070] The water drain port 93 discharges water that flows backward from the tank 80, as illustrated by an arrow of dashed-dotted line D22. Water discharged to the water drain port 93 is discharged to the toilet 10 through a water drain channel 85 formed in the tank 80, and this will be described later.

[0071] Thus, the sanitary washing apparatus 20 according to the present embodiment is provided with the above-mentioned backflow prevention mechanism 90, and thereby, for example, a backward flow from the tank 80 to the water supply pipe A can be prevented.

[0072] In the present embodiment, the backflow prevention mechanism 90 is a horizontal-type backflow prevention mechanism, and hence, the sanitary washing apparatus 20 can be downsized. That is, for example, if the backflow prevention mechanism 90 is a vertical-type backflow prevention mechanism that spouts water in a vertical direction, the above-mentioned distance C1 in the space 94 is secured in a vertical direction. Hence, in a case where a vertical-type backflow prevention mechanism is used, a height of the sanitary washing apparatus 20 may be increased by the distance C1 in the space 94.

[0073] Because the backflow prevention mechanism 90 in the present embodiment is a horizontal-type backflow prevention mechanism that secures the distance C1 in the space 94 in a horizontal direction, such a height can be reduced, and hence, the sanitary washing apparatus 20 can be downsized even when the backflow prevention mechanism 90 is disposed on top of the tank 80.

[0074] The above-mentioned backflow prevention mechanism 90 is formed integrally with the tank 80, so that the sanitary washing apparatus 20 can be further downsized.

[0075] For a detailed description, as illustrated in FIG. 6, the tank 80 is formed into a rectangular shape or a substantially rectangular shape that has a space capable of storing water inside thereof, in a cross-sectional side view. The tank 80 includes an inflow port 81a, a water inflow pipe 81, an outflow port 82b, a water outflow pipe 82, a water drain hole 83, a direction-changing part 84, and the water drain channel 85. The water drain channel 85 may be disposed outside the tank 80.

[0076] Water supplied from the first flow passage 60 through the backflow prevention mechanism 90 flows into the inflow port 81 a of the tank 80. The inflow port 81 a is the above-mentioned water-receiving port 92 of the backflow prevention mechanism 90. That is, in the present embodiment, the water-receiving port 92 serves as the inflow port 81 a of the tank 80. Because the water-receiving port 92 serves as the inflow port 81 a of the tank 80, the space 94 (air gap 94a) of the backflow prevention mechanism 90 is also formed on top of the tank 80.

[0077] Thus, a part or all of components of the backflow prevention mechanism 90 is/are formed integrally with the tank 80, and thereby, for example, the number of components can be reduced. Thereby, even when the backflow prevention mechanism 90 is disposed on top of the tank 80, a height thereof can be reduced, and as a result, the sanitary washing apparatus 20 can be further downsized.

[0078] The backflow prevention mechanism 90 is formed integrally with the tank 80, and hence, it is also possible to reduce man-hours for installing the backflow prevention mechanism 90 in the tank 80 in a process for producing the sanitary washing apparatus 20.

[0079] The spout port 91 that is installed in the tank 80 is illustrated in FIG. 6 as an example, and is not limited thereto but may be formed integrally with the tank 80. The water-receiving port 92 is configured to serve as the inflow port 81 a in the above description, and is not limited thereto but may be configured in such a manner that the water-receiving port 92 as a separate body is installed in the inflow port 81 a.

[0080] The direction-changing part 84 in the tank 80 is formed at a position to be opposed to the spout port 91 and on an opposite side thereof with respect to the inflow port 81a, in other words, at a position where water passing through the inflow port 81 a that serves as the water-receiving port 92 impinges thereon.

[0081] As illustrated in FIG. 7, the direction-changing part 84 includes a direction-changing surface 84a that has a predetermined elevation angle α with respect to an X-axis that is a direction of a spout of water from the spout port 91. Such a predetermined elevation angle α is set at a value that is, for example, greater than 0 degrees and less than 90 degrees ($0° < \alpha < 90°$). Therefore, as indicated by the arrow D1, the direction-changing part 84 causes water spouted from the spout port 91 and passing through the water-receiving port 92 (inflow port

81 a) to change a direction of its flow downwardly. Thereby, received water can efficiently be guided into the tank 80.

[0082] As is well-illustrated in FIG. 6, the water inflow pipe 81 is communicated with the inflow port 81 a and formed to extend in a negative direction of a Z-axis. An outlet 81 b of the water inflow pipe 81 is disposed under the inflow port 81 a. Specifically, the outlet 81 b of the water inflow pipe 81 is positioned, for example, closer to the bottom surface 80b of the tank 80 and further in a neighborhood of the heating element 71. In FIG. 6, an outlet 181 b indicated by an imaginary line is also illustrated, and such an outlet 181 b will be described in a variation described below.

[0083] Herein, a shape of the water inflow pipe 81 will be described with reference to FIG. 8. FIG. 8 is a cross-sectional diagram of FIG. 5 along a line VIII - VIII. FIG. 8 illustrates a longitudinal cross section of the water inflow pipe 81.

[0084] As illustrated in FIG. 8, the water inflow pipe 81 is formed in such a manner that a cross-sectional area of a site close to the outlet 81 b (for example, a site indicated by a reference symbol 81 b1) is greater than or equal to a cross-sectional area of a far site 81 a1. FIG. 8 illustrates a site around the inflow port 81 a as an example of the far site 81 a1.

[0085] The water inflow pipe 81 flows water from the inflow port 81 a located upstream to the outlet 81 b located downstream and is formed in such a manner that a width of a flow passage is increased in a direction of such a water flow. That is, the water inflow pipe 81 is formed in such a manner that a width W81 b1 of a flow passage at the site 81b1 close to the outlet 81 b is greater than or equal to a width W81 a1 of a flow passage at the far site 81 a1.

[0086] Thereby, inflow water can be guided into the tank 80 while a flow rate thereof is reduced. FIG. 8 illustrates a value of a flow rate by a length of an arrow D3 or D4. That is, FIG. 8 indicates that a flow rate (arrow D4) of the site 81b1 close to the outlet 81 b is less than a flow rate (arrow D3) of the far site 81 a1.

[0087] Thus, water with a reduced flow rate is guided into the tank 80, so that, for example, floating of scale in the tank 80 can be prevented and water before heating can be held on bottom of the tank 80.

[0088] By returning to descriptions for FIG. 6, the outflow port 82b is an aperture that is drilled along a direction of a Z-axis (vertical direction) on bottom of the tank 80 and flows water in the tank 80 to the second flow passage 100 (see FIG. 2) through the strainer 110. In FIG. 6, a center line of the outflow port 82b is indicated by a reference symbol 82c.

[0089] The water outflow pipe 82 is communicated with the outflow port 82b and extends in a positive direction of a Z-axis to form an upward inlet 82a. Thus, the inlet 82a of the water outflow pipe 82 is upward, and hence, for example, scale accumulating on the bottom surface 80b of the case 31 can be prevented from being readily introduced.

[0090] The inlet 82a of the water outflow pipe 82 is disposed at a position higher than the outlet 81 b of the water inflow pipe 81 by a predetermined distance C2. In the tank 80, the inlet 82a of the water outflow pipe 82 is positioned on top of a neighborhood of a side surface on an opposite side of a side surface where the outlet 81 b of the water inflow pipe 81 is disposed.

[0091] Therefore, water passing through the backflow prevention mechanism 90 is guided by the water inflow pipe 81 so as to flow into a bottom of the tank 80, and is heated by the heating element 71. As indicated by an arrow D5, heated water is directed upward in the tank 80 by convection thereof, flows to the inlet 82a of the water outflow pipe 82, passes through the water outflow pipe 82, and flows out through the outflow port 82b.

[0092] Thus, in the sanitary washing apparatus 20 according to the present embodiment, heated water is directed upward by convection thereof and flows out through the outflow port 82b sequentially, and hence, water before heating does not readily flow out, so that heated water can be taken out from the tank 80 efficiently. The predetermined distance C2 is appropriately set based on a volume of the tank 80, a performance of the pump 130, or the like.

[0093] In the sanitary washing apparatus 20 according to the present embodiment, the tank 80 of the heat exchanger 70 is configured as mentioned above, and hence, a configuration that separately provides an open-type tank having a backflow prevention mechanism to discard excess water like a conventional technique is not required, so that water can be saved.

[0094] As illustrated in FIG. 6, the bimetal 74 and the thermistor 73 as mentioned above are disposed at positions lower than the inlet 82a of the water outflow pipe 82. Therefore, for example, even when washing of a human body is executed by the discharge nozzle 41 to lower water level of the tank 80, the bimetal 74 and the like are not exposed above water in the tank 80. Thereby, in the present embodiment, the bimetal 74 or the thermistor 73 can reliably be prevented from erroneously detecting air temperature.

[0095] The water drain hole 83 is disposed on a lower side of a side surface of the tank 80 and sealed with the strainer 110. Sealing with the strainer 110 will be described later. A position of the water drain hole 83 as illustrated in FIG. 6 is an illustration and not limited thereto.

[0096] For example, as water is drained in order to execute cleaning of the tank 80 or the like, the water drain hole 83 is not sealed with the strainer 110, namely, is provided in an open state, so that water stored in the tank 80 is discharged to exterior thereof.

[0097] As illustrated in FIG. 6, the water drain hole 83 is provided in such a manner that at least a portion of an aperture in the tank 80 is disposed under the heating element 71. Thereby, in the present embodiment, scale in the tank 80 can be discharged efficiently.

[0098] Specifically, for example, in a case where the heating element 71 with an elongated cylindrical shape is inserted from a side surface of, and disposed, in the tank 80 as illustrated in FIG. 6, the water drain hole 83 is disposed in such a manner that a center line 83c is disposed under a center line 71 a of the heating element 71. The center line 83c of the water drain hole 83 is a line that passes through a center of an aperture plane in the tank 80. The center line 71 a of the heating element 71 is, for example, a line that passes through a center of a cross section of the heating element 71 in a direction vertical to an axial direction thereof.

[0099] Temperature of the heating element 71 is comparatively high, and hence, scale is readily produced neat the heating element 71. The present embodiment is configured as mentioned above, where water in the tank 80 flows so as to go around a periphery of the heating element 71 as indicated by an arrow D6 and is discharged from the water drain hole 83 while scale closer to the heating element 71 is involved therein, so that scale in the tank 80 can be discharged efficiently.

[0100] Next, the water drain channel 85 will be described. The water drain channel 85 communicates with the above-mentioned water drain port 93 of the backflow prevention mechanism 90. The water drain channel 85 is disposed on an outer wall 80a on a side surface of the tank 80 and formed so as to be exposed partially, as illustrated in FIG. 3 to FIG. 5 and the like. The outer wall 80a is a part of a wall of the tank 80 constituting a part of the water drain channel 85.

[0101] The water drain channel 85 that is disposed on the outer wall 80a of the tank 80 will be described with reference to FIG. 9. FIG. 9 is a cross-sectional view of FIG. 4 along a line IX-IX. Whereas a cover 95 is mounted on a part of the water drain channel 85 in FIG. 4, FIG. 9 illustrates a state where the cover 95 is removed. In FIG. 9, a partition wall 80c that is formed in the tank 80 is indicated by a broken line in order to distinguish the partition wall 80c from the outer wall 80a of the tank 80.

[0102] As illustrated in FIG. 9, the water drain port 93 and the water drain channel 85 are formed into shapes provided by denting the outer wall 80a of the tank 80 toward an inside of the tank 80. Thereby, in the heat exchanger that includes the backflow prevention mechanism 90, the water drain channel 85 is not required to be mounted as a separate member, so that the number of components can be reduced and the tank 80 can be downsized.

[0103] As illustrated in FIG. 9, the water inflow pipe 81 is formed in such a manner that the outer wall 80a of the tank 80 is a part of a peripheral surface thereof. In FIG. 9, the outer wall 80a that is a part of a peripheral surface of the water inflow pipe 81 is indicated by a reference symbol 81 c provided thereto. The water drain channel 85 is disposed adjacent to the water inflow pipe 81 while the outer wall 81 c (80a) that is a part of a peripheral surface of the water inflow pipe 81 is interposed therebetween. In FIG. 9, water discharged from the water drain port 93 and flowing on the water drain channel is indicated by an arrow D7.

[0104] Thereby, the water drain channel 85 is disposed adjacent to and along the water inflow pipe 81 at a comparatively low temperature in the tank 80 of the heat exchanger 70. Hence, water that flows on the water drain channel 85, that is, cold water that does not flow into the tank 80, can be prevented from drawing heat of, and cooling, hot water in the tank 80.

[0105] As illustrated in FIG. 3 to FIG. 5 and the like, the water drain port 93 and the water drain channel 85 are disposed at positions in the tank 80 and closer to the discharge nozzle 41. Thereby, a length of the water drain channel 85 of the backflow prevention mechanism 90 can be reduced.

[0106] Herein, a water drain function or the like on the case 31 will be described with reference to FIG. 5 in order to explain a reason why a length of the above-mentioned water drain channel 85 can be reduced.

[0107] As illustrated in FIG. 5, the case 31 includes a discharge hole 32, a water drainage channel 33, and a taking-out hole (or opening) 34. For example, a plurality of the discharge holes 32 (two of them are illustrated in FIG. 5) are drilled in the bottom surface 31 a1 of the plate 31 a closer to the central part 31 c of the case 31.

[0108] Thereby, for example, a member that readily produces a water droplet thereon, such as the discharge nozzle 41, is disposed around the central part 31 c of the case 31, and hence, such a water droplet can readily be discharged from the discharge hole 32.

[0109] The discharge hole 32 is disposed at, for example, a position to face the bowl 12 (see FIG. 2) of the toilet 10. Thereby, water that passes through the discharge hole 32 is discharged to the bowl 12. The number, positions of disposition, and shapes of the discharge holes 32 illustrated in FIG. 5 and the like are merely illustrations and not limited thereto.

[0110] The water drainage channel 33 is a water drain channel that is used at time of water drainage of the tank 80. Specifically, the water drainage channel 33 is a gutter-shaped wall member that stands on the bottom surface 31 a1 of the plate 31 a. Water drainage of the tank 80 is executed by discharging water from the water drain hole 83 of the tank 80 with the strainer 110 installed therein, as described later. Therefore, the water drainage channel 33 is shaped such that water discharged from the water drain hole 83 is guided to the discharge hole 32, as indicated by an arrow D8.

[0111] Thereby, water that flows out of the water drain hole 83 can readily be discharged to the toilet 10 through the discharge hole 32 or the like. It is preferable to provide the bottom surface 31 a1 of the plate 31 a with a gradient that is inclined toward the discharge hole 32. Thereby, water on the bottom surface 31a1 can smoothly be discharged toward the discharge hole 32.

[0112] As is also well-illustrated in FIG. 3, the taking-out hole 34 is an aperture disposed on a side surface of the case 31, and is disposed at a site that corresponds

to a position where the strainer 110 is disposed. Therefore, the taking-out hole 34 is a hole for taking out the strainer 110 from the tank 80 as the strainer 110 is removed and cleaned. The taking-out hole 34 is an example of an opening.

[0113] As mentioned above, while the discharge port 32 is disposed closer to the discharge nozzle 41 in the case 31, the water drain port 93 and the water drain channel 85 are also disposed at positions in the tank 80 and closer to the discharge nozzle 41. Thereby, a length of the water drain channel 85 can be reduced.

4. Configuration of Air Hole of Tank

[0114] As illustrated in FIG. 6, the tank 80 is supplied with water through the water inflow pipe 81 connected to the backflow prevention mechanism 90 that is open to an atmosphere. Hence, a mechanism is needed that releases air on an upper side in the tank 80 when water is supplied from the water inflow pipe 81 to elevate water level of the tank 80, or introduces air into the tank 80 when water in the tank 80 flows out to lower water level therein.

[0115] In the tank 80 according to the present embodiment, an air hole 86 is disposed at an upper side. Air that is introduced into or released from the tank 80 in accordance with a variation of a water level therein passes through the air hole 86. Thereby, air in the tank 80 can be released or air can be introduced into the tank 80.

[0116] An intake or exhaust channel 87 is connected to the air hole 86. For example, a tube or the like can be used for the intake or exhaust channel 87 that is not limited thereto.

[0117] The intake or exhaust channel 87 extends to a neighborhood of the discharge hole 32 on the bottom surface 31 a1 of the plate 31a, as illustrated in FIG. 3 to FIG. 5. Thereby, water that is released from the air hole 86 toward exterior of the tank 80 is discharged from the discharge hole 32 through the intake or exhaust channel 87, and hence, water can be prevented from being diffused in the case 31.

[0118] As illustrated in FIG. 2 or FIG. 6, the intake or exhaust channel 87 is configured to serve as the atmosphere open channel 141 of the vacuum breaker 140. In FIG. 2 and FIG. 6, a position where the intake or exhaust channel 87 and the atmosphere open channel 141 join together is indicated by a reference symbol P.

[0119] Thus, the intake or exhaust channel 87 does not only function as an atmosphere open channel that is a channel with one end that is open to an atmosphere, for the air hole 86, but also functions as the atmosphere open channel 141 of the vacuum breaker 140. Thereby, the intake or exhaust channel 87 and the atmosphere open channel 141 can be partially shared with each other, so that the number of components can be reduced and cost can be reduced.

5. Configurations of Strainer and Cover

[0120] Next, configurations of the strainer 110 and a cover 120 will be described that are disposed on a downstream side of the outflow port 82b of the tank 80.

[0121] In an example illustrated in FIG. 6, a downstream side of the outflow port 82b is communicated with the water drain hole 83 and the second flow passage 100 (not illustrated in FIG. 6), and the water drain hole 83 is mounted and sealed with the strainer 110 as mentioned above. Therefore, when the water drain hole 83 is sealed with the strainer 110, water in the tank 80 flows from the outflow port 82b to the second flow passage 100 through the strainer 110, as described below. The tank 80 includes a cover 120 and the cover 120 is mounted for the water drain hole 83.

[0122] FIG. 10 is a perspective view of the strainer 110 and FIG. 11 is a perspective view of the cover 120. FIG. 12A is a cross-sectional view of FIG. 6 along a line XII-XII.

[0123] As illustrated in FIG. 10, the strainer 110 includes a head 111, a shaft 112, and a cap 113. The head 111 is formed into a cylindrical shape or a substantially cylindrical shape and includes an operation knob 111 a and a flange 111 b.

[0124] The operation knob 111 a is formed on one end 111 c of the head 111. The operation knob 111 a is a protrusion that is provided to protrude from the end 111 c in a direction of separation therefrom, and such a protrusion is held and rotationally-operated by a user or a tool.

[0125] Because the above-mentioned operation is executed at timing other than timing of washing of a human body by the sanitary washing apparatus 20, a "user" herein may be different from a user whose body is washed thereby. A shape of the operation knob 111 a illustrated in FIG. 10 and the like is an illustration, is not limited thereto, and may be, for example, another shape such as a concave shape.

[0126] The flange 111 b is formed on the other end 111 d of the head 111 and provided to extend in a direction vertical to an axial direction of the head 111 with a cylindrical shape.

[0127] The shaft 112 is formed so as to be continuous with the head 111 and formed into a cylindrical shape or substantially cylindrical shape with a diameter less than that of the head 111. The shaft includes a male screw 112a, a flat part 112b, and a filter frame 112c.

[0128] The male screw 112a is disposed on the shaft 112 on a side of the head 111. The male screw 112a is partially disposed on the shaft 112 on a side of the head 111. Thereby, for example, a user can execute attachment or detachment of the strainer 110 with respect to the water drain hole 83 as described below, with a comparatively small number of rotational operations. The male screw 112a is an example of an engagement part.

[0129] The flat part 112b is a flat site where the male screw 112a is not formed in an axial direction on a side of the head 111 of the shaft 112. The flat part 112b is

formed at, for example, a position under a nominal diameter of the male screw 112a. A function of the above-mentioned flat part 112b will be described later.

[0130] The filter frame 112c is an aperture disposed around an end 112d of the shaft 112 on an opposite side of the head 111. A filter 114 is set in the filter frame 112c.

[0131] The filter 114 is made of a material that does not pass a foreign substance such as scale but pass water. For example, a non-woven fabric, a mesh, or the like can be used for the filter 114 that is not limited thereto. The numbers or shapes of the filter frame 112c and the filter 114 illustrated in FIG. 10 and the like are illustrations and not limited thereto.

[0132] As is well-illustrated in FIG. 12A, the cap 113 is formed into a cylindrical shape or substantially cylindrical shape with a diameter less than that of the shaft 112, and includes a sealing part 113a. The sealing part 113a is formed into a disc shape or a substantially disc shape, and is disposed on an end 113b of the cap 113. A diameter of the sealing part 113a is set at, for example, a value that is slightly less than an aperture diameter of the water drain hole 83 in the tank 80.

[0133] The cap 113 configured as mentioned above is inserted into and engages with a hollow portion of the shaft 112, where a head thereof is an end 113c (see FIG. 12A) on an opposite side of the end 113b with the sealing part 113a disposed thereon. A length of the cap 113 is set at, for example, a value such that the sealing part 113a is exposed from the shaft 112 in a state where the cap 113 is engaged with the shaft 112, and the sealing part 113a is positioned at an aperture of the water drain hole 83 in the tank 80 in a state where the strainer 110 is mounted for the water drain hole 83.

[0134] The strainer 110 with the cap 113 that is a separate member with respect to the head 111 and the shaft 112 is used in the above description, and is not limited thereto, where, for example, the head 111, the shaft 112, and the cap 113 may be integrated. The head 111, the shaft 112, and the cap 113 may be separate from one another or any one of them may be separate.

[0135] The strainer 110 further includes a first seal member 116a and a second seal member 116b. For example, an O-ring can be used for the first or second seal member 116a or 116b that is not limited thereto.

[0136] The first seal member 116a is mounted on the shaft 112 on a side of the head 111. The first seal member 116a seals a gap between the shaft 112 and the water drain hole 83 in a watertight manner when the strainer 110 is disposed at a position where the water drain hole 83 is sealed thereby.

[0137] The second seal member 116b is mounted on the sealing part 113a of the cap 113. The second seal member 116b seals a gap between the sealing part 113a and the water drain hole 83 in a watertight manner when the strainer 110 is disposed at a position where the water drain hole 83 is sealed thereby.

[0138] As illustrated in FIG. 11, the cover 120 includes a peripheral surface 120a, an engagement part 120b, and an opening 120c. The cover 120 also includes one end 120d and the other end 120f. The peripheral surface 120a is formed into a cylindrical shape or a substantially cylindrical shape. A hole for fixation 120e is drilled in the peripheral surface 120a closer to one end 120d.

[0139] As illustrated in FIG. 12A, a protrusion for fixation 83a with a shape corresponding to the hole for fixation 120e is formed on an outlet side of the water drain hole 83. Therefore, the protrusion for fixation 83a is inserted into the hole for fixation 120e and installed in the water drain hole 83, so that the cover 120 is fixed on an outlet side of the water drain hole 83.

[0140] As illustrated in FIG. 11, the engagement part 120b of the cover 120 is disposed in a notch 120g disposed on the peripheral surface 120a on a side of the other end 120f. For example, a plurality (for example, two) of the engagement parts 120b are disposed on the peripheral surface 120a at substantially regular intervals. A claw 120b1 that protrudes in an inner radial direction is formed at a tip of the engagement part 120b.

[0141] In FIG. 11, the two engagement parts 120b are disposed on the peripheral surface 120a at positions that are opposed to each other, where the number or positions of disposition of the engagement parts 120b are illustrations and not limited thereto.

[0142] The cover 120 is fabricated by using a material that has flexibility (for example, a resin or the like). Thereby, the cover 120 that includes the engagement part 120b has flexibility, and hence, the engagement part 120b is elastically deformable in a radial direction.

[0143] The opening 120c is formed in a rectangular shape in a bottom view and a plurality of (for example, two) openings 120c are formed on a lower side of the peripheral surface 120a in a state where the cover 120 is installed in the water drain hole 83. The opening 120c functions as a flow passage for passing water discharged from the tank 80 through the water drain hole 83, and this matter will be described later.

[0144] In FIG. 11, a shape of the opening 120c is a rectangular shape, is not limited thereto, and may be another shape such as, for example, a circular shape or an elliptical shape. The number of the openings 120c is not limited to an example illustrated in FIG. 11, and may be one or three or more.

[0145] Herein, a dimension of the cover 120 relative to the strainer 110 will be described. As illustrated in FIG. 12A, an inner diameter E1 of the peripheral surface 120a of the cover 120 is set to be greater than an outer diameter of the flange 111 b of the strainer 110.

[0146] A distance E2 between the claws 120b1 that are oppositely disposed in the cover 120 is set to be less than an outer diameter of the flange 111 b. An outer diameter of the flange 111 b is a site with a maximum diameter in the strainer 110.

[0147] The cover 120 configured as mentioned above is installed in the water drain hole 83 so that one end 120d of the cover 120 is communicated with the water drain hole 83.

[0148] A female screw 83b capable of engaging with the male screw 112a is formed on the water drain hole 83 of the tank 80. Therefore, the male screw 112a is engaged with the female screw 83b, so that the strainer 110 is installed in the water drain hole 83. The male screw 112a is loosened with respect to the female screw 83b, so that the strainer 110 is removed from the water drain hole 83.

[0149] Thus, the strainer 110 is provided so as to be attachable to and detachable from the water drain hole 83, and hence, the strainer 110 is removed from the water drain hole 83, so that scale in the tank 80 can reliably be discharged.

6. Specific Function of Strainer

[0150] Next, a specific function of the strainer 110 will be described. Hereinafter, for the sanitary washing apparatus 20, a case of a normal operation that executes washing of a human body or the like, a case where water drainage for the tank 80 is executed, and a case where cleaning of the strainer 110 is executed will be described separately.

[0151] FIG. 12A illustrates a position of the strainer 110 in a case of a normal operation. FIG. 12B is a diagram that illustrates a position of the strainer 110 in a case where water drainage for the tank 80 is executed, and FIG. 12C is a diagram that illustrates the strainer 110 having been removed in a case where cleaning of the strainer 110 is executed.

[0152] As illustrated in FIG. 12A, in the sanitary washing apparatus 20 in a case of a normal operation thereof, the strainer 110 is engaged with and installed in the water drain hole 83 and positioned so as to seal the water drain hole 83.

[0153] Herein, the outflow port 82b of the tank 80 is positioned around the filter 114 of the strainer 110. It is preferable for the outflow port 82b to be positioned in such a manner that the center line 82c is orthogonal to the center line 83c of the water drain hole 83. Thereby, a die for the tank 80 can readily be fabricated, as compared with, for example, a case where the center lines 82c and 83c are not orthogonal to each other, namely, in a case of being skew lines.

[0154] For example, in a case where washing of a human body is executed, water supplied from the tank 80 passes through the outflow port 82b and the filter 114 as indicated by an arrow D9, and as water passes through the filter 114, scale included therein is captured. Water having passed through the filter 114 flows on the second flow passage 100, and subsequently, is discharged from the discharge nozzle 41 through the pump 130.

[0155] Next, a case where water drainage for the tank 80 is executed will be described with reference to FIG. 12B. As illustrated in FIG. 12B, the male screw 112a of the strainer 110 is loosened with respect to the female screw 83b. Thereby, a part of the shaft 112 of the strainer 110 moves out of the water drain hole 83 to release engagement with the water drain hole 83 and opens the sealed water drain hole 83. As the water drain hole 83 is opened, water in the tank 80 flows out through a gap between the strainer 110 and the water drain hole 83, as indicated by an arrow D10.

[0156] Herein, as mentioned above, setting is executed in such a manner that an inner diameter E1 of the peripheral surface 120a of the cover 120 is greater than an outer diameter of the flange 111 b of the strainer 110 and a distance E2 between the claws 120b1 is less than an outer diameter of the flange 111 b.

[0157] Therefore, a part of the shaft 112 of the strainer 110 moves out of the water drain hole 83 but the remaining part of the shaft 112 (for example, a site with the filter 114 formed thereon) or the like remains inserted in the water drain hole 83. In other words, a part of the strainer 110 remains inserted in the water drain hole 83 and is in an idling state, even though engagement with the water drain hole 83 is released.

[0158] The claw 120b1 of the engagement part 120b of the cover 120 contacts, from an outside thereof, the head 111 of the strainer 110 with released engagement of the male screw 112a with the water drain hole 83, at a position where the head 111 seals the other end 120f. Thereby, water that flows out through the water drain hole 83 is held back by the flange 111b, and hence, water that flows out through the tank 80 can be prevented from scattering from a side of the other end 120f as the strainer 110 is removed from the water drain hole 83.

[0159] The strainer 110 is pushed by a water pressure from the water drain hole 83 in a horizontal direction (accurately, a negative direction of an X-axis) to be pressed against and locked on the claws 120b1 of the engagement part 120b, and hence, water that flows out of the tank 80 can be further prevented from scattering. A part of the shaft 112 remains in the water drain hole 83, and hence, the strainer 110 does not shake even at time of water drainage.

[0160] The opening 120c is disposed on a lower side of the cover 120, and hence, water that is held back by the flange 111b flows through the opening 120c to exterior thereof. Thus, the opening 120c functions as a flow passage for flowing water discharged from the tank 80 through the water drain hole 83. Water discharged from the opening 120c falls on the plate 31a, is guided to the discharge hole 32 by the above-mentioned water drainage channel 33, and is discharged into the bowl 12 (see an arrow D8 in FIG. 5). Thus, the water drainage channel 33 is disposed on the plate 31a, so that water that flows out of the water drain hole 83 can be discharged into the bowl 12 of the toilet 10.

[0161] As mentioned above, the flat part 112b is formed on the shaft 112 of the strainer 110. Thereby, a gap is formed between the female screw 83b of the water drain hole 83 and the flat part 112b. Therefore, as the male screw 112a is loosened to execute water drainage, water starts to flow out through such a gap, and as the male screw 112a is loosened, an amount of water that

flows out of the gap is gradually increased. Thus, in the present embodiment, the flat part 112b is disposed on the shaft 112 of the strainer 110, so that a flow rate of discharged water can be controlled.

[0162] A diameter of the water drain hole 83 is set to be greater than a diameter of the second flow passage 100 or the outflow port 82b. Thereby, comparatively large scale in the tank 80 can also be readily discharged to exterior thereof. As the above-mentioned water drainage is executed, the pump 130 is not driven, and hence, water in the tank 80 at time of water drainage does not flow to the second flow passage 100.

[0163] Thus, water drainage is executed by using the strainer 110 attachable to and detachable from the tank 80, so that scale that accumulates in the tank 80 can readily be discharged to exterior thereof.

[0164] Next, a case where cleaning for removing scale captured by the strainer 110 is executed after water drainage for the tank 80 is completed will be described with reference to FIG. 12C.

[0165] As illustrated in FIG. 12C, the strainer 110 is removed from the cover 120 in a case where cleaning of the strainer 110 is executed. As the strainer 110 is pulled in a horizontal direction (accurately, a negative direction of an X-axis) by a user, the claws 120b1 that locks the flange 111 b is pushed out in an outer radial direction, and the strainer 110 is pulled out of the cover 120 and removed from the water drain hole 83 and the cover 120.

[0166] The case 31 is provided with the above-mentioned taking-out hole 34 (see FIG. 3), and hence, the strainer 110 is taken out through the taking-out hole 34. Thus, the case 31 is provided with the taking-out hole 34, so that the strainer 110 can be removed from the tank 80 without removing the case cover 31 b or the like.

[0167] The engagement part 120b that has been pushed out in an outer radial direction is restored due to elastic deformation thereof, after passing the flange 111 b therethrough. Although illustration is omitted, as scale on the filter 114 is removed to complete cleaning of the strainer 110, the strainer 110 is inserted into the cover 120 and the water drain hole 83 while the sealing part 113a of the cap 113 is a leading end thereof. The male screw 112a is engaged with the female screw 83b of the water drain hole 83, so that the strainer 110 is installed in and fixed to the water drain hole 83.

7. Position of Disposition of Pump

[0168] Next, positions where the tank 80, the pump 130, and the like are disposed in an internal space of the case 31 will be described in more detail. FIG. 13 is a cross-sectional view of FIG. 5 along a line XIII - XIII.

[0169] As illustrated in FIG. 13, the case cover 31 b of the case 31 includes a rectangular part 36 and a slope part 37. The rectangular part 36 is positioned so as to cover a back side of the plate 31 a (a positive direction of a Y-axis). The rectangular part 36 is provided in such a manner that a front surface 36a and a back surface 36b extend in a vertical direction in an X-axis direction view that is a side view, and a rectangular or substantially rectangular internal space 38 is formed. The tank 80 is disposed in the internal space 38.

[0170] The slope part 37 is positioned so as to cover a front side of the plate 31 a (a negative direction of a Y-axis). The slope part 37 is formed in such a manner that an upper surface 37a thereof is continuous with the rectangular part 36. The upper surface 37a of the slope part 37 is continuous with the front surface 36a of the rectangular part 36 on a side of a proximal end 37a1 thereof, and is sloped forward and downward so as to be directed downward on a side of a distal end 37a2 thereof.

[0171] In other words, the bowl 12 of the toilet 10 is disposed on a side of the distal end 37a2 as indicated by an imaginary line in FIG. 13, and hence, the above-mentioned slope part 37 is formed in such a manner that the upper surface 37a is sloped downward on a side of the bowl 12 of the toilet 10 in a side view.

[0172] The slope part 37 configured as mentioned above is provided in such a manner that an internal space 39 with a trapezoidal shape or a substantially trapezoidal shape is formed in a side view. The internal space 39 is comparative narrow and has a deformed shape, and hence, is frequently a dead space. However, the above-mentioned pump 130 is contained on a side of the distal end 37a2 of the slope part 37 in the sanitary washing apparatus 20 according to the present embodiment. Thereby, a dead space of the case 31 can be utilized effectively.

[0173] In the configuration as mentioned above, the pump 130 can be positioned under the tank 80. For example, the pump 130 may be disposed under the upper surface 37a closer to the bowl 12. Thereby, pipes disposed in the pump 130 are filled with water from the tank 80, and hence, even when the pump 130 is, for example, a non-self-priming pump, it is possible to start discharge of water early after activation thereof.

8. Configuration of Control Part

[0174] Next, a configuration of the control part 200 illustrated in FIG. 2 will be described. The control part 200 includes a state detection unit 201, a water supply control unit 202, and a heating element control unit 203. The state detection unit 201, the water supply control unit 202, and the heating element control unit 203 as mentioned above are communicably connected to one another.

[0175] The state detection unit 201 detects a seating state of a user, an operation instruction from a user, or a state of the tank 80. The state detection unit 201 detects seating of a user in a case where an ON signal is output from the seating sensor 210, while seat-leaving of a user in a case where an OFF signal is output therefrom. The state detection unit 201 detects a start instruction for starting washing of a human body or a stop instruction for stopping such washing that is output from the opera-

tion part 220.

[0176] The state detection unit 201 detects that a water level in the tank 80 is a predetermined level or higher in a case where an ON signal is output from the float switch 72. On the other hand, the state detection unit 201 detects that a water level in the tank 80 is lower than a predetermined level in a case where an OFF signal is output from the float switch 72. The state detection unit 201 detects temperature of water in the tank 80 based on a signal that is output from the thermistor 73.

[0177] The water supply control unit 202 controls operations of the electromagnetic valve 62 and the pump 130 based on various states detected by the state detection unit 201. Specifically, the water supply control unit 202 operates the electromagnetic valve 62 to supply water into the tank 80 and drive the pump 130 to discharge water in the tank 80 from the discharge nozzle 41.

[0178] The heating element control unit 203 operates the heating element 71 to heat water in the tank 80 in a case where temperature of water in the tank 80 that is detected by the state detection unit 201 is lower than a reference temperature. On the other hand, the heating element control unit 203 stops an operation of the heating element 71 in a case where temperature of water in the tank 80 is higher than or equal to such a reference temperature.

[0179] Meanwhile, there is room for improvement in a conventional technique from the viewpoint of utilizing water, accurately hot water, in the tank 80 effectively. In the sanitary washing apparatus 20 according to the embodiment, hot water in the tank 80 can be utilized as effectively as possible. Hereinafter, this matter will be described in detail.

9. Specific Operation of Sanitary Washing Apparatus

[0180] Next, an operation of the sanitary washing apparatus 20 configured as mentioned above will be described with reference to FIG. 14 or later. FIG. 14 is a timing chart that illustrates an example of steps of a process for the sanitary washing apparatus 20 according to the embodiment.

[0181] FIG. 14 illustrates, sequentially from the top, an output signal of the seating sensor 210, a driving state of the pump 130, an output signal of the float switch 72, a cumulative drive time of the pump 130, an open or closed state of the electromagnetic valve 62, an elapsed time after seat-leaving, and a float switch ON time.

[0182] FIG. 15A to FIG. 15G are illustration diagrams that illustrate a state of water in the tank 80. Hereinafter, timing of supply of water into the tank 80 will be described with a focus and in detail.

[0183] In FIG. 14, first, as a user is seated at a time T1, the state detection unit 201 detects an ON signal from the seating sensor 210. Then, as an instruction for starting washing is input by a user through the operation part 220 at a time T2, the water supply control part 202 drives the pump 130 to discharge water (hot water) in the tank 80 from the discharge nozzle 41.

[0184] Thereby, as illustrated in FIG. 15A, a water level in the tank 80 is gradually lowered. In FIG. 15A to FIG. 15G, hot water in the tank 80 is provided with a reference symbol HW and indicated by dots, and cold water is provided with a reference symbol CW and indicated by diagonal lines. Herein, hot water HW means water heated by the heating element 71 to have temperature around reference temperature, and cold water CW means water at temperature that has not yet reached such reference temperature, for example, immediately after water flows into the tank 80 through the water inflow pipe 81.

[0185] The description for FIG. 14 is continued, and as an output of the float switch 72 is switched from an ON signal to an OFF signal at a time T3 while water level in the above-mentioned tank 80 is lowered, the water supply control unit 202 activates a timer that measures a cumulative pump drive time.

[0186] As such a cumulative pump drive time is greater than a first predetermined time A1, the water supply control unit 202 opens the electromagnetic valve 62 to start supply of water into the tank 80. Thereby, as illustrated in FIG. 15B, cold water CW starts to accumulate around a bottom of the tank 80. Herein, an amount of water supplied into the tank 80 is greater than an amount of water discharged from the discharge nozzle 41.

[0187] The above-mentioned first predetermined time A1 is set depending on a performance of the pump 130 or the like. Specifically, the first predetermined time A1 is set at, for example, a value such that supply of water is started before a water level in the tank 80 is lowered to expose the inlet 82a of the water outflow pipe 82 above water. Thereby, water discharged from the discharge nozzle 41 can be prevented from being depleted.

[0188] Subsequently, as a water level is elevated by supplying water into the tank 80 and an output of the float switch 72 is switched from an OFF signal to an ON signal at a time T5, the water supply control unit 202 closes the electromagnetic valve 62 to stop supply of water (see FIG. 15C).

[0189] As washing of a user is continued, a water level in the tank 80 is lowered again, and an output of the float switch 72 is switched from an ON signal to an OFF signal at a time T6. At such timing, the water supply control unit 202 reactivates a timer that measures a cumulative pump drive time.

[0190] As a cumulative pump drive time is longer than the first predetermined time A1 at a time T7, the water supply control unit 202 opens the electromagnetic valve 62 to start supply of water into the tank 80, as illustrated in FIG. 15D.

[0191] Thus, in the present embodiment, supply of water is not started at timing when an output of the float switch 72 is switched from an ON signal to an OFF signal, but is started in a case where a cumulative pump drive time is longer than the first predetermined time A1. Thereby, it is possible to delay timing when supply of water into the tank 80 is started, as much as possible, that is, supply

of water can be started after hot water HW in the tank 80 is utilized as much as possible.

[0192] Subsequently, as, for example, an instruction for stopping washing is input by a user through the operation part 220 at a time T8, the water supply control unit 202 stops the pump 130 to stop discharge of water from the discharge nozzle 41. The water supply control unit 202 also closes the electromagnetic valve 62 to stop supply of water into the tank 80 (see FIG. 15E).

[0193] Then, as a user leaves a seat at a time T9, the water supply control part 202 measures an elapsed time after seat-leaving at timing when an output of the seating sensor 210 is switched from an ON signal to an OFF signal. Subsequently, as an elapsed time after seat-leaving is longer than a second predetermined time A2 at a time T10, the water supply control unit 202 opens the electromagnetic valve 62 to start supply of water into the tank 80. Such a second predetermined time A2 is settable at an arbitrary value, and for example, is set at a value of a few seconds to several tens of seconds.

[0194] Thus, in the present embodiment, supply of water into the tank 80 is not started immediately after seat-leaving but such supply of water is started after a lapse of the second predetermined time A2. Thereby, hot water HW in the tank 80 can be utilized as effectively as possible.

[0195] That is, for example, as supply of water is started in a case where a user instantaneously leaves a seat to sit again or the like, a proportion of cold water CW to hot water HW in the tank 80 may be increased to decrease an amount of available hot water HW consequently. On the other hand, in the present embodiment, supply of water is not started in a case of instantaneous seat-leaving, and hence, hot water HW in the tank 80 can be utilized as much as possible.

[0196] Subsequently, as a water level is elevated by supply of water into the tank 80 and an output of the float switch 72 is switched from an OFF signal to an ON signal at a time T11, the water supply control unit 202 activates a timer that measures a float switch ON time. The above-mentioned float switch ON time is a time after seat-leaving and when an output signal of the float switch 72 is an ON signal. That is, as illustrated in FIG. 15F, supply of water into the tank 80 is continued in the present embodiment even when an output of the float switch 72 is an ON signal.

[0197] As supply of water into the tank 80 is thus continued, it is possible to dip a float of the float switch 72 in water, as illustrated in FIG. 15G. Thereby, drying of a float can be prevented. Although scale may be floated on a surface of water in the tank 80, a float is dipped in water so that the scale can be prevented from adhering to the float.

[0198] Then, as a float switch ON time is longer than a third predetermined time A3 at a time T12, the water supply control unit 202 closes the electromagnetic valve 62 to stop supply of water into the tank 80. Such a third predetermined time A3 is settable at an arbitrary value, and is set at, for example, a value of a few seconds to several tens of seconds.

10. Variation

[0199] Next, a variation of the sanitary washing apparatus 20 according to the embodiment will be described. In the above-mentioned embodiment, the outlet 81 b of the water inflow pipe 81 is positioned closer to the heating element 71. As illustrated in FIG. 6, the water inflow pipe 81 is provided in such a manner that the outlet 81 b is disposed above the center line 71 a of the heating element 71, and is not limited thereto.

[0200] In the sanitary washing apparatus 20 according to a variation, the water inflow pipe 81 is provided in such a manner that an outlet 181 b thereof is disposed at a position lower than that of the heating element 71, as indicated by an imaginary line in FIG. 6. Specifically, the water inflow pipe 81 is provided in such a manner that the outlet 181 b is disposed under the center line 71 a of the heating element 71. Thereby, in the variation, water supplied from the water inflow pipe 81 to the tank 80 readily stays around the heating element 71, and hence, it is possible to heat water more efficiently.

[0201] As described above, the sanitary washing apparatus 20 according to the embodiment includes the tank 80, the discharge nozzle 41, the pump 130, the backflow prevention mechanism 90, the case 31, and the strainer 110. The tank 80 is provided with the heating element 71 inside thereof and stores water therein. The discharge nozzle 41 discharges water in the tank 80 toward a private part of a user. The pump 130 is disposed on a downstream side of the tank 80 and supplies water stored in the tank 80 to the discharge nozzle 41.

[0202] The backflow prevention mechanism 90 has the air gap 94a disposed on an upstream side of the tank 80 and at the site B where a flow passage is divided by the atmosphere open space 94. The case 31 houses the tank 80, the discharge nozzle 41, the pump 130, and the backflow prevention mechanism 90. The strainer 110 is attachable to and detachable from the tank 80 through the taking-out hole 34 of the case 31 and filters water that flows from the tank 80 to the pump 130. Thereby, scale in the tank 80 can readily be discharged.

[0203] In the above-mentioned embodiment, the backflow prevention mechanism 90 is a horizontal type, where this is an illustration, is not limited thereto, and may be another kind of backflow prevention mechanism such as a vertical type.

[0204] In the above, supply of water into the tank 80 is started after an output of the float switch 72 is switched from an ON signal to an OFF signal and subsequently the first predetermined time A1 is elapsed, and is not limited thereto. That is, for example, supply of water into the tank 80 may be started at a time when an output of the float switch 72 is switched from an ON signal to an OFF signal.

[0205] In the above, supply of water into the tank 80 is

started after the second predetermined time A2 is elapsed after seat-leaving of a user, and is not limited thereto, and supply of water may be started, for example, immediately after seat-leaving.

[0206] In the above, supply of water into the tank 80 is stopped after a user leaves a seat and after a time when an output of the float switch 72 is an ON signal passes through the third predetermined time A3, and is not limited thereto. That is, for example, supply of water into the tank 80 may be stopped at a time when the float switch 72 outputs an ON signal after a user leaves a seat.

Claims

1. A sanitary washing apparatus (20), comprising:

a nozzle (41) that is configured to discharge water toward a private part of a user;
a water passage (50) that is configured to communicate with the nozzle (41) and a water supply pipe (A);
a tank (80) that is disposed on the water passage (50), the tank (80) being provided with a heating element (71) inside thereof and configured to store water therein, the tank (80) being configured to supply water to the nozzle (41);
a backflow prevention mechanism (90) that is disposed on the water passage (50) and upstream of the tank (80), the backflow prevention mechanism (90) including an air gap (94a) communicating with an atmosphere, thereby preventing backflow of water;
a pump (130) that is disposed downstream of the tank (80) and supplies water stored in the tank (80) to the nozzle (41);
a case (31) that houses the tank (80), the nozzle (41), the pump (130), and the backflow prevention mechanism (90), the case having an opening (34); and
a strainer (110) that is detachably mounted on the tank (80) such that attachment and/or detachment work of the strainer (110) is conducted through the opening (34) of the case (31), the strainer (110) filtering water that flows from the tank (80) to the pump (130).

2. The sanitary washing apparatus (20) according to claim 1, wherein:

the tank (80) includes a hole (83) that drains water stored therein; and
the strainer (110) is detachably mounted at a position of the hole (83).

3. The sanitary washing apparatus (20) according to claim 2, wherein
the strainer (110) includes a head (111), a shaft (112) with a diameter less than that of the head (111), the shaft (112) including a part (112a) that is disposed closer to the head (111) and engages with the hole (83), and
the tank (80) includes a flexible cover (120) that has one end (120d) communicating with the hole (83), the other end (120f), and an engagement part (120b), the flexible cover (120) having a cylindrical shape, the flexible cover (120) having an opening (120c) at a lower position of the flexible cover (120), and the strainer (110) is inserted into the flexible cover (120), and the other end (120f) of the flexible cover (120) and the head (111) are fit to each other when the head (111) contacts the engagement part (120b) of the flexible cover (120) in a state where engagement of the part (112a) with the hole (83) is released.

4. The sanitary washing apparatus (20) according to claim 2 or 3, wherein the case (31) includes, on a bottom surface (31a1) thereof, a channel (33) that guides, to a bowl (12) of a toilet (10), water that flows out of the hole (83).

5. The sanitary washing apparatus (20) according to claim 2, 3, or 4, wherein the hole (83) is disposed below the heating element (71).

FIG.1

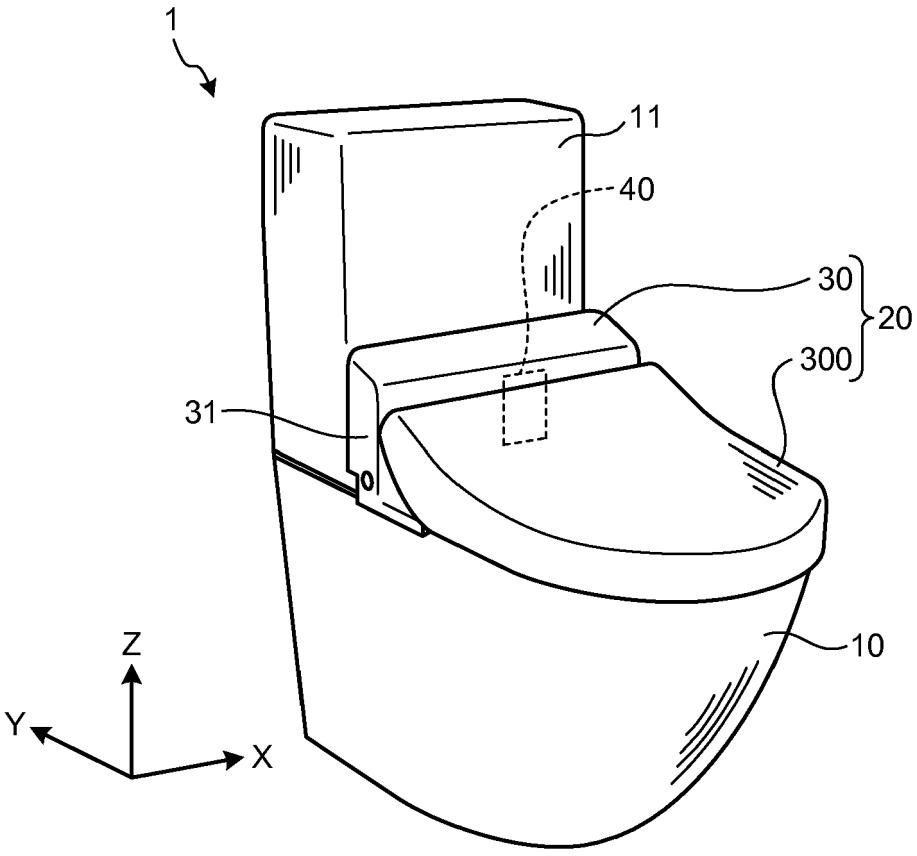


FIG.2

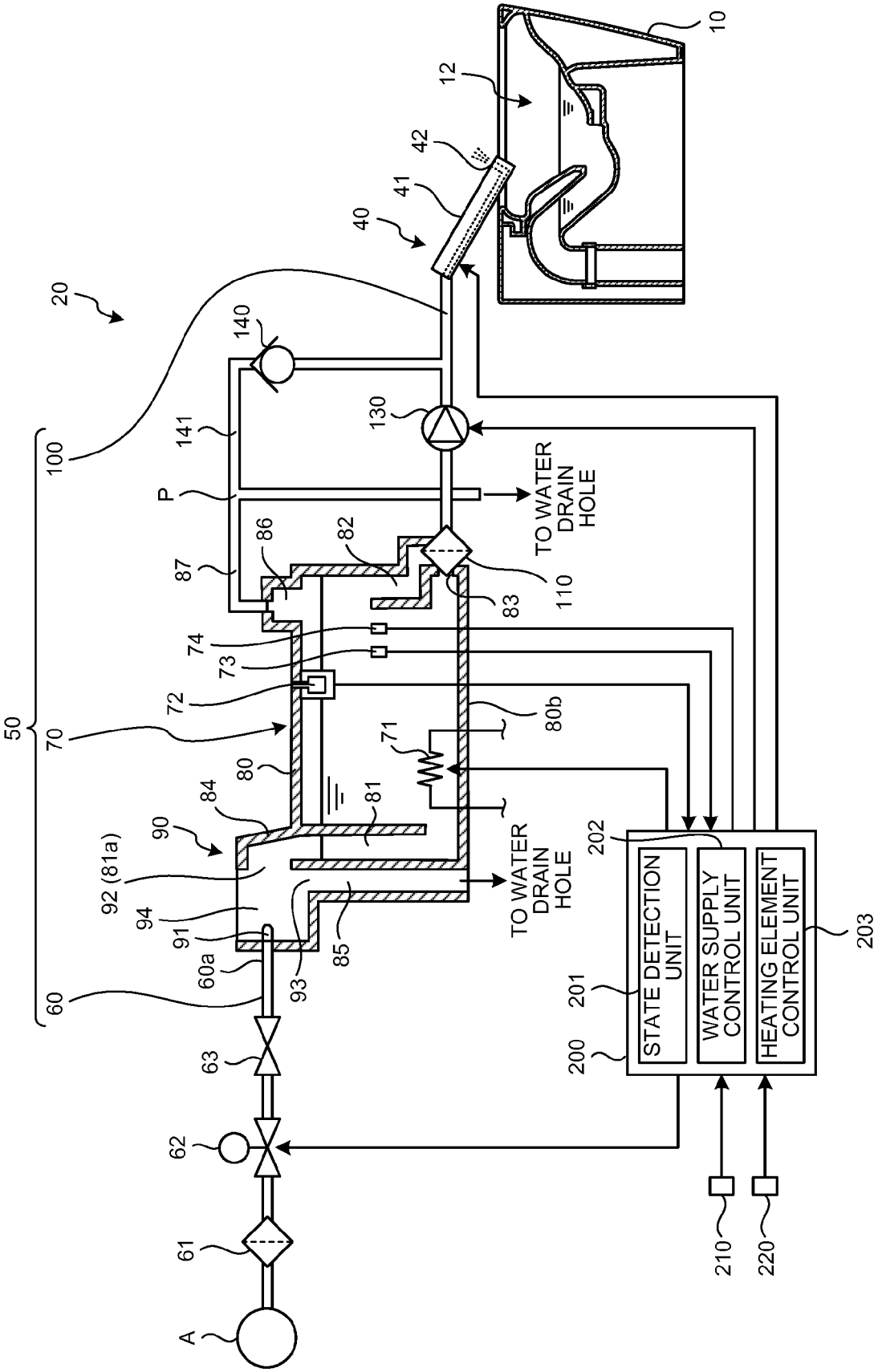

10
12
42
41
40
20
140
141
130
100
P
TO WATER DRAIN HOLE
86
82
87
110
83
74
73
72
50
70
80b
71
80
84
81
90
92 (81a)
94
91
60a
93
85
TO WATER DRAIN HOLE
202
STATE DETECTION UNIT
WATER SUPPLY CONTROL UNIT
HEATING ELEMENT CONTROL UNIT
203
201
200
60
63
62
61
A
210
220

FIG.3

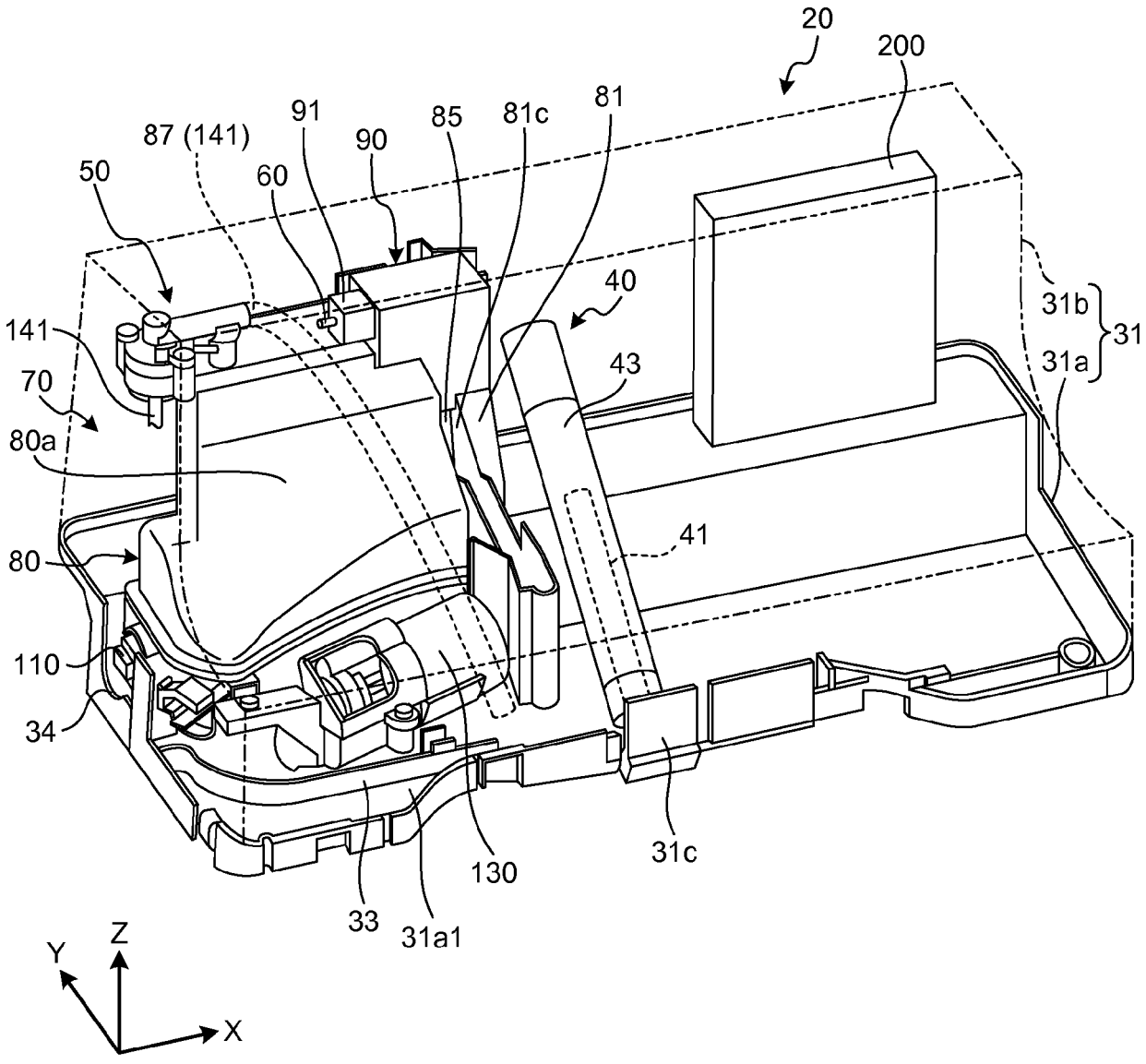

20
200
87 (141)
91
90
85
81c
81
50
60
40
31b
31
31a
141
70
43
80a
41
80
110
34
130
31c
33
31a1
Z
Y
X

FIG.4

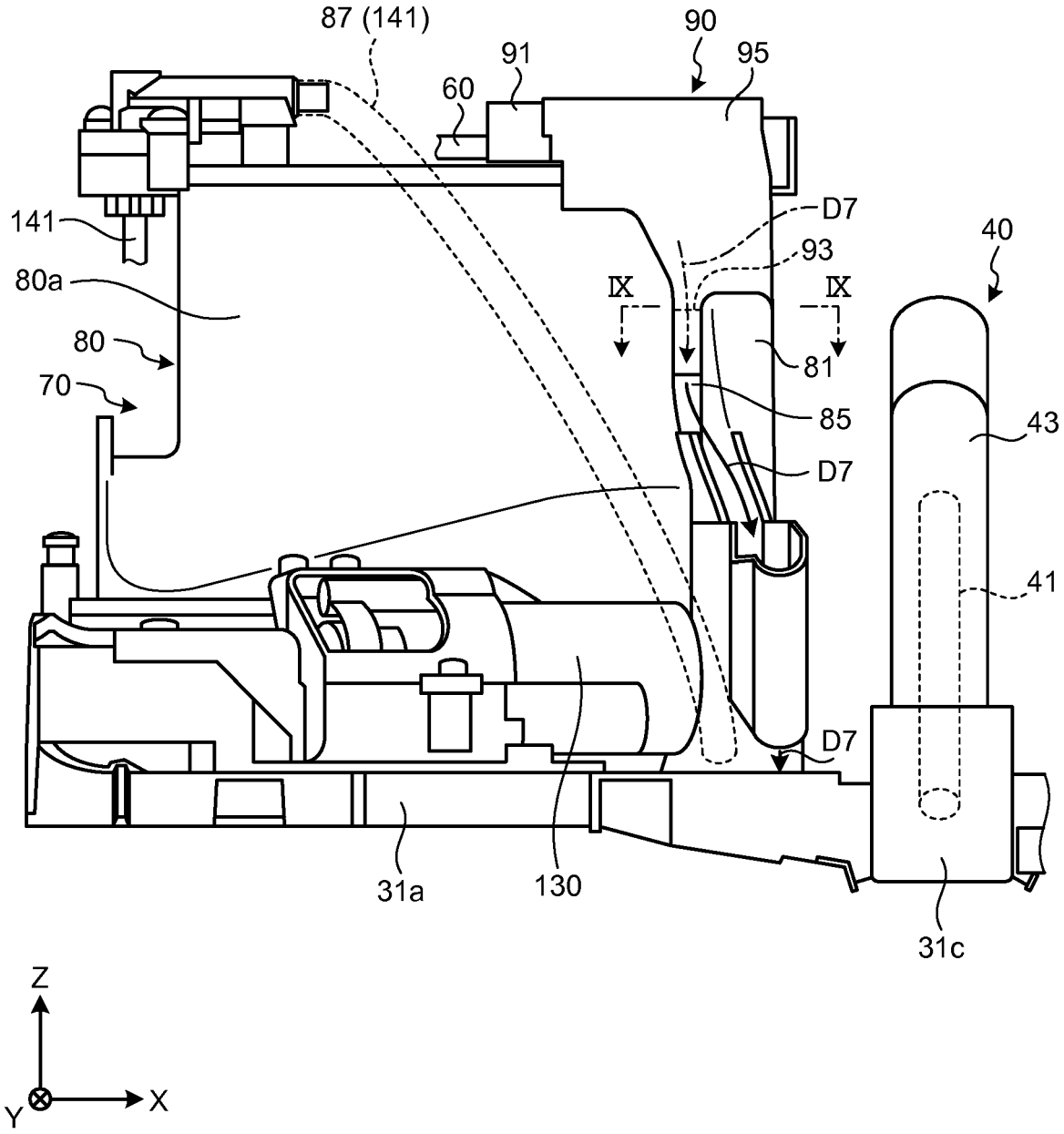

87 (141)
90
91
95
60
141
D7
93
40
80a
IX
IX
80
81
70
85
43
D7
41
D7
31a
130
31c
Z
Y
X

FIG.5

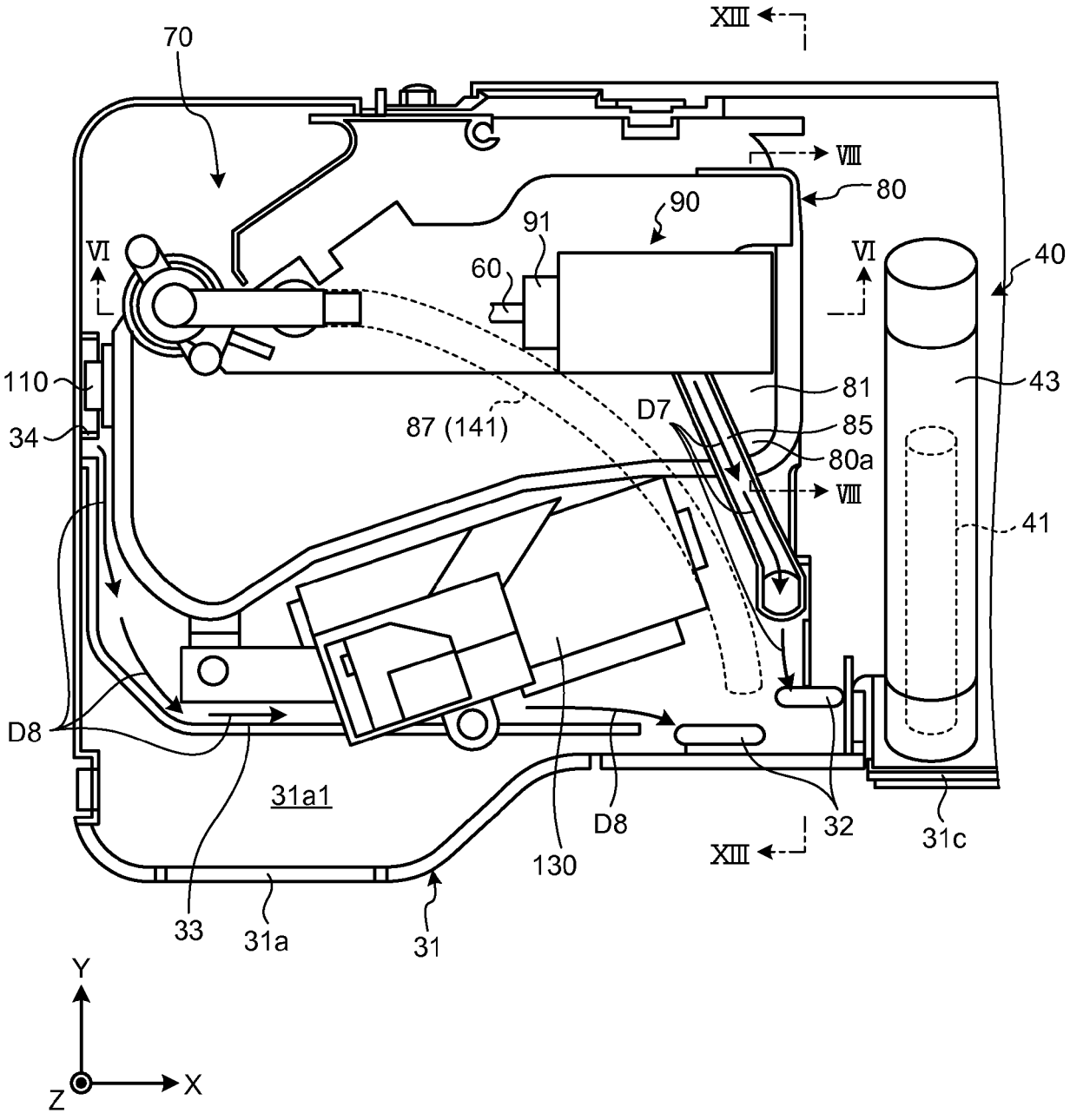

XIII
70
VIII
80
90
91
VI
60
VI
40
110
81
43
34
87 (141)
D7
85
80a
VIII
41
D8
31a1
D8
32
XIII
31c
130
33
31a
31
Y
X
Z

FIG.6

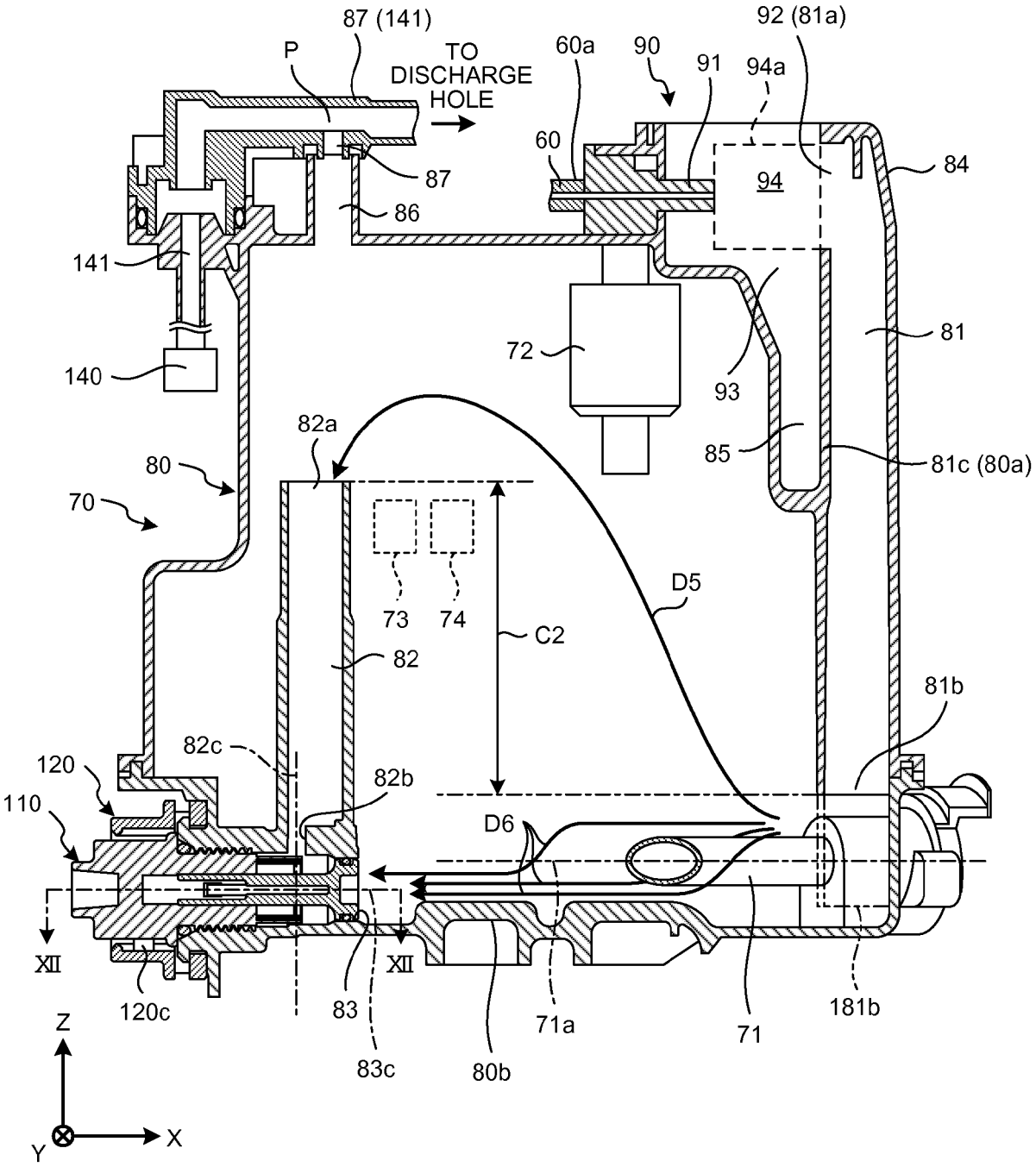

87 (141)
P
TO DISCHARGE HOLE
60a
90
91
94a
92 (81a)
60
87
86
84
94
141
72
81
140
93
82a
85
81c (80a)
80
70
73
74
C2
D5
82
81b
82c
120
82b
110
D6
XII
XII
120c
83
83c
80b
71a
71
181b
Z
Y
X

FIG.7

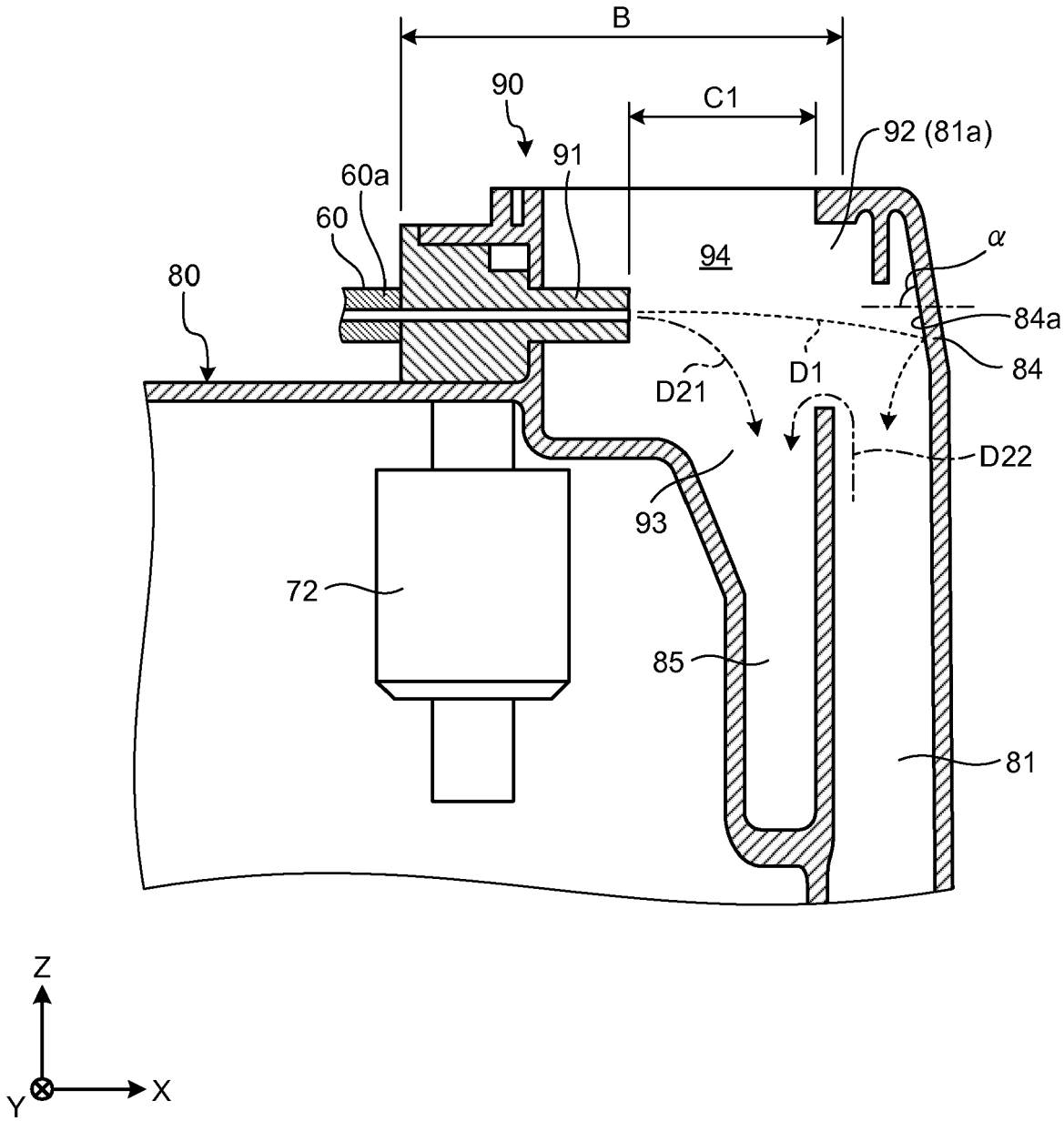


FIG.8

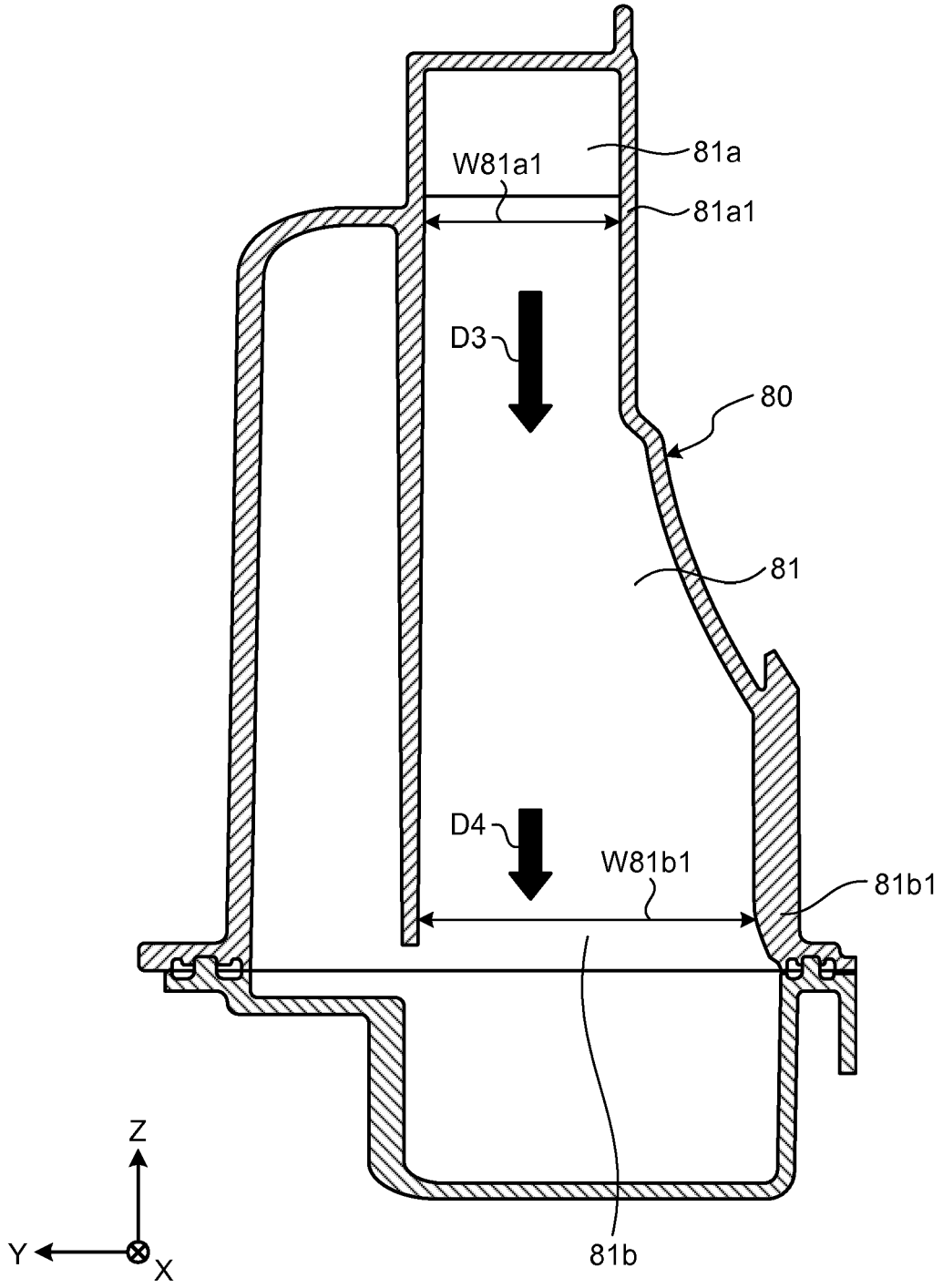


FIG.9

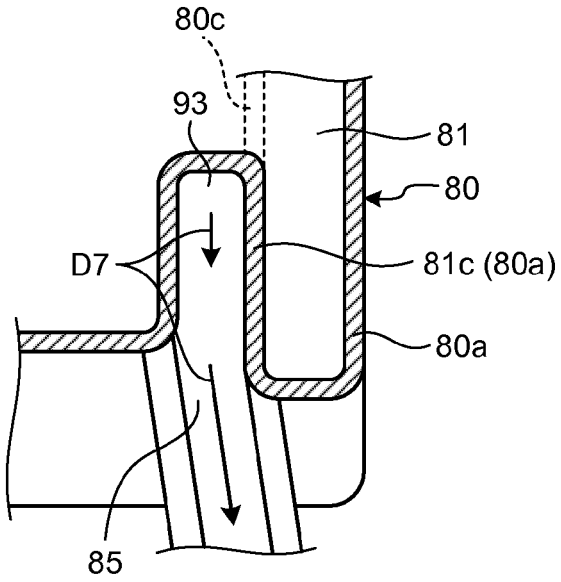

80c
93
81
80
D7
81c (80a)
80a
85

FIG.10

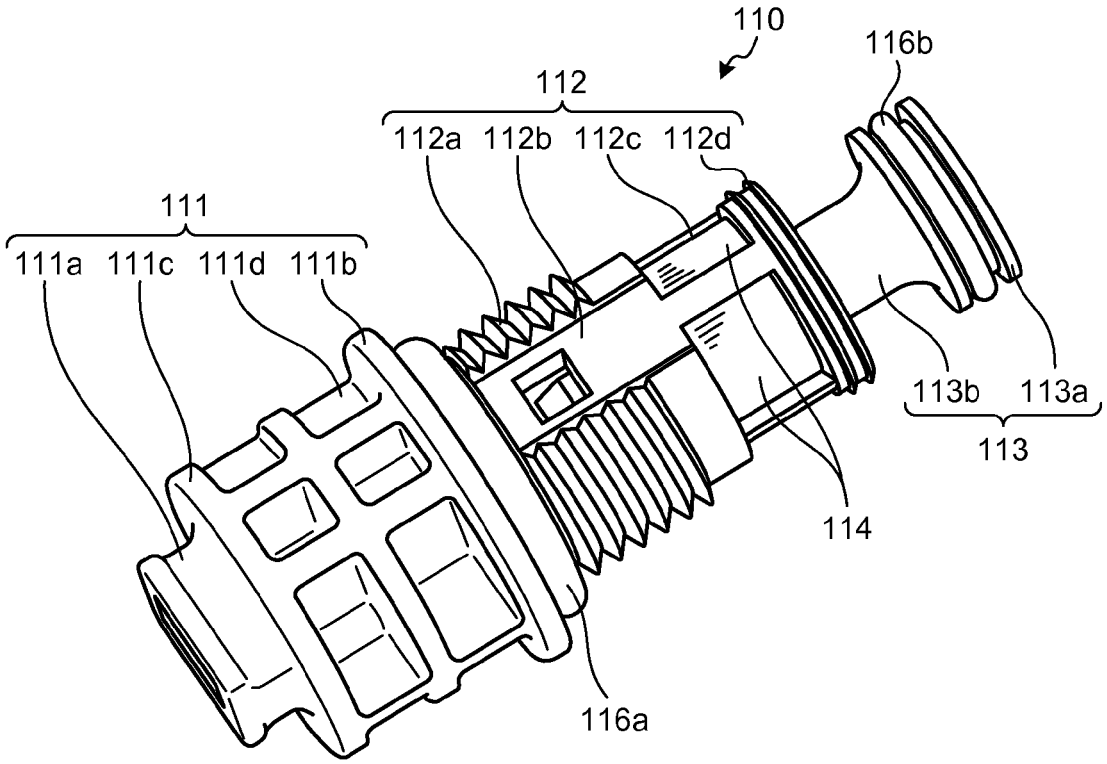

110
116b
112
112a 112b 112c 112d
111
111a 111c 111d 111b
113b 113a
113
114
116a

FIG.11

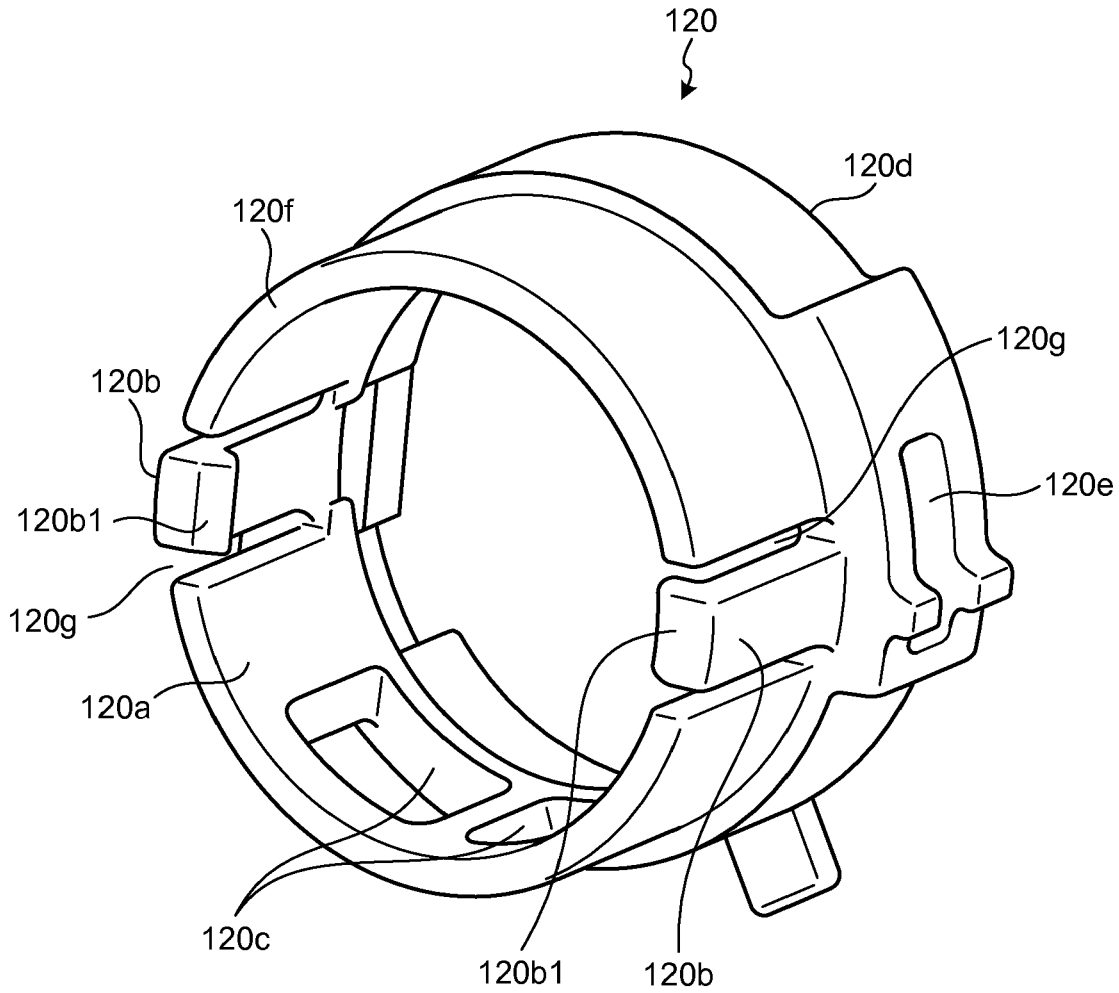


FIG.12A

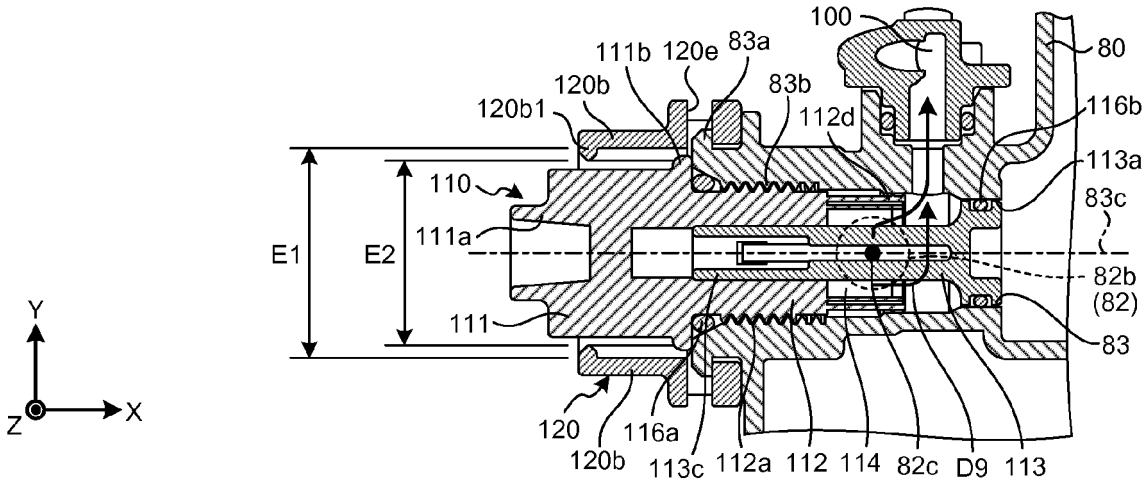


FIG.12B

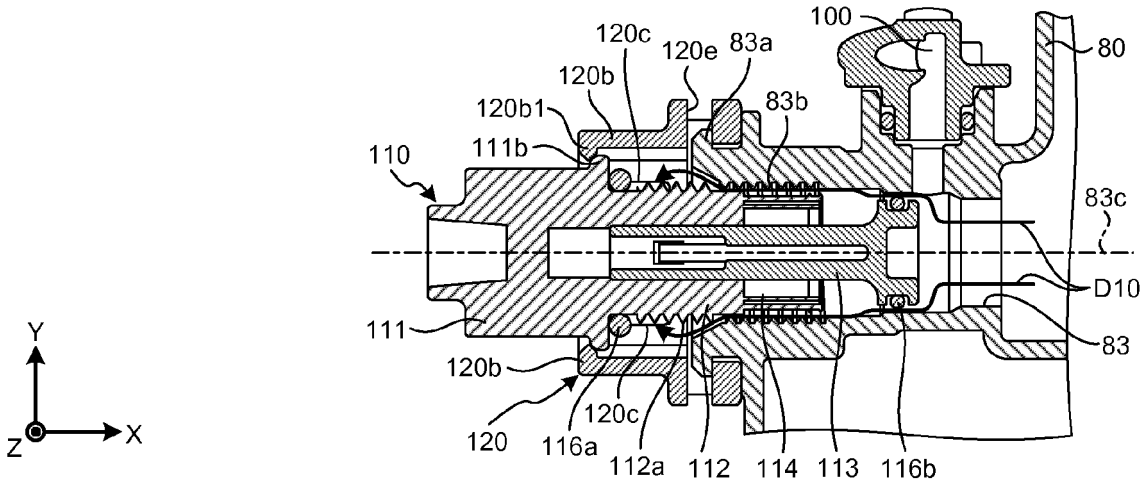


FIG.12C

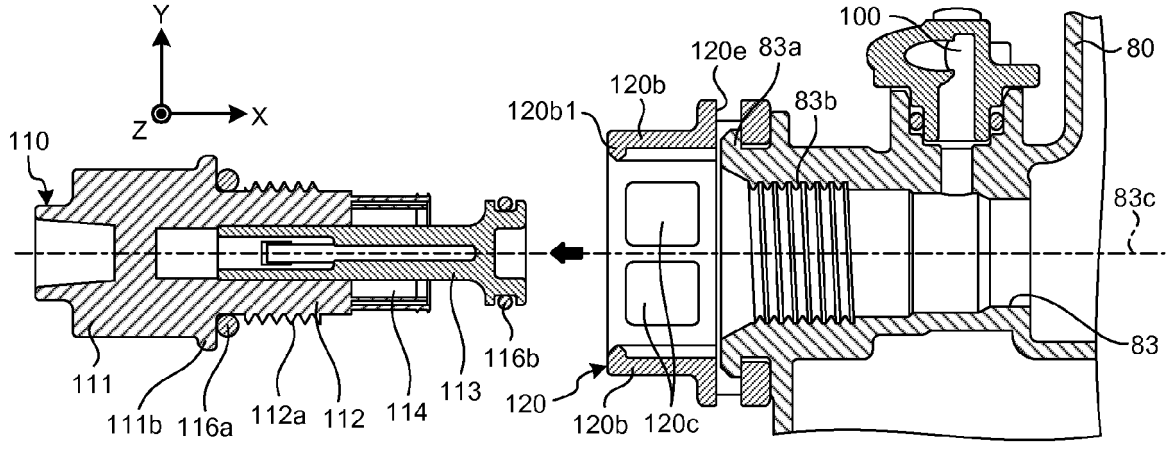


FIG.13

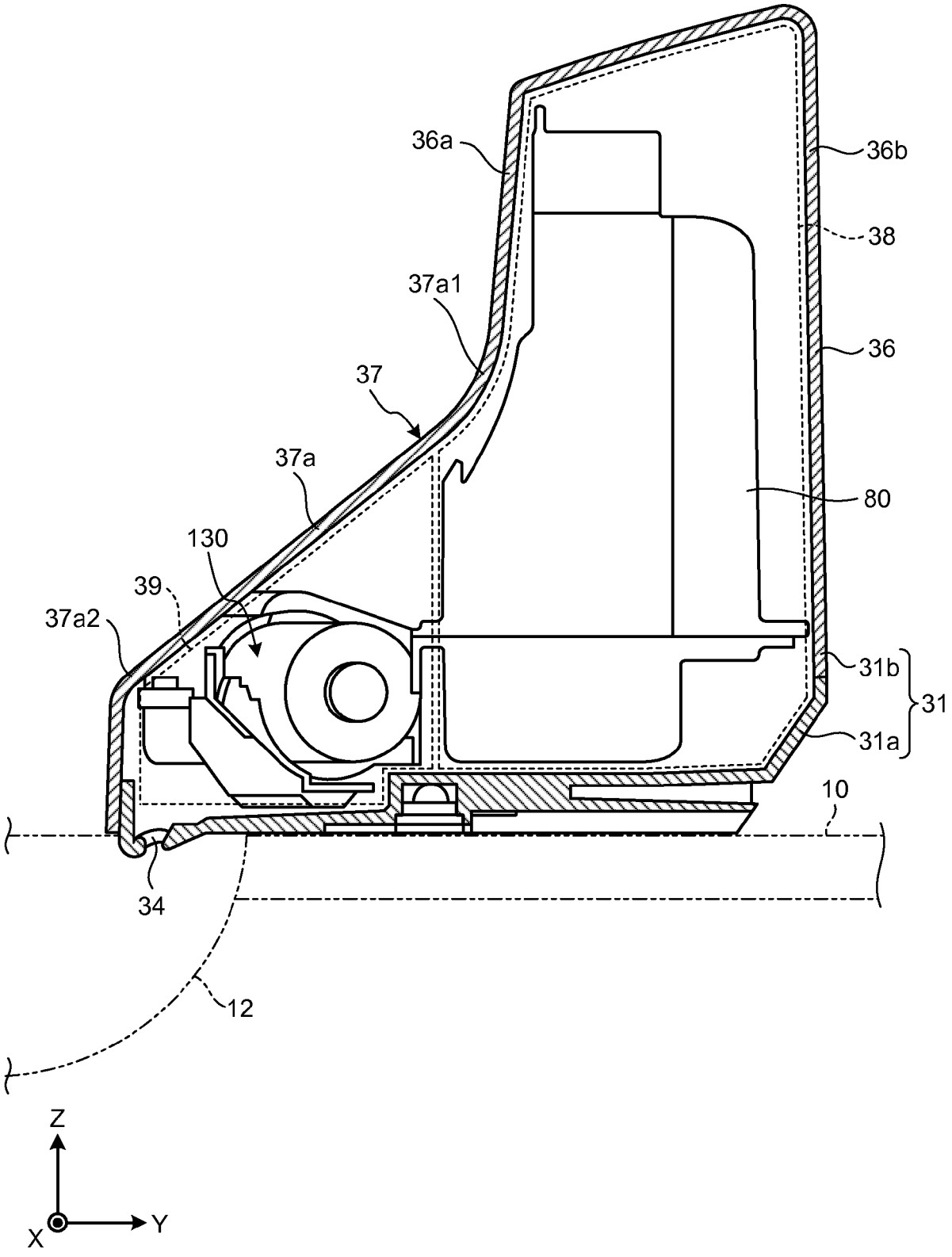


FIG.14

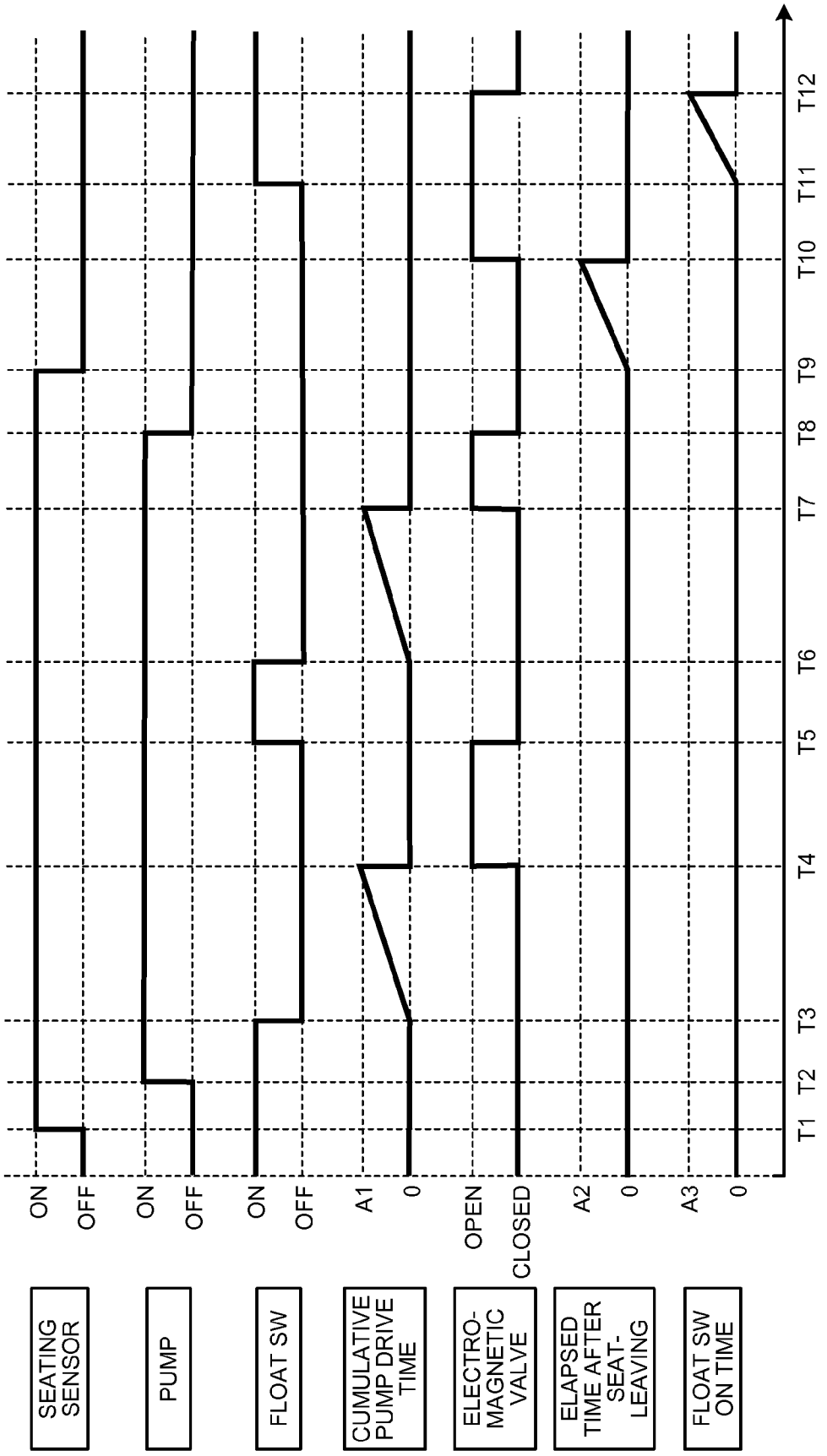

SEATING SENSOR
PUMP
FLOAT SW
CUMULATIVE PUMP DRIVE TIME
ELECTRO-MAGNETIC VALVE
ELAPSED TIME AFTER SEAT-LEAVING
FLOAT SW ON TIME
ON
OFF
ON
OFF
ON
OFF
A1
0
OPEN
CLOSED
A2
0
A3
0
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12

FIG.15A

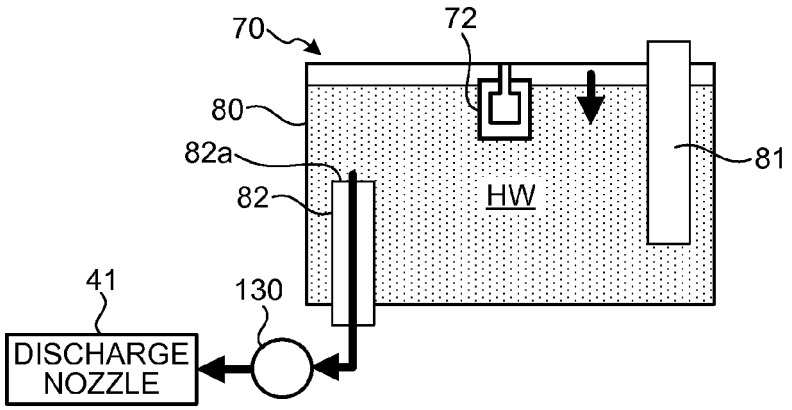


FIG.15B

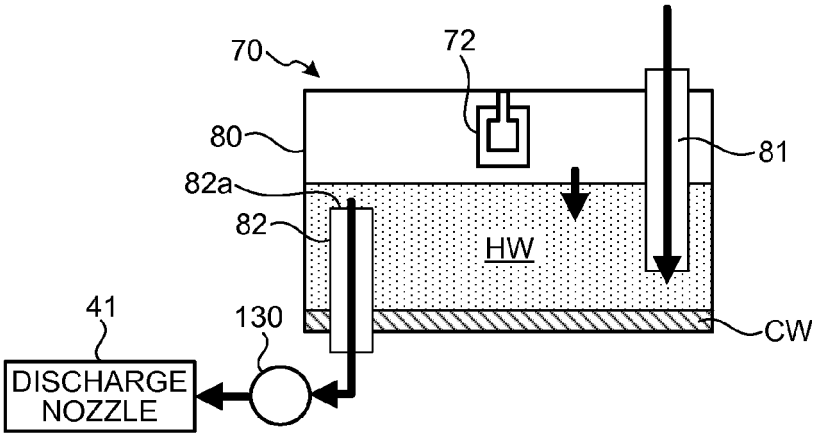


FIG.15C

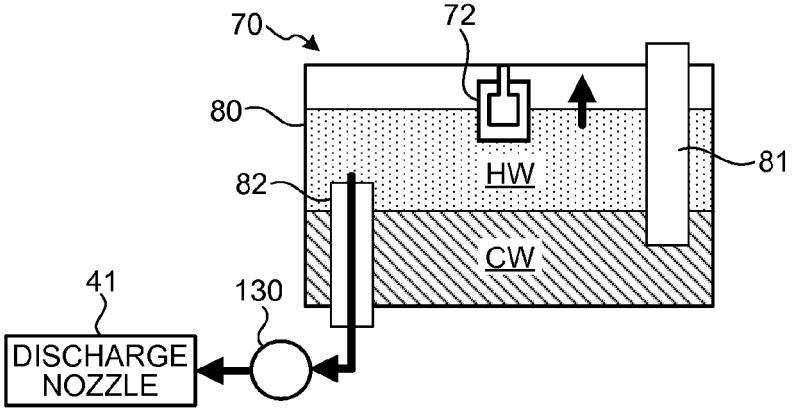


FIG.15D

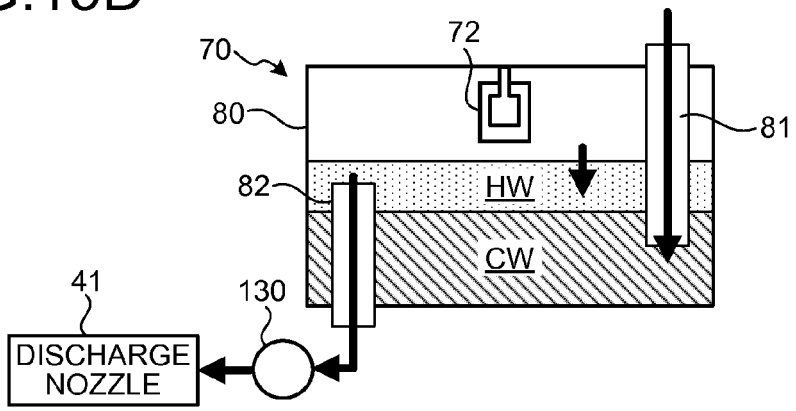


FIG.15E

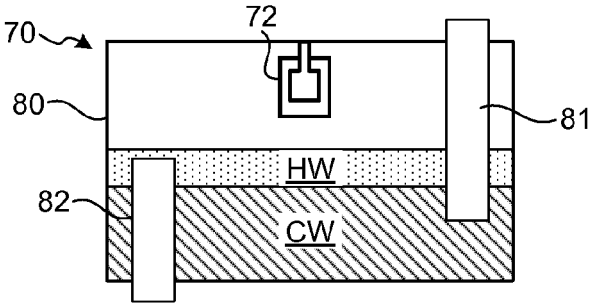


FIG.15F

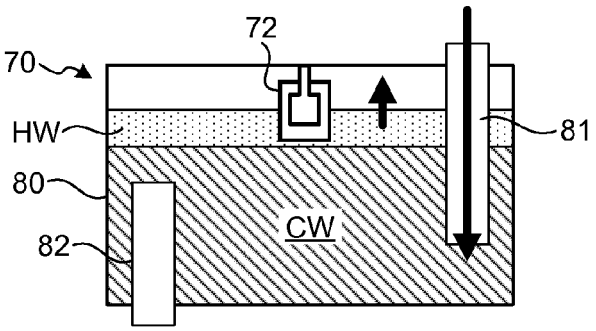
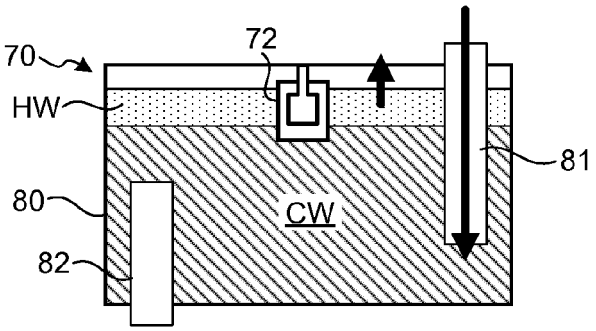


FIG.15G



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Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 October 2016	Leher, Valentina

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