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(54) SANITARY WASHING DEVICE

(57) A sanitary washing device (100) includes:

a water discharge nozzle (131) configured to discharge water at a human body part;

a water supply channel configured to supply water to the water discharge nozzle;

a solenoid valve (174) provided in the water supply channel and configured to control supply of water from a water supply source;

an open tank provided in the water supply channel and including:

a tank main body (180);

an inflow port (181) configured to allow water to flow into the tank main body;

an outflow port (182) configured to allow the water inside the tank main body to flow out to the water discharge nozzle; and

an overflow port (183) provided so as to form an air gap between the overflow port and the inflow port and configured to drain excess water inside the tank main body to outside;

a washing pump (191)provided in the water supply channel downstream of the open tank and configured to pump water out of the outflow port and supply the water downstream in the water supply channel;

a casing housing the open tank; and

a toilet seat and a toilet lid attached to the casing, wherein

the sanitary washing device further comprising: a control device (160) configured to perform drainage control for draining water from inside the open tank with supply of water to the open tank being stopped.

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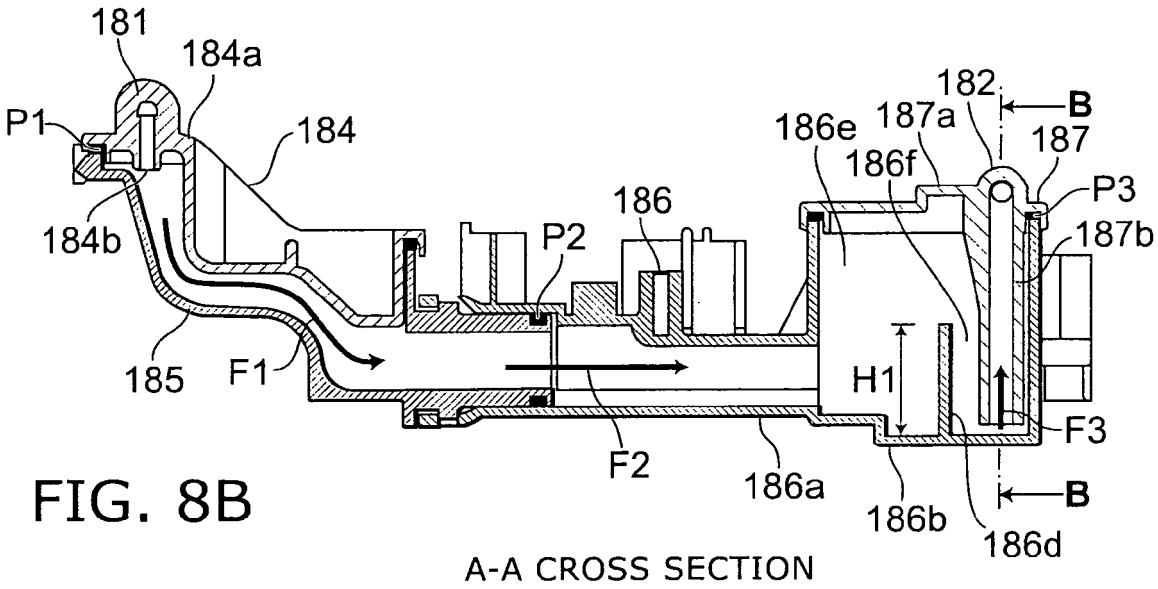
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A-A CROSS SECTION

FIG. 8B

Description

[0001] This invention relates to a sanitary washing device, and more particularly to a sanitary washing device capable of washing the "bottom" and the like of a user with water.

[0002] This case is a divisional application divided from EP09252162.4, published as EP2163695. That parent application was filed in Japanese, the entire contents of which are incorporated herein by way of reference to ensure full disclosure herein.

[0003] As a sanitary washing device installed above a sit-down toilet main body and provided with a washing nozzle for washing a human body with discharged wash water, a sanitary washing device with a reserve tank provided in a water channel to the washing nozzle is known. A draining notch is provided at the sidewall of the tank body of the reserve tank housed in the device main body, and excess water in the tank body flows out of this draining notch into a gutter-shaped drainage channel. After further flowing along the gutter-shaped drainage channel, the excess water is drained from a drainage port provided in the gutter-shaped drainage channel into the sit-down toilet main body (JP-A-8-120733).

[0004] However, in the sanitary washing device disclosed in JP-A-8-120733, water remains in the reserve tank also during non-washing time. Hence, at cleaning time and at relocation time of the sanitary washing device, for instance, if the sanitary washing device is detached from the sit-down toilet main body and tilted, residual water in the reserve tank may leak from the draining notch and splash on other components in the device main body, which may suffer a breakdown.

[0005] This invention has been made in view of this problem. An object of the invention is to provide a sanitary washing device including an open tank in the supply water channel, where even if the sanitary washing device is tilted at cleaning time or relocation time, no water is splashed on other components.

[0006] In order to solve the above problem, a sanitary washing device according to the invention includes: a water discharge nozzle configured to discharge water at a human body part; a water supply channel configured to supply water to the water discharge nozzle; a solenoid valve provided in the water supply channel and configured to control supply of water from a water supply source; an open tank provided in the water supply channel and including: a tank main body; an inflow port configured to allow water to flow into the tank main body; an outflow port configured to allow the water inside the tank main body to flow out to the water discharge nozzle; and an overflow port provided so as to form an air gap between the overflow port and the inflow port and configured to drain excess water inside the tank main body to outside; a washing pump provided in the water supply channel downstream of the open tank and configured to pump water out of the outflow port and supply the water downstream in the water supply channel; a casing housing the open tank; and a toilet seat and a toilet lid attached to the casing, the sanitary washing device further includes: a control device configured to perform drainage control for draining water from inside the open tank with supply of water to the open tank being stopped.

[0007] According to the invention, the control device performs the drainage control to drain water from inside of the open tank. Thus, leakage of water to the casing does not occur even if the sanitary washing device is tilted at cleaning time or relocation time. As a result, a situation to cause breakdown by leakage of water to other components placed in the casing can be prevented.

[0008] Also, decay of residual water by prolonged storage of water in the open tank can be suppressed.

[0009] According to a favorable aspect of the invention, the sanitary washing device includes: a human body sensor configured to sense a presence of a human body, and the control device performs the drainage control when the human body sensor has entered a state of non-sensing human body.

[0010] According to the invention, the drainage control is performed at a time when the usage of the sanitary washing device is not disturbed, and water can be drained from inside of the open tank. More specifically, the control device performs the drainage control when determining the sanitary washing device is in a non-used state on the basis of the fact that there is no presence of a user nearby. Accordingly, a situation to cause compromising usability of the sanitary washing device, such as draining water from inside of the open tank while using the sanitary washing device, can be prevented.

[0011] According to a favorable aspect of the invention, the control device performs the drainage control when the state of the human body sensor not sensing the presence of a human body has continued for a prescribed time period.

[0012] There is a case that the human body sensor temporarily does not sense the presence of the human body by the movement of a user while using the sanitary washing device. Thus, if the control device is configured to perform the drainage control immediately when the human body sensor stops sensing the human body, water in the open tank is drained in the case of temporarily stopping to sense the human body as described above although the user is still using the sanitary washing device. Therefore, when the user subsequently desires another wash, it takes time to store water again in the open tank, which has already been drained. This causes a delayed start of discharging water from the water discharge nozzle.

[0013] According to the invention, when a non-sensing state of the human body sensor has continued for the prescribed time period, the control device determines that the user has completely finished using the sanitary washing device, and performs the drainage control. As a result, the above problem, which water in the open tank is drained while the user is still using the sanitary washing device, can be resolved.

[0014] According to a favorable aspect of the invention, the control device performs the drainage control on the basis of manipulation of a drainage switch.

[0015] According to the invention, a worker who cleans or moves the sanitary washing device can manipulate the drainage switch to start the drainage control at the beginning of the work. At the time of state that the sanitary washing device waits by use, water is stored in the open tank in order to start discharging quickly from the water discharge nozzle at the beginning of cleaning. Further, water in the open tank is drained at the beginning of cleaning or relocation so that leakage of water to other components in the casing can be prevented.

[0016] According to a favorable aspect of the invention, the sanitary washing device includes: a toilet lid closure sensor configured to sense that the toilet lid is closed, and the control device performs the drainage control when the toilet lid closure sensor has sensed that the toilet lid is closed.

[0017] According to the invention, the drainage control is performed at a time when the usage of the sanitary washing device is not disturbed, and water can be drained from inside of the open tank. More specifically, the control device performs the drainage control when determining the sanitary washing device is in a non-used state on the basis of the closure of the toilet lid. Accordingly, a situation to cause compromising usability of the sanitary washing device, such as draining water from inside of the open tank while using the sanitary washing device, can be prevented.

[0018] According to a favorable aspect of the invention, the control device performs the drainage control by activating the washing pump.

[0019] According to the invention, the washing pump is configured to pump water out and drain the water from inside of the open tank by activation in the drainage control. More specifically, the washing pump, which supplies water to the water discharge nozzle, is also used for the drainage control. Therefore, the sanitary washing device does not need to separately include other components for draining water from inside of the open tank, and can be provided at low cost and compact size.

[0020] According to a favorable aspect of the invention, the sanitary washing device further includes: a drainage device, independent of the washing pump, configured to drain water from inside the open tank, and the control device performs the drainage control by activating the drainage device.

[0021] According to the invention, the drainage device, independent of a washing pump, is included to drain water from inside of the open tank so that an independent channel from the water supply channel can be easily configured for draining water from inside of the open tank. By making water draining channels independent from the open tank, most suitable setting about the lengths of the channels, the arrangements in the casing and the like for each channel to supply water to the water discharge nozzle and to drain water in the open tank can be performed.

[0022] According to a favorable aspect of the invention, the sanitary washing device further includes: a heat exchanger provided in the water supply channel downstream of the washing pump, configured to store water supplied from the washing pump, and including a heater configured to heat the stored water, and a backflow prevention device is provided in the water supply channel between the open tank and the heat exchanger and configured to prevent backflow of water.

[0023] According to a sanitary washing device disclosed in JP-A-8-120733, a reserve tank is located below the high-water level of stored water in a hot-water store tank (see FIG. 3 of JP-A-8-120733). Therefore, the stored water in the hot-water store tank flows back by head pressure and leaks into the reserve tank through a pump when the pump is deactivated in a non-washing state. Further, a water level in the hot-water store tank falls by draining water to outside from a draining notch of the reserve tank. As a result, in the hot-water store tank configured to drain the stored water from the inside upper parts sequentially, it requires to store water again in the hot-water store tank at the time of next washing a human body. This causes a delay of quick start of discharging water from the washing nozzle.

[0024] Furthermore, from the viewpoint of safety, sanitary washing devices in general have a float switch inside of the hot-water store tank to detect the amount of stored water and prevent a heater from starting to heat water when no sufficient amount of water is in the hot-water store tank (so-called boil-dry). As described above, when the water level in the hot-water store tank falls by backflow of water from the hot-water store tank to the reserve tank through the pump, a sufficient water to start heating in the hot-water store tank might not be held. Consequently, it takes time to heat water up for discharging from the washing nozzle at the time of next washing the human body. This causes a delay of quick start of discharging hot water.

[0025] On the other hand, the invention prevents backflow of water into the open tank from the heat exchanger. Thus, water in the open tank is not drained by overflow when the washing pump is deactivated, and the water level in the heat exchanger does not fall. As a result, the heat exchanger can hold a full of stored water, and it allows a quick start of discharging water from the water discharge nozzle at the time of next washing. Moreover, the open tank can be placed lower than the heat exchanger, and the degree of the freedom of the configuration can be improved.

[0026] By preventing the backflow described above and holding the water amount in the heat exchanger, the sanitary washing device, which prevents the heater from starting to heat stored water when no sufficient amount of water is in the heat exchanger, is able to maintain stored water in the heat exchanger at a suitable temperature by heating with the heater. As a result, a quick start of discharging water having a suitable temperature from the water discharge nozzle at the time of next washing

is possible.

[0027] According to a favorable aspect of the invention, the method of the backflow prevention includes an air-opening valve, which opens the water supply channel to the air above the highest water level of the stored water in the heat exchanger.

[0028] Opening the water supply channel to the air by the air-opening valve can prevent backflow from the heat exchanger to the open tank. Moreover, water in the water supply channel does not leak to outside because the air-opening valve opens the water supply channel to the air above the highest water level of the stored water in the heat exchanger. As a result, the heat exchanger can be filled with the stored water, and a quick start of discharging water from the water discharge nozzle at the time of next washing is possible.

[0029] According to a favorable aspect of the invention, the air-opening valve is installed and fixed on the top surface of the heat exchanger.

[0030] According to this, while opening to the air above the highest water level of the stored water in the heat exchanger, defining a position can be easily performed. The air-opening valve does not need to be directly fixed to the top surface of the heat exchanger. But, the air-opening valve may be installed and be fixed through jigs such as brackets on the top surface of the heat exchanger as standard.

[0031] According to a favorable aspect of the invention, the method of the backflow prevention includes a backflow prevention valve, which includes a valve disc blocking the water supply channel to enable flow water only in one direction.

[0032] According to this, water in the water supply channel does not leak to outside; therefore, limitation by the water level of the stored water in the heat exchanger does not occur. As a result, a position to prevent backflow can be defined, and the degree of the freedom of the configuration can be further improved.

[0033] According to a favorable aspect of the invention, the control device performs overflow drainage control for opening the solenoid valve to supply water to the open tank and causing overflow of water from the overflow port of the open tank.

[0034] According to a favorable aspect of the invention, the amount of water supplied from the water supply source is larger than the amount of water pumped out of the open tank by the washing pump.

[0035] According to the sanitary washing device disclosed in JP-A-8-120733, the reserve tank is opened by a draining notch placed in the upper end of the sidewall of the tank. Thus, garbage jamming through the reserve tank to the washing nozzle in the channel of the downstream may occur by garbage such as a piece of toilet paper or cotton dust, which enters in the tank from the air-opening section. This may cause decreasing the amount of discharging wash water, lowering a feeling of washing, or stopping discharging wash water.

[0036] On the other hand, according to the invention, the amount of water supplied from the water supply source is larger than the amount of water pumped out by the washing pump. Thus, water in the open tank overflows unfailingly and can eject garbage from the open tank even when the washing pump is being activated. As a result, a failure of discharging water caused by garbage jamming can be prevented.

[0037] Performing the overflow drainage control by the control device drains water in the open tank, and ejects garbage entering in the open tank from the overflow port, thus the failure of discharging water caused by garbage jamming can be prevented.

[0038] According to a favorable aspect of the invention, the control device performs the overflow drainage control before starting water discharge from the water discharge nozzle, and subsequently activates the washing pump to start discharge of water from the water discharge nozzle.

[0039] According to this, the overflow drainage control is performed before washing the sanitary washing device, and garbage can be ejected from the open tank. In other words, garbage can be ejected by overflow of water in the open tank right before using the sanitary washing device by a user; therefore, the failure of discharging water caused by garbage jamming can be prevented.

[0040] According to a favorable aspect of the invention, the control device performs the overflow drainage control when the human body sensor senses a user nearby the sanitary washing device.

[0041] According to this, the overflow drainage control is performed at a time when the usage of the sanitary washing device is not disturbed, and garbage can be ejected from inside of the open tank. In other words, the control device determines that the sanitary washing device will be used on the basis of the presence of a user nearby the sanitary washing device, and performs the overflow drainage control. Garbage can be ejected by overflow of water in the open tank before using the sanitary washing device by a user; therefore, the failure of discharging water caused by garbage jamming can be prevented.

[0042] According to a favorable aspect of the invention, the control device performs the overflow drainage control when the human body sensor has continuously sensed a user for a prescribed time period.

[0043] For example, there is a case that the human body sensor temporarily senses a presence of a human body even when a human passes the front of the sanitary washing device. If the control device is configured to perform the overflow drainage control immediately when the human body sensor senses the human body, water in the open tank is drained by overflow in the case of temporarily sensing the human body as described above while no one is in use. This causes a waste of water by overflow.

[0044] Therefore, when the human body sensor has continuously sensed the presence of the human body for the prescribed time period, the control device determines

that a user will use the sanitary washing device, and performs the overflow drainage control. As a result, wasting water that occurs by overflow of water in the open tank while no one uses the sanitary washing device can be prevented, and the above problem can be resolved.

[0045] According to a favorable aspect of the invention, the control device performs the overflow drainage control when the human body sensor is in a state of non-sensing a user after sensing the user nearby the sanitary washing device.

[0046] According to this, the overflow drainage control is performed at a time when the usage of the sanitary washing device is not disturbed, and garbage can be ejected from inside of the open tank. As a result, the failure of discharging water caused by garbage jamming can be prevented.

[0047] In other words, the control device determines that the sanitary washing device is not used on the basis of the fact that there is no presence of a user nearby the sanitary washing device, and performs the overflow drainage control. As a result, wasting water that occurs by overflow of water in the open tank while the sanitary washing device is being used can be prevented.

[0048] According to a favorable aspect of the invention, the control device performs the overflow drainage control when the human body sensor has continuously been in a state of non-sensing a user for the prescribed time period.

[0049] For example, there is a case that the human body sensor temporarily stops sensing a presence of a human body by the movement of a user while the sanitary washing device is being used. If the control device is configured to perform the overflow drainage control immediately when the human body sensor stop sensing the human body, water in the open tank is drained by overflow in the case of temporarily stopping sensing the human body as described above while the sanitary washing device is being used. This causes a waste of water by overflow.

[0050] Therefore, when the human body sensor has continuously been in a state of non-sensing the presence of the human body for the prescribed time period, the control device determines that the user completely finishes using the sanitary washing device, and performs the overflow drainage control. As a result, wasting water that occurs by overflow of water in the open tank while the sanitary washing device is being used can be prevented, and the above problem can be resolved.

[0051] According to a favorable aspect of the invention, the control device performs the overflow drainage control when the toilet lid closure sensor senses a closure of the toilet lid.

[0052] According to this, the overflow drainage control is performed at a time when the usage of the sanitary washing device is not disturbed, and garbage can be ejected from inside of the open tank by the overflow of water. In other words, the control device determines that the sanitary washing device is not used on the basis of the fact that the toilet lid is closed, and performs the overflow drainage control. As a result, wasting water that occurs by overflow of water in the open tank while the sanitary washing device is being used can be prevented, and the problem can be resolved.

[0053] According to a favorable aspect of the invention, a switch to manipulate the sanitary washing device is included, and the control device performs the overflow drainage control on the basis of the user's manipulation of the switch.

[0054] According to this, when garbage such as dust gets through inside of the open tank during cleaning the sanitary washing device, the overflow drainage control can be performed by the manipulation of the drainage switch. As a result, water in the open tank can be overflow to eject garbage by performing the overflow drainage control in response to the user's needs at a time when the usage of the sanitary washing device is not disturbed.

[0055] According to a favorable aspect of the invention, the control device performs the overflow drainage control at regular intervals.

[0056] Regardless of the use situation of the user, water in the open tank can be overflow to eject garbage at regular intervals; therefore, the failure of discharging water caused by garbage jamming can be prevented.

[0057] According to a favorable aspect of the invention, the casing is located above a toilet bowl and further houses the water discharge nozzle, the water supply channel, the solenoid valve, the washing pump, and the control device, a container including a water receiver surrounded by a partition wall is provided inside the casing and below the overflow port, one end of the container is formed into a drainage port extending to above a bowl portion of the toilet bowl, the open tank includes a cover covering the upper side of the water receiver of the container, configured to guide excess water drained from the overflow port to the water receiver of the container, and including a release port located above the container, and the excess water drained from the overflow port of the open tank is allowed to flow from the release port into the water receiver of the container and to be drained from the drainage port to the bowl portion of the toilet bowl.

[0058] According to the sanitary washing device disclosed in JP-A-8-120733, when the flowing amount of excess water is large, the excess water blasts out from a drainage notch and may spatter to a device main body over a gutter-shaped drainage channel. If electronic parts and the like arranged in the device main body is got by water spattered to the device main body, a breakdown of the sanitary washing device may occur.

[0059] On the other hand, in the invention, the excess water drained from the open tank is received by a water receiver of the container provided below the overflow port, and is drained to a bowl portion of the toilet bowl. The water receiver of the container is surrounded by a partition wall, which prevents water from spreading outside the container. As a result, the excess water can be unfailingly drained to the bowl portion of the toilet bowl

without spillover into the casing, and a situation of breakdown caused by getting water in the control device housed inside of the casing can be suppressed.

[0060] When the excess water is drained from the overflow port and drops, the excess water collides with the water receiver of the below container of the overflow port. The excess water might be scattered by the collision. However, the invention provides a cover to cover the upper side of the water receiver of the container. Thus, the cover can prevent scattering water outside of the container, and the excess water can be promptly drained into the bowl portion of the toilet bowl.

[0061] According to a favorable aspect of the invention, the container is formed integrally with at least one of a deodorizing duct constituting a path to suck air from inside the bowl portion of the toilet bowl and a hot-air duct constituting a path to supply hot air to the human body part.

[0062] According to the invention, integrally forming a container with at least one of a deodorizing duct and a hot-air duct allows draining excess water, which is drained from overflow, to a bowl portion of a toilet bowl without increasing members housing in the casing.

[0063] According to the invention, there is provided a sanitary washing device including an open tank in a supply water channel, where even if the sanitary washing device is tilted at cleaning time or relocation time, no water is splashed on other components.

FIG. 1 is an external view of a toilet device provided with a sanitary washing device according to a first embodiment of the invention;

FIG. 2 is a transparent view showing the internal configuration of the sanitary washing device according to the first embodiment of the invention;

FIG. 3 is a control block diagram of the sanitary washing device according to the first embodiment of the invention;

FIG. 4 is a perspective view around a deodorizing unit and an open tank of the sanitary washing device according to the first embodiment of the invention;

FIG. 5 is an exploded perspective view of a deodorizing duct of the sanitary washing device according to the first embodiment of the invention;

FIG. 6 is an exploded perspective view around a deodorizing unit and the open tank of the sanitary washing device according to the first embodiment of the invention;

FIGS. 7A to 7C are schematic views showing the structure of the open tank of the sanitary washing device according to the first embodiment of the invention and a flow of water therein;

FIGS. 8A to 8C are schematic views showing the structure of an open tank according to a variation and a flow of water therein;

FIG. 9 is a cross-sectional view showing a flow of excess water from the open tank according to the variation;

FIG. 10 is a block diagram showing a water channel configuration of the sanitary washing device according to the first embodiment of the invention;

FIG. 11 is a schematic view showing the configuration around the heat exchanger and the open tank according to the first embodiment of the invention;

FIG. 12 is a schematic diagram showing an example sequence of the sanitary washing device according to the first embodiment of the invention;

FIG. 13 is a block diagram showing a water channel configuration of a sanitary washing device according to a second embodiment of the invention;

FIG. 14 is a perspective view around an open tank of a sanitary washing device according to a third embodiment of the invention;

FIG. 15 is a block diagram showing a water channel configuration of the sanitary washing device according to the third embodiment of the invention;

FIG. 16 is a schematic diagram showing an example sequence of the sanitary washing device according to the third embodiment of the invention; and

FIG. 17 is a schematic diagram showing an example sequence of a sanitary washing device according to a fourth embodiment of the invention.

[0064] Embodiments of the invention will now be described with reference to the drawings.

[0065] FIG. 1 is an external view of a toilet device 10 provided with a sanitary washing device according to a first embodiment of the invention.

[0066] The sanitary washing device 100 according to this embodiment includes a main body section 110 provided above the rear of a toilet bowl 200. A toilet lid 130 and a toilet seat, not shown, covered with the toilet lid 130 are rotatably and pivotally supported on a casing 120 constituting a housing of the main body section 110.

[0067] FIG. 2 is a transparent view showing the internal configuration of the sanitary washing device according to the first embodiment of the invention.

[0068] The casing 120 includes a case cover 121 and a case plate 122. The case plate 122 is formed in a flat plate and mounted on the toilet bowl 200, and a water discharge nozzle 131 is disposed in front thereof. In addition, on the case plate 122, various components required for sanitary washing are disposed, including a deodorizing unit 140, a heat exchanger 150, a control device 160, a remote control receiver 161, a seating sensor 162, a water supply valve unit 170, and an open tank 180. Furthermore, on the lateral side of the case cover 121 is provided a water supply section 190 for receiving supply of water from a water pipe. In this description, "water" includes not only cold water, but also heated hot water.

[0069] The water discharge nozzle 131 is extendable into and retractable from the bowl portion of the toilet bowl 200 and has a function of washing the "bottom" and the like of a user seated on the toilet bowl 200 by discharging water thereat. In the state of being advanced into the bowl portion of the toilet bowl 200, this water

discharge nozzle 131 discharges water which has passed through the water supply valve unit 170 including a solenoid valve for switching passage/stoppage of water.

[0070] The heat exchanger 150 heats water supplied from the water supply valve unit 170 in order to discharge hot water from the water discharge nozzle 131. As described later, a heater 151 generating heat by energization is provided inside the heat exchanger 150.

[0071] The control device 160 controls, for instance, the advancing/retracting and the amount of discharged water of the water discharge nozzle 131 and the amount of heating of the heat exchanger 150 on the basis of signals received by the remote control receiver 161 from a remote controller, not shown.

[0072] The deodorizing unit 140, as described later in detail, serves to suck air in the bowl portion of the toilet bowl 200, deodorize it, and exhaust it from a deodorized air outlet 141. When the seating sensor 162 detects that a user is seated on the toilet seat, the deodorizing unit 140 activates a deodorizing fan 142 to start sucking air in the bowl portion through a deodorizing duct 143.

[0073] FIG. 3 is a control block diagram of the sanitary washing device according to the first embodiment of the invention.

[0074] A remote controller R is a user interface allowing a user to manipulate the sanitary washing device 100, and includes a stop switch S1 for stopping the operation of the sanitary washing device 100, and operation mode switches respectively corresponding to a plurality of washing modes provided by the sanitary washing device 100. Specifically, three operation mode switches are provided, which are a "BOTTOM" switch S2, a "BIDET" switch S3, and a "SOFT" switch S4. The user manipulates an operation mode switch corresponding to the operation mode, which he/she wants the sanitary washing device 100 to perform.

[0075] On the basis of the user's manipulation, the remote controller R sends a manipulation signal to the control device 160. The control device 160 receives the manipulation signal and controls switching between closing and opening a solenoid valve 174, switching of the supply destination of water by a switching valve 192, and activation of the deodorizing fan 142, the heater 151, a washing pump 191, and a nozzle driving device 132. Furthermore, the control device 160 is configured to receive a sense signal transmitted from the seating sensor 162, and suitably determines control specifics on the basis of the received sense signal. These components controlled by the control device 160 are described later in detail.

[0076] FIG. 4 is a perspective view around the deodorizing unit 140 and the open tank 180 of the sanitary washing device according to the first embodiment of the invention, FIG. 5 is an exploded perspective view of the deodorizing duct 143 of the sanitary washing device according to the first embodiment of the invention, and FIG. 6 is an exploded perspective view around the deodorizing unit 140 and the open tank 180 of the sanitary washing device according to the first embodiment of the invention.

[0077] As shown in FIG. 4, an extension plate receiving notch 123 notched toward the rear side of the toilet bowl 200 is provided in part of the case plate 122. This extension plate receiving notch 123 is located above the bowl portion of the toilet bowl 200, and an extension plate 300 (see FIG. 5) having a corresponding shape is fitted therein.

[0078] As shown in FIG. 5, the inside of the extension plate 300 is partitioned by a rear partition wall 301 provided upright at the rear and side partition walls 302a, 302b provided upright on the left and right, respectively, from the electronic functional components including the control device 160 and the remote control receiver 161 disposed in the casing 120. Furthermore, the inside of the extension plate 300 is compartmentalized by a diaphragm 303 provided upright therein into a duct lower case 304 and a container 305. Among them, the duct lower case 304 is surrounded in all directions because a front partition wall 306 is provided upright in front thereof, and a draft port 308 is opened in its bottom surface 307. The draft port 308 is located above the bowl portion of the toilet bowl 200 and equipped with a filter 309 with numerous pores drilled therein, removing dust contained in air passing through the draft port 308.

[0079] On the other hand, on the bottom surface 305a of the container 305 is formed a water receiver 330 with the rear side partitioned by the rear partition wall 301 and the left and right side partitioned by the diaphragm 303 and the side partition wall 302b. The front side of the container 305 is opened, and a drainage port 305b is formed between the diaphragm 303 and the side partition wall 302b. Ribs 310a and 310b are projected from the diaphragm 303 and the side partition wall 302b, respectively, and opposed to each other, thus narrowing the drainage port 305b.

[0080] A duct upper case 400 having a surface corresponding to the slope of the case cover 121 of the main body section 110 is placed above the duct lower case 304 and integrated therewith to constitute a deodorizing duct 143 having a space therein. Furthermore, in the top surface 401 of the duct upper case 400, a rectangular deodorizing duct opening 402 is opened and communicates into the deodorizing duct 143.

[0081] As shown in FIG. 6, a deodorizing fan 142 for sucking air by rotary operation is connected to the deodorizing duct opening 402. That is, the deodorizing fan 142 sucks air in the bowl portion of the toilet bowl 200 through the draft port 308 and the deodorizing duct 143.

[0082] The deodorizing fan 142 causes the air sucked from inside the bowl portion of the toilet bowl 200 to blow out toward a deodorizing catalyst 144 located to the left. The deodorizing catalyst 144 removes odor by decomposing or adsorbing odor components in the air blown therein by the deodorizing fan 142. The air deodorized by the deodorizing catalyst 144 is exhausted from the deodorized air outlet 141 provided in the side surface of the deodorizing unit 140. As shown in FIG. 4, the deo-

dorized air outlet 141 has downward sloped slits formed from a plurality of vertically spaced plate-like bodies. Thus, the air exhausted from the deodorized air outlet 141 is directed obliquely downward, and hence it does not offend the user by, for instance, blowing the exhaust air on the user's face and the like.

[0083] An open tank 180 is disposed in a gap formed between the deodorizing duct 143 and the case plate 122. The open tank 180 has a function of providing a so-called air gap in the water channel to prevent backflow of sewage to the water pipe even if the sewage has entered the water channel from the water discharge port of the water discharge nozzle 131. The open tank 180 can store water therein, and has an inflow port 181 for allowing water having passed through the water supply valve unit 170 (see FIG. 2) to flow therein, and an outflow port 182 for draining the water therein to the outside. Furthermore, the open tank 180 has a horizontally long configuration. The inflow port 181 and the outflow port 182 are located to the left and right of the deodorizing duct 143, respectively. A washing pump 191 is provided behind the open tank 180.

[0084] In the following, the structure of the open tank 180 is described in detail.

[0085] FIGS. 7A to 7C are schematic views showing the structure of the open tank 180 of the sanitary washing device according to the first embodiment of the invention and a flow of water therein, in which FIG. 7A is a perspective view of the open tank 180, FIG. 7B is an A-A cross-sectional view of the open tank 180, and FIG. 7C is a B-B cross-sectional view of the open tank 180.

[0086] As shown in FIG. 7B, the open tank 180 is composed of a plurality of members assembled with packings P1-P3 provided therebetween. A water inlet lid member 184 including the inflow port 181 covers the top of a water guide member 185 in a watertight manner via the packing P1. The water guide member 185 allows water flowing in from the water inlet lid member 184 to be guided downward as indicated by arrow F1. The open tank 180 further includes a water storage member 186 connected to the water guide member 185. The water storage member 186 allows water flowing in from the water guide member 185 as indicated by arrow F2 to be guided below the deodorizing duct 143 to the right of the deodorizing duct 143. The upper side of the water storage member 186 is covered watertight with a water outlet lid member 187 including the outflow port 182 via the packing P3.

[0087] The water inlet lid member 184 has a shape corresponding to the opening at the top of the water guide member 185, and from the top surface 184a thereof, the inflow port 181 to which an inlet piping 503 is connected is projected backward. Below the inflow port 181 (inside the open tank 180) is formed a protrusion 184b for guiding downward the water flowing in from the inflow port 181.

[0088] The water storage member 186 is composed of a box-like portion 186b capable of storing a prescribed amount of water and a cylindrical portion 186a for introducing water into the box-like portion 186b. The cylindrical portion 186a is connected to the water guide member 185 and formed in a circular cylindrical shape elongated to left and right so as to guide water below the deodorizing duct 143 to the box-like portion 186b.

[0089] The top of the box-like portion 186b of the water storage member 186 is opened and covered watertight with the water outlet lid member 187 via the packing P3. From the top surface 187a of the water outlet lid member 187, the outflow port 182 to which an outlet piping 504 (see FIG. 10) is connected is projected backward. Furthermore, a cylindrical suction pipe 187b extends so as to be located in the box-like portion 186b inside the water storage member 186, and the suction pipe 187b communicates with the outflow port 182. As shown in FIG. 7C, a front wall 186g, which constitutes the front surface of the water storage member 186 of the open tank 180, is bent forward to form a bent portion 186h at the position of height H2 from the bottom surface 186c of the box-like portion 186b. Furthermore, an overflow port 183 is opened above the bent portion 186h, and a release port 186i is opened at the lower end of the bent portion 186h, so as to communicate with an overflow space 188 formed between the bent portion 186h and a cover portion 187c formed in front of the water outlet lid member 187.

[0090] Next, a variation of the open tank 180 and a flow of excess water from the open tank 180 are described.

[0091] FIGS. 8A to 8C are schematic views showing the structure of the open tank 180 according to the variation and the flow of water therein, and FIG. 9 is a cross-sectional view showing the flow of excess water from the open tank 180 according to the variation.

[0092] As shown in FIGS. 8A to C, the open tank 180 according to the variation is compartmentalized into a first chamber 186e and a second chamber 186f by a compartment wall 186d with height H 1 provided upright from the bottom surface 186c of the water storage member 186.

[0093] As shown in FIG. 9, the open tank 180 is placed behind the container 305 so that the overflow port 183 is located higher than the bottom surface 305a of the container 305. Here, the height from the bottom surface 305a of the container 305 to the upper end of the bent portion 186h is set to A2. The bent portion 186h is arranged so as to face into the container 305 from above the rear partition wall 301. That is, the release port 186i provided at the lower end of the bent portion 186h is located lower than the upper end of the rear partition wall 301.

[0094] In the open tank 180 thus configured, water supplied by the inlet piping 503 (see FIG. 8A) flows therein from the inflow port 181 of the water inlet lid member 184. The water poured therein is guided to below the deodorizing duct 143 by the water guide member 185 and further guided to the first chamber 186e inside the box-like portion 186b of the water storage member 186 through the cylindrical portion 186a thereof.

[0095] In the first chamber 186e, when the water level of water stored therein exceeds H1, the water flows into the second chamber 186f beyond the compartment wall

186d, and then is stored in the second chamber 186f. At this time, the washing pump 191 connected to the outlet piping 504 is activated, and thereby the water stored in the second chamber 186f is sucked by the suction pipe 187b as indicated by arrow F3.

[0096] As described above, if the flow rate of water pumped out by the washing pump 191 and flowing out of the outflow port 182 is lower than the flow rate of water flowing from the inflow port 181 into the open tank 180, the water level of water stored in the second chamber 186f rises. When the water level exceeds H2, the water surface overpasses the upper end of the front wall 186g, passes through the overflow port 183, and flows out of the open tank 180 as excess water from the release port 186i, as indicated by arrow OF. That is, an air gap is formed between the upper end of the front wall 186g and the lower end of the protrusion 184b of the water inlet lid member 184 and prevents backflow of water via the protrusion 184b.

[0097] The water receiver 330 of the container 305, in which the excess water flowing out of the release port 186i flows, is surrounded by the diaphragm 303, the side partition wall 302b, and the rear partition wall 301 as shown in FIG. 5. Hence, the excess water can be reliably drained to the bowl portion 210 of the toilet bowl 200 without spillover into the casing 120. Furthermore, the container 305 is formed integrally with the deodorizing duct 143 constituting a path through which the deodorizing fan 142 sucks air from inside the bowl portion 210. Thus, the number of components can be reduced.

[0098] As shown in FIG. 9, the excess water flows out of the overflow port 183 located at a height of A2 from the bottom surface 305a of the container 305, drops from the release port 186i to the outside of the open tank 180, and collides with the bottom surface 305a therebelow. At this collision, the excess water may be scattered. Furthermore, also in such cases as the force of water flowing out of the overflow port 183 is strong, scattering may occur. In this regard, in this variation, the upper side of the container 305 near the overflow port 183 is covered with the cover portion 187c of the water outlet lid member 187; thereby the excess water is prevented scattering out of the container 305. This can avoid such situations as the scattered excess water is splashed on electronic functional components including the control device 160 to induce a breakdown in the sanitary washing device 100.

[0099] The excess water poured into the container 305 is drained from the drainage port 305b opened in front of the container 305 to the bowl portion 210 of the toilet bowl 200. As described above, the drainage port 305b is configured so that the ribs 310a and 310b are projected to narrow the flow channel and increase the flow velocity of the excess water drained from the drainage port 305b. This can prevent the excess water from running along the bottom surface 305a of the container 305 to the backside of the bottom surface 305a.

[0100] Furthermore, this variation is based on the configuration in which the excess water flowing out of the open tank 180 is received by the container 305 separate from the open tank 180 and drained to the bowl portion 210 of the toilet bowl 200, and the container 305 is formed as a component integrated with the deodorizing duct 143. Thus, the lower surface of the portion extending above the bowl portion 210 can be formed as a continuous surface without a "gap". More specifically, the drainage port for draining excess water from the open tank 180 and the suction port for sucking air by the deodorizing duct 143 both need to be provided above the bowl portion 210 so as to face it. However, if the deodorizing duct 143 and the container 305 are each formed as a separate component, a "gap" will be formed therebetween. When the toilet bowl 200 is used, sewage or the like scatters at the time of, for instance, urination and water discharge by the water discharge nozzle 131. If the lower surface of the casing 120 of the sanitary washing device has any gap, the scattered sewage penetrates therein, and cleanliness is not easy to maintain.

[0101] In contrast, in this variation, as shown in FIG. 5 and the like, the deodorizing duct 143 and the container 305 are integrated together so as to avoid any gap therebetween. As a result, the lower surface of the casing 120 of the sanitary washing device has no gap and the like, and sewage and the like attached thereto, if any, can be wiped out to maintain the clean state. That is, it is possible to provide a sanitary washing device, which ensures cleanliness.

[0102] Furthermore, in this variation, the open tank 180, which receives water supplied from the water supply valve unit 170 provided in the casing 120 of the sanitary washing device 100, is configured so as to extend below the rear side of the deodorizing duct 143 from left to right and drain excess water to the container 305 provided on the right side of the deodorizing duct 143. In other words, the container 305 for draining excess water from the open tank 180 is located on the right side of the deodorizing duct 143, that is, at a position closer to the center of the casing 120. Thus, as shown in FIG. 9, the drainage port for excess water drained from the container 305 can be located more distant from the rim 212, which constitutes the sidewall of the bowl portion 210 of the toilet bowl 200.

[0103] This is because the amount of extension of the front end of the casing 120 of the sanitary washing device 100 to the bowl portion 210 is larger at a position closer to the center of the casing 120 (the position of the water discharge nozzle 131). That is, the front end of the casing 120 does not significantly protrude above the bowl portion 210 at the left and right end portion of the casing 120, but protrudes most significantly above the bowl portion 210 at the center of the casing 120. Furthermore, this variation is based on the structure in which the container 305 is located between the deodorizing duct 143 and the water discharge nozzle 131, and the open tank 180 extends to left and right below the rear side of the deodorizing duct 143 so as to drain excess water to the container 305. As shown in FIG. 9, this structure allows

excess water to drop to the bowl portion 210 at a position distant from the rim 212 of the toilet bowl 200. This can prevent the drained excess water from running along the lower surface of the container 305 and penetrating into the gap between the upper surface of the toilet bowl 200 and the container 305. That is, it is possible to provide a sanitary washing device, which can avoid odor generation and the like due to penetration of water between the casing 120 and the toilet bowl 200 to maintain the clean state.

[0104] In FIG. 9, the flow of excess water from the open tank 180 has been described with reference to the open tank 180 according to the variation shown in FIG. 8. However, this flow of excess water similarly applies to the open tank 180 shown in FIG. 7.

[0105] Next, the flow of water supplied to the water discharge nozzle 131 is described with reference to FIGS. 10 and 11.

[0106] FIG. 10 is a block diagram showing a water channel configuration of the sanitary washing device according to the first embodiment of the invention.

[0107] FIG. 11 is a schematic view showing the configuration around the heat exchanger and the open tank according to the first embodiment of the invention.

[0108] A water stop valve 501 connected to a water pipe 500 is connected to the water supply valve unit 170 by a flexible hose 502. The water supply valve unit 170 illustratively includes a check valve 171 for preventing upstream backflow of water, a strainer 172 for trapping foreign matter in water, a constant flow rate valve 173 for keeping the flow rate of water constant irrespective of the supply water pressure, and a solenoid valve 174, which is opened by energization and selectively switches passage/stoppage of downstream water.

[0109] The water having passed through the solenoid valve 174 passes through the inlet piping 503 and flows into the open tank 180 from the inflow port 181. The inflow water is stored in the open tank 180. When its water level exceeds H2, excess water flows out of the overflow port 183 provided in front of the open tank 180 to the outside as indicated by arrow OF (overflow). That is, an air gap A1 is formed between the inflow port 181 and the overflow port 183, and the stored water does not reach the inflow port 181 even if the water level in the open tank 180 rises. This prevents backflow of sewage to the upstream of the open tank 180. Furthermore, there is a distance of height A2 from the overflow port 183 to the rim surface of the toilet bowl 200, and this also functions as an air gap to avoid the situation where sewage splashes in the bowl portion and penetrates into the open tank 180 from the overflow port 183.

[0110] A washing pump 191 is connected downstream of the outlet piping 504 connected to the outflow port 182. The washing pump 191 pumps out the water in the open tank 180 from the outflow port 182 to supply it downstream, and is also capable of regulating its flow rate (force of water).

[0111] A heat exchanger 150 is provided downstream of the washing pump 191. The heat exchanger 150 includes a heater 151 as a heating source, such as a sheath heater, and stores and heats water supplied from the upstream washing pump 191. When water is supplied from the washing pump 191, heated water is pushed and flows out of a hot water outlet 152 provided at the top of the heat exchanger 150. Furthermore, a float switch 156 for sensing the water level of stored water is provided inside the heat exchanger 150. The heat exchanger 150 has a so-called boil-dry protection function by which the heater 151 is deactivated when the sensed water level is equal to or lower than a prescribed water level.

[0112] A switching valve 192 and a water discharge nozzle 131 are provided downstream of the heat exchanger 150. The supply destination of the water poured out of the hot water outlet 152 of the heat exchanger 150 is switched by the switching valve 192 to one of a plurality of water discharge ports of the water discharge nozzle 131. For instance, when the user manipulates the "BOTTOM" switch S2 (see FIG. 3) of the remote controller R, the control device 160 switches the switching valve 192 so that water is supplied to the water discharge port of the water discharge nozzle 131 corresponding to the "bottom" washing position. The force and temperature of the water discharged from the water discharge nozzle 131 can be changed by the user in accordance with his/her preference, and the user can use the remote controller R to adjust the operating state of the washing pump 191 and the amount of heating of the heater 151. The water discharge nozzle 131 is retractable between the position of being housed in the casing 120 and the position of being advanced into the bowl portion of the toilet bowl 200 by driving a nozzle driving device 132 composed of an electric motor and the like.

[0113] By the above configuration, the water stored in the open tank 180 can be pumped out by the washing pump 191, and the flow rate of water pumped out and discharged from the water discharge nozzle 131 can be adjusted by the user in accordance with his/her preference. Hence, if the flow rate of water pumped out by the washing pump 191 and flowing out of the outflow port 182 is lower than the flow rate of water flowing from the inflow port 181 into the open tank 180, the water level of water stored in the open tank 180 rises beyond H2, and the water flows out of the overflow port 183 as excess water as indicated by arrow OF. After dropping to the water receiver 330 of the container 305, this excess water is drained from the drainage port 305b to the bowl portion of the toilet bowl 200 (see FIG. 5), and drained with the water in the bowl portion at the time of drainage of the toilet bowl 200.

[0114] Here, the heat exchanger 150 has high capacity and is relatively large among the components of the sanitary washing device 100 so as to heat and discharge a sufficient amount of water from the water discharge nozzle 131 at washing time. Furthermore, the water heated by the heater 151 rises in the heat exchanger 150 by convection. Hence, in order to efficiently heat the water

in the heat exchanger 150 sequentially from that at low temperature, the heater 151 is located on the lower side in the heat exchanger 150, and the heat exchanger 150 is upsized particularly in the vertical direction. Thus, the highest water level L of the water stored in the heat exchanger 150 shown in FIG. 11 is located higher than the open tank 180.

[0115] In accordance with this arrangement, in order to prevent the water stored in the heat exchanger 150 from backflow to the open tank 180 by head pressure, the configuration is designed so that the water pumped out from inside the open tank 180 by the washing pump 191 is first supplied to a vacuum breaker 153 by a primary piping 154, and then the water having passed through the vacuum breaker 153 flows into the heat exchanger 150 from its lower portion by a secondary piping 155. As shown in FIG. 11, the vacuum breaker 153 opens to the atmosphere the portion between the primary piping 154 and the secondary piping 155 above the highest water level L. Thus, for instance, even during non-washing time when the washing pump 191 is not in operation, the water stored in the heat exchanger 150 is prevented from backflow to the open tank 180. Hence, while the open tank 180 is located lower than the heat exchanger 150, the water level in the heat exchanger 150 does not fall, and the water in the heat exchanger 150 can be maintained nearly at full capacity. Thus, at the time of next washing start, water can be rapidly discharged from the water discharge nozzle 131. Furthermore, by retaining water at a sufficient water level in the heat exchanger 150, the water in the heat exchanger 150 can be heated by the heater 151 and maintained at a temperature suitable for discharge.

[0116] As shown in FIG. 11, the vacuum breaker 153 is fixed to the upper surface of the heat exchanger 150 via a bracket 157. This can ensure opening to the atmosphere above the highest water level L of the water in the heat exchanger 150 and facilitate determining the fixing position of the vacuum breaker 153.

[0117] Here, instead of the vacuum breaker 153, it is also possible to use a backflow prevention valve having a valve body for blocking the water channel to allow passage of water only in one direction. In this case, the backflow prevention valve will still be provided between the primary piping 154 and the secondary piping 155. However, in contrast to the vacuum breaker 153, there is no danger of leakage of water from the position opened to the atmosphere. Therefore, the installation position of the backflow prevention valve can be determined without the limitation of the highest water level L.

[0118] FIG. 12 is a schematic diagram showing an example sequence of the sanitary washing device according to the first embodiment of the invention.

[0119] Chart A shows the state of whether the seating sensor 162 has sensed a user's sitting down on the toilet seat, and chart B shows the open/closed state of the solenoid valve 174 of the water supply valve unit 170. Furthermore, chart C shows the operating state of the washing pump 191, chart D shows the position of the water discharge nozzle 131, and chart E shows the supply destination of water by the switching valve 192.

[0120] In the standby state of the sanitary washing device 100, the seating sensor 162 senses a user's sitting down on the toilet seat at t1, and the control device 160 opens the solenoid valve 174 to start supplying water to the open tank 180. Thus, water is stored in the open tank 180 to prepare to discharge water from the water discharge nozzle 131.

[0121] Next, when water supply to the open tank 180 is completed at t2, the control waits for the user to select the operation mode by the remote controller R (see FIG. 3). When the user manipulates the "BIDET" switch S3 (see FIG. 3) at t3, the control device 160 switches the switching valve 192 so that water flowing out of the heat exchanger 150 is supplied to the water discharge port of the water discharge nozzle 131 corresponding to "bidet". Furthermore, at t4, the nozzle driving device 132 is activated to advance the water discharge nozzle 131 from inside the casing 120 to the position corresponding to "bidet".

[0122] Subsequently, the control device 160 reopens the solenoid valve 174 at t5, and increases the flow rate (force) of water supplied by the operation of the washing pump 191 in five steps toward t6. Thus, water with the force gradually increased is discharged from the water discharge port of the water discharge nozzle 131.

[0123] When the user manipulates the stop switch S1 of the remote controller R at t7, the control device 160 closes the solenoid valve 174 to terminate water discharge from the water discharge nozzle 131, and activates the nozzle driving device 132 to house the water discharge nozzle 131 into the casing 120. Furthermore, when the housing of the water discharge nozzle 131 is completed at t8, the switching valve 192 is next returned to the "soft" position, and the control enters the standby state at t9.

[0124] When the user finishes washing and leaves the toilet seat at t10, the seating sensor 162 enters the non-sensing state. When (t11) the duration of this non-sensing state of the seating sensor 162 becomes equal to or more than a prescribed time period T0 (such as 30 seconds), the control device 160 determines that the user has finished using the sanitary washing device 100, and starts drainage of water in the open tank 180.

[0125] The seating sensor 162 enters the non-sensing state as well when the user seated on the toilet seat temporarily leaves the toilet seat to take spare toilet paper, for instance. Hence, if the control device 160 is configured so as to start drainage of water in the open tank 180 immediately when the seating sensor 162 enters the non-sensing state, water in the open tank 180 is drained in the case of temporarily entering the non-sensing state as described above although the user is still using the sanitary washing device 100. Thus, when the user subsequently desires another wash and manipulates the remote controller R, it takes time to store water again in

the open tank 180, which has already been drained. This causes a delayed start of discharging water from the water discharge nozzle 131.

[0126] Hence, in this embodiment, when the duration of the non-sensing state of the seating sensor 162 becomes equal to or more than a prescribed time period T0, it is determined that the user has finished using the sanitary washing device 100 and completely left the toilet seat, and drainage of water in the open tank 180 is started. As a result, the above problem is resolved.

[0127] Here, the control device 160 performs drainage of water in the open tank 180 by operating the washing pump 191. The water pumped from inside the open tank 180 by the operation of the washing pump 191 travels through the heat exchanger 150 to the water discharge nozzle 131 housed in the casing 120, and is gently drained from the water discharge port of the water discharge nozzle 131 into the bowl portion of the toilet bowl 200.

[0128] When drainage of water in the open tank 180 is completed at t12, the control device 160 deactivates the washing pump 191, and the sanitary washing device 100 enters again the standby state.

[0129] As described above, in the sanitary washing device 100, the water in the open tank 180 can be drained without compromising usability. Hence, the sanitary washing device 100 can be detached from the toilet bowl 200 for cleaning and relocation while avoiding such situations as the sanitary washing device 100 is tilted and the water in the open tank 180 leaks from the overflow port 183 and splashes on the deodorizing fan 142 and the control device 160 provided in the casing 120. Furthermore, it is also possible to prevent decay of residual water due to prolonged storage of water in the open tank 180. Moreover, the washing pump 191 for supplying water to the water discharge nozzle 131 is also used for drainage of water in the open tank 180;therefore, the sanitary washing device 100 does not need to separately include other components for draining water, and can be configured at low cost and compact size.

[0130] FIG. 13 is a block diagram showing a water channel configuration of a sanitary washing device according to a second embodiment of the invention. Here, in FIG. 13, the same components as those in FIG. 10 are labeled with same reference numerals, and the description thereof is omitted as appropriate.

[0131] As shown in FIG. 13, the sanitary washing device according to the second embodiment includes a drainage port 193 communicating into the open tank 180, besides the outflow port 182 and the overflow port 183. To this drainage port 193 is connected a drainage pipe 194, which is a pipe configured so that the water in the open tank 180 flowing out of the drainage port 193 is guided to the bowl portion of the toilet bowl 200. Furthermore, along the drainage pipe 194 is provided a drainage pump 195 for pumping out the water in the open tank 180 from the drainage port 193 and supplying it downstream of the drainage pipe 194.

[0132] In the sanitary washing device according to the second embodiment, the drainage pump 195 is operated instead of the washing pump 191 in the drainage of the open tank 180 described above with reference to the sanitary washing device according to the first embodiment. Thus, the water in the open tank 180 is pumped out by the drainage pump 195 and is drained through the drainage port 193 and the drainage pipe 194. By providing a drainage pipe 194 independent of the outlet piping 504 as a path for draining the water in the open tank 180, the length of the outlet piping 504 and the drainage pipe 194 and the routing thereof in the casing can be optimally adapted to each of supply to the water discharge nozzle 131 and drainage of water in the open tank 180. Here, instead of the drainage pump 195, it is also possible to use a drainage valve for opening/closing the drainage pipe 194.

[0133] The first and second embodiments of the invention have been described with reference to examples. However, the invention is not limited to these examples. In the above embodiments, on the basis of the fact that the seating sensor 162 enters the non-sensing state, the control device 160 determines that the sanitary washing device has entered the non-used state, and drains the water in the open tank 180. However, the invention is not limited thereto. Instead of the seating sensor 162, it is also possible to provide a toilet lid closure sensor for sensing that the toilet lid 130 is closed. On the basis of the sensing state of this toilet lid closure sensor, it can be determined that the sanitary washing device has entered the non-used state. That is, on the basis of the fact that the toilet lid closure sensor has sensed closure of the toilet lid 130, it can be determined that the sanitary washing device has entered the non-used state, and the water in the open tank 180 can be drained. This can avoid such situations compromising the usability of the sanitary washing device as the water in the open tank 180 is drained although the sanitary washing device is being used. Alternatively, instead of the seating sensor 162 and the toilet lid closure sensor, it is possible to use a toilet usage sensor for sensing that a user stands in front of the toilet device, or an entrance sensor for sensing a user entering a toilet room. In addition, the user's manipulations which can be regarded as the end of use of the sanitary washing device illustratively include the case of pushing a bottom dry switch after stopping such operation modes as the bottom wash and bidet wash, and the case of sensing the execution of flushing the toilet bowl. On the basis of such sensing, the water in the open tank 180 can be drained.

[0134] In another possible configuration, for instance, a drainage switch is provided on the outside of the casing 120, and on the basis of the user's manipulation of the drainage switch, the control device 160 can drain the water in the open tank 180. Thus, when the sanitary washing device is ready to use, water is left in the open tank 180 so as to be able to rapidly start discharging water from the water discharge nozzle 131, and at the

time of starting cleaning or relocation work, water can be drained from inside the open tank 180 to prevent the water from splashing on other components in the casing 120.

[0135] Next, a sanitary washing device according to a third embodiment of the invention is described.

[0136] FIG. 14 is a perspective view around the open tank 180 of the sanitary washing device according to the third embodiment of the invention.

[0137] As shown in FIG. 14, an extension plate receiving notch 123 notched toward the rear side of the toilet bowl 200 is provided in part of the case plate 122. This extension plate receiving notch 123 is located above the bowl portion of the toilet bowl 200.

[0138] The open tank 180 has a function of providing a so-called air gap in the water channel to prevent backflow of sewage to the water pipe even if the sewage has entered the water channel from the water discharge port of the water discharge nozzle 131. The open tank 180 can store water therein, and has an inflow port 181 for allowing water having passed through the water supply valve unit 170 (see FIG. 2 shown in the first embodiment) to flow therein, and an outflow port 182 for draining the water therein to the outside. Furthermore, the open tank 180 has a horizontally long configuration, where the inflow port 181 and the outflow port 182 are located to the left and right of the deodorizing duct 143, respectively. A washing pump 191 is provided behind the open tank 180.

[0139] As in the previous embodiments, the overflow port 183 of the open tank 180 is located in the end portion opposed to the inflow port 181 so that garbage having entered the open tank is collected near the overflow port 183 located in the end portion opposed to the inflow port 181 by the water supplied from the inflow port 181. This allows the collected garbage to be smoothly guided to the overflow port 183 and ejected outside the open tank.

[0140] Next, the flow of water supplied to the water discharge nozzle 131 is described with reference to FIG. 15. FIG. 15 is a block diagram showing a water channel configuration of the sanitary washing device according to the third embodiment of the invention.

[0141] A water stop valve 501 connected to a water pipe 500 is connected to the water supply valve unit 170 by a flexible hose 502. The water supply valve unit 170 illustratively includes a check valve 171 for preventing upstream backflow of water, a strainer 172 for trapping foreign matter in water, a constant flow rate valve 173 for keeping the flow rate of water constant irrespective of the supply water pressure, and a solenoid valve 174, which is opened by energization and selectively switches passage/stoppage of downstream water.

[0142] The water having passed through the solenoid valve 174 passes through the inlet piping 503 and flows into the open tank 180 from the inflow port 181. The inflow water is stored in the open tank 180. When its water level exceeds H2, excess water flows out of the overflow port 183 provided in front of the open tank 180 to the outside as indicated by arrow OF (overflow). That is, an air gap A1 is formed between the inflow port 181 and the overflow port 183, and the stored water does not reach the inflow port 181 even if the water level in the open tank 180 rises. This prevents backflow of sewage to the upstream of the open tank 180. Furthermore, there is a distance of height A2 from the overflow port 183 to the rim surface of the toilet bowl 200, and this also functions as an air gap to avoid the situation where sewage splashes in the bowl portion and penetrates into the open tank 180 from the overflow port 183.

[0143] A washing pump 191 is connected downstream of the outlet piping 504 connected to the outflow port 182. The washing pump 191 pumps out the water in the open tank 180 from the outflow port 182 to supply it downstream, and is also capable of regulating its flow rate (force of water).

[0144] A heat exchanger 150 is provided downstream of the washing pump 191. The heat exchanger 150 includes a heater 151 as a heating source, such as a sheath heater, and stores and heats water supplied from the upstream washing pump 191. When water is supplied from the washing pump 191, heated water is pushed and flows out of the hot water outlet 152 provided at the top of the heat exchanger 150. Furthermore, a float switch 156 for sensing the water level of stored water is provided inside the heat exchanger 150. The heat exchanger 150 has a so-called boil-dry protection function by which the heater 151 is deactivated when the sensed water level is equal to or lower than a prescribed water level.

[0145] A switching valve 192 and a water discharge nozzle 131 are provided downstream of the heat exchanger 150. The supply destination of the water poured out of the hot water outlet 152 of the heat exchanger 150 is switched by the switching valve 192 to one of a plurality of water discharge ports of the water discharge nozzle 131. For instance, when the user manipulates the "BOTTOM" switch S2 (see FIG. 3) of the remote controller R, the control device 160 switches the switching valve 192 so that water is supplied to the water discharge port of the water discharge nozzle 131 corresponding to the "bottom" washing position. The force and temperature of the water discharged from the water discharge nozzle 131 can be changed by the user in accordance with his/her preference, and the user can use the remote controller R to adjust the operating state of the washing pump 191 and the amount of heating of the heater 151. The water discharge nozzle 131 is retractable between the position of being housed in the casing 120 and the position of being advanced into the bowl portion of the toilet bowl 200 by driving a nozzle driving device 132 composed of an electric motor and the like.

[0146] By the above configuration, the water stored in the open tank 180 can be pumped out by the washing pump 191, and the flow rate of water pumped out and discharged from the water discharge nozzle 131 can be adjusted by the user in accordance with his/her preference. Hence, if the flow rate of water pumped out by the washing pump 191 and flowing out of the outflow port

182 is lower than the flow rate of water flowing from the inflow port 181 into the open tank 180, the water level of water stored in the open tank 180 rises beyond H2, and the water flows out of the overflow port 183 as excess water as indicated by arrow OF. This excess water is drained to the bowl portion 210 of the toilet bowl 200 (see FIG. 15), and drained with the water in the bowl portion at the time of drainage of the toilet bowl 200.

[0147] FIG. 16 is a schematic diagram showing an example sequence of the sanitary washing device according to the third embodiment of the invention. Chart A shows the state of whether the seating sensor 162 has sensed a user's sitting down on the toilet seat, and chart B shows the open/closed state of the solenoid valve 174 of the water supply valve unit 170. Furthermore, chart C shows the operating state of the washing pump 191, chart D shows the position of the water discharge nozzle 131, and chart E shows the supply destination of water by the switching valve 192.

[0148] In the standby state of the sanitary washing device 100, the seating sensor 162 senses a user's sitting down on the toilet seat at t1. Then, the control device 160 determines that the sanitary washing device will probably be used, and the solenoid valve 174 is opened to start supplying water to the open tank 180 as a preparation for washing. Thus, water is supplied into the open tank 180. Even if the washing pump 191 is not activated at this stage, the open tank 180 is overflowed to eject garbage in the open tank into the bowl portion of the toilet bowl 200.

[0149] Next, when water supply to the open tank 180 is completed at t2, the control waits for the user to select the operation mode by the remote controller R (see FIG. 3). When the user manipulates the "BOTTOM" switch S2 (see FIG. 3) at t3, the control device 160 switches the switching valve 192 so that water flowing out of the heat exchanger 150 is supplied to the water discharge port of the water discharge nozzle 131 corresponding to "bottom". Furthermore, at t4, the nozzle driving device 132 is activated to advance the water discharge nozzle 131 from inside the casing 120 to the position corresponding to "bottom".

[0150] Subsequently, the control device 160 reopens the solenoid valve 174 at t5, and increases the flow rate (force) of water supplied by the operation of the washing pump 191 in five steps toward t6. Thus, water with the force gradually increased is discharged from the water discharge port of the water discharge nozzle 131.

[0151] When the user manipulates the stop switch S1 of the remote controller R at t7, the control device 160 closes the solenoid valve 174 to terminate water discharge from the water discharge nozzle 131, and activates the nozzle driving device 132 to house the water discharge nozzle 131 into the casing 120. Furthermore, at t8, the switching valve 192 is returned to the "stop" position. Then, the housing of the water discharge nozzle 131 is completed, and the control enters the standby state at t9. When the user finishes washing and leaves the toilet seat at t10, the seating sensor 162 enters the non-sensing state.

[0152] As described above, before the sanitary washing device 100 is used, water is supplied into the open tank 180 to overflow it so that garbage in the open tank can be ejected. Furthermore, it is only necessary to open the solenoid valve 174 to supply water to the open tank 180. Thus, the sanitary washing device 100 does not need to separately include other components for removing garbage, and can be configured at low cost and compact size.

[0153] The third embodiment of the invention has been described with reference to examples. However, this embodiment is not limited to these examples. In the above embodiment, on the basis of the fact that the seating sensor 162 enters the sensing state, the control device 160 determines that the sanitary washing device will probably be used. Thus, water is supplied to the open tank 180 to overflow it and eject garbage in the open tank into the bowl portion of the toilet bowl 200. However, the invention is not limited thereto. Instead of the seating sensor 162, it is also possible to provide a human body sensor for sensing that a human body is present near the sanitary washing device, and its usage can be determined on the basis of the sensing state of this human body sensor. That is, on the basis of the fact that the human body sensor has sensed that a user has approached the sanitary washing device, it can be determined that the sanitary washing device is about to be used, and water can be supplied into the open tank 180 to overflow it and eject garbage. Thus, before the sanitary washing device 100 is used, garbage k can be ejected into the open tank 180. Here, for prevention of false sensing, preferably, the presence of a human body near the sanitary washing device is determined on the basis of the fact that the human body sensor has continuously sensed the human body for a prescribed duration.

[0154] Alternatively, instead of using the seating sensor 162, on the basis of a manipulation for directing a washing operation by an operation mode switch (such as "bottom" switch S2), the control device 160 can determine that the sanitary washing device is about to be used. Then, while the washing pump 191 is not activated immediately before starting water discharge, water can be supplied into the open tank 180 to overflow it and eject garbage in the open tank. Thus, garbage in the open tank 180 can be ejected immediately before the sanitary washing device is used. In addition, if the washing pump is activated to discharge water simultaneously with, or a certain time (such as 1 second) behind the overflow of water in the open tank 180, the time elapsed from the manipulation of the operation mode switch to the discharge of water from the water discharge nozzle can be reduced, which serves to avoid the situation of compromising the usability of the sanitary washing device.

[0155] FIG. 17 is a schematic diagram showing an example sequence of a sanitary washing device according to a fourth embodiment of the invention.

[0156] Chart A shows the state of whether the seating sensor 162 has sensed a user's sitting down on the toilet seat, and Chart B shows the open/closed state of the solenoid valve 174 of the water supply valve unit 170.

[0157] Furthermore, chart C shows the operating state of the washing pump 191, chart D shows the position of the water discharge nozzle 131, and chart E shows the supply destination of water by the switching valve 192.

[0158] In the standby state of the sanitary washing device 100, the seating sensor 162 senses a user's sitting down on the toilet seat at t1. Next, when the user manipulates the "BOTTOM" switch S2 (see FIG. 3) at t2, the control device 160 switches the switching valve 192 so that water flowing out of the heat exchanger 150 is supplied to the water discharge port of the water discharge nozzle 131 corresponding to "bottom". Furthermore, at t3, the nozzle driving device 132 is activated to advance the water discharge nozzle 131 from inside the casing 120 to the position corresponding to "bottom".

[0159] Subsequently, the control device 160 reopens the solenoid valve 174 at t4, and increases the flow rate (force) of water supplied by the operation of the washing pump 191 in five steps toward t5. Thus, water with the force gradually increased is discharged from the water discharge port of the water discharge nozzle 131.

[0160] When the user manipulates the stop switch S1 of the remote controller R at t6, the control device 160 closes the solenoid valve 174 to terminate water discharge from the water discharge nozzle 131, and activates the nozzle driving device 132 to house the water discharge nozzle 131 into the casing 120. Furthermore, at t7, the switching valve 192 is returned to the "stop" position. Next, at t8, the housing of the water discharge nozzle 131 is completed. Then, the control enters the standby state at t8. When the user finishes washing and leaves the toilet seat at t9, the seating sensor 162 enters the non-sensing state.

[0161] When (t10) the duration of this non-sensing state of the seating sensor 162 becomes equal to or more than a prescribed time period T0 (such as 30 seconds), the control device 160 determines that the user has finished using the sanitary washing device 100. Then, the control device 160 opens the solenoid valve 174 to start supplying water to the open tank 180. Thus, water is supplied into the open tank 180. Even if the washing pump 191 is not activated at this stage, the open tank 180 is overflowed to eject garbage in the open tank into the bowl portion of the toilet bowl 200. When garbage ejection by overflow in the open tank 180 is completed at t11, the control device 160 deactivates the washing pump 191, and the sanitary washing device 100 enters again the standby state.

[0162] The seating sensor 162 enters the non-sensing state as well when the user seated on the toilet seat temporarily leaves the toilet seat to take spare toilet paper, for instance. Hence, if the control device 160 is configured so as to supply water into the open tank 180 to overflow it and eject garbage immediately when the seating sensor 162 enters the non-sensing state, then in the case of temporarily entering the non-sensing state as described above, water is supplied into the open tank 180 although the user is still using the sanitary washing device 100. Thus, water in the open tank is not wastefully discarded by overflow.

[0163] Hence, in this embodiment, when the duration of the non-sensing state of the seating sensor 162 becomes equal to or more than a prescribed time period T0, it is determined that the user has finished using the sanitary washing device 100 and completely left the toilet seat, and water is supplied into the open tank 180 to overflow it and eject garbage. Thus, the above problem is resolved.

[0164] As described above, even if garbage such as a slip of toilet paper generated during the use of the sanitary washing device 100 enters the open tank 180, the garbage can be ejected immediately after use.

[0165] The fourth embodiment of the invention has been described with reference to examples. However, the invention is not limited to these examples. In the above embodiment, on the basis of the fact that the seating sensor 162 enters the non-sensing state, the control device 160 determines that the sanitary washing device has entered the non-used state, and supplies water into the open tank 180 to overflow it and eject garbage. However, the invention is not limited thereto. Instead of the seating sensor 162, it is also possible to provide a toilet lid closure sensor for sensing that the toilet lid 130 has been closed. On the basis of the sensing state of this toilet lid closure sensor, it can be determined that the sanitary washing device has entered the non-used state. That is, on the basis of the fact that the toilet lid closure sensor has sensed closure of the toilet lid 130, it can be determined that the sanitary washing device has entered the non-used state, and water can be supplied into the open tank 180 to overflow it and eject garbage. This can avoid such situations as water is supplied into the open tank 180 to overflow it wastefully although the sanitary washing device is being used.

[0166] Alternatively, instead of the seating sensor 162, it is also possible to provide a human body sensor for sensing that a human body is present near the sanitary washing device, and it can be determined that the sanitary washing device has entered the non-used state on the basis of the sensing state of this human body sensor. That is, on the basis of the fact that the human body sensor has sensed that the user has left the sanitary washing device, it can be determined that the sanitary washing device has entered the non-used state, and water can be supplied into the open tank 180 to overflow it and eject garbage. This can avoid such situations as water is supplied into the open tank 180 to overflow it wastefully although the sanitary washing device is being used.

[0167] In another possible configuration, for instance, a garbage ejection switch is provided on the outside of the casing 120, and on the basis of the user's manipulation of the garbage ejection switch, the control device

160 can cause overflow of water in the open tank 180 to eject garbage. Thus, water can be supplied into the open tank 180 to eject garbage in response to the user's needs at times when the usage of the sanitary washing device is not disturbed.

[0168] In still another possible configuration, for instance, the control device 160 can cause overflow of water in the open tank 180 to eject garbage at regular intervals (such as at every 12 hours) or at a certain time (such as at 2 a.m. every day).

[0169] Components included in the sanitary washing device of the invention can be suitably modified in design by those skilled in the art to similarly practice the invention and achieve similar effects, and such modifications are also encompassed within the scope of the invention as long as they include the spirit of the invention.

[0170] Further Statements of Invention:

1. A sanitary washing device comprising:

a water discharge nozzle configured to discharge water at a human body part;
a water supply channel configured to supply water to the water discharge nozzle;
a solenoid valve provided in the water supply channel and configured to control supply of water from a water supply source;
an open tank provided in the water supply channel and including:

a tank main body;
an inflow port configured to allow water to flow into the tank main body;
an outflow port configured to allow the water inside the tank main body to flow out to the water discharge nozzle; and
an overflow port provided so as to form an air gap between the overflow port and the inflow port and configured to drain excess water inside the tank main body to outside;

a washing pump provided in the water supply channel downstream of the open tank and configured to pump water out of the outflow port and supply the water downstream in the water supply channel;
a casing housing the open tank;
a toilet seat and a toilet lid attached to the casing;
the sanitary washing device further comprising:
a control device configured to perform drainage control for draining water from inside the open tank with supply of water to the open tank being stopped.

2. The sanitary washing device according to clause 1, further comprising:

a human body sensor configured to sense a presence of a human body,
the control device performing the drainage control when the human body sensor has entered a state of sensing no human body.

3. The sanitary washing device according to clause 2, wherein the control device performs the drainage control when the state of the human body sensor not sensing the presence of a human body has continued for a prescribed time period.

4. The sanitary washing device according to clause 1, wherein the control device performs the drainage control on the basis of manipulation of a drainage switch.

5. The sanitary washing device according to clause 1, further comprising:

a toilet lid closure sensor configured to sense that the toilet lid is closed,
the control device performing the drainage control when the toilet lid closure sensor has sensed that the toilet lid is closed.

6. The sanitary washing device according to any one of clauses 1 to 5, wherein the control device performs the drainage control by activating the washing pump.

7. The sanitary washing device according to any one of clauses 1 to 5, further comprising:

a drainage device, independent of the washing pump, configured to drain water from inside the open tank,
the control device performing the drainage control by activating the drainage device.

8. The sanitary washing device according to clause 1, further comprising:

a heat exchanger provided in the water supply channel downstream of the washing pump, configured to store water supplied from the washing pump, and including a heater configured to heat the stored water,
a backflow prevention device being provided in the water supply channel between the open tank and the heat exchanger and configured to prevent backflow of water.

9. The sanitary washing device according to clause 1, wherein the control device performs overflow drainage control for opening the solenoid valve to supply water to the open tank and causing overflow of water from the overflow port of the open tank.

10. The sanitary washing device according to clause

9, wherein the amount of water supplied from the water supply source is larger than the amount of water pumped out of the open tank by the washing pump.

11. The sanitary washing device according to clause 9, wherein the control device performs the overflow drainage control before starting water discharge from the water discharge nozzle, and subsequently activates the washing pump to start discharge of water from the water discharge nozzle.

12. The sanitary washing device according to clause 1, wherein

the casing is located above a toilet bowl and further houses the water discharge nozzle, the water supply channel, the solenoid valve, the washing pump, and the control device,
a container including a water receiver surrounded by a partition wall is provided inside the casing and below the overflow port,
one end of the container is formed into a drainage port extending to above a bowl portion of the toilet bowl,
the open tank includes a cover covering the upper side of the water receiver of the container, configured to guide excess water drained from the overflow port to the water receiver of the container, and including a release port located above the container, and
the excess water drained from the overflow port of the open tank is allowed to flow from the release port into the water receiver of the container and to be drained from the drainage port to the bowl portion of the toilet bowl.

Claims

1. A sanitary washing device (100) comprising:

a water discharge nozzle (131) configured to discharge water at a human body part;
a water supply channel configured to supply water to the water discharge nozzle (131);
a solenoid valve (174) provided in the water supply channel and configured to control supply of water from a water supply source (500);
an open tank (180) provided in the water supply channel and including:

a tank main body (180);
an inflow port (181) configured to allow water to flow into the tank main body (180);
a box-like portion (186b) being capable of storing a prescribed amount of water flowed from the inflow port (181);
an outflow port (182) provided on the box-like portion (186b), the outflow port (182) being configured to allow the water inside the box-like portion (186b) to flow out to the water discharge nozzle (131); and

an overflow port (183) provided so as to form an air gap between the outflow port (182) and the inflow port (181) by being located lower than the inflow port (181), the overflow port (183) being configured to drain excess water inside the box-like portion (186b) to outside;

a washing pump (191) provided in the water supply channel downstream of the open tank (180) and configured to pump water out of the outflow port (182) and supply the water downstream in the water supply channel;
a casing (120) housing the open tank (180);
a toilet seat and a toilet lid (130) attached to the casing (120); and
a control device (160) provided in the casing (120), and configured to control at least the discharge of the water from the water discharge nozzle (131),
characterised by:

the control device (160) being configured to perform
a human body part washing for washing human body part by discharging water from inside the box-like portion (186b) via the water discharge nozzle (131) by activating the washing pump (191), the control device (160) performing the human body part washing when the solenoid valve (174) is opened, water thus being supplied to the open tank (180); and
a drainage control for draining water from inside the box-like portion (186b) via the water discharge nozzle (131) by activating the washing pump (191), the control device (160) performing the drainage control when the solenoid valve (174) is closed, the supply of water to the open tank (180) thus being stopped, the drainage control being performed separately from the human body part washing.

2. The sanitary washing device (100) according to claim 1, further comprising:

a human body sensor (162) configured to sense a presence of a human body,
the control device (160) performing the drainage control when the human body sensor (162) has entered a state of sensing no human body.

3. The sanitary washing device (100) according to claim 2, wherein the control device (160) performs the drainage control when the state of the human body sensor (162) not sensing the presence of a human body has continued for a prescribed time period.

4. The sanitary washing device (100) according to claim 1, wherein the control device (160) performs the drainage control on the basis of manipulation of a drainage switch.

5. The sanitary washing device (100) according to claim 1, further comprising:

a toilet lid closure sensor configured to sense that the toilet lid (130) is closed,
the control device (160) performing the drainage control when the toilet lid closure sensor has sensed that the toilet lid (130) is closed.

6. The sanitary washing device (100) according to any one of claims 1 to 5, comprising a drainage device that comprises a drainage pump (195) that is connected to a drainage pipe (194) that is connected to a drainage port (193) of the open tank (180).

7. The sanitary washing device (100) according to any one of claims 1 to 5, comprising a drainage device that comprises a drainage valve for opening and closing a drainage pipe (194) that is connected to a drainage port (193) of the open tank (180).

8. The sanitary washing device (100) according to claim 1, further comprising:

a heat exchanger (150) provided in the water supply channel downstream of the washing pump (191), configured to store water supplied from the washing pump (191), and including a heater (151) configured to heat the stored water, a backflow prevention device (153) being provided in the water supply channel between the open tank (180) and the heat exchanger (150) and configured to prevent backflow of water.

9. The sanitary washing device (100) according to claim 1, wherein the control device (160) performs overflow drainage control for opening the solenoid valve (174) to supply water to the open tank (180) and causing overflow of water from the overflow port (183) of the open tank (180).

10. The sanitary washing device (100) according to claim 9, wherein the amount of water supplied from the water supply source (500) is larger than the amount of water pumped out of the open tank (180) by the washing pump (191).

11. The sanitary washing device (100) according to claim 9, wherein the control device (160) performs the overflow drainage control before starting water discharge from the water discharge nozzle (131), and subsequently activates the washing pump (191) to start discharge of water from the water discharge nozzle (131).

12. The sanitary washing device (100) according to claim 1, wherein when in use:

the casing (120) is locatable above a toilet bowl (200) and further houses the water discharge nozzle (131), the water supply channel, the solenoid valve (174), the washing pump (191), and the control device (160),
a container (305) including a water receiver (330) surrounded by a partition wall (301, 302a, 302b, 303) is provided inside the casing (120) and below the overflow port (183),
one end of the container (305) is formed into a drainage port (305b) extending to above a bowl portion of the toilet bowl (200),
the open tank (180) includes a cover (187c) covering the upper side of the water receiver (330) of the container (305), configured to guide excess water drained from the overflow port (183) to the water receiver (330) of the container (305), and including a release port (186i) located above the container (305), and
the excess water drained from the overflow port (183) of the open tank (180) is allowed to flow from the release port (186i) into the water receiver (330) of the container (305) and to be drained from the drainage port (305b) to the bowl portion of the toilet bowl (200).

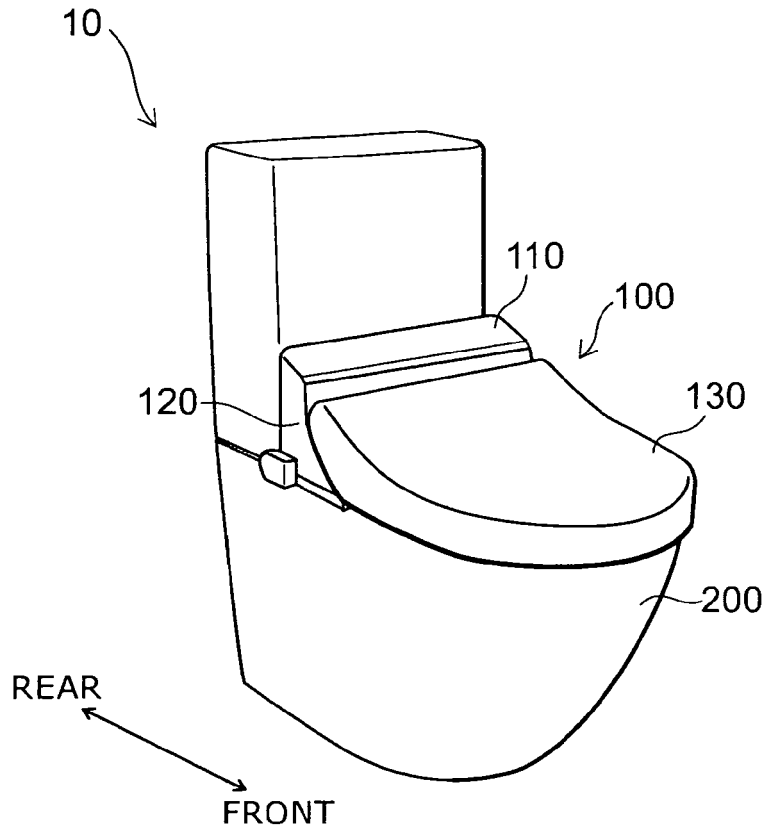
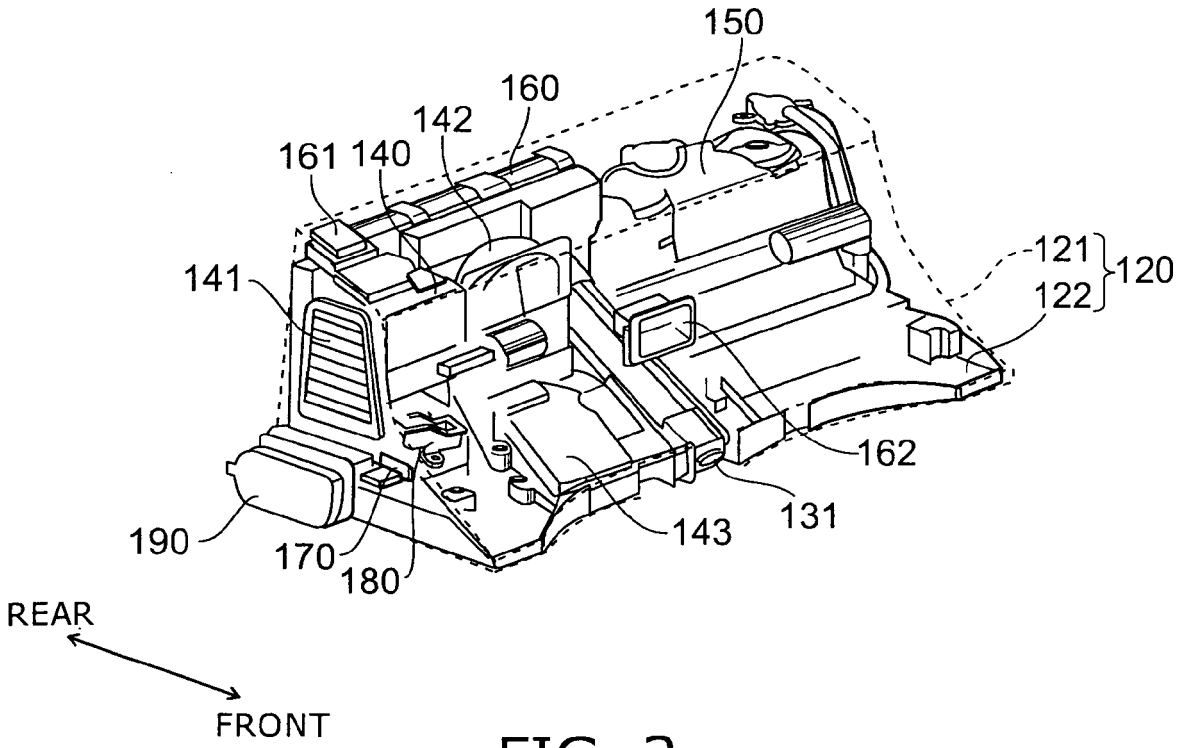

10
110
100
120
130
200
REAR
FRONT

FIG. 1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162
131
143
190
170
180
REAR
FRONT

FIG. 2

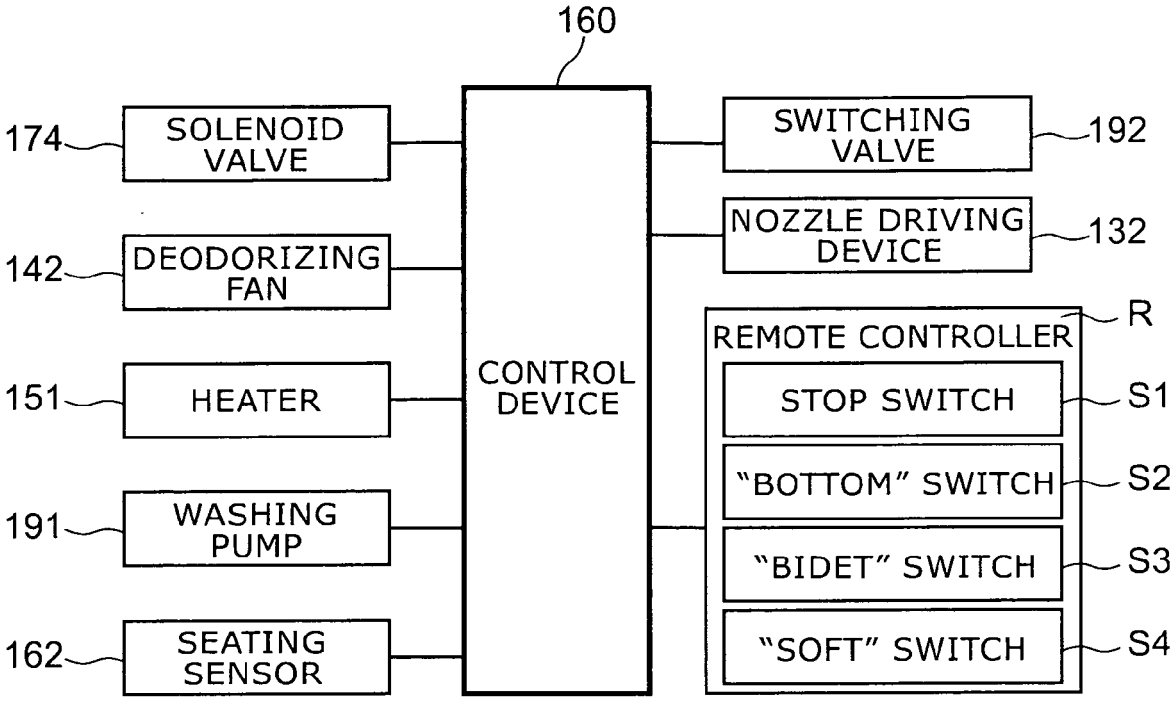
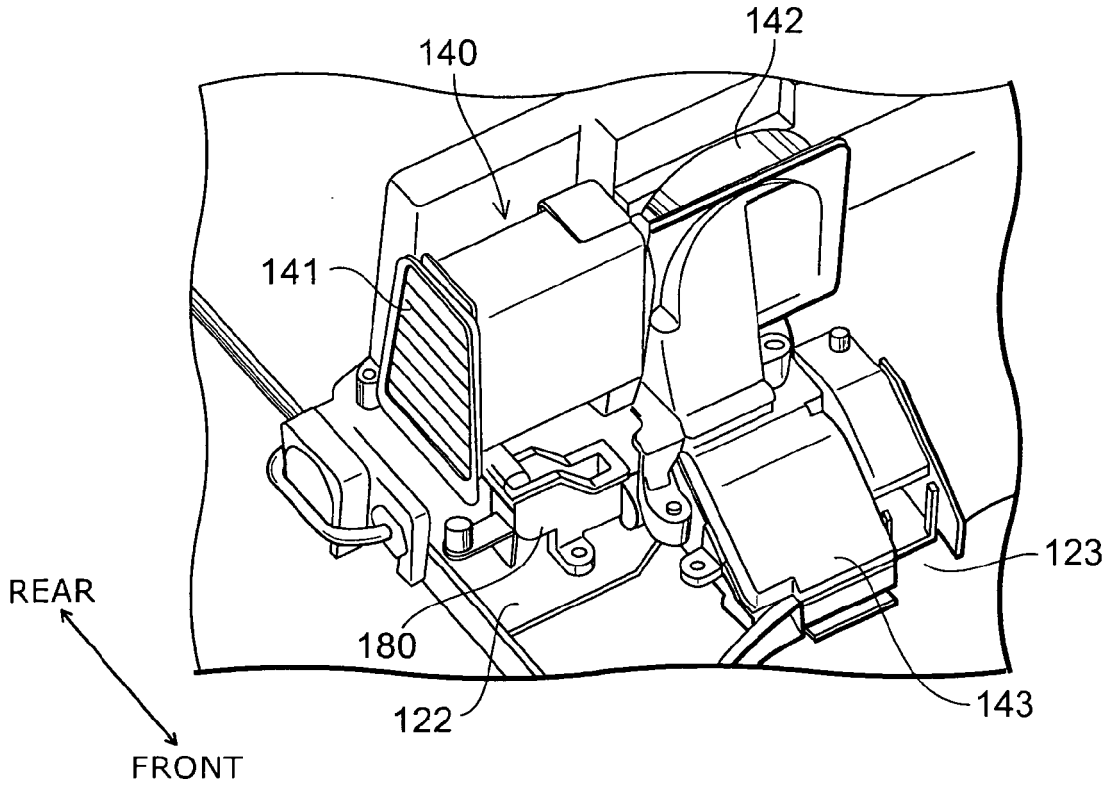

160
174
SOLENOID VALVE
142
DEODORIZING FAN
151
HEATER
191
WASHING PUMP
162
SEATING SENSOR
CONTROL DEVICE
SWITCHING VALVE
192
NOZZLE DRIVING DEVICE
132
REMOTE CONTROLLER
R
STOP SWITCH
S1
"BOTTOM" SWITCH
S2
"BIDET" SWITCH
S3
"SOFT" SWITCH
S4

FIG. 3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140
141
123
REAR
180
122
143
FRONT

FIG. 4

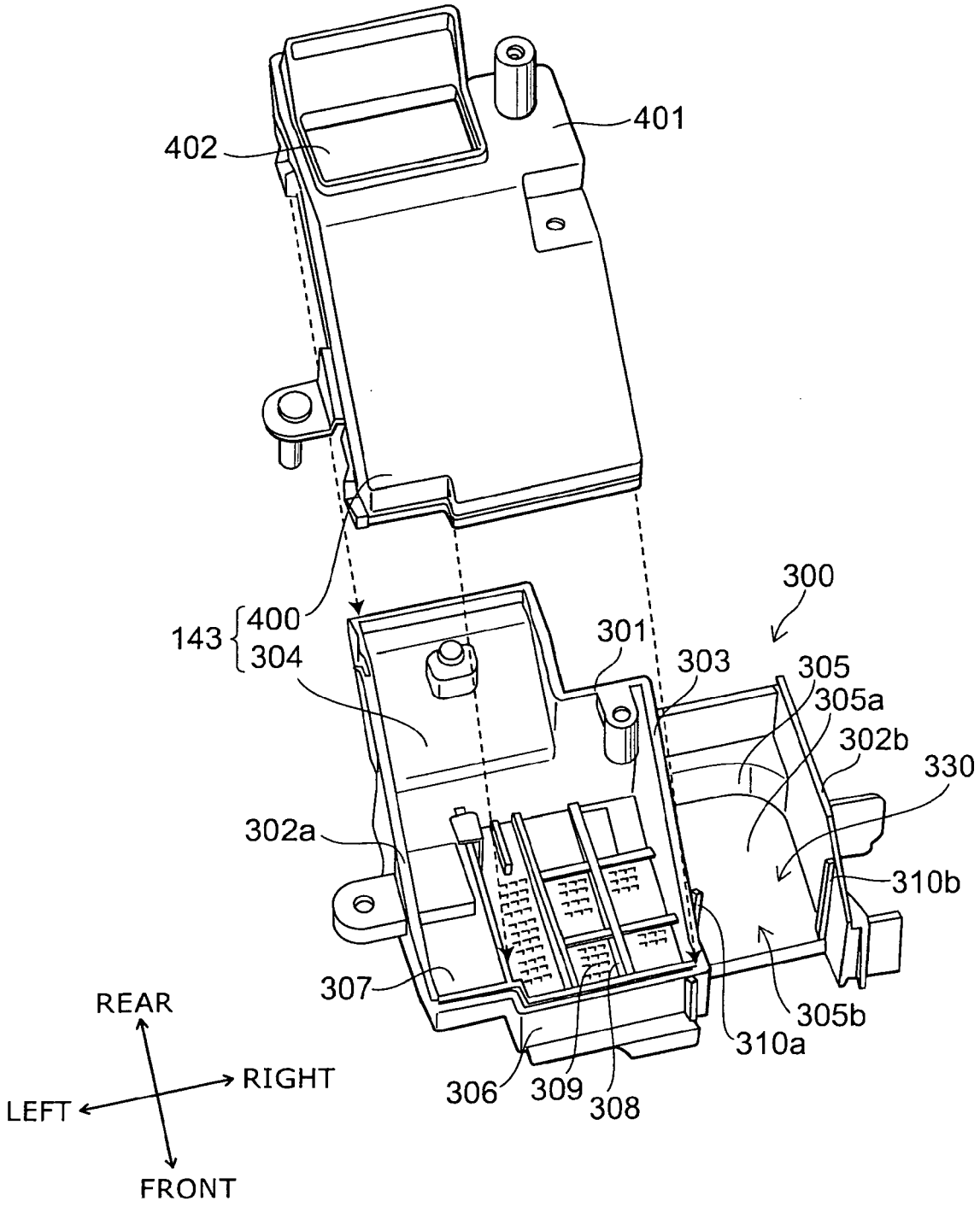
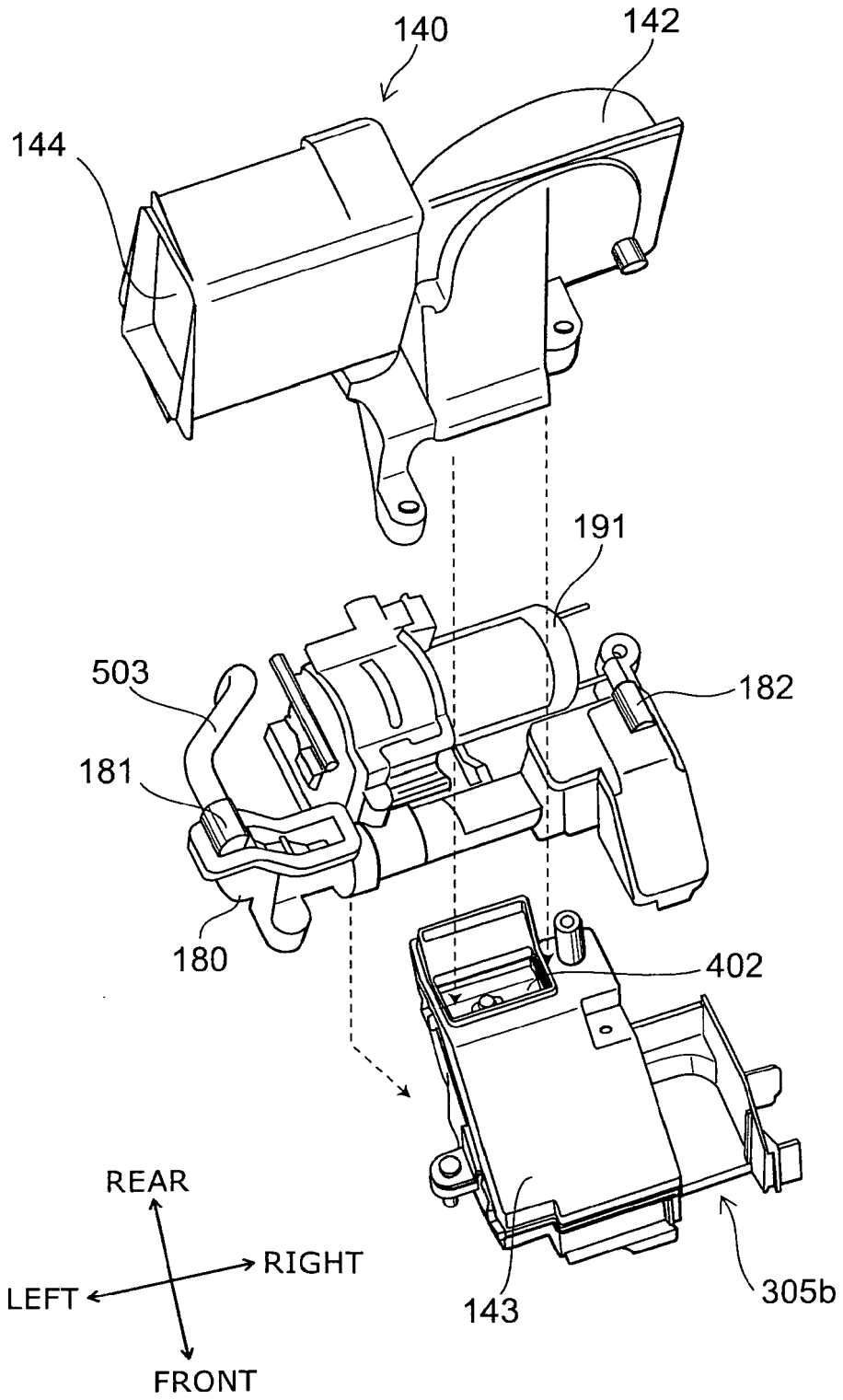

402
401
143
400
304
300
301
303
305
305a
302b
330
302a
310b
307
305b
310a
306
309
308
REAR
RIGHT
LEFT
FRONT

FIG. 5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142
144
191
503
182
181
180
402
REAR
RIGHT
LEFT
FRONT
143
305b

FIG. 6

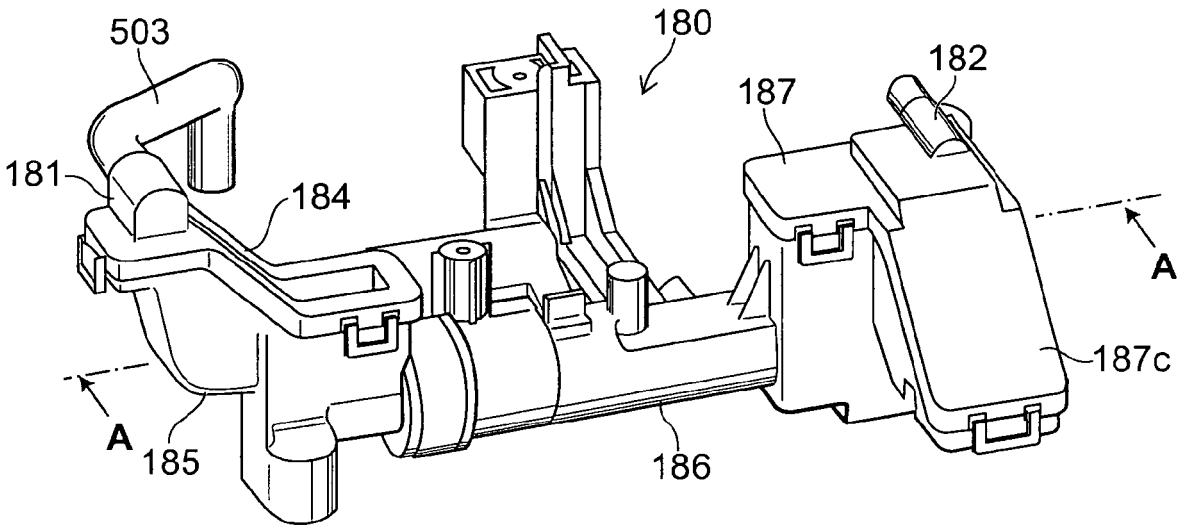

FIG. 7A

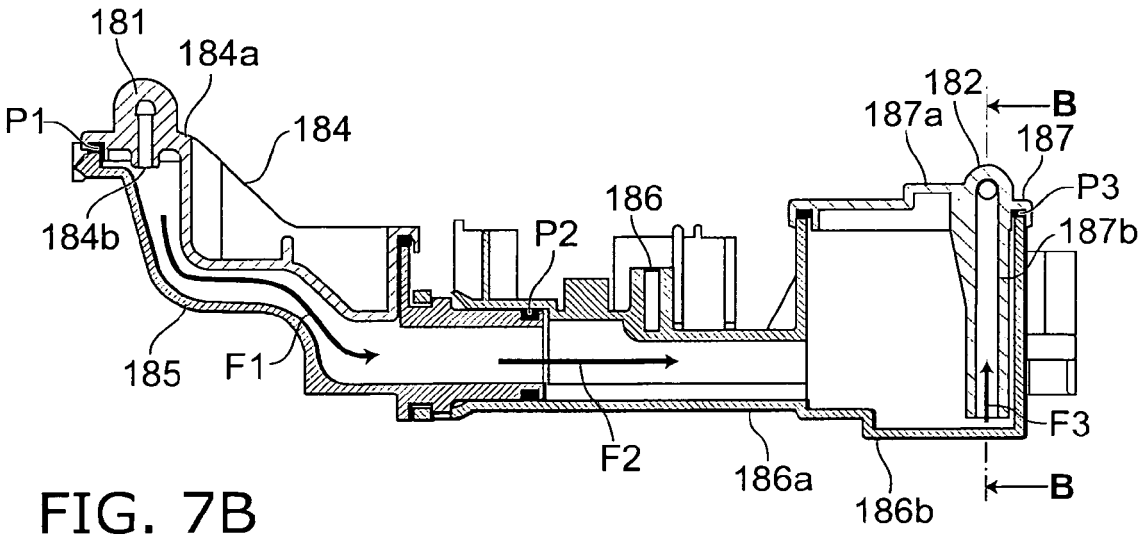

FIG. 7B

A-A CROSS SECTION

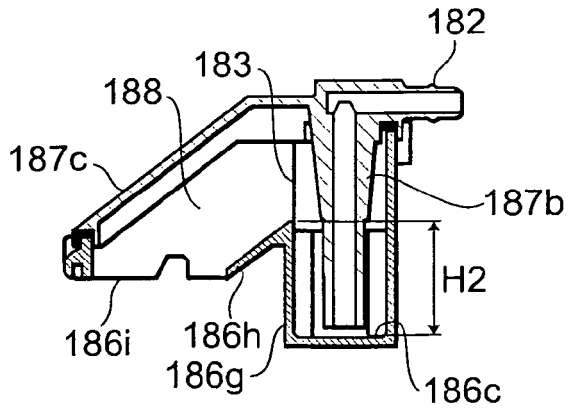

FIG. 7C

B-B CROSS SECTION

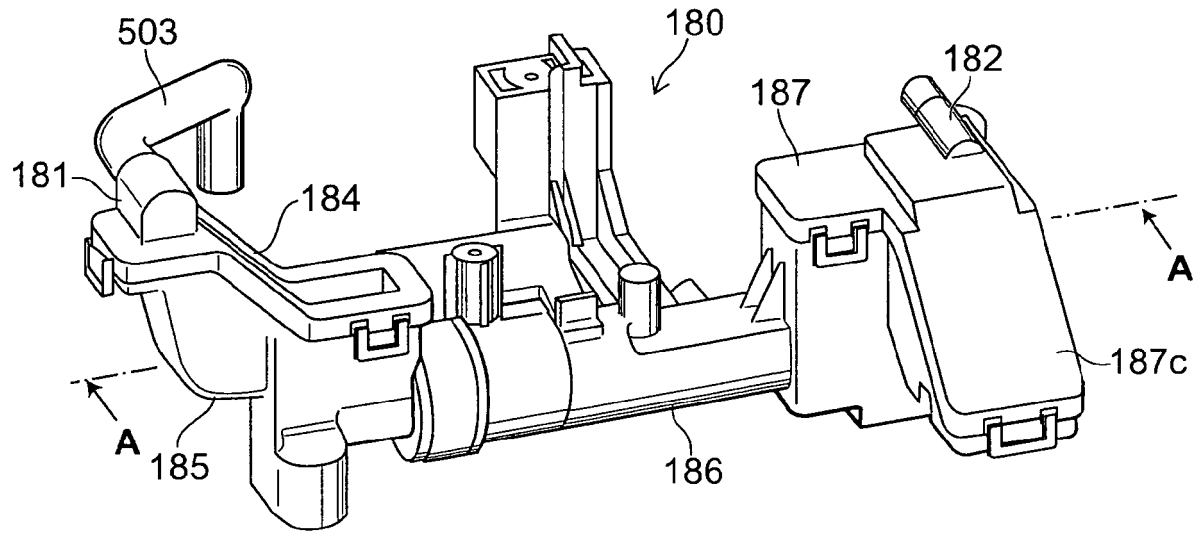

FIG. 8A

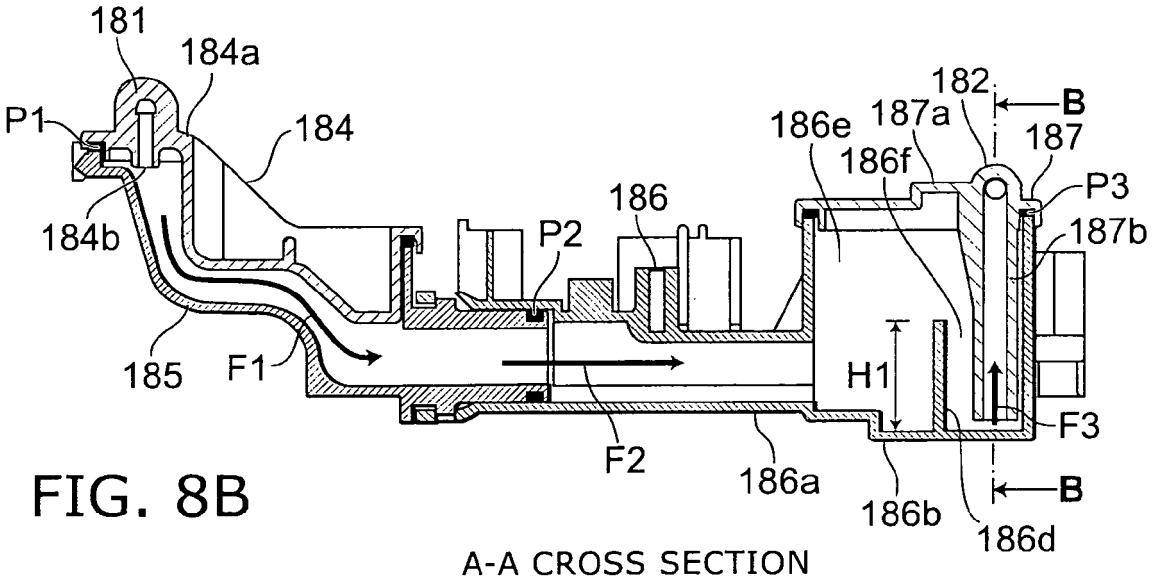

FIG. 8B

A-A CROSS SECTION

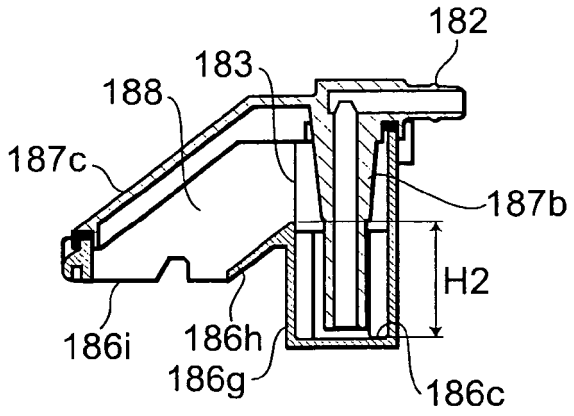

FIG. 8C

B-B CROSS SECTION

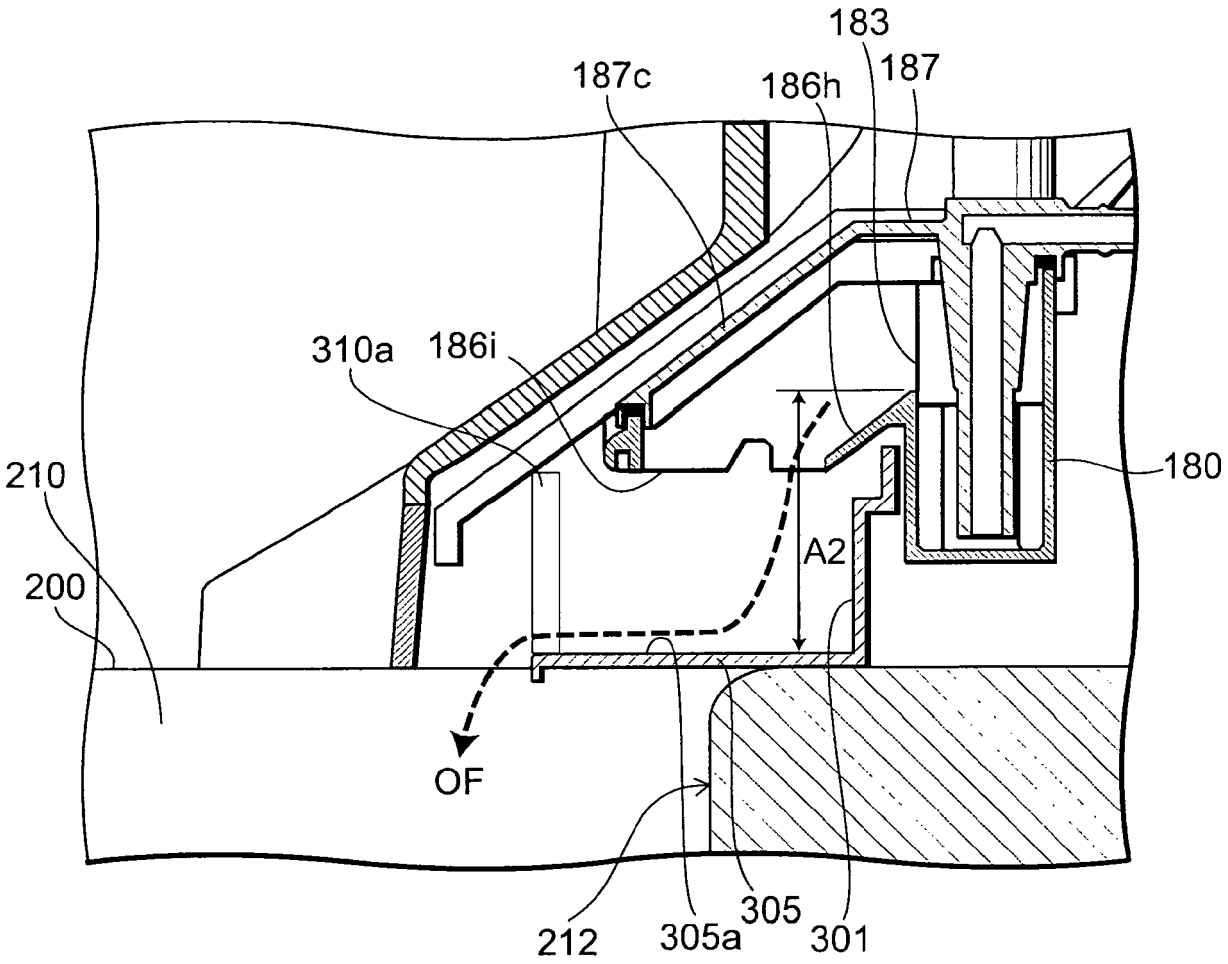

FIG. 9

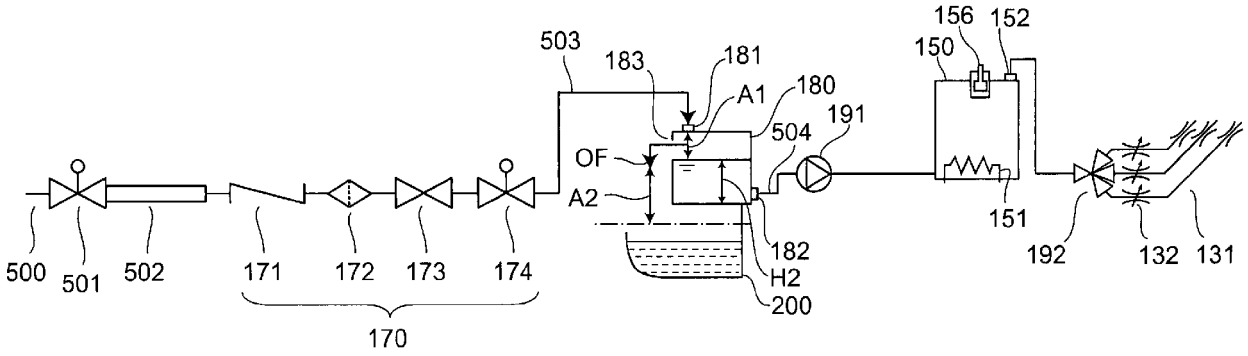
503
183
181
A1
180
191
156
152
150
504
OF
A2
151
500
501
502
171
172
173
174
182
H2
200
192
132
131
170

FIG. 10

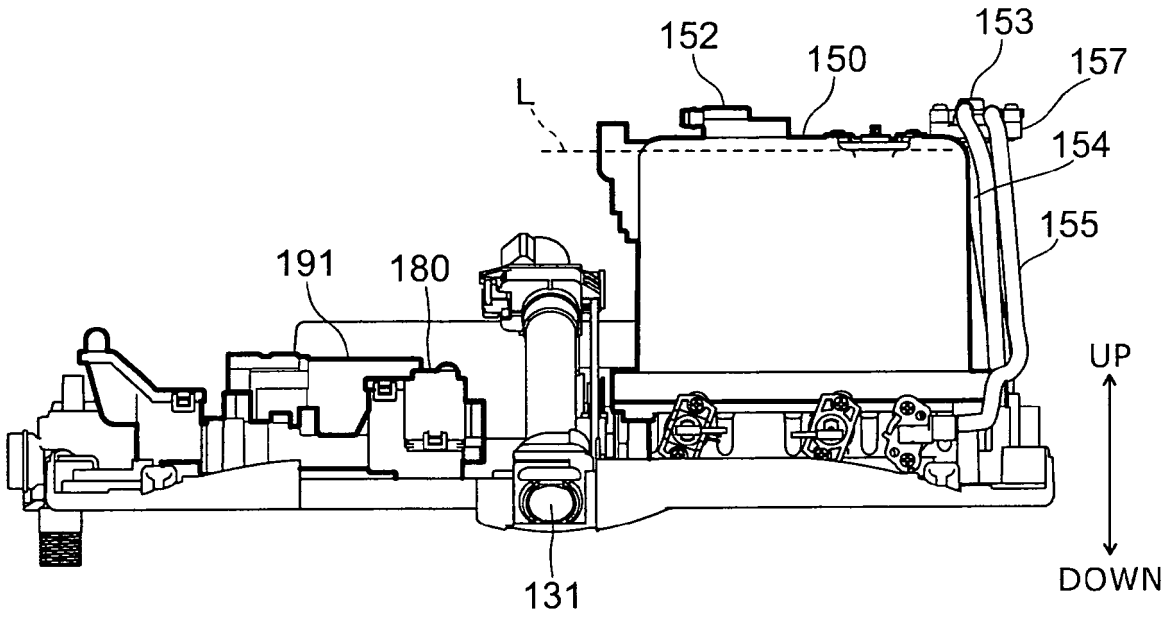

FIG. 11

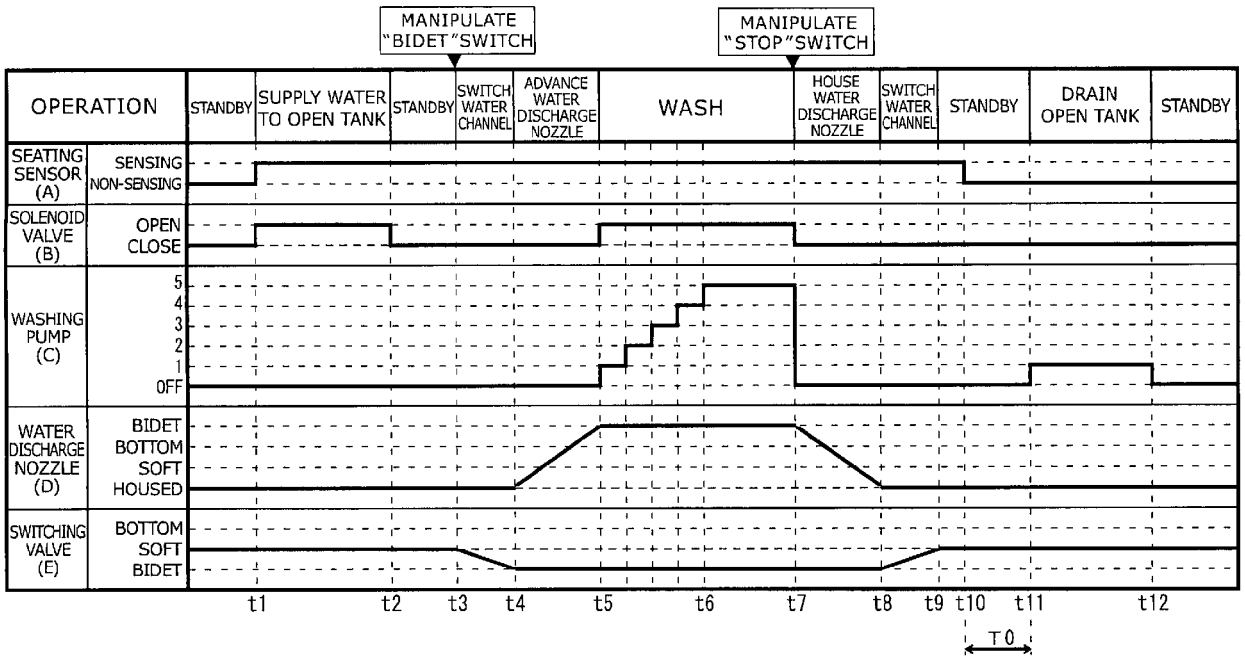
MANIPULATE "BIDET" SWITCH
MANIPULATE "STOP" SWITCH
OPERATION
STANDBY
SUPPLY WATER TO OPEN TANK
STANDBY
SWITCH WATER CHANNEL
ADVANCE WATER DISCHARGE NOZZLE
WASH
HOUSE WATER DISCHARGE NOZZLE
SWITCH WATER CHANNEL
STANDBY
DRAIN OPEN TANK
STANDBY
SEATING SENSOR (A)
SENSING
NON-SENSING
SOLENOID VALVE (B)
OPEN
CLOSE
WASHING PUMP (C)
5
4
3
2
1
OFF
WATER DISCHARGE NOZZLE (D)
BIDET
BOTTOM
SOFT
HOUSED
SWITCHING VALVE (E)
BOTTOM
SOFT
BIDET
t1
t2
t3
t4
t5
t6
t7
t8
t9
t10
t11
t12
T0

FIG. 12

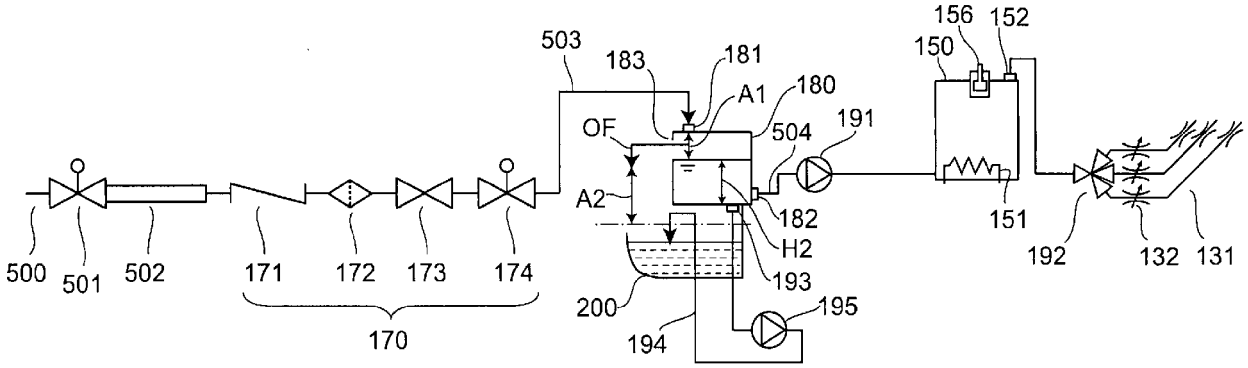
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FIG. 13

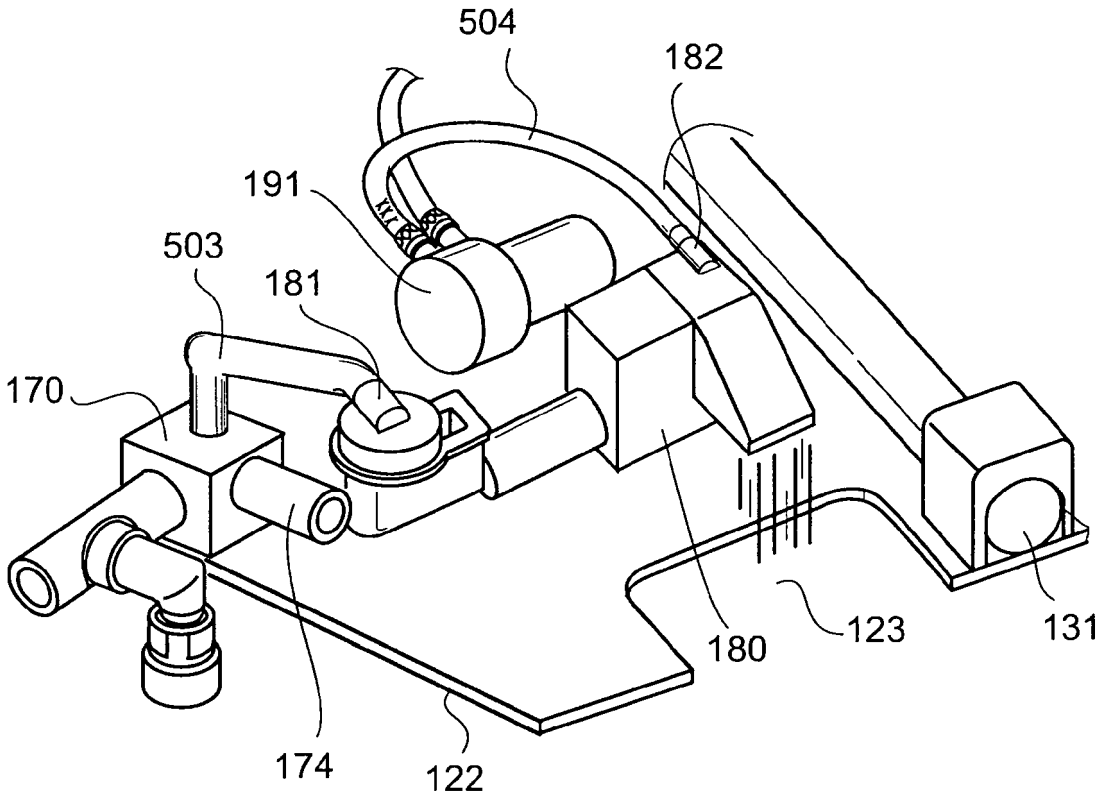
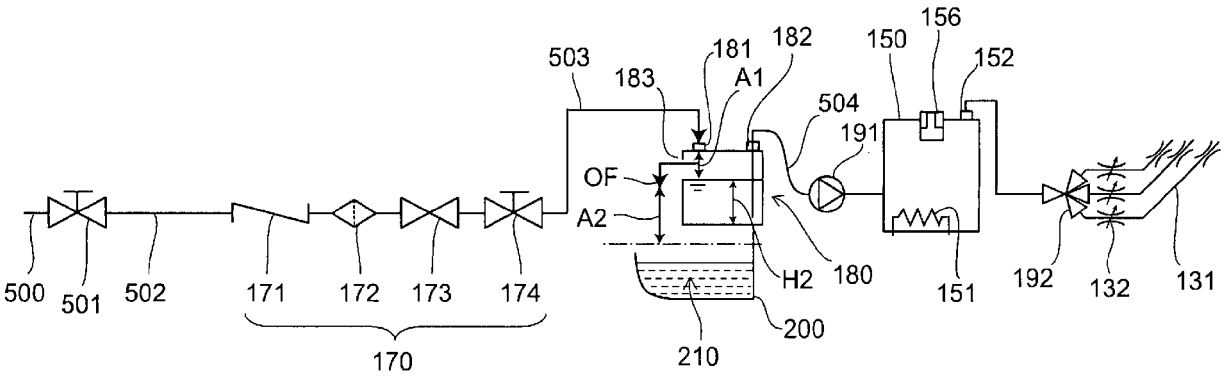


FIG. 14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501
502
171
172
173
174
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503
183
181
182
A1
OF
A2
H2
200
210
504
191
180
150
156
152
151
192
132
131

FIG. 15

WASHING OPERATION TIMING CHART

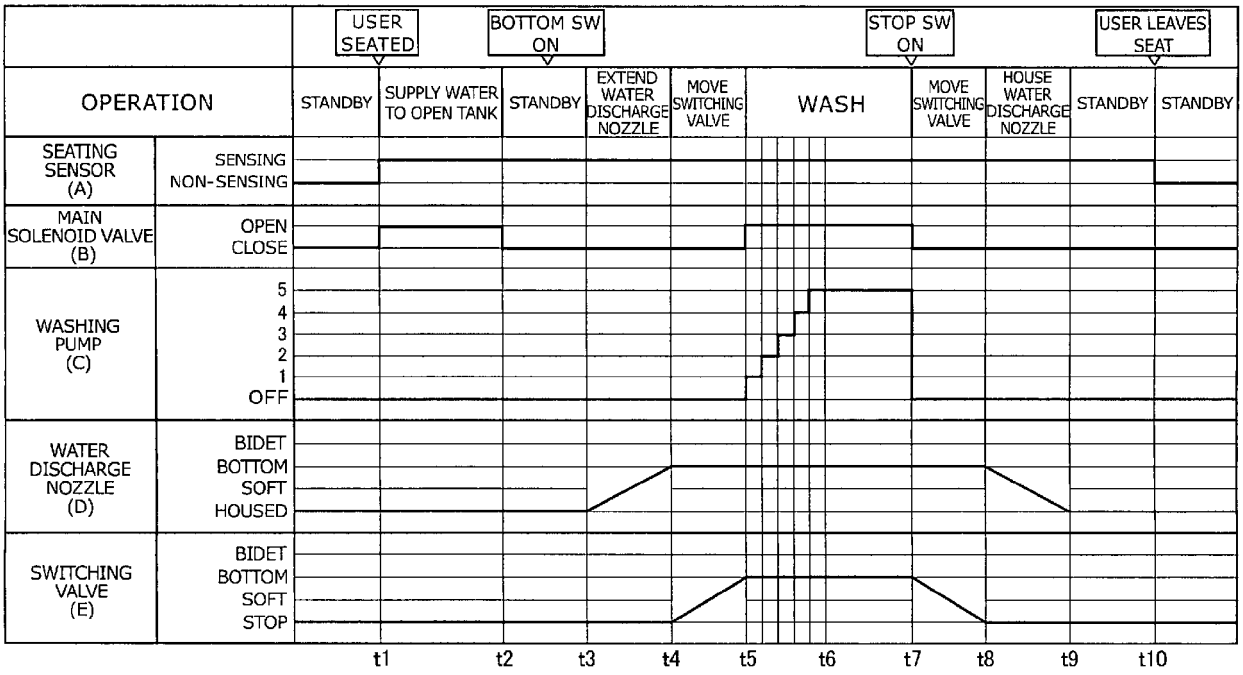

FIG. 16

WASHING OPERATION TIMING CHART

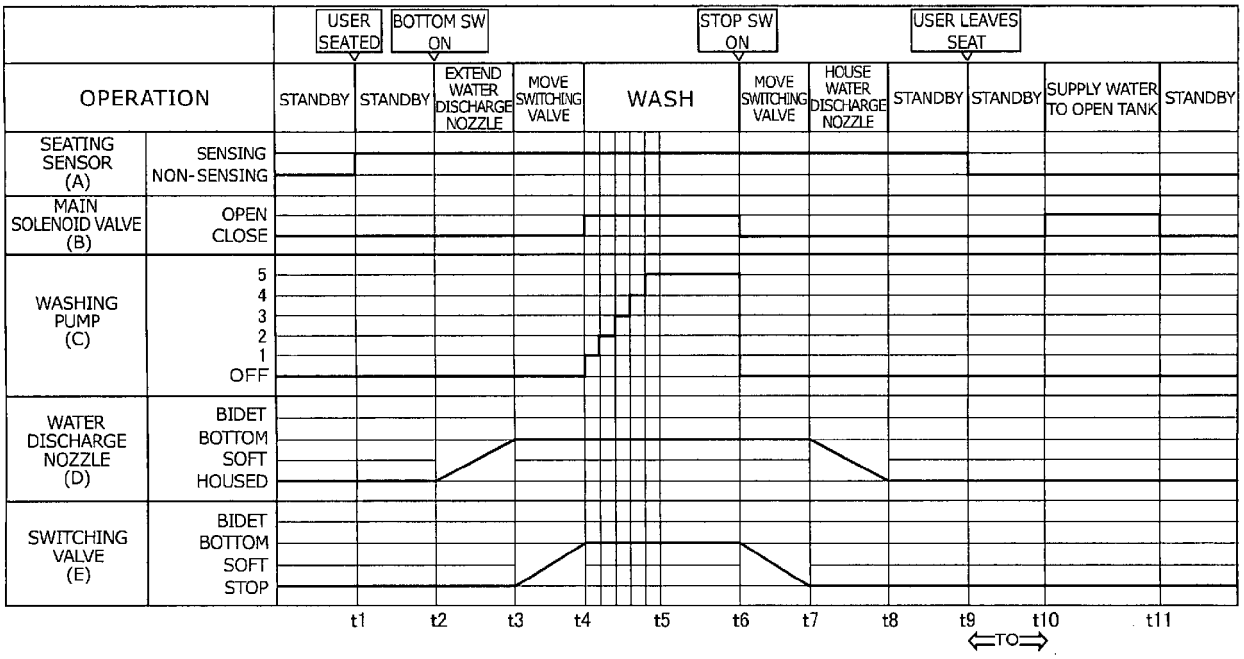

FIG. 17

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 20 15 9146

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	JP 8 120733 A (MATSUSHITA ELECTRIC WORKS LTD) 14 May 1996 (1996-05-14) * paragraph [0026]; figures 26-30 * -----	1	INV. E03D9/08

TECHNICAL FIELDS SEARCHED (IPC)

E03D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 May 2020	Flygare, Esa

CATEGORY OF CITED DOCUMENTS

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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

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08-05-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 8120733 A	14-05-1996	----------	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

- EP 09252162 **[0002]**
- EP 2163695 A **[0002]**
- JP 8120733 A **[0003] [0004] [0023] [0035] [0058]**