



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.12.2020 Bulletin 2020/51

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

(21) Application number: **20184404.0**

(22) Date of filing: **22.09.2014**

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

• **Kuniki, Yasuhiro**
Osaka 540-6207 (JP)
• **Satoi, Takayuki**
Osaka 540-6207 (JP)

(30) Priority: **08.10.2013 JP 2013210789**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
14851912.7 / 3 056 616

(71) Applicant: **Panasonic Intellectual Property Management Co., Ltd.**
Osaka-shi, Osaka 540-6207 (JP)

(74) Representative: **SSM Sandmair**
Patentanwälte Rechtsanwalt
Partnerschaft mbB
Joseph-Wild-Straße 20
81829 München (DE)

(72) Inventors:
• **Koga, Ryoichi**
Osaka 540-6207 (JP)

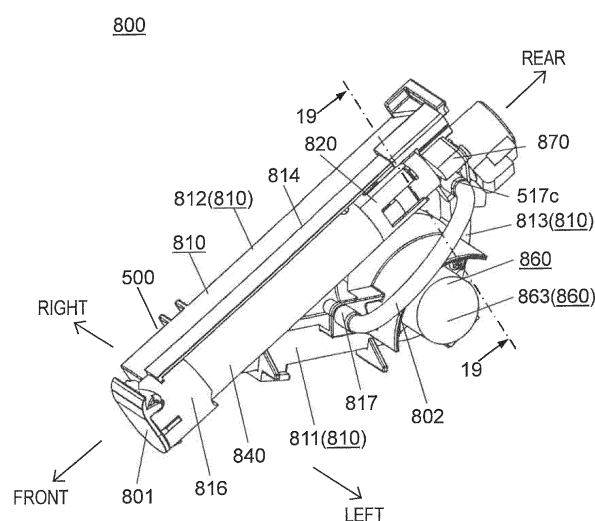
Remarks:

This application was filed on 07-07-2020 as a divisional application to the application mentioned under INID code 62.

(54) **SANITARY CLEANING DEVICE**

(57) A sanitary washing device includes a nozzle device 830, a water pump 516, a heat exchanger 700, a flow regulating valve, and a control part 130. The nozzle device includes a buttock washing water flow passage 835, a bidet washing water flow passage 837, and a nozzle cleaning flow passage 839. When a washing operation which is one of buttock washing and bidet washing is performed, the control part starts driving of the water pump and driving of the heat exchanger sequentially, and switches the selection of the flow regulating valve to the nozzle cleaning flow passage after hot water heated by the heat exchanger is supplied to the selected flow passage for a predetermined time. Further, the supply of hot water to the nozzle cleaning flow passage is continued also in the course of advancing the nozzle portion to a washing position from an accommodated position. With such an operation, lowering of a temperature of washing water during the movement of the nozzle portion is suppressed, and sufficiently heated hot water is jetted from the beginning of jetting thus realizing comfortable washing.

FIG. 18



Description

TECHNICAL FIELD

[0001] The present invention relates to preheating of a washing nozzle in a sanitary washing device of an instantaneous heating method provided with a heat exchanger.

BACKGROUND ART

[0002] Conventionally, with respect to such a sanitary washing device provided with a heat exchanger for instantaneously heating washing water, there has been known the configuration where preheating of a washing nozzle is performed as described hereinafter (see patent literature 1, for example).

[0003] That is, in the sanitary washing device described in patent literature 1, in performing a washing operation, first of all, in a state where the washing nozzle is accommodated at an accommodated position, a pump which supplies washing water and a heat exchanger which heats washing water are driven. Then, pre-washing is performed where hot water is supplied to a flow passage of the washing nozzle and hot water is jetted from a jetting port. In this manner, cleaning and preheating of the washing nozzle are performed.

[0004] Next, after pre-washing is finished, driving of the pump and the heat exchanger is temporarily stopped. Then, in a state where jetting of washing water is stopped, a nozzle drive motor is driven so as to project the washing nozzle to a washing position from an accommodated position.

[0005] Then, after the washing nozzle reaches the washing position, the pump and the heat exchanger are driven again so that washing water is jetted from the jetting port. Accordingly, a private part washing operation is started.

[0006] Hereinafter, a specific manner of operation of the sanitary washing device described in patent literature 1 is described by reference to FIG. 36.

[0007] FIG. 36 is a view showing a timing chart of respective constitutional elements of a conventional sanitary washing device.

[0008] Firstly, as shown in FIG.36, pre-washing is performed from a point of time t15 to a point of time t17. That is, driving of the pump is started at the point of time t15, and driving of the heat exchanger is started at the point of time t16 which comes slightly after the point of time t15. Then, at the point of time t17, driving of the pump and the heat exchanger is stopped so that pre-washing is finished.

[0009] Next, during a period from a point of time t18 to a point of time t19, a nozzle drive motor is driven so that the washing nozzle is projected to the washing position from the accommodated position.

[0010] Then, driving of the pump is started at the point of time t19, and driving of the heat exchanger is started

at the point of time t20 which comes slightly after the point of time t19. Accordingly, a private part washing operation is started.

[0011] However, in the sanitary washing device having the conventional configuration, driving of the pump and the heat exchanger is stopped during the period where the washing nozzle is projected from the finishing of the pre-washing to starting of private part washing. Accordingly, a temperature of washing water stored in a flow passage of the washing nozzle or the like is lowered during that period.

[0012] Further, when the pump and the heat exchanger are driven again after the washing nozzle reaches the washing position, there is a time difference between starting of driving of the pump and starting of driving of the heat exchanger. Accordingly, cold water which is not heated is supplied to the washing nozzle during this period. That is, washing water which is jetted from the jetting port immediately after the private part washing operation is started is not sufficiently heated and hence, low-temperature hot water is jetted from the washing nozzle. Accordingly, with the conventional sanitary washing device, there is still room for improvement from a viewpoint of comfortableness.

Citation List

Patent Literature

[0013] PTL 1: Unexamined Japanese Patent Publication No. 2008-275283

SUMMARY OF THE INVENTION

[0014] The present invention provides a comfortably used sanitary washing device which can jet washing water of a predetermined temperature immediately after starting of private part washing.

[0015] That is, a sanitary washing device of the present invention includes: a plurality of jetting ports for jetting washing water; a nozzle portion provided with a plurality of flow passages communicating with the jetting ports; a nozzle drive part which is configured to advance and retract the nozzle portion between an accommodated position and a plurality of washing positions; a flow regulating valve for selectively supplying washing water to the plurality of flow passages; a water pump which is configured to supply washing water to the nozzle portion; a heat exchanger arranged upstream of the water pump and heating washing water; an operating part; and a control part. The plurality of flow passages include at least; a buttock washing water flow passage communicating with a buttock washing water jetting port; a bidet washing water flow passage communicating with a bidet washing water jetting port; and a nozzle cleaning flow passage communicating with a nozzle cleaning water jetting port. The control part is configured, when a washing operation which is one of buttock washing and bidet washing is

performed by the operating part, to drive the water pump and the heat exchanger and, at the same time, switches the flow passages such that one of the buttock washing water flow passage and the bidet washing water flow passage is selected by the flow regulating valve, and the control part is configured to supply hot water heated by the heat exchanger to the selected flow passage for a predetermined time. The control part is configured, after the predetermined time elapses, to switch the selection of the flow passage by the flow regulating valve to the nozzle cleaning flow passage, and to drive the nozzle drive part so as to advance the nozzle portion to one of the plurality of washing positions from the accommodated position. The control part is configured, at a point of time that the nozzle portion reaches the one of the plurality of washing positions, to switch the flow passage to one of the buttock washing water flow passage and the bidet washing water flow passage corresponding to a washing operation selected by the operating part using the flow regulating valve.

[0016] With such a configuration, firstly, when the washing operation is performed, driving of the water pump and the heat exchanger is started in a state where the nozzle portion is at an accommodated position. Then, during a period where the nozzle portion advances to the washing position and a private part washing operation is performed, the water pump and the heat exchanger are continuously driven. Accordingly, it is possible to suppress lowering of a temperature of the nozzle portion and a temperature of washing water in the course of movement of the nozzle portion. Simultaneously, washing water which is heated in the heat exchanger immediately after the supply of electricity to the heat exchanger and has an unstable discharge temperature is prevented from being jetted to a human body intentionally, and the washing water is discharged as washing water for washing the nozzle portion. Accordingly, at the washing position, washing water jetted from the buttock washing water jetting port or the bidet washing water jetting port can be jetted with a stable hot water temperature from the beginning of the jetting in a state where washing water is sufficiently heated. As a result, it is possible to realize a sanitary washing device capable of performing comfortable washing.

BRIEF DESCRIPTION OF DRAWINGS

[0017]

FIG. 1 is a perspective view showing a state where a sanitary washing device according to an exemplary embodiment of the present invention is installed on a toilet bowl.

FIG. 2 is a perspective view showing a state where a front body case of a body of the sanitary washing device is removed.

FIG. 3 is a perspective view showing a state where the front body case of the body and a control part of

the sanitary washing device are removed.

FIG. 4 is a perspective view showing an upper surface of an operation part of the sanitary washing device.

FIG. 5 is a perspective view showing an external appearance of a remote controller.

FIG. 6 is a schematic view showing a configuration of a water circuit of a washing part of the sanitary washing device.

FIG. 7 is a perspective view showing a disassembled state of the water circuit of the sanitary washing device.

FIG. 8 is a perspective view showing an assembled state of the water circuit of the sanitary washing device.

FIG. 9 is a perspective view showing an external appearance of a sub tank.

FIG. 10 is a cross-sectional view of the sub tank in a transverse direction.

FIG. 11 is a cross-sectional view of the sub tank in a longitudinal direction.

FIG. 12 is a graph showing a change in output voltage of an upper electrode, a change in output voltage of a common electrode and a threshold value.

FIG. 13 is a graph showing a change in output voltage of a lower electrode, a change in output voltage of the common electrode and a threshold value.

FIG. 14 is a perspective view showing an external appearance of a heat exchanger.

FIG. 15 is a cross-sectional view of the heat exchanger.

FIG. 16 is a perspective view showing an external appearance of a water pump.

FIG. 17 is a cross-sectional view of the water pump.

FIG. 18 is a perspective view showing an external appearance of a storage state of a nozzle device.

FIG. 19 is a cross-sectional view taken along a line 19-19 in FIG. 18.

FIG. 20 is a longitudinal cross-sectional view showing a storage state of the nozzle device.

FIG. 21 is a cross-sectional view showing a detailed configuration of a B portion shown in FIG. 20.

FIG. 22 is a cross-sectional view taken along a line 22-22 in FIG. 21.

FIG. 23 is a transverse cross-sectional view showing a storage state of the nozzle device.

FIG. 24 is a cross-sectional view showing a detailed configuration of a C portion shown in FIG. 23.

FIG. 25 is a longitudinal cross-sectional view showing a buttock washing state of the nozzle device.

FIG. 26 is a cross-sectional view showing a detailed configuration of a D portion shown in FIG. 25.

FIG. 27 is a longitudinal cross-sectional view showing a bidet washing state of the nozzle device.

FIG. 28 is a cross-sectional view showing a detailed configuration of an E portion shown in FIG. 27.

FIG. 29 is a transverse cross-sectional view showing a bidet washing state of the nozzle device.

FIG. 30 is a cross-sectional view showing a detailed configuration of a G portion shown in FIG. 29.

FIG. 31 is a plan view of a fixed disc of a flow regulating valve.

FIG. 32 is a plan view of a movable disc of the flow regulating valve.

FIG. 33 is a schematic view showing relative positions between the fixed disc and the movable disc in respective operation states of the flow regulating valve.

FIG. 34 is a timing chart of the washing part at an initial stage of use of the sanitary washing device.

FIG. 35 is a timing chart of the washing part at a usual stage of use the sanitary washing device.

FIG. 36 is a view showing timing charts of respective constitutional elements of a conventional sanitary washing device.

DESCRIPTION OF EMBODIMENTS

[0018] Hereinafter, exemplary embodiments of the present invention are described with reference to drawings. However, the present invention is not limited by these exemplary embodiments.

FIRST EXEMPLARY EMBODIMENT

<1> Overall configuration of sanitary washing device

[0019] Hereinafter, the overall configuration of the sanitary washing device according to the first exemplary embodiment is described with reference to FIG. 1 to FIG. 5.

[0020] FIG. 1 is a perspective view showing a state where the sanitary washing device according to the first exemplary embodiment is installed on a toilet bowl. FIG. 2 is a perspective view showing a state where a front body case of a body of the sanitary washing device is removed. FIG. 3 is a perspective view showing a state where the front body case of the body and a control part of the sanitary washing device are removed. FIG. 4 is a perspective view showing an upper surface of an operation part of the sanitary washing device. FIG. 5 is a perspective view showing an external appearance of a remote controller.

[0021] As shown in FIG. 1, sanitary washing device 100 of this exemplary embodiment includes, as main constitutional elements thereof, at least body 200, toilet seat 300, toilet lid 320, remote controller 400, human body detection sensor 450 and the like. Body 200, toilet seat 300, and toilet lid 320 are formed as an integral body, and are mounted on an upper surface of toilet bowl 110.

[0022] Hereinafter, the arrangement of the respective constitutional elements is described by assuming a side of sanitary washing device 100 where body 200 is disposed as a rear side, a side of the sanitary washing device 100 where toilet seat 300 is disposed as a front side, a right side when a user faces frontward as a right side, and a left side when the user faces frontward as a left side.

[0023] Operating part 210 is integrally mounted on body 200 in a state where operating part 210 projects sideward from body 200. Toilet seat and toilet lid rotating mechanism 360 is disposed on a front portion side of body 200, and drives toilet seat 300 and toilet lid 320 in an openable and closeable manner. Toilet seat and toilet lid rotating mechanism 360 includes a DC motor and a plurality of gears, for example, and can open or close toilet seat 300 and toilet lid 320 independently from each other or simultaneously.

[0024] As shown in FIG. 1, when toilet lid 320 is opened, toilet lid 320 is raised so as to be positioned at a rearmost portion of sanitary washing device 100. On the other hand, when toilet lid 320 is closed, toilet lid 320 conceals a top surface of toilet seat 300.

[0025] Toilet lid 320 is molded by using a resin material such as PP (polypropylene) and ABS, for example. Toilet lid 320 has the heat insulation structure formed of the double structure and a heat insulation material.

[0026] A toilet seat heater (not shown in the drawing) which heats a seating surface is incorporated in toilet seat 300. The toilet seat heater heats the seating surface of toilet seat 300 such that the seating surface becomes a comfortable temperature for a user.

[0027] Further, a seating sensor (not shown in the drawing) is mounted on a bearing portion disposed inside body 200 which supports a rotary shaft of toilet seat 300, and detects a human body seated on toilet seat 300. The seating sensor is formed of a weight-type sensor, for example, and opens and closes a switch in response to a change in weight brought about by sitting of a user on toilet seat 300. Due to such an operation, the seating sensor detects that a user is seated on the seating surface of toilet seat 300.

[0028] As shown in FIG. 2 and FIG. 3, in the inside of body 200, sub tank 600, heat exchanger 700, washing part 500 which includes nozzle device 800 for washing a private part of a human body, deodorizing device 120 for deodorizing odor generated at the time of defecation, control part 130 for controlling various functions of sanitary washing device 100 and the like are incorporated. The detailed configuration of washing part 500 is described later.

[0029] Nozzle device 800 which is a main constitutional element of washing part 500 is disposed on a center portion in the inside of body 200, and deodorizing device 120 is disposed on a left side of nozzle device 800. Further, toilet seat and toilet lid rotating mechanism 360 which drives toilet seat 300 and toilet lid 320 in an openable and closeable manner is disposed on a left side portion of nozzle device 800.

[0030] Water stop electromagnetic valve 514 of washing part 500, sub tank 600 and the like are disposed on a right and a front side of nozzle device 800. Heat exchanger 700 is disposed on a rear side of nozzle device 800. Water pump 516 is disposed behind heat exchanger 700. Control part 130 is disposed above washing part 500.

[0031] As shown in FIG. 4, a plurality of switches and display lamps 240 for operating and setting the respective functions of sanitary washing device 100 are disposed on operating part 210. An operation board (not shown in the drawing) is disposed inside operating part 210. A plurality of tact switches and a plurality of LEDs are disposed on the operation board. With such a configuration, a user can operate the tact switches by pushing and can visually recognize the LEDs by means of a switch name plate adhered to an upper surface of operating part 210.

[0032] Operating part 210 includes infrared-ray receiver 211. Infrared-ray receiver 211 is disposed on a rear side of an upper surface of operating part 210. Infrared-ray receiver 211 receives infrared ray signals transmitted from remote controller 400 and human body detection sensor 450 shown in FIG. 1.

[0033] The switches of operating part 210 are constituted of a plurality of operation switches 220 for operating a washing operation, a plurality of setting switches 230 for setting various kinds of functions and the like. Further, display lamps 240 are constituted of a plurality of LEDs for displaying set states.

[0034] Operation switches 220 of operating part 210 are constituted of: buttock washing switch 221 which is auxiliarily used when battery exhaustion or a failure occurs in remote controller 400; and nozzle cleaning switch 222 which is operated at the time of cleaning a nozzle.

[0035] Setting switches 230 of operating part 210 are constituted of, for example: hot water temperature switch 231; toilet seat temperature switch 232; 8-hour warming stop switch 233; power saving switch 234; toilet lid automatically opening/closing switch 235 and the like. The respective switches perform the following operation in response to pushing operations. That is, hot water temperature switch 231 is provided for setting a temperature of washing water. Toilet seat temperature switch 232 is provided for setting a temperature of toilet seat 300. When 8-hour warming stop switch 233 is turned on, warming of toilet seat 300 is stopped, and warming of toilet seat 300 is started again after 8 hours elapse. Power saving switch 234 automatically learns a period of time where sanitary washing device 100 is not used, and lowers a warming temperature of toilet seat 300 during the period of time where sanitary washing device 100 is not used, thus achieving power saving. Toilet lid automatically opening/closing switch 235 is provided for setting automatic opening/closing operation of toilet seat 300 and toilet lid 320.

[0036] Many operations of sanitary washing device 100 are performed by remote controller 400 which is constituted as a constitutional element separated from body 200. Accordingly, remote controller 400 is mounted on a wall surface or the like of a toilet room which a user seated on toilet seat 300 can easily operate.

[0037] As shown in FIG. 5, the overall shape of remote controller 400 is formed into a thin rectangular parallelepiped shape. Remote controller 400 is configured such

that the plurality of switches and indicator lamps are mounted on an upper surface and a front surface of box-shaped remote controller body 401 which molded by using a resin material such as PP and ABS, for example.

Transmitting part 402 which transmits an operation signal from remote controller 400 to body 200 in the form of infrared rays is disposed in a vicinity of an upper corner portion of remote controller body 401.

[0038] A printed circuit board (not shown in the drawing) which forms a control functional part of remote controller 400, a battery (not shown in the drawing) which is a power source for remote controller 400 and the like are incorporated in the inside of remote controller body 401.

[0039] Buttock washing switch 410, bidet washing switch 411, stop switch 412, move washing switch 413, rhythm washing switch 414 and the like are disposed on a front center portion of remote controller body 401, for example. The following operations are performed when the respective switches are operated by pushing. When buttock washing switch 410 is operated, buttock washing starts. When bidet washing switch 411 is operated, bidet washing for washing a private part of a woman starts. When stop switch 412 is operated, buttock washing or bidet washing stops. When move washing switch 413 is operated, washing in a wide range becomes possible by advancing and retracting a washing position of a nozzle periodically at the time of performing buttock washing or bidet washing. When rhythm washing switch 414 is operated, washing becomes possible where a washing strength of washing water is changed periodically at the time of performing buttock washing.

[0040] Washing strength switch 415, washing position switch 416, nozzle sterilizing switch 417 and the like are disposed on an upper front portion of remote controller body 401, for example. When washing strength switch 415 is operated, a washing strength at the time of performing buttock washing and a washing strength at the time of performing bidet washing can be adjusted using two switches. When washing position switch 416 is operated, a washing position at the time of performing buttock washing and a washing position at the time of bidet washing can be adjusted using two switches. When nozzle sterilizing switch 417 is operated, the nozzle is sterilized by being washed with hot water of 40°C for approximately 1 minute, for example.

[0041] Strength display lamp 421 formed of LEDs which displays a washing strength in five stages is disposed above washing strength switch 415. Further, position display lamp 422 which displays a washing position in five stages is disposed above washing position switch 416.

[0042] Toilet lid switch 418 for electrically opening and closing toilet lid 320, and toilet seat switch 419 for electrically opening and closing toilet seat 300 are disposed on an upper surface of remote controller body 401. By operating respective switches, a user can arbitrarily open and close toilet seat 300 and toilet lid 320.

[0043] Human body detection sensor 450 shown in

FIG. 1 is constituted as a constitutional element separated from body 200, and is mounted on the wall surface of the toilet room or the like, for example. Human body detection sensor 450 includes: a pyroelectric sensor; a sensor control part; an infrared-ray transmitting part; a battery which is a power source for human body detection sensor 450 and the like not shown in the drawings. The pyroelectric sensor receives infrared rays emitted from a human body. The sensor control part detects the presence of a human body in response to a signal from the pyroelectric sensor. The infrared-ray transmitting part transmits a human body detection signal from the sensor control part to the control part of body 200 in the form of infrared rays.

[0044] The sanitary washing device according to this exemplary embodiment is configured as described above.

<2> Configuration of washing part

[0045] Hereinafter, the configuration of the washing part of the sanitary washing device according to this exemplary embodiment is described with reference to FIG. 6 to FIG. 8.

[0046] FIG. 6 is a schematic view showing a configuration of a water circuit of the washing part of the sanitary washing device. FIG. 7 is a perspective view showing a disassembled state of the water circuit of the sanitary washing device. FIG. 8 is a perspective view showing an assembled state of the water circuit of the sanitary washing device.

[0047] Washing part 500 shown in FIG. 6 is incorporated in body 200, and washes a private part of a user.

[0048] As shown in FIG. 6, washing part 500 includes at least: nozzle device 800 for jetting washing water; a series of washing water supply passage 900 through which washing water is supplied to nozzle device 800 from water supply connecting port 510 and the like.

[0049] Water supply connecting port 510, strainer 511, check valve 512, constant flow regulating valve 513, water stop electromagnetic valve 514, relief valve 515, sub tank 600, heat exchanger 700, buffer tank 750, water pump 516, flow regulating valve 870 are sequentially mounted in washing water supply passage 900. A most downstream end of washing water supply passage 900 is connected to nozzle device 800.

[0050] Water supply connecting port 510 is disposed below a right side of body 200, and is connected with a city water pipe. Strainer 511 is disposed inside water supply connecting port 510, and prevents the inflow of dusts contained in tap water. Check valve 512 prevents the backflow of water stored in sub tank 600 to the city water pipe.

[0051] Constant flow regulating valve 513 maintains an amount of washing water which flows in washing water supply passage 900 at a fixed value. Water stop electromagnetic valve 514 electrically opens and closes washing water supply passage 900. Constant flow regulating

valve 513, water stop electromagnetic valve 514, and relief valve 515 are formed into an integral body as shown in FIG. 7.

[0052] Sub tank 600 is disposed downstream of water stop electromagnetic valve 514, and has an atmosphere open port 603. Heat exchanger 700 heats washing water instantaneously. Buffer tank 750 makes a temperature of hot water which is heated by heat exchanger 700 uniform.

[0053] Water pump 516 is connected to a downstream side of buffer tank 750. Nozzle device 800 is connected to water pump 516 by way of flow regulating valve 870. Further, buttock washing part 831, bidet washing part 832, nozzle cleaning part 833 and the like of nozzle device 800 are connected to respective ports of flow regulating valve 870.

[0054] As shown in FIG. 7 and FIG. 8, out of members which constitute washing part 500, water supply connecting port 510, strainer 511, check valve 512, constant flow regulating valve 513, water stop electromagnetic valve 514, relief valve 515, sub tank 600, heat exchanger 700, buffer tank 750, water pump 516 are assembled into chassis 501 which is molded by using a resin material such as ABS, for example, and are constituted as an integral body. Further, those members are assembled to rear body case 201 of body 200 in a state where the members are assembled into chassis 501.

[0055] Strainer 511 and check valve 512 are integrally assembled into water supply connecting port 510, and constant flow regulating valve 513 and relief valve 515 are integrally assembled into water stop electromagnetic valve 514. Buffer tank 750 is integrally formed with heat exchanger 700.

[0056] Connecting ports of water supply connecting port 510 and water stop electromagnetic valve 514, connecting ports of water stop electromagnetic valve 514 and sub tank 600, and connecting ports of sub tank 600 and heat exchanger 700 are respectively directly connected to each other with a packing, for example, an O-ring sandwiched therebetween without interposing a connecting tube or the like therebetween. These members which constitute the water circuit are disposed and fixed to chassis 501 at predetermined positions respectively.

[0057] By adopting the above-mentioned configuration in the water circuit, the watertight structure is enhanced and, at the same time, the accuracy in relative arrangement of respective members can be enhanced. Particularly, the accuracy in relative arrangement of sub tank 600 and heat exchanger 700 is enhanced. Accordingly, the accuracy in controlling a flow rate of washing water is enhanced. As a result, the performance of washing part 500 is enhanced and, at the same time, the accuracy in controlling a flow rate is enhanced.

[0058] Next, the configuration of above-mentioned water pump 516 is described with reference to FIG. 16 and FIG. 17 while also referencing Fig. 7.

[0059] FIG. 16 is a perspective view showing an external appearance of the water pump. FIG. 17 is a cross-

sectional view of the water pump.

[0060] As shown in FIG. 16 and FIG. 17, water pump 516 is formed of a piston pump which is a positive displacement pump having an outer shape of an approximately L shape (including an L shape), for example. Specifically, water pump 516 includes: motor part 516a which has an approximately circular cylindrical shape (including a circular cylindrical shape); link mechanism part 516b which converts a rotary motion of the motor into a reciprocating motion; and piston part 516c which is driven by the reciprocating motion of link mechanism part 516b. Water suction port 516d and water discharge port 516e are formed in an outer surface of piston part 516c as connecting ports.

[0061] In case of water pump 516 of this exemplary embodiment, at the time of driving water pump 516, vibrations generated in motor part 516a which performs only a rotary motion are smaller than vibrations generated by link mechanism part 516b and piston part 516c which perform a reciprocating motion.

[0062] To describe the operation of water pump 516 specifically, firstly when motor part 516a is driven, piston part 516c starts a reciprocating motion. Washing water is sucked into water pump 516 from water suction port 516d of piston part 516c and washing water is discharged from water discharge port 516e. Washing water discharged from water discharge port 516e is discharged while forming the flow of water having appropriate pulsation along with a reciprocating motion of piston part 516c.

[0063] The outer periphery of motor part 516a having an approximately circular columnar shape (including circular columnar shape) of water pump 516 having the above-mentioned configuration is surrounded by a buffer member (not shown in the drawing) made of a foamed resin having resiliency. By inserting motor part 516a into water pump mounting portion 501a having an approximately circular cylindrical shape (including circular cylindrical shape) formed on a rear portion of chassis 501, motor part 516a is supported on water pump mounting portion 501a. In such a configuration, link mechanism part 516b and piston part 516c are disposed in a downwardly suspended manner.

[0064] As shown in FIG. 7, water pump mounting portion 501a is formed to have a thin wall thickness, and is formed on an upper portion of rib-shaped leg portion 501b which is raised from a bottom surface of chassis 501. That is, by forming water pump mounting portion 501a with thin wall thickness, it is possible to effectively absorb vibrations of water pump 516 due to resiliency of a resin from which water pump mounting portion 501a is formed.

[0065] Hot water outflow port 712 which is a connecting port of heat exchanger 700 with which buffer tank 750 is integrally formed and water suction port 516d which is a connecting port of water pump 516 are connected to each other by a connecting tube made of a soft resin.

[0066] As described above, in water pump 516 of this exemplary embodiment, motor part 516a which gener-

ates a small amount of vibrations is mounted in water pump mounting portion 501a having a thin wall thickness of chassis 501 by way of the buffer member. On the other hand, link mechanism part 516b and piston part 516c which generate a large amount of vibrations are freely suspended. Further, piston part 516c and the like are connected to buffer tank 750 by way of connecting tube 502 (see FIG. 8) made of a soft resin. With such a configuration, it is possible to suppress vibrations generated at the time of driving water pump 516 from being transmitted to chassis 501, other members, and body 200. As a result, comfortability and durability of the sanitary washing device can be enhanced.

[0067] Particularly, water pump 516 is supported by way of two members made of materials different from each other, that is, the buffer member made of a foamed resin and water pump mounting portion 501a made of a resin having resiliency. Therefore, vibrations frequencies in a wide range can be absorbed. Accordingly, it is possible to further effectively suppress the transmission of vibrations to body 200.

<3> Configuration of sub tank

[0068] Hereinafter, the configuration of the sub tank of the sanitary washing device of this exemplary embodiment is described with reference to FIG. 9 to FIG. 11.

[0069] FIG. 9 is a perspective view showing an external appearance of the sub tank. FIG. 10 is a transverse cross-sectional view of the sub tank. FIG. 11 is a longitudinal cross-sectional view of the sub tank.

[0070] Firstly, as shown in FIG. 9, sub tank 600 includes at least: tank body 610 which is molded by using a resin material such as ABS, for example; water level detection sensor 620; inflow water temperature sensor 630 and the like. Water level detection sensor 620 detects a water level of washing water stored in tank body 610. Inflow water temperature sensor 630 is formed of a thermistor, for example, and detects a temperature of washing water supplied into the inside of tank body 610.

[0071] Tank body 610 includes three members, that is, front tank 611 which forms a front wall, side walls, a bottom surface, and a top surface of the tank, rear tank 612 which forms a rear wall of the tank, and atmosphere open portion 613 which is disposed on a top surface of tank body 610. The overall shape of tank body 610 is formed of a plurality of planes consisting of the front wall, the rear wall, side walls, the bottom surface and the top surface. As shown in FIG. 10, the overall shape of tank body 610 as viewed in a plan view is formed into an approximately quadrangular shape (including a quadrangular shape). The front wall of front tank 611 has an inclined portion which is inclined rearward from an intermediate portion of the front wall. That is, when tank body 610 is viewed in a side view as shown in FIG. 11, tank body 610 is formed into an approximately trapezoidal shape (including a trapezoidal shape) where a width of an upper portion is smaller than a width of a lower portion. With

such a configuration, a cross-sectional area of the upper portion of tank body 610 is smaller than a cross-sectional area of the lower portion of tank body 610.

[0072] Water inflow port 601 is formed in a lower portion of one side wall of tank body 610, and water outflow port 602 is formed in a lower portion of the rear wall of tank body 610.

[0073] Further, atmosphere open port 603 which makes the inside and the outside of tank body 610 communicate with each other is formed in atmosphere open portion 613 which is disposed on the top surface of tank body 610. Atmosphere open port 603 discharges air accumulated in tank body 610 to the outside so as to consistently maintain an inner pressure of tank body 610 at an atmospheric pressure. With such a configuration, the inside of sub tank 600 is consistently maintained at an atmospheric pressure, and washing water supply passage 900 from a downstream side of sub tank 600 to water suction port 516d of water pump 516 is also maintained at an atmospheric pressure. Accordingly, water pump 516 can suck water without being influenced by fluctuation of water pressure. As a result, water pump 516 can perform a pump function stably.

[0074] As shown in FIG. 10, in a flow passage which communicates with atmosphere open port 603 of atmosphere open portion 613 in water pump 516, buffer portion 613a at where the passage has a large cross-sectional area is formed. In the case where washing water intends to flow out with an impulse along with bubbles from atmosphere open port 603 or the like, buffer portion 613a temporarily stores washing water. Due to such an operation, the flowing out of washing water from atmosphere open port 603 is suppressed.

[0075] Partition wall 614 is disposed inside tank body 610. Partition wall 614 divides the inside of tank body 610 into two tanks, that is, water inflow tank 615 and storage tank 616. Water inflow port 601 is formed in a side surface of water inflow tank 615 in a vicinity of a bottom surface of water inflow tank 615, and water outflow port 602 is formed in a rear wall of storage tank 616 in a vicinity of a bottom surface of storage tank 616.

[0076] That is, by forming water inflow tank 615 and storage tank 616 by partition wall 614, when air is contained in washing water which flows into tank body 610 through water inflow port 601, air passes through atmosphere open port 603 from an upper portion of water inflow tank 615 and is discharged to the outside. Accordingly, only washing water containing no air is allowed to flow into storage tank 616.

[0077] Above water inflow tank 615 of tank body 610, barrier wall 617 which is interposed between upper surface opening portion 615a of water inflow tank 615 and atmosphere open portion 613 is disposed in a state where barrier wall 617 projects from the side wall of tank body 610 in a substantially horizontal direction (including a horizontal direction). Barrier wall 617 has a size capable of covering the whole surface of upper surface opening portion 615a of water inflow tank 615.

[0078] In the inside of water inflow tank 615, a plurality of flow straightening ribs 618 are formed on the side wall of tank body 610 and partition wall 614 alternately in an projecting manner in the substantially horizontal direction (including a horizontal direction).

[0079] Hereinafter, the flow of washing water in sub tank 600 is described. Washing water which flows into sub tank 600 from water inflow port 601, firstly, flows into a lower portion of water inflow tank 615. Then, washing water rises in water inflow tank 615 while the flow direction of washing water is changed by flow straightening ribs 618. At this stage of operation, when a pressure of washing water which flows into sub tank 600 from water inflow port 601 is high, or when washing water contains a large amount of air so that the flow of washing water is remarkably turbulent, flow straightening ribs 618 suitably straighten the flow of washing water. Further, flow straightening ribs 618 separate air contained in washing water due to a vortex generated downstream of flow straightening rib 618.

[0080] Washing water which rises in water inflow tank 615 and from which air is separated overflows an upper end of partition wall 614, flows into storage tank 616, and is stored in storage tank 616. At this stage of operation, even when a pressure of washing water which flows into storage tank 616 from water inflow port 601 is high, or even when washing water contains a large amount of air so that the flow of washing water is remarkably turbulent, the flow of washing water in the upward direction is suppressed by barrier wall 617. Accordingly, washing water hits atmosphere open portion 613 and hence, it is possible to prevent washing water from directly flowing out to the outside of sub tank 600 from atmosphere open port 603.

[0081] As described above, during a period where washing water which flows into sub tank 600 from water inflow port 601 of sub tank 600 rises in water inflow tank 615, air contained in the washing water is separated from the washing water due to flow straightening ribs 618 and the like. Separated air is discharged to the outside of tank body 610 from atmosphere open port 603. With such a configuration, washing water containing no air is stored in storage tank 616, and such washing water is supplied to heat exchanger 700 from water outflow port 602 of sub tank 600.

[0082] When air is contained in washing water supplied to heat exchanger 700 from sub tank 600, bubbles are generated in heat exchanger 700. Accordingly, there may be a case where a temperature in heat exchanger 700 is abnormally increased so that heat exchanger 700 is damaged. Therefore, sub tank 600 of this exemplary embodiment is provided with partition wall 614 therein, thus preventing the mixing of air. With such a configuration, it is possible to effectively prevent heat exchanger 700 from being damaged.

[0083] As shown in FIG. 10 and FIG. 11, sub tank 600 includes therein water level detection sensor 620 which includes common electrode 621 made of a stainless ma-

terial and used in common, and a plurality of water level electrodes 622 disposed corresponding to respective water levels. In this exemplary embodiment, an example where water level detection sensor 620 includes one common electrode 621 and two water level electrodes 622 is described.

[0084] Common electrode 621 is disposed on an inner surface of a lower portion of the front wall of tank body 610, and water level electrodes 622 are disposed on an inner surface of the rear wall of tank body 610. Water level electrodes 622 include upper limit electrode 623 disposed on an upper portion of the inner surface of the rear wall, and lower limit electrode 624 disposed on a lower portion of the inner surface of the rear wall. On the other hand, common electrode 621 is disposed at a position below lower limit electrode 624 which constitutes one of water level electrodes 622, and is always immersed in water in a normal use state.

[0085] That is, by disposing common electrode 621 and upper limit electrode 623 and lower limit electrode 624 which constitute water level electrodes 622 on the surfaces different from each other, it is possible to suppress the occurrence of the case where residual water adhering to the inner surface of tank body 610 is erroneously detected as stored water.

[0086] Detection of water level of washing water by water level electrodes 622 is performed as follows. Firstly, a DC current is applied between common electrode 621 and water level electrodes 622. Then, whether or not water level electrodes 622 are immersed in water is detected based on a change in voltage. A water level of washing water is detected by such detection. That is, when the water level of washing water in storage tank 616 rises, lower limit electrode 624 and upper limit electrode 623 are immersed in water. In this case, voltage between common electrode 621 and lower limit electrode 624 and a voltage between common electrode 621 and upper limit electrode 623 are lowered. Consequently, control part 130 detects a water level of washing water based on the lowering of voltages.

[0087] Upper limit electrode 623 which constitutes one of water level electrodes 622 is used for detecting an upper limit water level, and lower limit electrode 624 which constitutes the other of water level electrodes 622 is used for detecting a lower limit water level. Upper limit electrode 623 is disposed at a position below atmosphere open port 603. With such a configuration, it is possible to prevent washing water from flowing out from atmosphere open port 603. Further, lower limit electrode 624 is disposed above water outflow port 602 through which water is supplied to heat exchanger 700. With such a configuration, it is possible to prevent air from flowing into heat exchanger 700.

[0088] Control part 130 is configured to apply a DC current between common electrode 621 and water level electrodes 622 while periodically inverting a polarity of the DC current. Metals which form the electrode are eluded by oxidation and ionization of the metal due to an

action of electrolysis generated when a DC current is applied between common electrode 621 and water level electrodes 622 via washing water. This inversion of polarity of the DC current is performed for preventing such elusion of metals. That is, when a DC current is applied, there may be a case where water level electrodes 622 are deteriorated within a short period of time. In view of the above, the deterioration of water level electrodes 622 caused by electrolysis is suppressed with a polarity of the DC current being cyclically inverted.

[0089] In this exemplary embodiment, a polarity inversion interval is set to a time corresponding to an AC power source which is supplied as power source for the sanitary washing device. That is, the polarity inversion interval is set to 1/50 seconds when the AC power source to be supplied is 50Hz, and the polarity inversion interval is set to 1/60 seconds when the AC power source to be supplied is 60Hz. With such a configuration, it is unnecessary to add a new control circuit for inverting a polarity, thus realizing the miniaturization and the reduction of cost of the sanitary washing device.

[0090] As described previously, in sanitary washing device 100 of this exemplary embodiment, water stop electromagnetic valve 514 is opened so that washing water is supplied to sub tank 600. Then, when an upper limit water level is detected by water level electrode 622, water stop electromagnetic valve 514 is closed so that the supply of water is stopped. Then, the inside of sub tank 600 is filled with water.

[0091] When normal washing operation is executed in a state where sub tank 600 is filled with water, a water level is lowered. When a lower limit water level is detected by water level electrode 622, water stop electromagnetic valve 514 is opened again so that washing water is supplied to sub tank 600. Due to such an operation, the supply of water is continued until an upper limit water level is detected by water level electrode 622.

[0092] Usually, a maximum amount of washing water stored in sub tank 600 is 100cc. In view of the above, in this exemplary embodiment, an amount of water from the upper limit water level to the lower limit water level of sub tank 600 is set to 65cc. However, this amount of water is merely one example, and it is needless to say that the amount of water is not limited to the example.

[0093] Usually, a flow rate of washing water used for washing is set to 450cc/min when washing is performed with highest washing strength, and the flow rate is set to 260cc/min when washing is performed with lowest washing strength. Accordingly, a time required until washing water reaches the lower limit water level from the upper limit water level is 8.7 seconds when washing is performed with highest washing strength, and the time is 15 seconds when washing is performed with lowest washing strength.

[0094] Generally, a time necessary for a user to wash his/her private part is 30 seconds or more. Accordingly, even when washing is performed with a lowest washing strength, washing water of 130cc is used. That is, during

a washing operation performed one time, it is possible to detect, at least one time, a change in amount of washing water from the upper limit water level to the lower limit water level by water level electrode 622.

[0095] Therefore, control part 130 measures an elapsed time from the upper limit water level to the lower limit water level, and performs an arithmetic operation based on the measured time and an amount of water (65cc) from the upper limit water level to the lower limit water level, thus calculating a flow rate of washing water. Then, when there exists a difference between the flow rate set for every washing strength and the calculated flow rate, control part 130 adjusts an output of water pump 516, thus correcting the flow rate of washing water.

[0096] In this exemplary embodiment, the description is made by taking the case where the bottom surface of sub tank 600 has an approximately quadrangular shape as an example. However, the present invention is not limited to such a configuration. For example, the bottom surface of sub tank 600 may be formed into other polygonal shapes, and may be changed by taking into account a balance between sub tank 600 and parts surrounding sub tank 600 and a situation of a place where sub tank 600 is installed.

[0097] In this exemplary embodiment, the description is made by taking the case where common electrode 621 and water level electrodes 622 are mounted on facing wall surfaces, that is, on the front wall and the rear wall respectively as an example. However, the present invention is not limited to such a configuration. For example, common electrode 621 and water level electrodes 622 may be mounted on surfaces different from the above-mentioned wall surfaces such as wall surfaces disposed adjacent to each other, that is, the front wall and the side wall. Further, common electrode 621 may be mounted on the front wall, and water level electrodes 622 may be mounted on a top surface. In this case, it is necessary to make a length of lower limit electrode 624 and a length of upper limit electrode 623 different from each other such that a distal end of lower limit electrode 624 is positioned at a lower limit water level and a distal end of upper limit electrode 623 is positioned at an upper limit water level.

[0098] In this exemplary embodiment, the description is made by taking the case where water level electrodes 622 include two electrodes, that is, upper limit electrode 623 and lower limit electrode 624 as an example. However, the present invention is not limited to such a configuration. For example, an interval of the water level detection may be subdivided by disposing three or more water level electrodes 622 or the like. Due to such a configuration, the accuracy of the water level detection and the accuracy of the flow rate detection can be further enhanced.

[0099] The sub tank of this exemplary embodiment is constituted as described above.

<4> Correction of threshold value in water level detection

[0100] Hereinafter, the correction of a threshold value of water level detection in the sanitary washing device of this exemplary embodiment is described by reference to FIG. 12 and FIG. 13.

[0101] FIG. 12 is a graph showing a change in output voltage of the upper limit electrode, a change in output voltage of the common electrode, and a threshold value for determining an immersed state and a non-immersed state of the upper limit electrode. FIG. 13 is a graph showing a change in output voltage of the lower limit electrode, a change in output voltage of the common electrode, and a threshold value for determining an immersed state and a non-immersed state of the lower limit electrode.

[0102] As described previously, detection data obtained by water level detection sensor 620 in the sub tank of this exemplary embodiment is not simply used only for the detection of a water level but is also used for the detection of a flow rate by arithmetic processing. Accordingly, it is necessary to detect a water level in the sub tank with high detection accuracy.

[0103] Usually, water level detection sensor 620 detects a water level based on a change in output voltage between two electrodes. That is, water level detection sensor 620 determines a water level by comparing an output voltage which changes depending on contacting or separating of water level electrodes 622 with or from a water surface of washing water with a threshold value. However, an irregularity occurs in an output voltage of water level detection sensor 620 due to electrical conductivity of washing water, a temperature of washing water or the like.

[0104] That is, in the case of the sanitary washing device, it is difficult to make electrical conductivity constant by limiting a kind of washing water to be used. Further, to correct an output voltage by detecting electrical conductivity of washing water when using the sanitary washing device, it is necessary to use a specific-use detection sensor. However, the use of the specific-use sensor pushes up a cost. In view of the above, according to this exemplary embodiment, a correction based on temperature is performed using detection data of inflow water temperature sensor 630 mounted on sub tank 600. With such a correction, the sanitary washing device is configured to cope with various washing water having electrical conductivity in a wide range.

[0105] To be more specific, as indicated by a broken line in FIG. 12, in a case where upper limit electrode 623 is not immersed in washing water, an output voltage between upper limit electrode 623 and common electrode 621 is approximately 4.7V when an inflow water temperature of washing water is 5°C, and is approximately 4.4V when the inflow water temperature of washing water is 40°C. Further, an output voltage between upper limit electrode 623 and common electrode 621 changes approximately linearly in response to a temperature change.

[0106] In a case where upper limit electrode 623 is immersed in washing water, an output voltage between upper limit electrode 623 and common electrode 621 is approximately 2V when an inflow water temperature of washing water is 5°C, and is approximately 1.4V when an inflow water temperature of washing water is 40°C. Further, an output voltage between upper limit electrode 623 and common electrode 621 changes approximately linearly in response to a temperature change.

[0107] That is, as described above, an output voltage changes depending on an inflow water temperature. Accordingly, when a threshold value for determining an immersed state and a non-immersed state of upper limit electrode 623 is made constant, there exists a possibility that an erroneous detection occurs when washing water having different electrical conductivity is used. Accordingly, it is effective to correct a threshold value in response to an inflow water temperature of washing water.

[0108] Accordingly, in this exemplary embodiment, as indicated by a solid line in FIG. 12, a threshold value within a temperature range of from 0°C to 5°C is set to 3.9V, and a threshold value within a temperature range of from 35°C to 40°C is set to 3.3V. A threshold value is set such that the threshold value changes in a stepwise manner for every 5°C within a temperature range of from 0°C to 40°C, for example.

[0109] Further, as indicated by a broken line in FIG. 13, in a case where lower limit electrode 624 is not immersed in washing water, an output voltage between lower limit electrode 624 and common electrode 621 is approximately 4.5V when an inflow water temperature of washing water is 5°C, and is approximately 4.0V when an inflow water temperature of washing water is 40°C. Further, an output voltage between lower limit electrode 624 and common electrode 621 changes approximately linearly in response to a temperature change.

[0110] In a case where lower limit electrode 624 is immersed in washing water, an output voltage between lower limit electrode 624 and common electrode 621 is approximately 1.5V when an inflow water temperature of washing water is 5°C, and is approximately 1V when an inflow water temperature of washing water is 40°C. Further, an output voltage between lower limit electrode 624 and common electrode 621 changes approximately linearly in response to a temperature change.

[0111] That is, as described above, in the same manner as the case of upper limit electrode 623, an output voltage changes depending on an inflow water temperature. Accordingly, when a threshold value for determining an immersed state and a non-immersed state of lower limit electrode 624 is made constant, there exists a possibility that an erroneous detection occurs when washing water having different electrical conductivity is used. Accordingly, it is effective to correct a threshold value in response to an inflow water temperature of washing water.

[0112] Accordingly, in this exemplary embodiment, as indicated by a solid line in FIG. 13, a threshold value

within a temperature range of from 0°C to 5°C is set to 3.5V, and a threshold value within a temperature range of from 35°C to 40°C is set to 2.9V. A threshold value is set such that the threshold value changes in a stepwise manner for every 5°C within a temperature range of from 0°C to 40°C, for example.

[0113] Control part 130 corrects threshold values for water level detection corresponding to upper limit electrode 623 and lower limit electrode 624 as described above based on detection data of a washing water temperature detected by inflow water temperature sensor 630. Due to such a correction, it is possible to accurately detect a water level of washing water having electrical conductivity in a wide range.

<5> Configuration of heat exchanger

[0114] Hereinafter, the configuration of the heat exchanger of the sanitary washing device of this exemplary embodiment is described by reference to FIG. 14 and FIG. 15.

[0115] FIG. 14 is a perspective view of an external appearance of the heat exchanger. FIG. 15 is a cross-sectional view of the heat exchanger.

[0116] In this exemplary embodiment, buffer tank 750 is integrally formed with heat exchanger 700, and buffer tank 750 is mounted on an upper portion of heat exchanger 700.

[0117] Firstly, heat exchanger 700 is formed into a flat plate shape having an approximately rectangular shape (including a rectangular shape) as viewed in a front view (see FIG. 15). Heat exchanger 700 includes at least: casing 701 which is molded by using a reinforced ABS resin made of an ABS resin compounded with glass fibers; flat-plate-shaped heater 702 made of ceramic, hot water outflow member 703 and the like.

[0118] Casing 701 includes: front surface member 710 which constitutes a front surface portion of casing 701, and back surface member 720 which constitutes a back surface portion of casing 701. Flat-plate-shaped heater 702 is disposed in a space formed between front surface member 710 and back surface member 720. Heating flow passage 715 is formed of: a gap defined between front surface member 710 and flat-plate-shaped heater 702; and a gap defined between back surface member 720 and flat-plate-shaped heater 702. Heat exchanger 700 having the above-mentioned configuration instantaneously increases a temperature of washing water which flows through heating flow passage 715 by flat-plate-shaped heater 702.

[0119] In heat exchanger 700, water inflow port 711 which constitutes a connecting port is formed in a lower right end of a front surface of front surface member 710, and hot water outflow port 712 which constitutes a connecting port is formed in hot water outflow member 703 which is mounted on an upper end of a right side surface of front surface member 710.

[0120] As shown in FIG. 15, water inflow passage 713

which is continuously formed with water inflow port 711 shown in FIG. 14 is formed over the substantially whole width of the lower end portion of casing 701. A plurality of slits 714 are formed over the whole width of the upper surface of water inflow passage 713, and washing water which flows into water inflow passage 713 passes through slits 714 and flows into heating flow passage 715. Slits 714 have a function of allowing washing water to flow into heating flow passage 715 uniformly over the whole width of heating flow passage 715.

[0121] Partition rib 716 is provided to an upper end portion of heating flow passage 715, and an area above partition rib 716 forms buffer tank 750. A plurality of water through holes 717 are formed in partition rib 716 over the substantially whole width (including the whole width) of partition rib 716. With such a configuration, washing water which is heated by heating flow passage 715 flows into buffer tank 750 through water through holes 717.

[0122] Projections 718 having an approximately semicircular cross section (including a semicircular cross section), for example, are disposed in buffer tank 750 at intervals in the substantially whole width (including the whole width) of buffer tank 750. Projections 718 are provided for making the flow of washing water which flows toward hot water outflow port 712 in the inside of buffer tank 750 turbulent. With such a configuration, washing water is agitated so that irregularity in temperature of washing water is eliminated whereby washing water having uniform temperature is flown out from hot water outflow port 712.

[0123] Two thermistors, that is, outflow hot water temperature sensor 730 and excessively elevated temperature sensor 731 are mounted on hot water outflow member 703. Outflow hot water temperature sensor 730 detects an outflow hot water temperature of washing water. Excessively elevated temperature sensor 731 detects an excessively elevated temperature of heat exchanger 700. With such a configuration, control part 130 controls a temperature of washing water flown out from heat exchanger 700.

<6> Configuration of nozzle device

[0124] Hereinafter, the configuration of the nozzle device of the sanitary washing device of this exemplary embodiment is described with reference to FIG. 18 to FIG. 30.

[0125] FIG. 18 is a perspective view showing a storage state of the nozzle device according to this exemplary embodiment. FIG. 19 is a cross-sectional view taken along a line 19-19 shown in FIG. 18. FIG. 20 is a longitudinal cross-sectional view showing a storage state of the nozzle device. FIG. 21 is a cross-sectional view showing a detailed configuration of a B portion shown in FIG. 20. FIG. 22 is a cross-sectional view taken along a line 22-22 shown in FIG. 21. FIG. 23 is a transverse cross-sectional view showing a storage state of the nozzle device. FIG. 24 is a cross-sectional view showing a detailed

configuration of a C portion shown in FIG. 23. FIG. 25 is a longitudinal cross-sectional view showing a buttock washing state of the nozzle device. FIG. 26 is a cross-sectional view showing a detailed configuration of a D portion shown in FIG. 25. FIG. 27 is a longitudinal cross-sectional view showing a bidet washing state of the nozzle device. FIG. 28 is a cross-sectional view showing a detailed configuration of an E portion shown in FIG. 27. FIG. 29 is a transverse cross-sectional view of the nozzle portion showing a bidet washing state of the nozzle device. FIG. 30 is a cross-sectional view showing a detailed configuration of a G portion shown in FIG. 29.

[0126] As shown in FIG. 18, nozzle device 800 includes at least support portion 810, nozzle portion 820, nozzle drive part 860, flow regulating valve 870 and the like. Support portion 810 is molded by using a resin material such as POM (polyoxymethylene) or ABS, for example, and is formed into an approximately triangular (including a triangular shape) frame shape as viewed in a side view. Nozzle portion 820 moves forward and backward along support portion 810. Nozzle drive part 860 drives and moves nozzle portion 820 forward and backward. Flow regulating valve 870 changes over the supply of washing water to nozzle portion 820.

[0127] In the description of the nozzle device made hereinafter, the arrangement of the respective constitutional elements is described by assuming that a direction along which the nozzle portion is stored is a rearward direction, a direction along which the nozzle portion advances is a frontward direction, a right side in a direction from a rear side to a front side is a right side, and a left side in a direction from a rear side to a front side is a left side.

[0128] Support portion 810 is formed into a frame shape, and is formed of: an inclined portion 812 which is lowered toward a front portion from a rear portion thereof with respect to a bottom side portion 811 disposed approximately horizontally (including horizontally); and vertical side portion 813 which connects a rear end of bottom side portion 811 and a rear end of inclined portion 812 to each other. Guide rail 814 which guides forward and backward movement of nozzle portion 820 and rack guide 815 (see FIG. 19) which guides flexible rack 861 (see FIG. 19) of nozzle drive part 860 are formed over the substantially whole length (including the whole length) of inclined portion 812. Holding portion 816 having an approximately circular cylindrical shape (including a circular cylindrical shape) which supports nozzle portion 820 in a surrounding manner is integrally formed on a lower side of a front end of inclined portion 812.

[0129] As shown in FIG. 19, guide rail 814 which guides nozzle portion 820 is formed into an approximately T shape (including a T shape) in cross section. Rack guide 815 which guides flexible rack 861 has an approximately U shape (including a U shape) as viewed in cross section where one side surface is opened. Rack guide 815 is configured to guide flexible rack 861 while restricting upper and lower surfaces and one side surface of flexible

rack 861.

[0130] Rack guide 815 is also formed on vertical side portion 813 and bottom side portion 811 disposed at a rear portion of support portion 810 continuously with inclined portion 812. Rack guides 815 at a corner formed by inclined portion 812 and vertical side portion 813 are connected to each other in an arcuate shape, for example, and rack guides 815 at a corner formed by vertical side portion 813 and bottom side portion 811 are connected to each other in an arcuate shape, for example. Rack guide 815 formed on vertical side portion 813 and rack guide 815 formed on bottom side portion 811 are formed into an approximately U shape (including a U shape) in cross section. On the other hand, with respect to an opened side surface of rack guide 815, a left side surface of rack guide 815 is opened at inclined portion 812, and a side opposite to the left side surface, that is, a right side surface of rack guide 815 is opened at vertical side portion 813 and bottom side portion 811. Further, opened surfaces of rack guides 815 at vertical side portion 813 and bottom side portion 811 are closed by a support portion lid or the like which is a member provided separately from rack guide 815, for example.

[0131] Nozzle drive portion 860 includes: flexible rack 861 which is joined to nozzle portion 820; pinion gear 862 which is meshed with flexible rack 861; and drive motor 863 which rotatably drives pinion gear 862. Nozzle drive part 860 moves nozzle portion 820 forward and backward along guide rail 814.

[0132] Drive motor 863 is formed of a stepping motor, for example, and a rotation angle of drive motor 863 is controlled by a pulse signal. Further, due to the rotation of drive motor 863, flexible rack 861 is driven by way of pinion gear 862.

[0133] A gap is defined between an inner peripheral surface of holding portion 816 of support portion 810 and an outer peripheral surface of nozzle portion 820. Washing water jetted from nozzle portion 820 flows into the gap and washes an outer peripheral surface of nozzle portion 820.

[0134] Nozzle lid 801 is disposed on a front side of holding portion 816 in an openable and closeable manner, and is opened or closed in response to advancing and retracting of nozzle portion 820. By closing nozzle lid 801 in a state where nozzle portion 820 is stored, it is possible to prevent nozzle portion 820 from being contaminated by feces or the like.

[0135] On bottom side portion 811 of support portion 810, water supply joint 817 which connects a water supply tube (not shown in the drawing) connected to a washing water supply portion and connecting tube 802 provided for supplying washing water to flow regulating valve 870 from support portion 810 to each other is formed.

[0136] As shown in FIG. 23, nozzle portion 820 includes at least: rod-like nozzle body 830 which is molded by using a resin material such as ABS, for example; nozzle cover 840; connecting portion 850 and the like. Nozzle cover 840 is formed into a cylindrical shape, and covers

substantially whole nozzle body 830 (including the whole nozzle body 830). In connecting portion 850, nozzle body 830 covers nozzle cover 840.

[0137] As shown in FIG. 6, nozzle body 830 of nozzle portion 820 includes: buttock washing portion 831 for washing a private part; bidet washing portion 832 for washing a women's private part; nozzle cleaning portion 833 for cleaning nozzle portion 820 and the like.

[0138] As shown in FIG. 25 and FIG. 26, buttock washing portion 831 includes: buttock washing water jetting port 834 which is formed on a distal end portion of nozzle body 830 in an upwardly opening manner; and buttock washing water flow passage 835 which communicates with buttock washing water jetting port 834 from a rear end of nozzle body 830. Buttock washing water flow passage 835 is disposed on a lower portion side of nozzle body 830, and has a bent portion which is bent upward and is formed below buttock washing water jetting port 834. Straightening plate 835a which straightens the flow of washing water is disposed on the bent portion. With such a configuration, washing water jetted from buttock washing water jetting port 834 is jetted upward through jetting opening 844 formed in nozzle cover 840.

[0139] As shown in FIG. 27 and FIG. 28, bidet washing portion 832 includes: bidet washing water jetting port 836 which is disposed behind buttock washing water jetting port 834; and bidet washing water flow passage 837 which communicates with bidet washing water jetting port 836 from a rear end of nozzle body 830. Washing water jetted from bidet washing water jetting port 836 is jetted upward through jetting port 844 formed in nozzle cover 840.

[0140] As shown in FIG. 29, nozzle cleaning portion 833 includes: nozzle cleaning jetting port 838 disposed on a side surface of nozzle body 830; and nozzle cleaning flow passage 839 which communicates with nozzle cleaning jetting port 838 from the rear end of nozzle body 830. Washing water jetted from nozzle cleaning jetting port 838 is jetted to the inside of nozzle cover 840, and is discharged to the outside of nozzle cover 840 from water discharge port 845 of nozzle cover 840. Washing water jetted from nozzle cleaning jetting port 838 is used for cleaning nozzle portion 820 and the surrounding of nozzle portion 820.

[0141] A front side of nozzle portion 820 is supported in a state where the front side of nozzle portion 820 is inserted into holding portion 816 of support portion 810, and a rear portion of nozzle portion 820 is disposed in a slidable manner in a state where the rear portion of nozzle portion 820 is suspended from guide rail 814. Nozzle portion 820 is configured to move frontward and backward among a storage position shown in FIG. 18 where nozzle portion 820 is stored in an area behind holding portion 816, a buttock washing position shown in FIG. 25 where nozzle portion 820 projects from holding portion 816, and a bidet washing position shown in FIG. 27.

[0142] Nozzle cover 840 includes nozzle cover body 841 and connecting member 842. Nozzle cover body 841

is formed by forming a stainless thin plate into a circular cylindrical shape, for example. A distal end surface of nozzle cover body 841 is formed into a closed surface, and a rear end surface of nozzle cover body 841 is formed into an opened surface. Connecting member 842 is molded by using a resin material such as ABS, for example, and is formed into an approximately circular cylindrical shape (including a circular cylindrical shape). Connecting piece 843 which engages with nozzle body 830 is formed on both side portions of connecting member 842.

[0143] A nozzle cover stopper (not shown in the drawing) for restricting a slide range of nozzle cover 840 is integrally formed on a right rear end of connecting member 842. Further, the nozzle cover stopper is configured such that the slide range of nozzle cover 840 is restricted by bringing the nozzle cover stopper into contact with a front stopper receiving portion (not shown in the drawing) and a rear stopper receiving portion (not shown in the drawing) formed on support portion 810.

[0144] A portion of connecting member 842 is fixed to and integrally formed with nozzle cover body 841 in a state where the portion of connecting member 842 is inserted into the inside of nozzle cover body 841 from an opening formed in a rear end of nozzle cover body 841.

[0145] Single jetting opening 844 which can face buttock washing water jetting port 834 and bidet washing water jetting port 836 of nozzle body 830 is formed on a front upper surface of nozzle cover body 841. Water discharge port 845 through which washing water flowing out to the inside of nozzle cover body 841 is discharged to the outside is formed in a front lower surface of nozzle cover body 841.

[0146] An inner diameter of nozzle cover 840 has a size slightly larger than an outer diameter of nozzle body 830. With such a configuration, nozzle body 830 and nozzle cover 840 are configured to be smoothly slidable relative to each other in a state where nozzle body 830 is inserted into nozzle cover 840.

[0147] Flow regulating valve 870 is mounted on a rear end surface of nozzle body 830. A water supply port (not shown in the drawing) for supplying washing water to flow regulating valve 870 is formed in an outer surface of flow regulating valve 870, and the water supply port is joined to and communicates with water supply joint 817 mounted on support portion 810 by means of connecting tube 802.

[0148] Hereinafter, connecting portion 850 of this exemplary embodiment which is formed of connecting member 842 of nozzle cover 840 and connection receiving portion 851 of nozzle body 830 is described with reference to FIG. 24 and FIG. 30.

[0149] As shown in FIG. 24 and FIG. 30, connection receiving portion 851 is formed on a right side of an outer periphery of a rear end portion of nozzle body 830. Two grooves having an approximately V-shape (including a V-shape) which constitute front recessed portion 851a and rear recessed portion 851b respectively are formed on a front side and a rear side of connection receiving

portion 851. Front recessed portion 851a and rear recessed portion 851b are disposed in a spaced-apart manner from each other in a longitudinal direction of nozzle body 830. A distance between front recessed portion 851a and rear recessed portion 851b is set equal to a distance between buttock washing water jetting port 834 and bidet washing water jetting port 836.

[0150] On the other hand, connecting member 842 of nozzle cover 840 is molded by using a resin material such as ABS and POM, for example, and is formed into an approximately circular cylindrical shape (including a circular cylindrical shape). Connecting piece 843 which projects rearward is formed on both side portions of a rear portion of connecting member 842. Approximately V-shaped (including a V-shaped) connecting projection 843a which projects inward is formed on a rear end portion of connecting piece 843.

[0151] When nozzle body 830 is inserted into nozzle cover 840, connecting projection 843a of connecting member 842 of nozzle cover 840 is always brought into pressure contact with connection receiving portion 851 of nozzle body 830 due to resiliency of connecting member 842. In such a state, when connecting projection 843a is made to engage with front recessed portion 851a or rear recessed portion 851b, nozzle body 830 and nozzle cover 840 are brought into a mutually connected state. With such a configuration, nozzle cover 840 is movable by being towed by nozzle body 830.

[0152] In a state where connecting projection 843a enters front recessed portion 851a as shown in FIG. 24, bidet washing water jetting port 836 of nozzle body 830 and jetting opening 844 of nozzle cover 840 face each other as shown in FIG. 28. On the other hand, as shown in FIG. 30, in a state where connecting projection 843a enters rear recessed portion 851b, buttock washing water jetting port 834 and jetting opening 844 face each other as shown in FIG. 21 and FIG. 26. With such a configuration, washing water can be jetted from a predetermined jetting port.

<7> Configuration of flow regulating valve

[0153] Firstly, the configuration of the flow regulating valve of the sanitary washing device of this exemplary embodiment is described by reference to FIG. 31 and FIG. 32.

[0154] FIG. 31 is a plan view of a fixed disc of the flow regulating valve. FIG. 32 is a plan view of a movable disc of the flow regulating valve.

[0155] As shown in FIG. 24 and FIG. 30, flow regulating valve 870 is fixed to casing 872 which is integrally formed with nozzle body 830, and includes at least fixed disc 873, movable disc 874, stepping motor 875 and the like. Fixed disc 873 includes ports communicating with respective washing water flow passages of nozzle body 830. Movable disc 874 switches the port through which washing water is supplied. Stepping motor 875 rotatably drives movable disc 874.

[0156] As shown in FIG. 31, fixed disc 873 includes at least stop port 876, nozzle cleaning port 877, buttock washing port 878, and bidet washing port 879. Stop port 876 is a port for stopping supply of washing water. Nozzle cleaning port 877 is a port for supplying washing water to nozzle cleaning flow passage 839. Buttock washing port 878 is a port for supplying washing water to buttock washing water flow passage 835. Bidet washing port 879 is a port for supplying washing water to bidet washing water flow passage 837.

[0157] Further, stop port 876 is formed of a flat surface which closes the flow passage. Nozzle cleaning port 877 is formed of a through hole having an approximately trapezoidal shape (including a trapezoidal shape).

[0158] Buttock washing port 878 is formed into a circular arcuate shape having a wide width as a whole. Buttock washing port 878 includes water passing portion 878a which penetrates fixed disc 873 and forms a portion of buttock washing port 878, and throttle portion 878b which is formed in a recessed manner without penetrating fixed disc 873 and forms a portion of the buttock washing port 878. Throttle portion 878b is formed on a side adjacent to nozzle cleaning port 877. Throttle portion 878b is provided for suppressing an amount of washing water which passes through buttock washing port 878.

[0159] Bidet washing port 879 includes, in the same manner as buttock washing port 878, water passing portion 879a and throttle portion 879b.

[0160] On the other hand, as shown in FIG. 32, water through hole 874a is formed in movable disc 874 in a penetrating manner in an approximately trapezoidal shape (including a trapezoidal shape). Further, bearing hole 874b into which a rotary shaft of stepping motor 875 is inserted is formed at the center of movable disc 874.

[0161] In an assembled state of flow regulating valve 870, fixed disc 873 and movable disc 874 are configured to be rotatable in a close contact state. Further, movable disc 874 is rotated by a predetermined angle and is stopped at a rotated position by driving stepping motor 875.

[0162] Hereinafter, the manner of operation of the flow regulating valve of this exemplary embodiment is described by reference to FIG. 33.

[0163] FIG. 33 is a schematic view showing the relative positional relationship between fixed disc 873 and movable disc 874 for respective operation states of flow regulating valve 870. On a left side column and a center column in FIG. 33, the individual arrangement states of fixed disc 873 and movable disc 874 in respective operation states are shown respectively. On a right side column in FIG. 33, the relative positions of fixed disc 873 and movable disc 874 in a set state are shown.

[0164] Firstly, in a stopped state, water through hole 874a formed in movable disc 874 is arranged on stop port 876 formed on fixed disc 873. With such a configuration, water through hole 874a is brought into a closed state by stop port 876. As a result, a state is brought about where washing water is supplied to none of flow

passages of nozzle body 830.

[0165] Then, in a nozzle cleaning state, water through hole 874a formed in movable disc 874 is arranged on nozzle cleaning port 877 formed in fixed disc 873. With such a configuration, washing water passes through water through hole 874a and nozzle cleaning port 877 and is supplied to nozzle cleaning flow passage 839 of nozzle body 830.

[0166] Next, when an operation state is switched to a buttock washing state from the nozzle cleaning state, an operation state is shifted to the buttock washing state through a state taken in the course of switching shown in FIG. 33. Then, immediately after the switching operation is started, as can be understood from a set state taken in the course of switching shown in FIG. 33, water through hole 874a formed in movable disc 874 is arranged on both nozzle cleaning port 877 and throttle portion 878b of buttock washing port 878 in a straddling manner. In such a state, washing water is supplied to both flow passages, that is, nozzle cleaning flow passage 839 and buttock washing water flow passage 835 of nozzle body 830 in parallel. Accordingly, washing water is supplied through throttle portion 878b of buttock washing port 878. As a result, it is possible to suppress an extremely large change in an amount of washing water which flows through the whole flow regulating valve 870.

[0167] As shown in FIG. 33, after an operation state passes the state taken in the course of switching, movable disc 874 stops at a position where movable disc 874 faces water passing portion 878a formed in buttock washing port 878. Accordingly, washing water can be supplied only to buttock washing water flow passage 835 of nozzle body 830.

[0168] As described above, flow regulating valve 870 of this exemplary embodiment has a simultaneous supply function capable of supplying washing water to both nozzle cleaning flow passage 839 and buttock washing water flow passage 835 of nozzle body 830 simultaneously when an operation state is switched to the buttock washing state from the nozzle cleaning state. With such a configuration, there is no possibility that flow of washing water is stopped at the time of switching the operation state. Accordingly, it is possible to suppress a sudden change in a load applied to water pump 516 and heat exchanger 700. As a result, a temperature of washing water can be stably maintained. Further, it is possible to prevent the flow passage members such as water pump 516 and heat exchanger 700 from being damaged.

[0169] During a period where washing water is simultaneously supplied to both nozzle cleaning flow passage 839 and buttock washing water flow passage 835 of nozzle body 830, washing water which flows through buttock washing port 878 is supplied through throttle portion 878b. Accordingly, a flow rate of washing water at the time of switching an operation state can be made more stable. Therefore, it is possible to make a temperature of washing water stable and, at the same time, it is possible to prevent the flow passage members from being

damaged with more certainty.

[0170] Usually, inputting of electricity to flat-plate-shaped heater 702 of heat exchanger 700 is controlled such that a temperature of washing water becomes a fixed value. Accordingly, when a flow rate of washing water changes, a temperature of washing water also changes. That is, it is preferable that a flow rate of washing water be set to a fixed flow rate as much as possible also when a flow passage is switched from nozzle cleaning flow passage 839 to buttock washing water flow passage 835. In view of the above, by making a flow rate at the time of switching a flow passage stable as described above, it is possible to suppress a change in temperature of washing water in hot water state.

[0171] In controlling a drive duty ratio of water pump 516 to a fixed value, it is preferable that a pressure loss in nozzle cleaning flow passage 839 and a pressure loss in buttock washing water flow passage 835 be set substantially equal as much as possible. Alternatively, when a pressure loss in nozzle cleaning flow passage 839 and a pressure loss in buttock washing water flow passage 835 cannot be set substantially equal, it is preferable to adjust a duty ratio of water pump 516 in an interlocking manner with an operation of flow regulating valve 870 for switching a flow passage.

[0172] In the above-mentioned exemplary embodiment, although the description has been made by reference to FIG. 33 by taking the case where an operation state of sanitary washing device 100 is switched from a nozzle cleaning state to a buttock washing state as an example, substantially the same manner of operation of the flow regulating valve is applicable to a case where an operation state is switched from a nozzle cleaning state to a bidet washing state. That is, the flow regulating valve is configured such that firstly, water through hole 874a formed in movable disc 874 passes a state taken in the course of switching where water through hole 874a formed in movable disc 874 is arranged on both nozzle cleaning port 877 and throttle portion 879b of bidet washing port 879 in a straddling manner and, then, water through hole 874a of movable disc 874 stops at water passing portion 879a of bidet washing port 879. With such a configuration, the manner of operation and advantageous effects substantially equal to those acquired in buttock washing can be acquired.

<8> Control and manner of operation of washing part

[0173] Hereinafter, control and the manner of operation of the washing part of the sanitary washing device according to this exemplary embodiment are described.

[0174] Firstly, the basic manner of operation of washing part 500 is described by reference to FIG. 6 hereinafter.

[0175] Firstly, tap water which flows through the city water pipe is supplied to sanitary washing device 100 from water supply connecting port 510 as washing water. Then, water stop electromagnetic valve 514 is opened

so that washing water is supplied to sub tank 600. At this stage of operation, a flow rate of washing water which flows through the flow passage is maintained at a fixed value by constant flow regulating valve 513. Driving of water stop electromagnetic valve 514 is controlled by control part 130 based on an operation of remote controller 400 and an operation of operating part 210.

[0176] Next, washing water supplied into sub tank 600 is stored in sub tank 600 and, at the same time, is supplied to heat exchanger 700 and water pump 516. Further, by driving water pump 516, washing water is supplied to nozzle device 800 through flow regulating valve 870. Driving of water pump 516 is controlled by control part 130 based on an operation of remote controller 400 and an operation of operating part 210.

[0177] Next, control part 130 starts driving of water pump 516, and confirms the normal operation of water pump 516. Thereafter, control part 130 starts heating of washing water by supplying electricity to flat-plate-shaped heater 702 of heat exchanger 700. At this stage of operation, control part 130 controls the supply of electricity to flat-plate-shaped heater 702 based on information detected by inflow water temperature sensor 630 and outflow hot water temperature sensor 730. Further, control part 130 performs a control of maintaining a temperature of the washing water at a temperature set by hot water temperature switch 231 of operating part 210.

[0178] Next, control part 130 controls flow regulating valve 870 based on operation information of operating part 210 and operation information of remote controller 400. In response to such a control, flow regulating valve 870 selects the washing water flow passage by switching and supplies washing water to any one of buttock washing part 831, bidet washing part 832, and nozzle cleaning part 833 of nozzle device 800. With such an operation, washing water is jetted from one of buttock washing water jetting port 834, bidet washing water jetting port 836, and nozzle cleaning jetting port 838.

[0179] Hereinafter, description is made with respect to a control relating to sub tank 600, heat exchanger 700 and water pump 516 in this exemplary embodiment.

[0180] Firstly, the description is made with respect to a control of the washing part at an initial stage of the use of the sanitary washing device of this exemplary embodiment by reference to FIG. 34.

[0181] FIG. 34 is a timing chart of the washing part at the initial stage of the use of the sanitary washing device. FIG. 34 is a timing chart of respective functions of the washing part at the initial stage of the use of the sanitary washing device where washing water is not stored in the washing part such as a case where the sanitary washing device is used for the first time after the installation of the sanitary washing device or a case where the washing part is used again after a draining operation for preventing freezing of washing water is performed.

[0182] As shown in FIG. 34, at a point of time P1, the washing switch of operating part 210 or the washing switch of remote controller 400 (for example, buttock

washing switch 221 or buttock washing switch 410) is operated. With such an operation, control part 130 starts the supply of washing water by supplying electricity to water stop electromagnetic valve 514. Simultaneously, control part 130 starts driving of water level detection sensor 620. Driving of water level detection sensor 620 is continued to a point of time P14 where water level detection sensor 620 detects an upper limit water level at which sub tank 600 reaches a fully filled state after the post-washing is finished.

[0183] Next, when water level detection sensor 620 detects an upper limit water level at a point of time P2, control part 130 starts the measurement of time. Further, after a predetermined time elapses, that is, at a point of time P3, the supply of electricity to water stop electromagnetic valve 514 is stopped so that the supply of washing water is stopped.

[0184] In this exemplary embodiment, the supply of electricity is stopped after two seconds elapse from the detection of upper limit water level. The reason is as follows. At the point of time P2 where the upper limit water level is detected, basically, sub tank 600 and heat exchanger 700 reach a fully filled state. By further continuing the supply of washing water for two seconds, a water pressure can be increased so that the supply of washing water to water pump 516 and the removal of air in heat exchanger 700 can be performed with certainty. As a result, no-water heating of heat exchanger 700 can be prevented with certainty and hence, stability and durability of heat exchanger 700 can be ensured.

[0185] Next, control part 130 starts driving of water pump 516 at the point of time P3 where the supply of electricity to water stop electromagnetic valve 514 is stopped. Simultaneously, control part 130 operates flow regulating valve 870 so as to start the supply of washing water to buttock washing water flow passage 835 of nozzle portion 820. At this stage of operation, due to driving of water pump 516, a water level of washing water in sub tank 600 is lowered and, at a point of time P4, the detection of an upper limit water level by water level detection sensor 620 is canceled. Therefore, at the point of time P4, control part 130 starts driving of heat exchanger 700. That is, due to detection of lowering of the water level, it is confirmed that water pump 516 is normally operated. With such an operation, it is possible to prevent the abnormal temperature increase in heat exchanger 700 or the like.

[0186] Then, washing water supplied to buttock washing water flow passage 835 is jetted from buttock washing water jetting port 834. The jetted washing water passes through jetting opening 844 and hits and is reflected on an inner surface of holding portion 816 formed on a distal end of support portion 810. With such an operation, an outer surface of nozzle cover 840 is cleaned. In this exemplary embodiment, such a cleaning operation is referred to as "pre-washing" hereinafter. The pre-washing is continued to, for example, a point of time P5 which comes after two seconds elapses from a point of time

where hot water temperature of washing water in heat exchanger 700 reaches 25°C.

[0187] Next, when the pre-washing is finished at the point of time P5, control part 130 starts driving of nozzle drive part 860 of nozzle device 800 so that nozzle portion 820 is made to advance from an accommodated position to a buttock washing position. At this stage of operation, simultaneously with starting of driving of nozzle drive part 860, control part 130 switches flow regulating valve 870 so that the supply of washing water to nozzle cleaning flow passage 839 is started. Washing water supplied to nozzle cleaning flow passage 839 is jetted to the inside of nozzle cover 840 from nozzle cleaning jetting port 838. The jetted washing water flows out to the outside of nozzle cover 840 from water discharge port 845 after washing the inner surface of nozzle cover 840. During such an operation, nozzle portion 820 is heated by washing water. Due to such heating, it is possible to prevent a user from feeling discomfort due to jetting of cold water during buttock washing performed after such a nozzle cleaning operation.

[0188] Next, at a point of time P6 where nozzle portion 820 reaches the buttock washing position, control part 130 switches flow regulating valve 870 from nozzle cleaning flow passage 839 to buttock washing water flow passage 835 so that the supply of washing water to buttock washing water flow passage 835 is started. Then, due to the parallel supply function of flow regulating valve 870 described in <7> Configuration of flow regulating valve, in the course of switching of the flow passage from nozzle cleaning flow passage 839 to buttock washing water flow passage 835, washing water is simultaneously supplied to both nozzle cleaning flow passage 839 and buttock washing water flow passage 835. Accordingly, there is no possibility that the supply of washing water is interrupted in the course of switching the flow passage.

[0189] Washing water supplied to buttock washing water flow passage 835 is jetted from buttock washing water jetting port 834, and passes through jetting opening 844, and washes a private part of a user. Then, the buttock washing operation is continued to a point of time P11 where a washing stopping operation is performed.

[0190] In general, there exists a possibility that a phenomenon takes place where an overshoot or an undershoot occurs in the initial rise in temperature of hot water discharged from heat exchanger 700 depending on a control condition. To overcome this drawback, in this exemplary embodiment, the sanitary washing device is configured to control the washing part so as to prevent washing water of an unstable temperature from hitting a human body due to such a phenomenon particularly in an initial stage of the washing operation. To be more specific, washing water whose temperature at the time of starting the washing operation is unstable is discharged toward an area below the nozzle from nozzle cleaning jetting port 838 as drain water.

[0191] That is, in this exemplary embodiment, particularly, washing water is jetted into the inside of nozzle

cover 840 from nozzle cleaning jetting port 838 between the pre-washing where the outer surface of nozzle cover 840 is cleaned and an operation where nozzle portion 820 is extended to the buttock washing position from the accommodated position. With such an operation, washing water which is heated by the heat exchanger immediately after the supply of electricity to the heat exchanger and has an unstable discharge temperature is prevented from being jetted to a human body intentionally, and the washing water is discharged as washing water for cleaning nozzle portion 820. As a result, at the washing position, washing water jetted from the buttock washing water jetting port or the bidet washing water jetting port can be jetted with a stable hot water temperature from the beginning of the jetting in a state where washing water is sufficiently heated.

[0192] Control part 130 controls a temperature of washing water to a set temperature based on detection data of inflow water temperature sensor 630 and detection data of outflow hot water temperature sensor 730 during driving of heat exchanger 700.

[0193] As described above, water pump 516 and heat exchanger 700 are continuously driven from a point of time where "pre-washing" is started to a point of time where the buttock washing is finished. Further, washing water is supplied at a stable temperature during such driving.

[0194] Next, when the driving of water pump 516 is continued, a water level of washing water in sub tank 600 is lowered. Then, at a point of time P7 where water level detection sensor 620 detects a lower limit water level, control part 130 starts the supply of electricity to water stop electromagnetic valve 514. Thereafter, the supply of electricity is continued to a point of time P8 where water level detection sensor 620 detects an upper limit water level.

[0195] At the point of time P8 where the upper limit water level is detected, control part 130 stops the supply of electricity to water stop electromagnetic valve 514 and, at the same time, starts the measurement of time. Then, the control part 130 measures a time elapsed from the point of time P8 to a point of time P9 where water level detection sensor 620 detects a lower limit water level next time.

[0196] Next, at the point of time P9 where the lower limit water level is detected, control part 130 calculates a flow rate of washing water by arithmetic processing based on a measured elapsed time and an amount of water from an upper limit water level to a lower limit water level (65cc). When there is a difference between a flow rate which is set for every washing strength and a flow rate of jetted washing water at a point of time P10 where the calculation of the flow rate of washing water by arithmetic processing is finished, control part 130 adjusts an output of water pump 516 so as to correct the flow rate of washing water.

[0197] Next, at a point of time P11 where a washing stop operation is performed using operating part 210 or

remote controller 400, control part 130 stops the supply of electricity to water pump 516 and heat exchanger 700. Simultaneously, control part 130 drives nozzle drive part 860 of nozzle device 800 so as to retract nozzle portion 820 to the accommodated position from the buttock washing position.

[0198] Then, at a point of time P12 where nozzle portion 820 is retracted to the accommodated position, control part 130 stops driving of nozzle drive part 860 of nozzle device 800. Simultaneously, control part 130 drives water pump 516 and heat exchanger 700 again so as to start "post-washing" where nozzle portion 820 is cleaned. Then, at a point of time P13 where a predetermined time elapses from starting "post-washing", control part 130 stops driving of water pump 516 and heat exchanger 700. With such an operation, the "post-washing" is finished.

[0199] Next, at the point of time P13 where the post-washing of nozzle portion 820 is finished, control part 130 supplies electricity to water stop electromagnetic valve 514 again so that washing water is supplied to sub tank 600. Then, at a point of time P14 where the upper limit water level is detected, control part 130 stops the supply of electricity to water stop electromagnetic valve 514 so that a series of control for buttock washing is finished. With such an operation, sub tank 600 takes a fully filled state, and the washing part is brought into a standby state.

[0200] As has been described heretofore, a control of the washing part at the time of initial use of the sanitary washing device of this exemplary embodiment is performed.

[0201] Hereinafter, the description is made with respect to a control of the washing part at the time of normal use of the sanitary washing device of this exemplary embodiment by reference to FIG. 35.

[0202] FIG. 35 is a timing chart of the washing part at the time of normal use of the sanitary washing device. FIG. 35 is a timing chart of the sanitary washing device when a washing operation is performed with the sanitary washing device in a standby state which comes after the initial use performed previously.

[0203] That is, a control of the washing part at the time of normal use shown in FIG. 35 differs from the control of the washing part at the time of initial use shown in FIG. 34 with respect to a point where sub tank 600 is already in a fully filled state at a point of time P20 where the washing operation is performed and a point where control part 130 stores in a memory that the initial use of the sanitary washing device is already performed.

[0204] That is, as shown in FIG. 35, at the point of time P20, the washing switch of operating part 210 or remote controller 400 (for example, buttock washing switch 221 or 410) is operated in a standby state where sub tank 600 is in a fully filled state. With such an operation, control part 130 supplies electricity to water stop electromagnetic valve 514 so that the supply of washing water is started. Simultaneously, control part 130 starts the supply of electricity to heat exchanger 700 based on stored data that

a control of an initial operation has been already performed. Then, control part 130 starts the "pre-washing" operation of nozzle device 800 simultaneously with the supply of electricity to heat exchanger 700. Further, control part 130 starts driving of water level detection sensor 620 simultaneously with the supply of electricity to heat exchanger 700.

[0205] That is, the case of the initial use described by reference to FIG. 34 and the case of the normal use differ from each other with respect to a control from a point of time that the washing operation is performed to a point of time that the supply of electricity to heat exchanger 700 is started. However, both cases are substantially equal with respect to the control and the manner of operation after a point of time P5 where driving of nozzle device 800 is started and hence, the repeated description of the control and the manner of operation after the point of time P5 is omitted.

[0206] As described above, in the sanitary washing device of this exemplary embodiment, when the washing operation is performed, driving of the water pump and the heat exchanger is started in a state where the nozzle portion is at an accommodated position. Thereafter, the nozzle portion advances to the washing position and a private part washing operation is performed. During such a period, the water pump and the heat exchanger are continuously driven. Accordingly, it is possible to suppress lowering of a temperature of the nozzle portion and the washing water in the course of movement of the nozzle portion. Accordingly, washing water jetted from the buttock washing water jetting port or the bidet washing water jetting port can be jetted at the washing position from the beginning of the jetting in a state where washing water is sufficiently heated. As a result, it is possible to realize a sanitary washing device capable of performing comfortable washing.

[0207] In the sanitary washing device of this exemplary embodiment, at the time of switching the flow passage from the nozzle cleaning flow passage to the buttock washing water flow passage or the bidet washing water flow passage, washing water is simultaneously supplied to both the nozzle cleaning flow passage and the buttock washing water flow passage or the bidet washing water flow passage. Accordingly, there is no possibility that the flow of washing water is stopped at the time of switching the flow passage. Accordingly, it is possible to suppress a sudden change in a load applied to the water pump and the heat exchanger. As a result, a temperature of washing water can be maintained at a stable temperature. Further, it is possible to prevent the flow passage members such as the water pump and the heat exchanger from being damaged.

[0208] Further, during a period where washing water is simultaneously supplied to both the nozzle cleaning flow passage and the buttock washing water flow passage or the bidet washing water flow passage, washing water which flows through the buttock washing port is supplied through the throttle portion. Accordingly, a flow

rate of washing water at the time of switching the flow passage can be made more stable. As a result, it is possible to make a temperature of washing water stable and, at the same time, it is possible to prevent the flow passage members from being damaged with more certainty.

[0209] Further, in the sanitary washing device of this exemplary embodiment, a change in water level is detected by the water level detection sensor mounted on the sub tank and a flow rate of washing water is detected by an arithmetic operation. With such an operation, it is unnecessary to provide a specific-use flow rate sensor for detecting a flow rate to the washing part additionally. As a result, the configuration of the washing part can be simplified thus realizing the reduction of cost.

[0210] In the sanitary washing device of this exemplary embodiment, a threshold value for determining a change in output voltage between the electrodes in the water level detection is corrected based on a temperature of washing water. With such an operation, it is possible to increase accuracy of water level detection and accuracy of flow rate detection so that water which differs from each other in electrical conductivity in a wide range can be used as washing water for the sanitary washing device. As a result, a range of application and usability of the sanitary washing device can be further enhanced.

[0211] Further, in the sanitary washing device of this exemplary embodiment, at the time of initial use of the sanitary washing device, a fully filled state of the sub tank is detected and, thereafter, the supply of water is continued for a predetermined time. Simultaneously, after driving the water pump, the supply of electricity to the heat exchanger is started after the detection of the upper limit water level by the water level detection sensor is canceled. With such an operation, it is possible to prevent no-water heating of the heat exchanger. Accordingly, the configuration of this exemplary embodiment can be simplified compared to the conventionally-adopted configuration which prevents no-water heating using a flow rate sensor. With such a configuration, it is possible to realize the sanitary washing device having high safety and reliability at a low cost.

[0212] In this exemplary embodiment, the description has been made by taking the configuration where the nozzle portion is provided with three jetting ports, that is, the buttock washing water jetting port, the bidet washing water jetting port, and the nozzle cleaning water jetting port as an example. However, the present invention is not limited to such a configuration. For example, the nozzle portion may be provided with four or more jetting ports or two or less jetting ports. With such a configuration, a nozzle portion provided with many washing functions or a nozzle portion provide with a specific-use washing function also can acquire substantially the same advantageous effects. In this case, it is sufficient for a nozzle portion to have flow passages respectively communicating with jetting ports corresponding to the respective functions.

[0213] In this exemplary embodiment, the description

has been made by taking the configuration where the nozzle portion is provided with flow passages respectively communicating with the buttock washing water jetting port, the bidet washing water jetting port, and the nozzle cleaning water jetting port such that one flow passage communicates with one water jetting port as an example. However, the present invention is not limited to such a configuration. For example, a configuration may be provided where a plurality of flow passages communicate with one jetting port. With such a configuration, it is possible to change a mode of jetting washing water so that a washing effect can be enhanced. To be more specific, a configuration may be adopted where two flow passages, that is, a direct jetting flow passage and a swirling flow passage communicate with the buttock washing water jetting port.

[0214] In this exemplary embodiment, the description has been made by taking the configuration where the flow regulating valve is provided with the stop port, the buttock washing port corresponding to the buttock washing water flow passage, the bidet washing port corresponding to the bidet washing water flow passage, and the nozzle cleaning port corresponding to the nozzle cleaning flow passage as an example. However, the present invention is not limited to such a configuration. For example, when the number of flow passages is different from the number of ports as described above, a configuration may be adopted where ports are provided corresponding to flow passages respectively. With such a configuration, the flow regulating valve can properly cope with functions which the nozzle portion has.

[0215] Further, in this exemplary embodiment, the description has been made by taking the configuration where one throttle portion is provided to each of the buttock washing port and the bidet washing port of the flow regulating valve as an example. However, the present invention is not limited to such a configuration. For example, a configuration may be adopted where a throttle portion is provided to only one port or to all ports. Further, a configuration may be adopted where two throttle portions are provided to one port instead of the configuration where one throttle portion is provided to one port. With such configurations, an optimum advantageous effect can be acquired in conformity with a characteristic of a member which constitutes the washing part. To be more specific, a configuration may be adopted where two throttle portions are provided to the nozzle cleaning port.

[0216] As has been described heretofore, the sanitary washing device of the present invention includes: the plurality of jetting ports for jetting washing water; the nozzle portion provided with the plurality of flow passages communicating with the jetting ports; the nozzle drive part which is configured to advance and retract the nozzle portion between the accommodated position and the plurality of washing positions; the flow regulating valve for selectively supplying washing water to the plurality of flow passages; the water pump which is configured to supply washing water to the nozzle portion; the heat exchanger

arranged upstream of the water pump and heating washing water; the operating part; and the control part. The plurality of flow passages include at least: the buttock washing water flow passage communicating with the buttock washing water jetting port; the bidet washing water flow passage communicating with the bidet washing water jetting port; and the nozzle cleaning flow passage communicating with the nozzle cleaning water jetting port. When a washing operation, that is, one of the buttock washing and the bidet washing is performed by the operating part, the control part drives the water pump and the heat exchanger and, at the same time, switches the flow passages such that one of the buttock washing water flow passage and the bidet washing water flow passage is selected by the flow regulating valve, and hot water heated by the heat exchanger is supplied to the selected flow passage for a predetermined time. Then, after a predetermined time elapses, the selection of the flow passage by the flow regulating valve is switched to the nozzle cleaning flow passage and, at the same time, the nozzle drive part is driven so as to advance the nozzle portion to one of the plurality of washing positions from an accommodated position. Further, the control part may be configured to switch the flow passage to one of the buttock washing water flow passage and the bidet washing water flow passage corresponding to a washing operation selected by the operating part by the flow regulating valve at a point of time that the nozzle portion reaches the one of the plurality of washing positions.

[0217] With such a configuration, firstly, when the washing operation is performed, driving of the water pump and the heat exchanger is started in a state where the nozzle portion is at an accommodated position. Then, during a period where the nozzle portion advances to the washing position and a private part washing operation is performed, the water pump and the heat exchanger are continuously driven. Accordingly, it is possible to suppress lowering of a temperature of the nozzle portion and the washing water in the course of movement of the nozzle portion. Simultaneously, washing water which is heated in the heat exchanger immediately after the supply of electricity to the heat exchanger and has an unstable discharge temperature is prevented from being jetted to a human body intentionally, and the washing water is discharged as washing water for cleaning the nozzle portion. Accordingly, at the washing position, washing water jetted from the buttock washing water jetting port or the bidet washing water jetting port can be jetted with a stable hot water temperature from the beginning of the jetting in a state where washing water is sufficiently heated. As a result, it is possible to realize a sanitary washing device capable of performing comfortable washing.

[0218] The flow regulating valve of the sanitary washing device of the present invention may have a simultaneous supply function of supplying washing water to both the nozzle cleaning flow passage and the buttock washing water flow passage or the bidet washing water flow passage simultaneously in the course of switching oper-

ation between the nozzle cleaning flow passage and the buttock washing water flow passage or the bidet washing water flow passage.

[0219] With such a configuration, it is possible to alleviate a change in a flow passage resistance at the time of switching the flow passage. Accordingly, it is possible to smoothly perform the switching of the flow passage by preventing a load from being inadvertently applied to the water pump and the heat exchanger which are continuously driven. As a result, the sanitary washing device can perform heating and supply of washing water in a stable manner.

[0220] The flow regulating valve of the sanitary washing device of the present invention includes at least the buttock washing port for supplying washing water to the buttock washing water flow passage, the bidet washing port for supplying washing water to the bidet washing water flow passage, the nozzle cleaning port for supplying washing water to the nozzle cleaning flow passage, and the stop port for stopping the supply of washing water. Further, at least one of the buttock washing port, the bidet washing port, and the nozzle cleaning port may have a throttle portion which suppresses a flow rate of washing water to be supplied.

[0221] With such a configuration, it is possible to alleviate a change in a flow passage resistance of the flow regulating valve at the time of switching the port. Accordingly, it is possible to make a flow rate of washing water at the time of switching the port more stable. Accordingly, a temperature of washing water can be made stable and, at the same time, it is possible to prevent the flow passage member from being damaged with more certainty.

INDUSTRIAL APPLICABILITY

[0222] According to the present invention, washing water of a set temperature can be jetted immediately after starting of washing and hence, the present invention is also applicable to usage for washing apparatus provided with another heat exchanger besides the sanitary washing device.

REFERENCE MARKS IN THE DRAWINGS

[0223]

100 sanitary washing device
110 toilet bowl
120 deodorizing device
130 control part
200 body
201 rear body case
210 operating part
211 infrared-ray receiver
220 operation switch
221 buttock washing switch
222 nozzle cleaning switch
230 setting switch

231
232
233
234
5 235

240
300
320
10 360

400
401
402
15 410
411
412
413
414
20 415
416
417
418
419
25 421
422
450
500
501
30 501a
501b
502
510
511
35 512
513
514
515
516
40 516a
516b
516c
516d
516e
45 600
601
602
603
610
50 611
612
613
613a
614
55 615
615a
616
617

hot water temperature switch
toilet seat temperature switch
8-hour warming stop switch
power saving switch
toilet lid automatically opening/closing switch
display lamp
toilet seat
toilet lid
toilet seat and toilet lid rotating mechanism
remote controller
remote controller body
transmitting part
buttock washing switch
bidet washing switch
stop switch
move washing switch
rhythm washing switch
washing strength switch
washing position switch
nozzle sterilizing switch
toilet lid switch
toilet seat switch
strength display lamp
position display lamp
human body detection sensor
washing part
chassis
water pump mounting portion
leg portion
connecting tube
water supply connecting port
strainer
check valve
constant flow regulating valve
water stop electromagnetic valve
relief valve
water pump
motor part
link mechanism part
piston part
water suction port
water discharge port
sub tank
water inflow port
water outflow port
atmosphere open port
tank body
front tank
rear tank
atmosphere open portion
buffer portion
partition wall
water inflow tank
upper surface opening portion
storage tank
barrier wall

618	flow straightening rib	850	connecting portion
620	water level detection sensor	851	connection receiving portion
621	common electrode	851a	front recessed portion
622	water level electrode	851b	rear recessed portion
623	upper limit electrode	5 860	nozzle drive part
624	lower limit electrode	861	flexible rack
700	heat exchanger	862	pinion gear
701, 872	casing	863	drive motor
702	flat-plate-shaped heater	870	flow regulating valve
703	hot water outflow member	10 873	fixed disc
710	front surface member	874	movable disc
711	water inflow port	874b	bearing hole
712	hot water outflow port	875	stepping motor
713	water inflow passage	876	stop port
714	slit	15 877	nozzle cleaning port
715	heating flow passage	878	buttock washing port
716	partition rib	878a, 879a	water passing portion
717, 874a	water through hole	878b, 879b	throttle portion
718	projection	879	bidet washing port
720	back surface member	20 900	washing water supply passage
730	outflow hot water temperature sensor		
731	excessively elevated temperature sensor		
750	buffer tank		
800	nozzle device		
801	nozzle lid	25	1. A sanitary washing device comprising:
802	connecting tube		
810	support portion		
811	bottom side portion		
812	inclined portion		
813	vertical side portion	30	a plurality of jetting ports for jetting washing water;
814	guide rail		
815	rack guide		
816	holding portion		
817	water supply joint		
820	nozzle portion	35	a nozzle portion provided with a plurality of flow passages communicating with the jetting ports;
830	nozzle body		
831	buttock washing part		
832	bidet washing part		
833	nozzle cleaning part		
834	buttock washing water jetting port (jetting port)	40	a nozzle drive part configured to advance and retract the nozzle portion between an accommodated position and a plurality of washing positions;
835	buttock washing water flow passage (flow passage)		
835a	straightening plate		
836	bidet washing water jetting port (jetting port)	45	a flow regulating valve for selectively supplying washing water to the plurality of flow passages;
837	bidet washing water flow passage (flow passage)		
838	nozzle cleaning jetting port (jetting port)		
839	nozzle cleaning flow passage (flow passage)	50	a water pump configured to supply washing water to the nozzle portion;
840	nozzle cover		
841	nozzle cover body		
842	connecting member		
843	connecting piece	55	a heat exchanger arranged upstream of the water pump and heating washing water;
843a	connecting projection		
844	jetting opening		
845	water discharge port		

[0224] The invention is comprised by the following embodiments:

1. A sanitary washing device comprising:

a plurality of jetting ports for jetting washing water;

a nozzle portion provided with a plurality of flow passages communicating with the jetting ports;

a nozzle drive part configured to advance and retract the nozzle portion between an accommodated position and a plurality of washing positions;

a flow regulating valve for selectively supplying washing water to the plurality of flow passages;

a water pump configured to supply washing water to the nozzle portion;

a heat exchanger arranged upstream of the water pump and heating washing water;

an operating part; and

a control part, wherein

the plurality of flow passages include at least: a buttock washing water flow passage communicating with a buttock washing water jetting port;

a bidet washing water flow passage communicating with a bidet washing water jetting port;

and a nozzle cleaning flow passage communicating with a nozzle cleaning water jetting port,

the control part is configured, when a washing operation which is one of buttock washing and bidet washing is performed by the operating part, to drive the water pump and the heat exchanger and, at the same time, to switch the flow passages such that one of the buttock washing water flow passage and the bidet washing water flow passage is selected by the flow regulating valve, and

the control part is configured to supply hot water heated by the heat exchanger to the selected flow passage for a predetermined time, the control part is configured, after the predetermined time elapses, to switch the selection of the flow passage by the flow regulating valve to the nozzle cleaning flow passage, and to drive the nozzle drive part so as to advance the nozzle portion to one of the plurality of washing positions from the accommodated position, and the control part is configured, at a point of time that the nozzle portion reaches the one of the plurality of washing positions, to switch the flow passage to one of the buttock washing water flow passage and the bidet washing water flow passage corresponding to a washing operation selected by the operating part using the flow regulating valve.

2. The sanitary washing device according to embodiment 1, wherein the flow regulating valve has a simultaneous supply function of supplying washing water to both the nozzle cleaning flow passage and the buttock washing water flow passage or the bidet washing water flow passage simultaneously in a course of switching operation between the nozzle cleaning flow passage and the buttock washing water flow passage or the bidet washing water flow passage.

3. The sanitary washing device according to any one of embodiments 1 and 2, wherein the flow regulating valve includes at least : a buttock washing port for supplying washing water to the buttock washing water flow passage;

a bidet washing port for supplying washing water to the bidet washing water flow passage;

a nozzle cleaning port for supplying washing water to the nozzle cleaning flow passage; and a stop port for stopping the supply of washing water, and

at least one of the buttock washing port, the bidet washing port, and the nozzle cleaning port has a throttle portion configured to suppress a flow rate of washing water to be supplied.

Claims

1. A sanitary washing device comprising:

a nozzle body (830) having a plurality of jetting ports (834, 836, 838) for jetting washing water and a plurality of flow passages (835, 837, 839) communicating with the plurality of jetting ports (834, 836, 838);

a nozzle portion (820) having a nozzle cover (840) which covers the nozzle body (830);

a nozzle drive part (860) configured to move the

nozzle portion (820) in an advancing and retracting manner between an accommodating position and a washing position;

a flow regulating valve (870) for selectively supplying washing water to the plurality of flow passages (835, 837, 839);

a water pump (516) configured to supply washing water to the nozzle portion (820);

a heat exchanger (700) for heating washing water;

an operating part (210); and

a control part (130), wherein

the plurality of jetting ports (834, 836, 838) include at least a jetting port (834) for jetting washing water for washing a private part, and a jetting port (838) for jetting washing water for cleaning an inner surface of the nozzle cover (840), and the sanitary washing device is configured in such a manner that when a start of washing of a private part is operated by the operating part (210), the washing water is heated by driving the heat exchanger (700), and until the nozzle portion (820) reaches the washing position from the accommodating position, the washing water is made to flow to the jetting port (834) for performing washing of the private part, and thereafter, the washing water is jetted to a surface of the nozzle cover (840) and, thereafter, the washing water is jetted to the inner surface of the nozzle cover (840) so as to heat the inner surface and an outer surface of the nozzle cover (840) by hot water while cleaning the inner surface and the outer surface of the nozzle cover (840) and when the nozzle portion (820) reaches the washing position, the washing water is jetted so as to perform washing of the private part.

2. The sanitary washing device according to claim 1, wherein

the jetting port (838) for jetting the washing water for cleaning the nozzle is provided inside the nozzle cover (840), and

the hot water is made to flow in the flow passage for cleaning the inner surface of the nozzle cover (840) during a period that the nozzle portion is driven from the accommodating position to the washing position.

3. The sanitary washing device according to claim 1 or 2, wherein

a grip portion is disposed on a periphery of the nozzle cover (840) so as to face the jetting port of the nozzle cover (840) in a state where the nozzle portion (820) is at the accommodating position,

the control part (130) controls the flow regulating valve (870) in such a manner that when the washing water is jetted from the jetting port (834) for washing the private part, the washing water is jetted between the grip portion and the surface of the nozzle cover

(840), and at the time of starting washing, the outer surface of the nozzle cover (840) is cleaned when the nozzle portion (820) is at the accommodating position, and the inner surface of the nozzle cover (840) is cleaned during the nozzle portion (820) is driven. 5

4. The sanitary washing device according to claims 1 to 3, wherein the flow regulating valve (870) is configured to simultaneously supply the washing water to a flow passage through which the washing water for cleaning the nozzle flows and a flow passage through which the washing water for washing the private part flows, and the water pump (516) and the heat exchanger (700) are continuously driven during a period that the nozzle portion (820) is driven from the accommodating position to the cleaning position. 10 15

20

25

30

35

40

45

50

55

FIG. 1

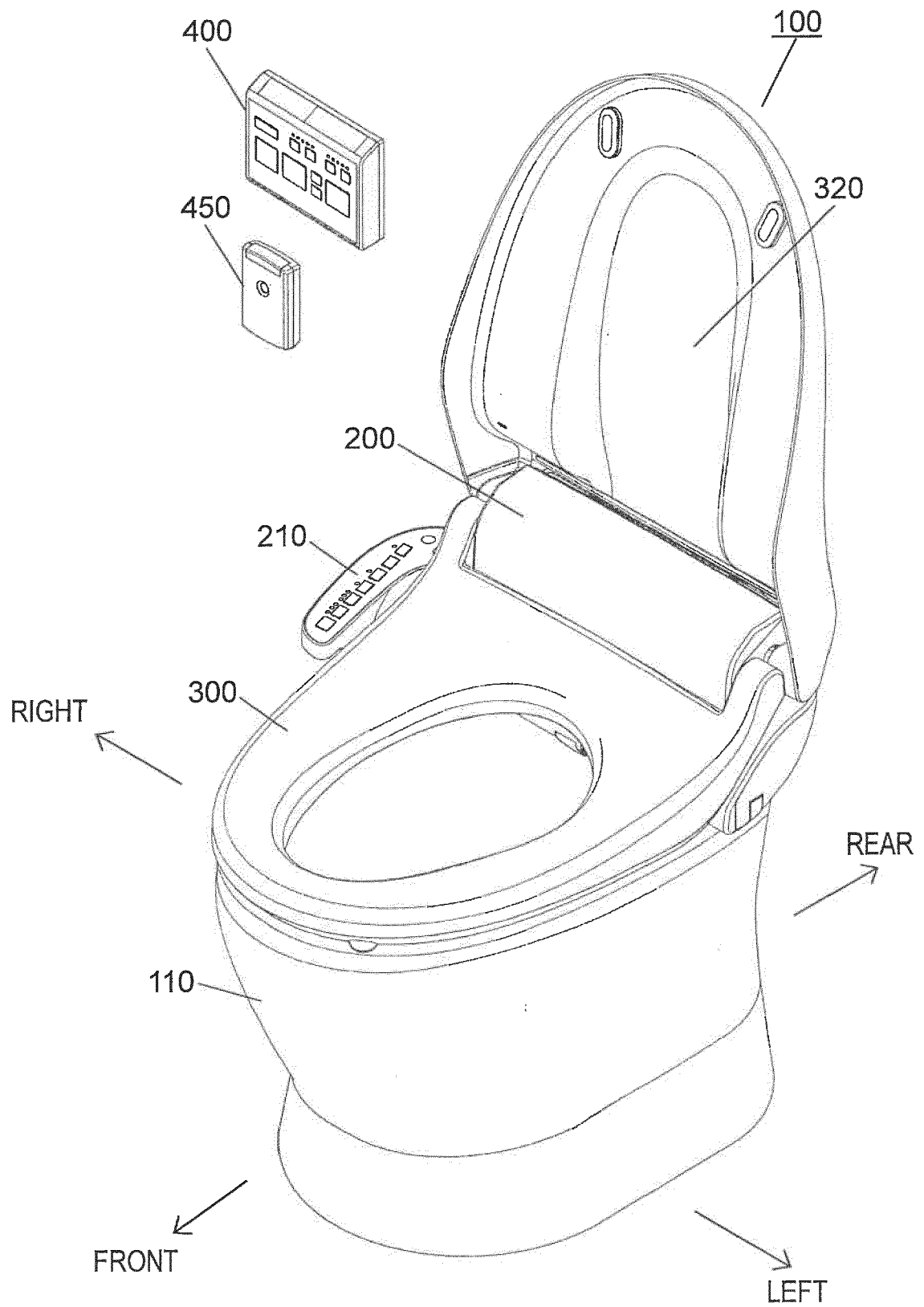


FIG. 2

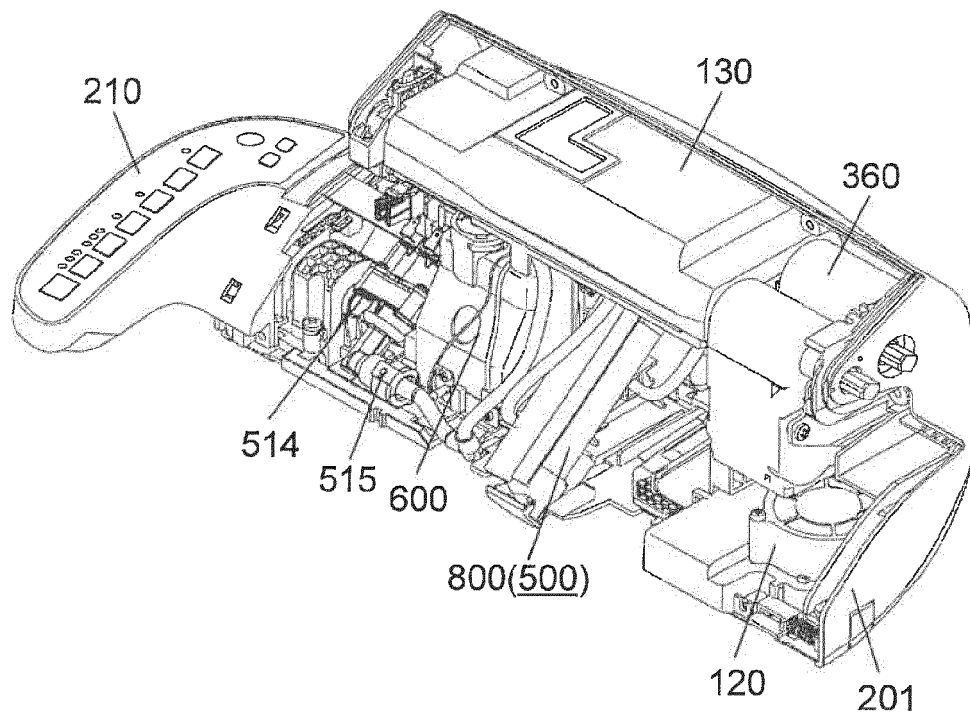


FIG. 3

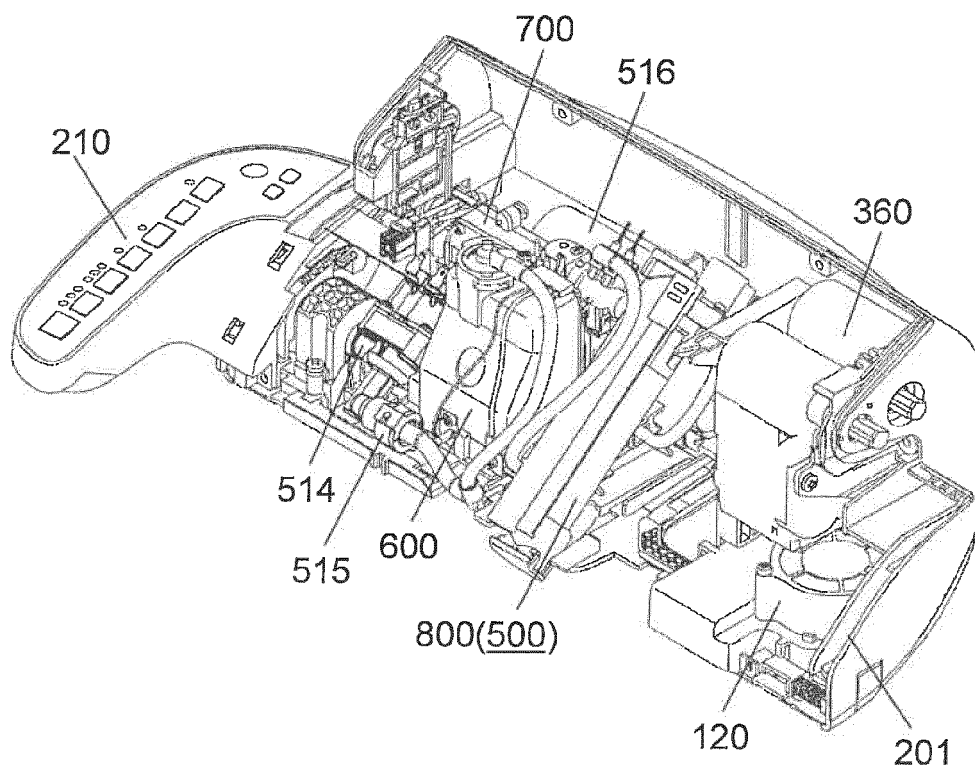


FIG. 4

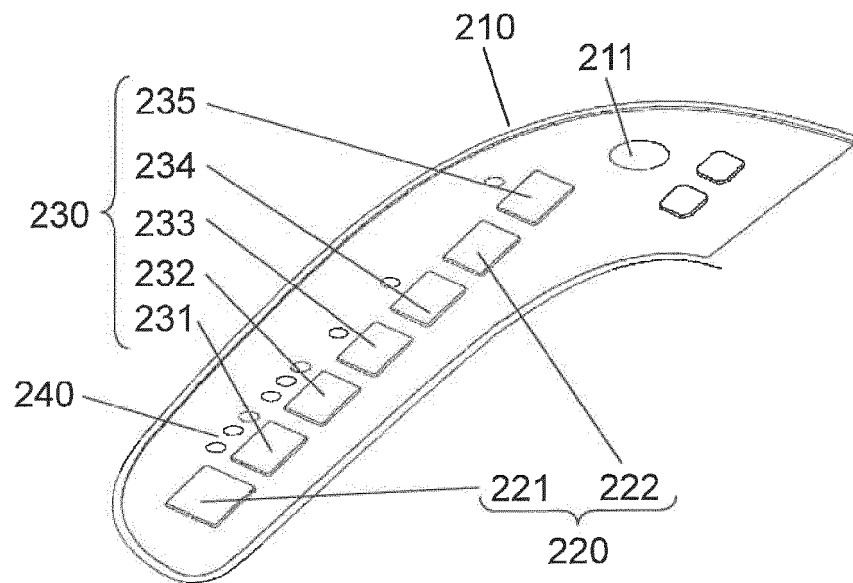


FIG. 5

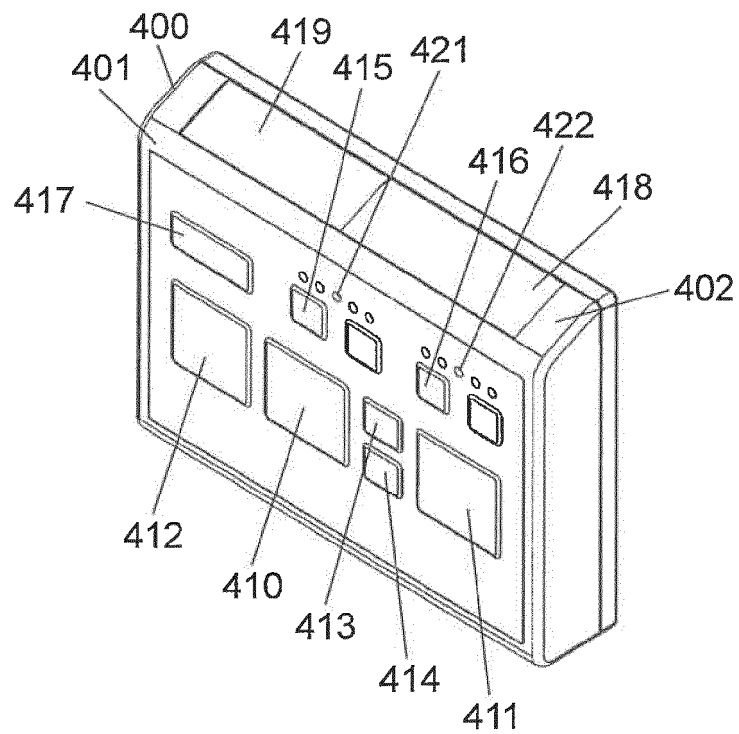


FIG. 6

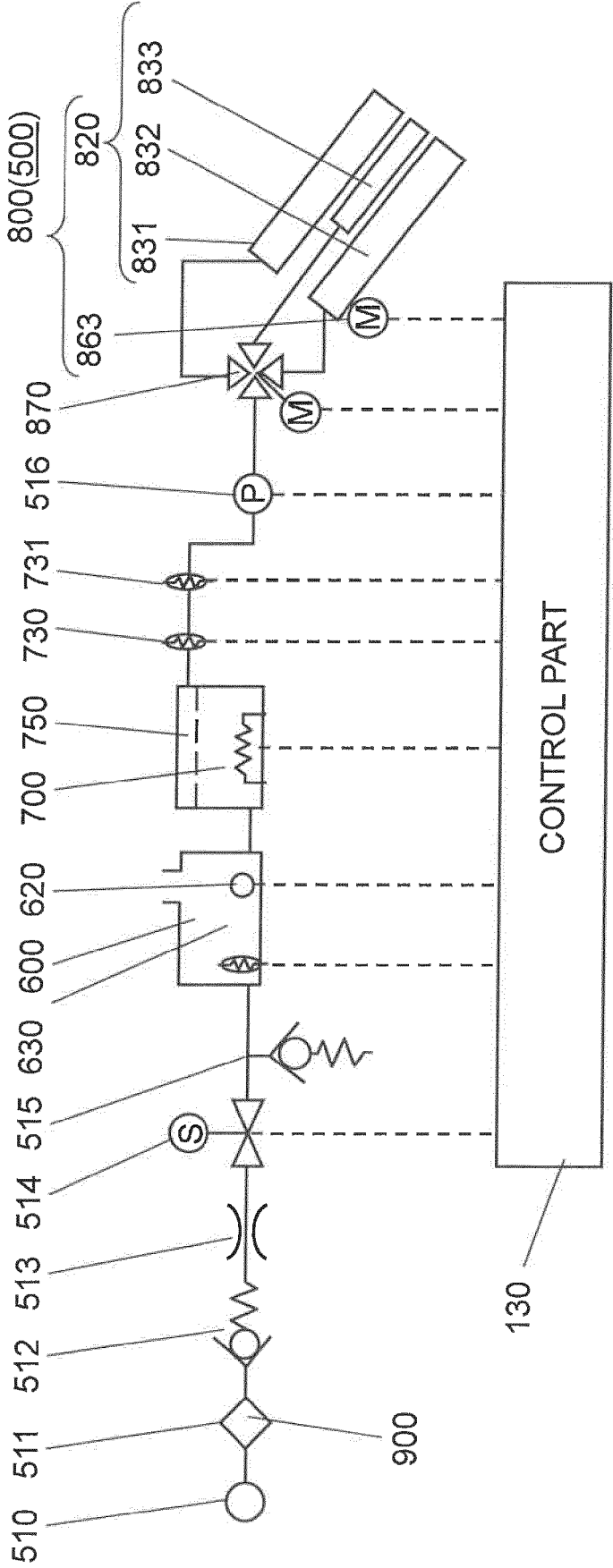


FIG. 7

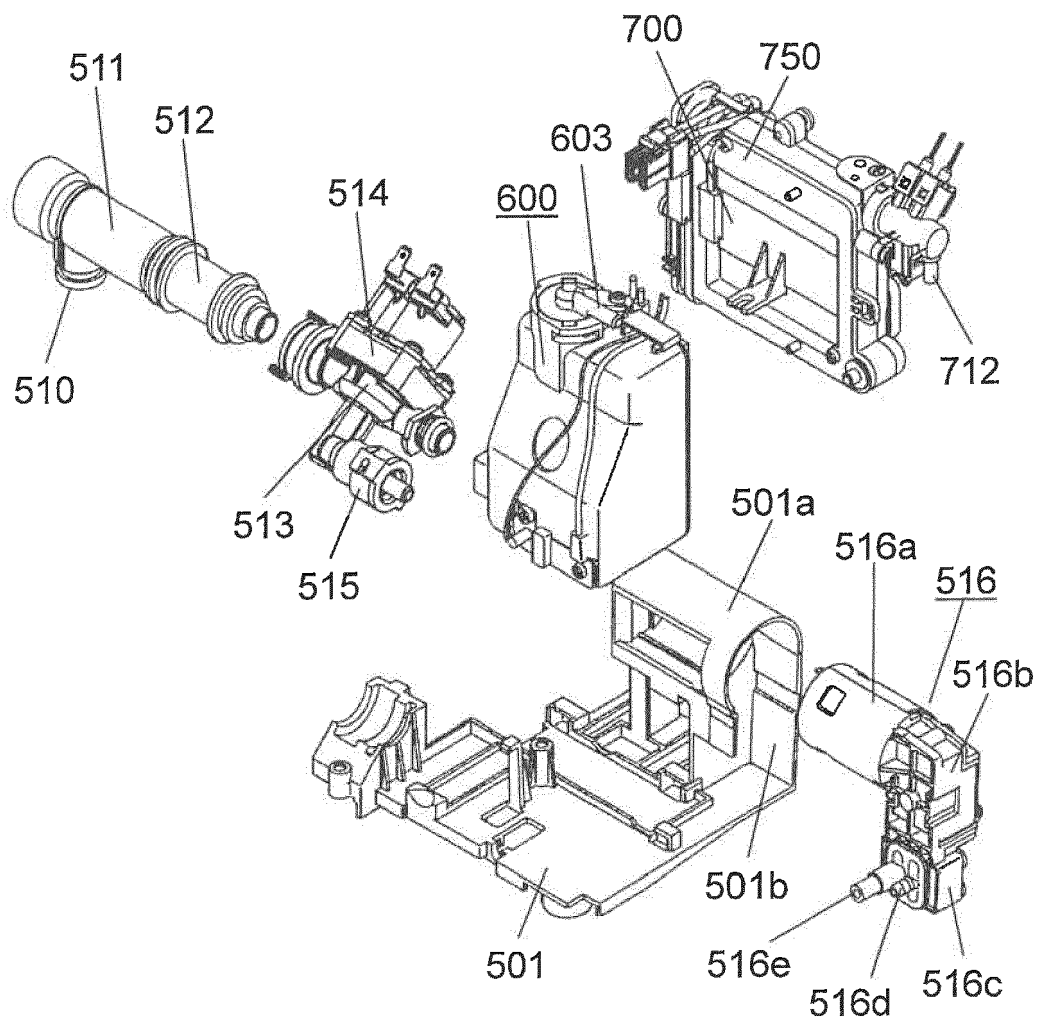


FIG. 8

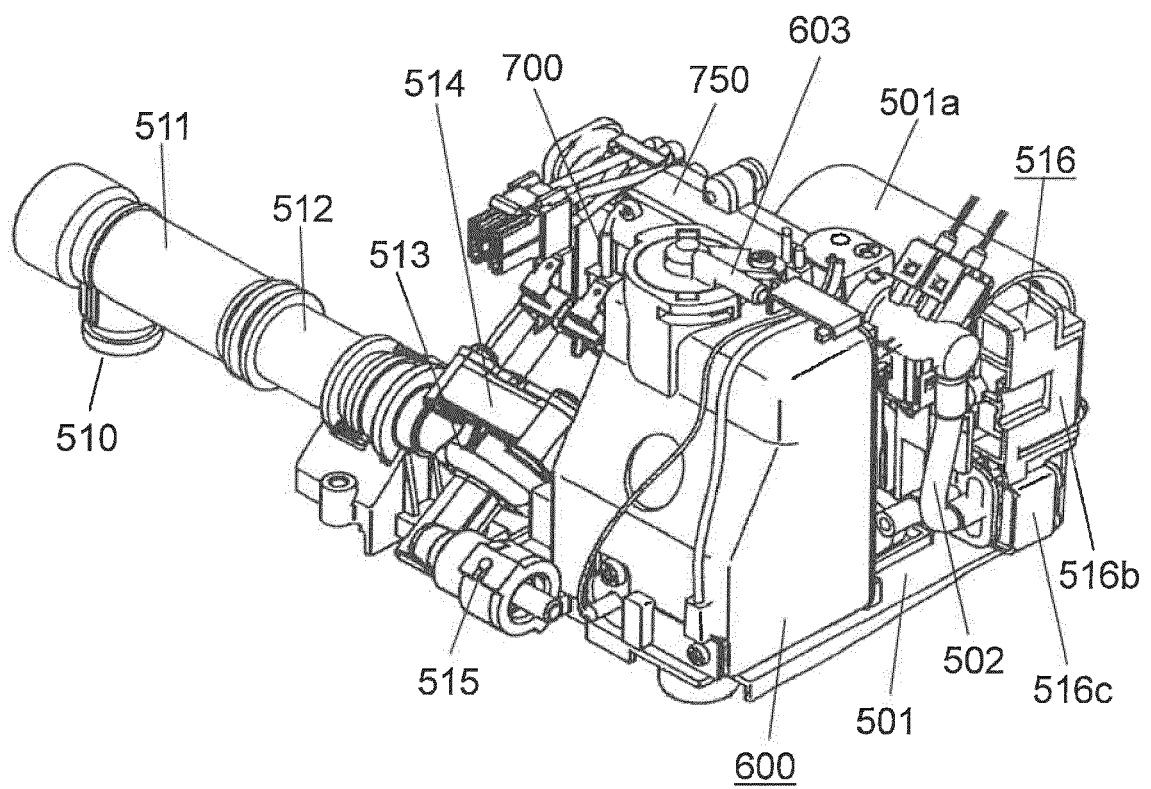


FIG. 9

600

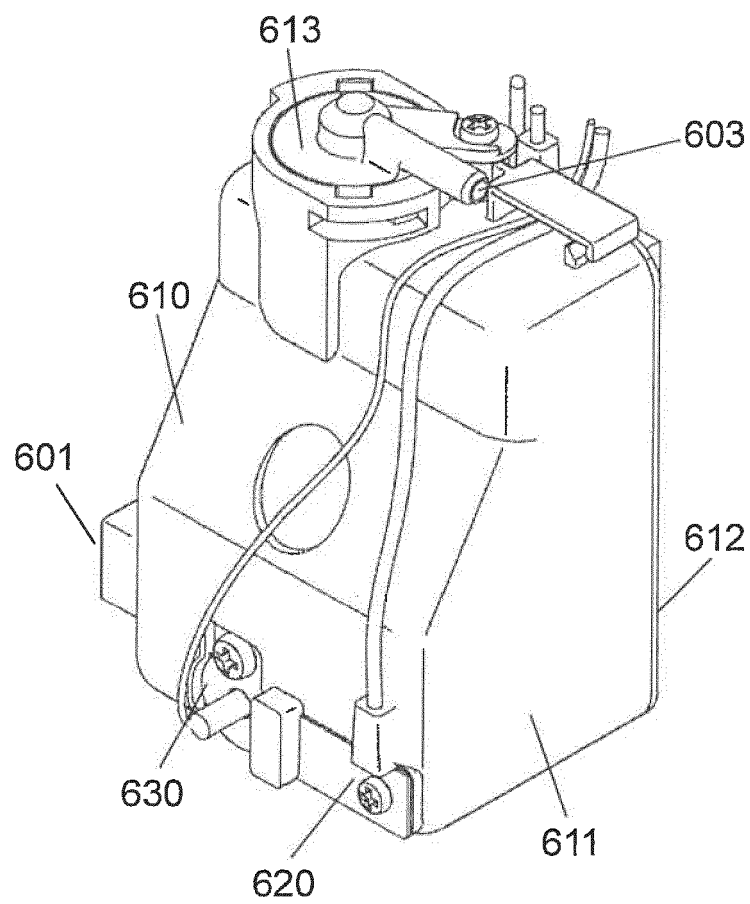


FIG. 10

600

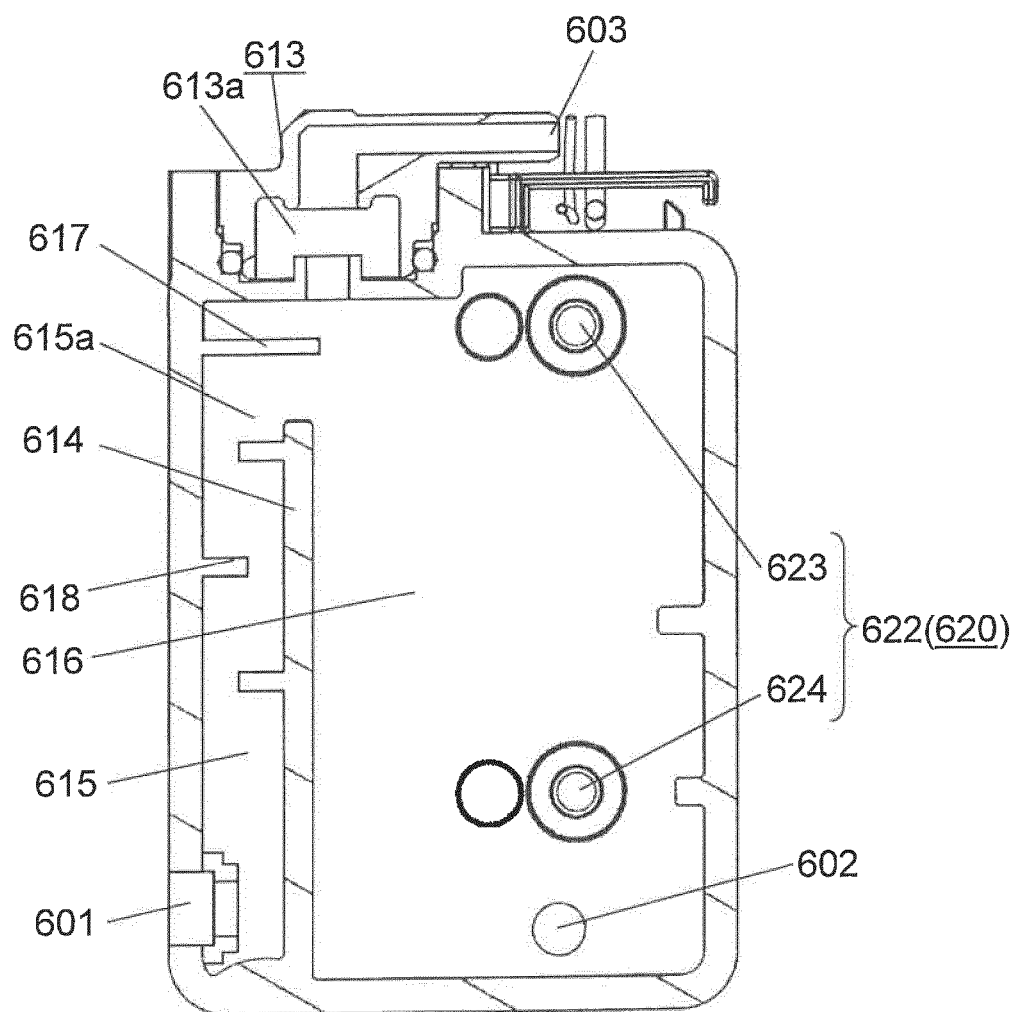


FIG. 11

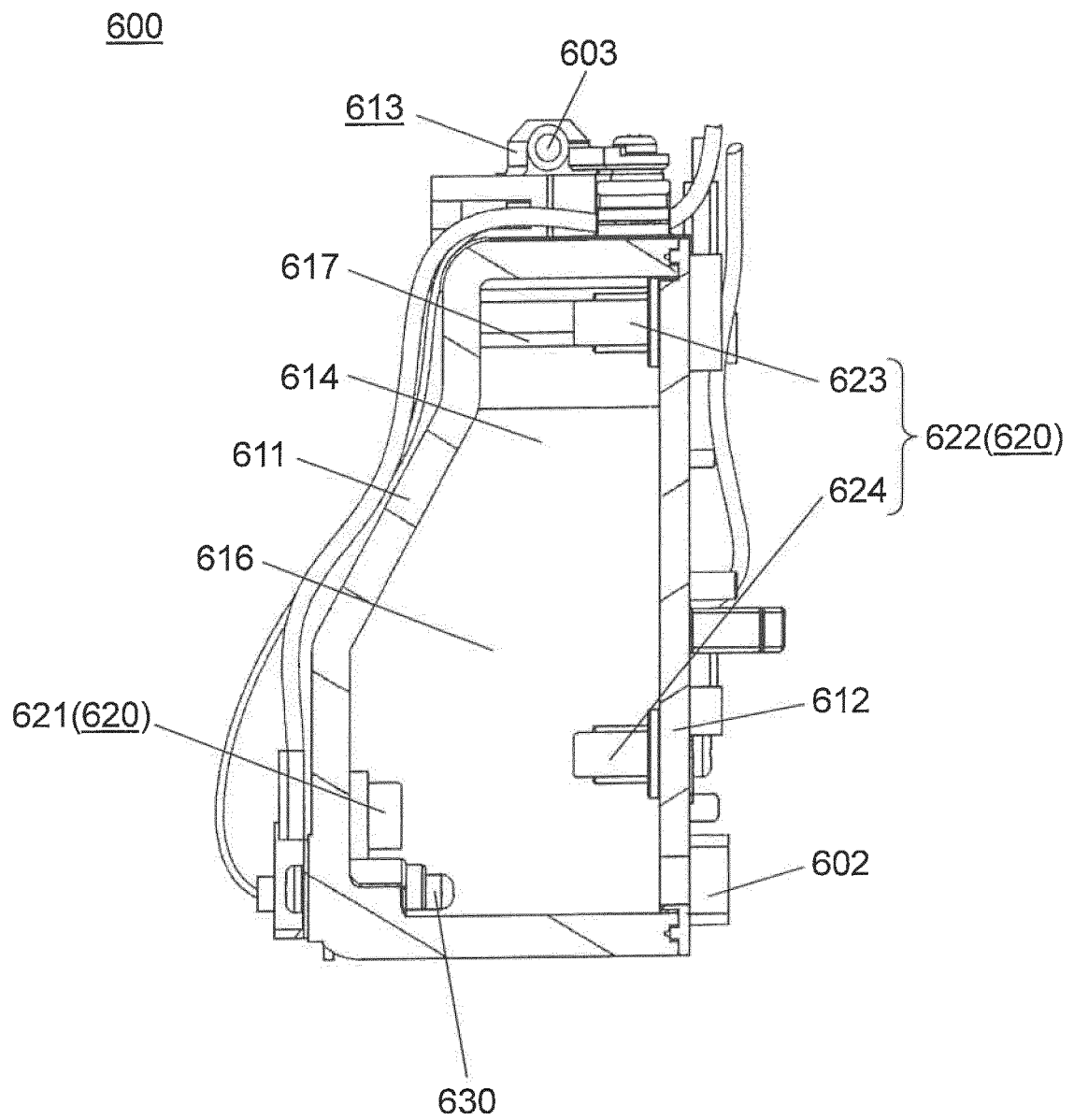


FIG. 12

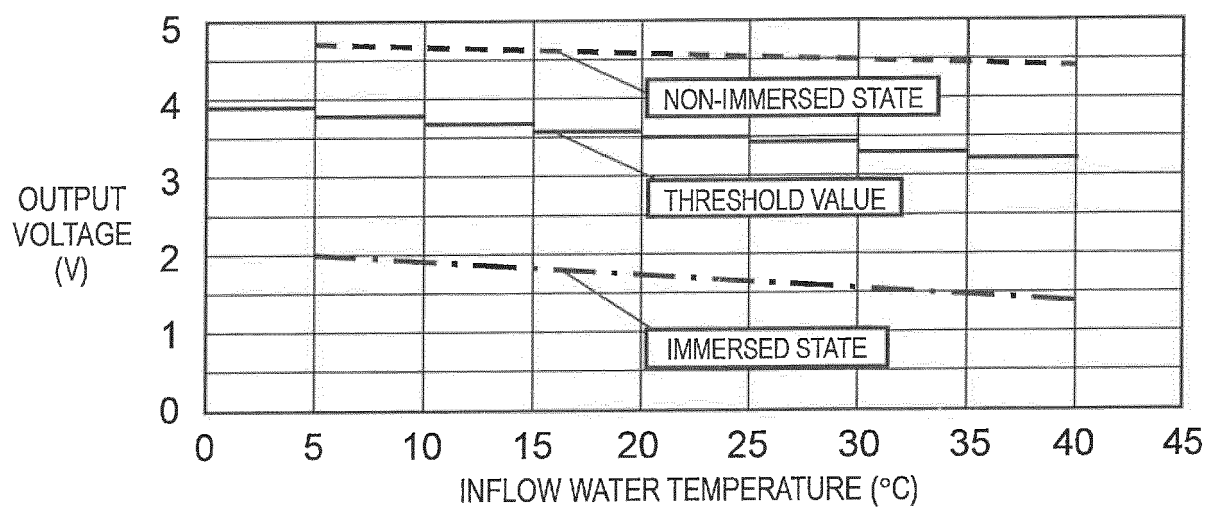


FIG. 13

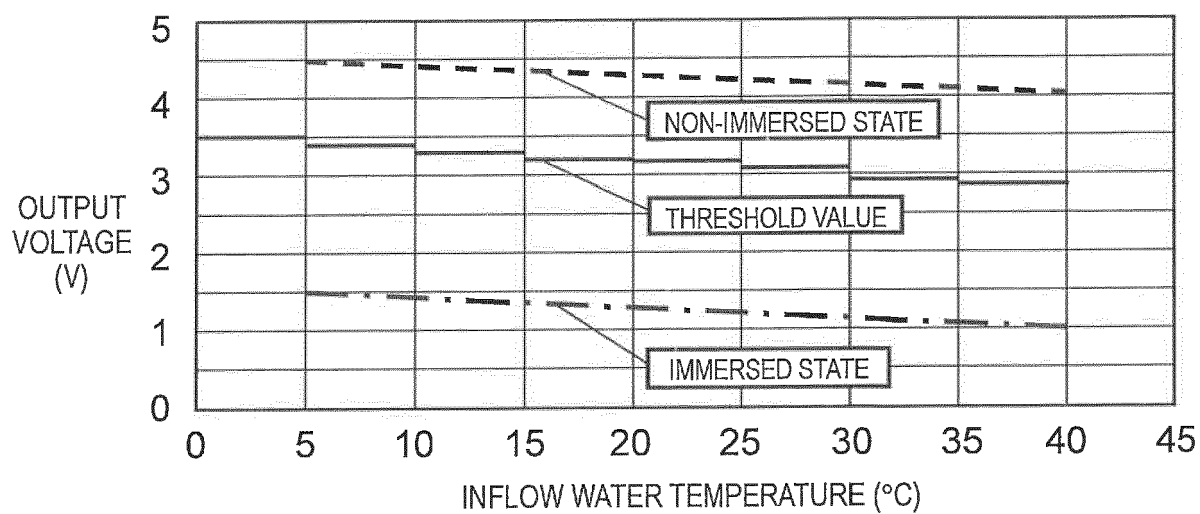


FIG. 14

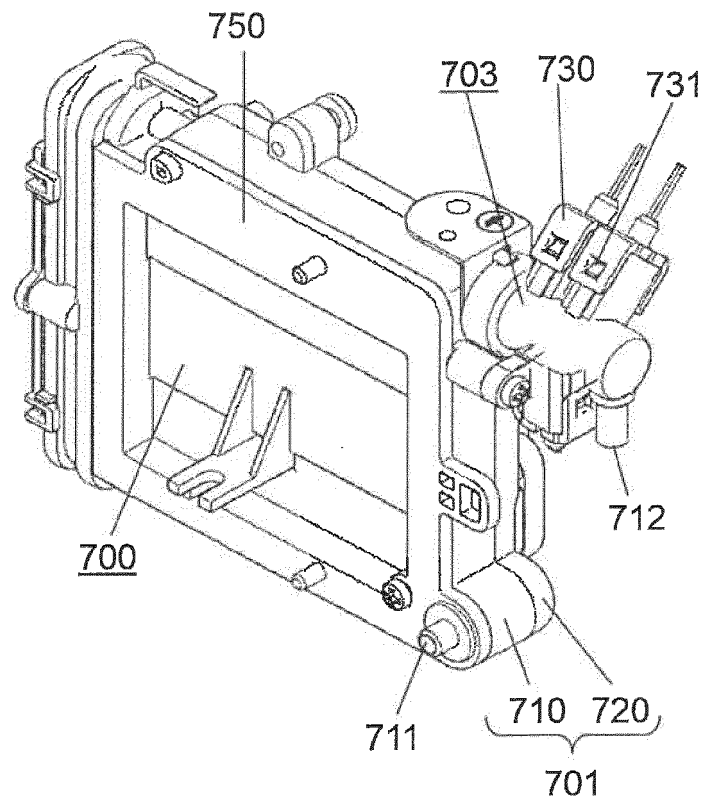


FIG. 15

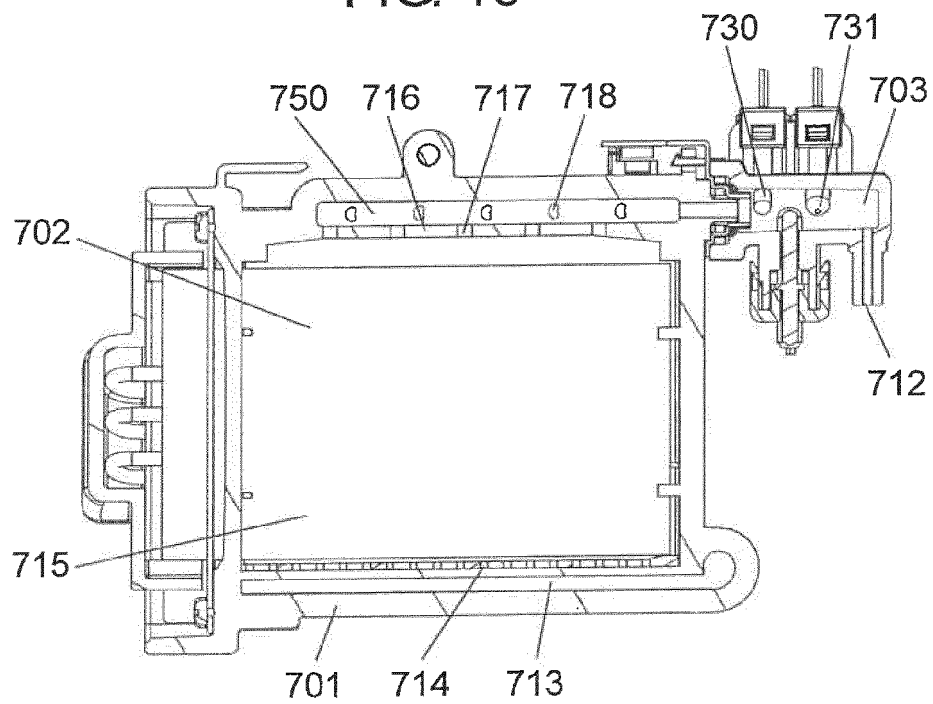


FIG. 16

516

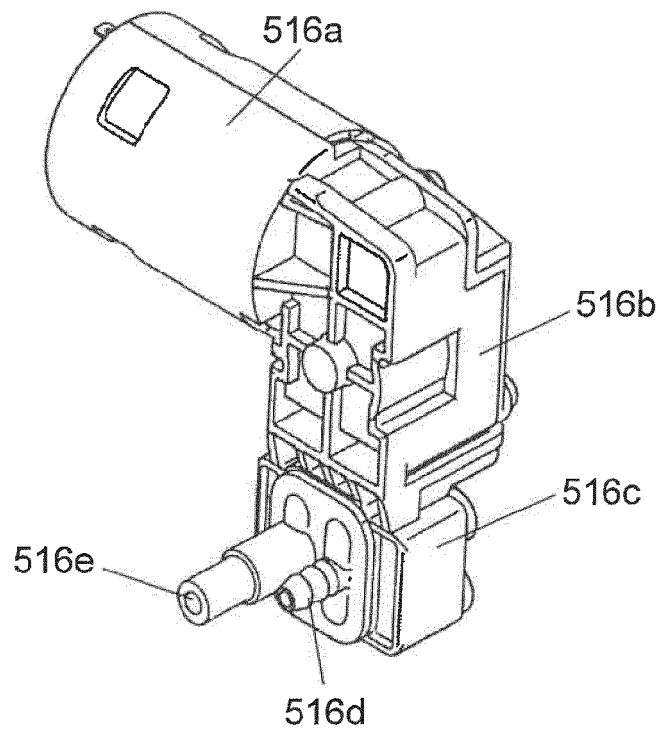


FIG. 17

516

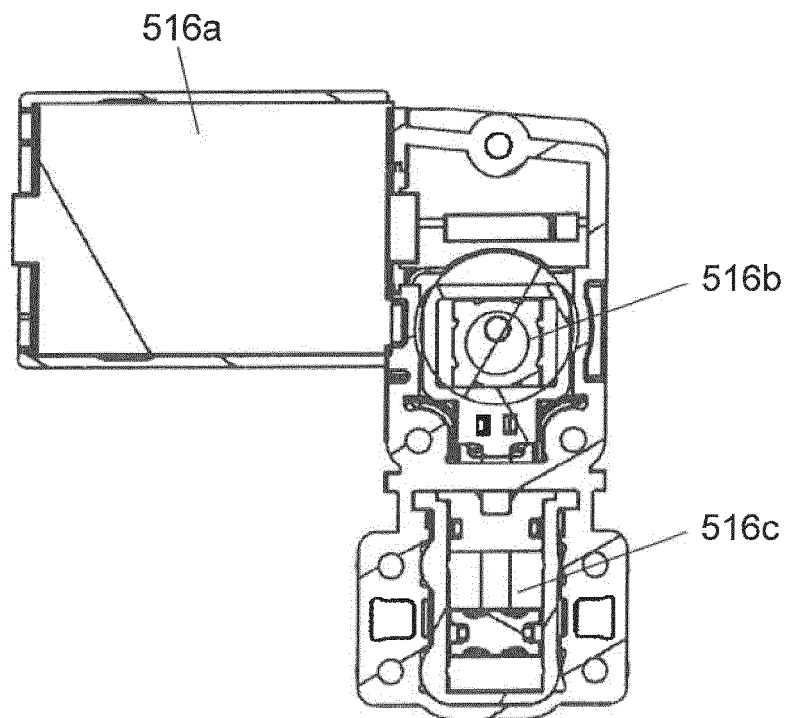


FIG. 18

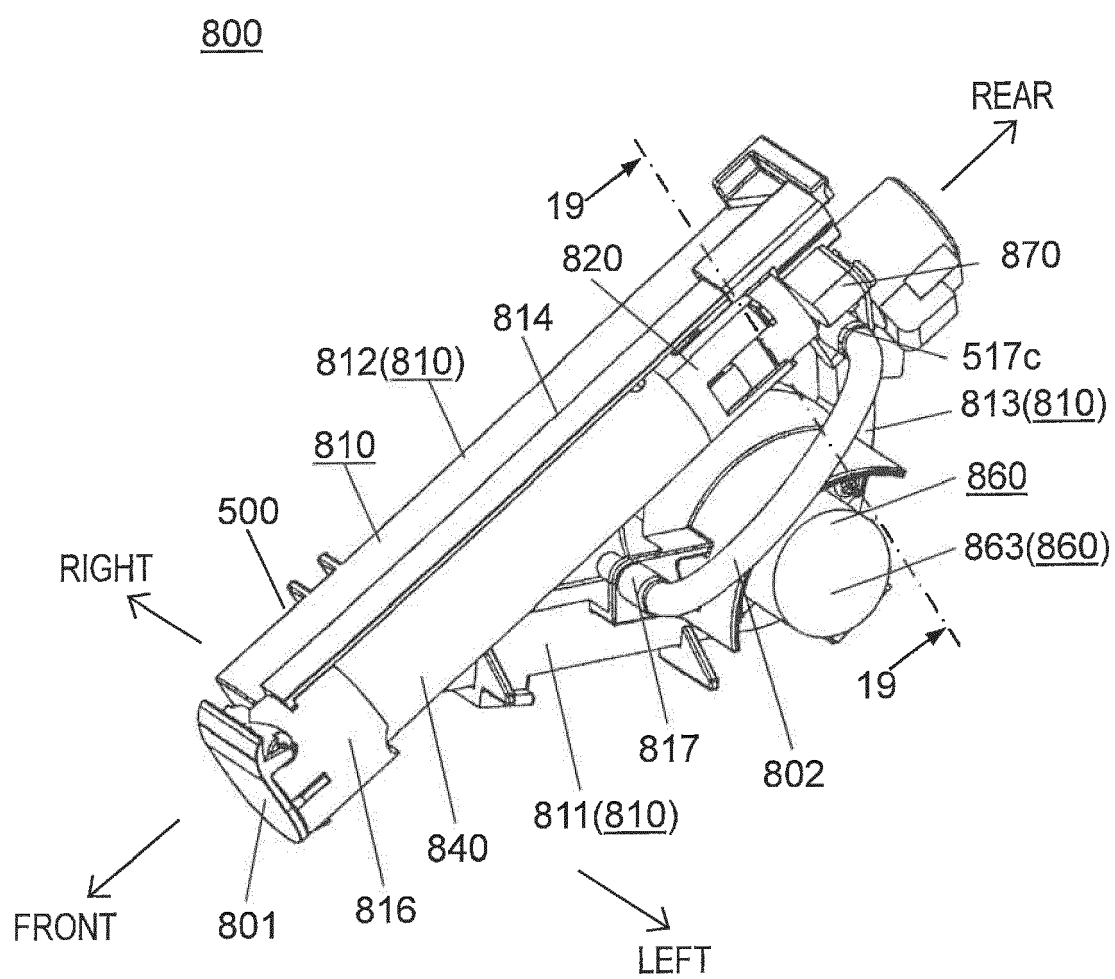


FIG. 19

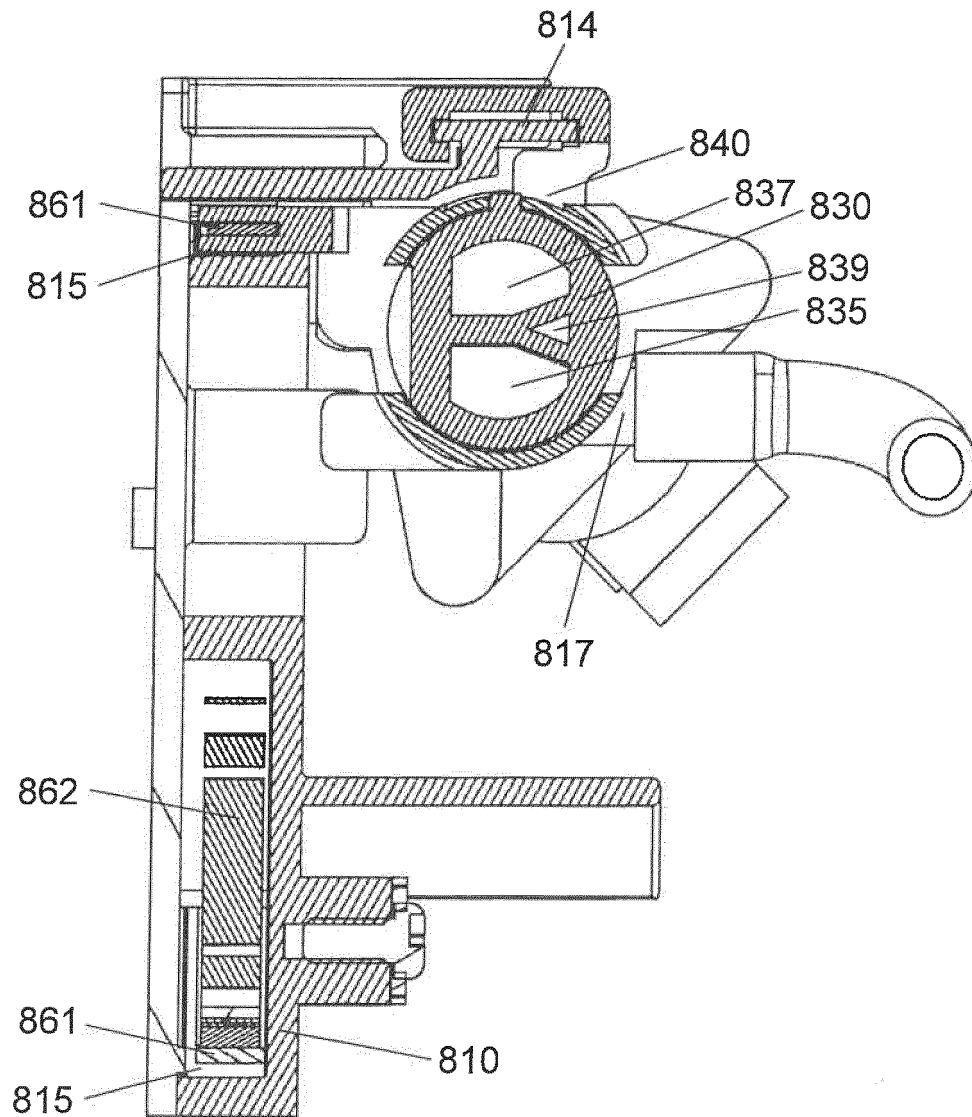


FIG. 20

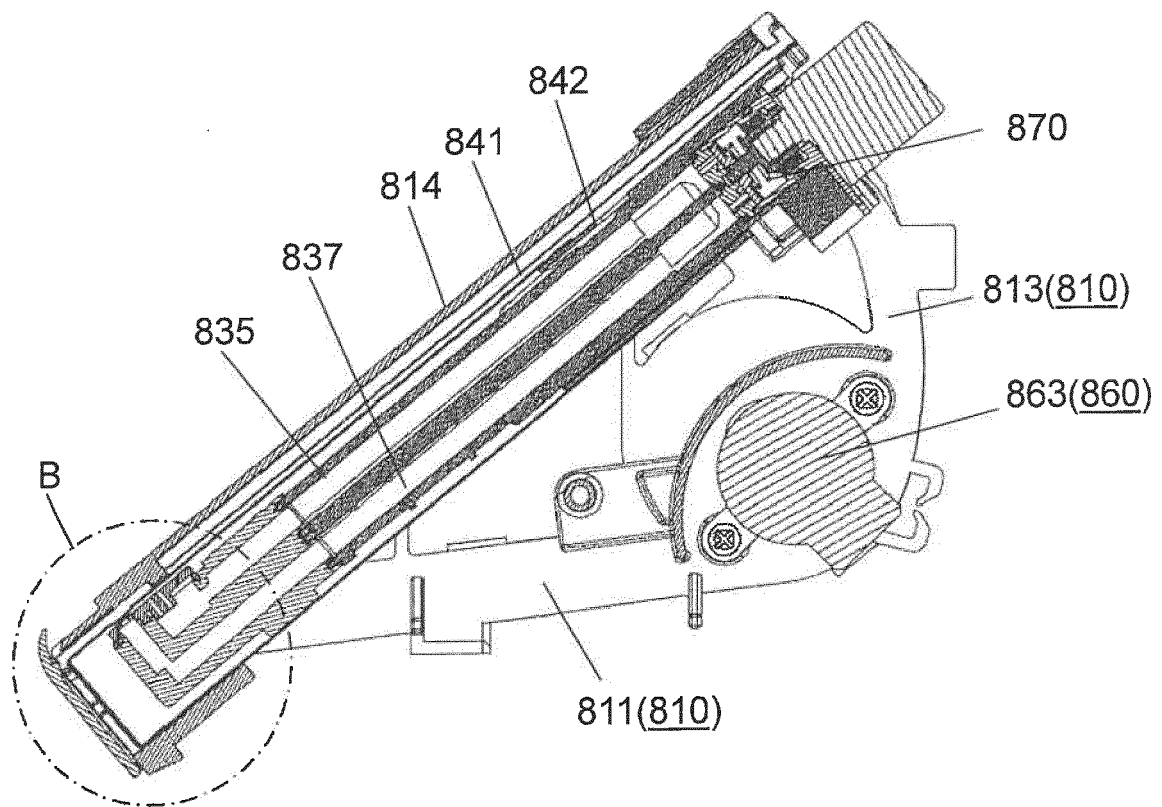


FIG. 21

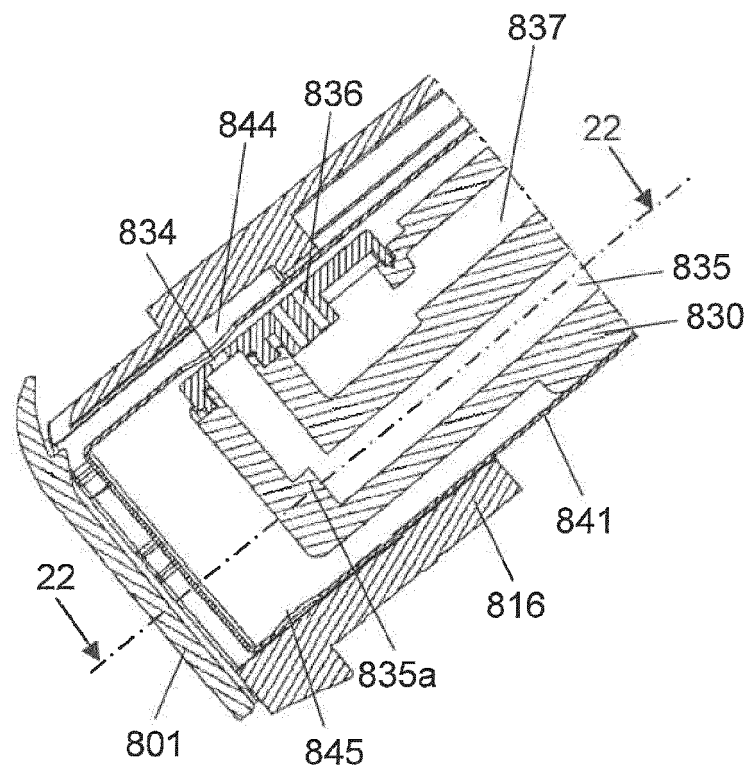


FIG. 22

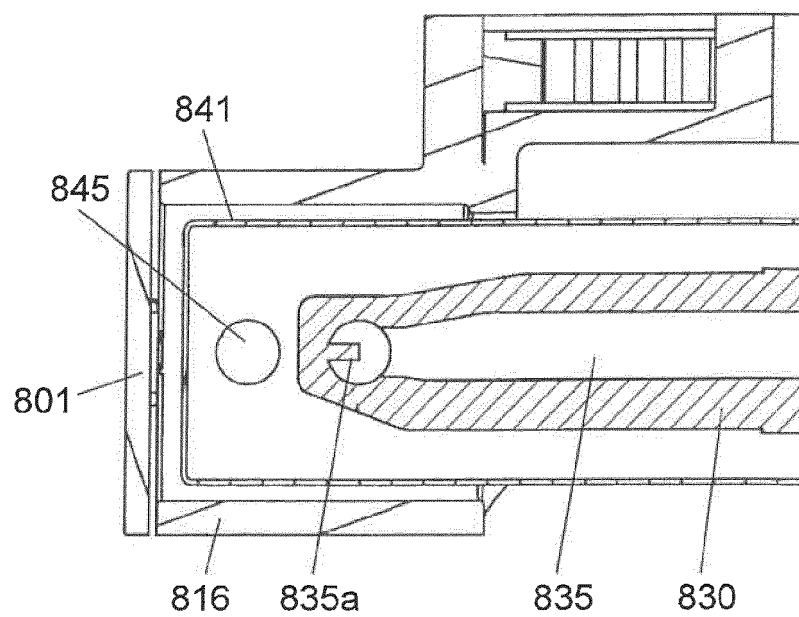


FIG. 23

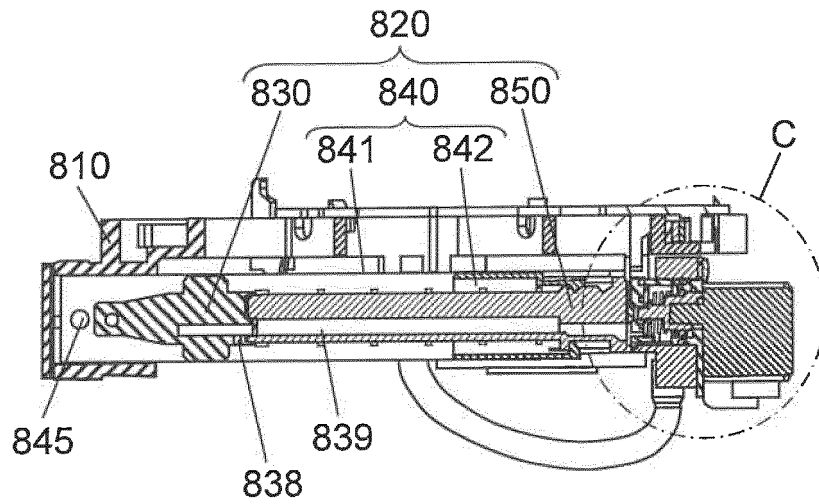


FIG. 24

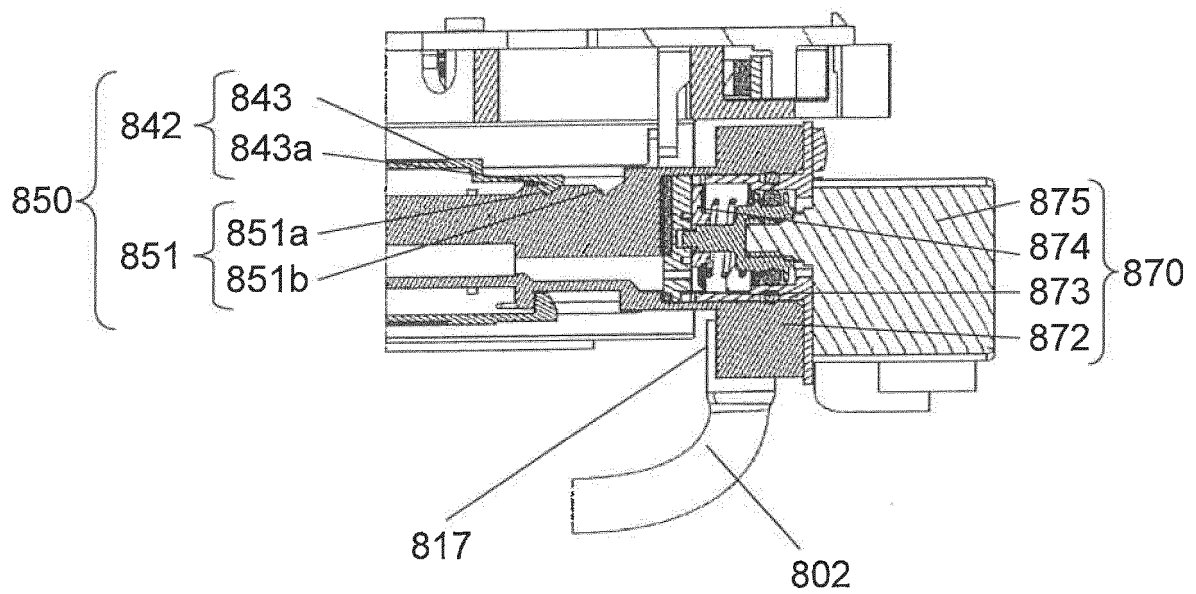


FIG. 25

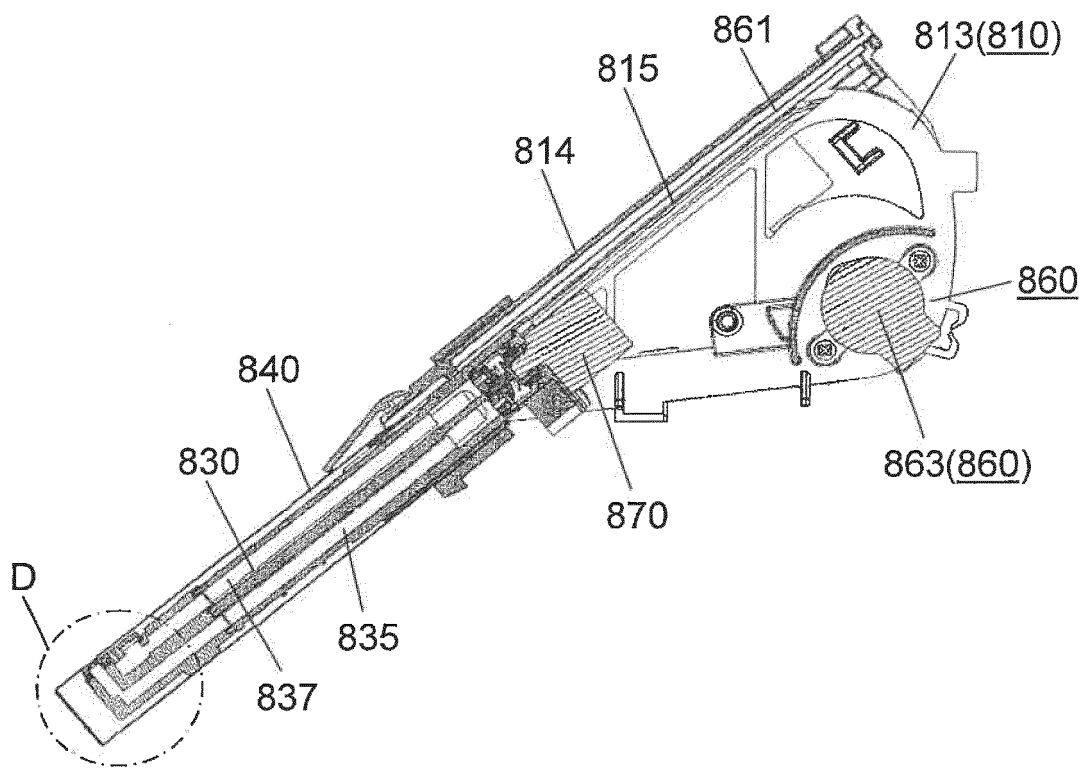


FIG. 26

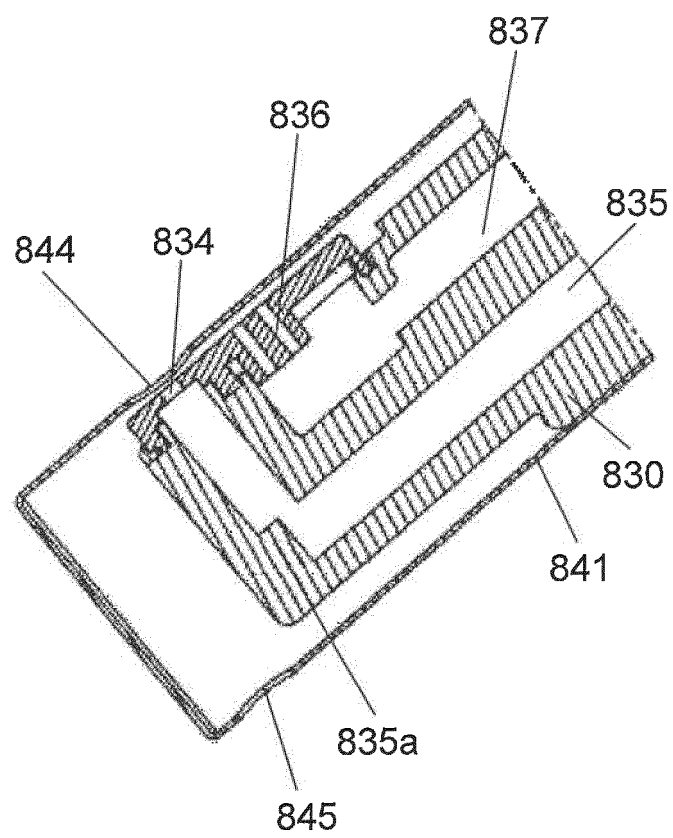


FIG. 27

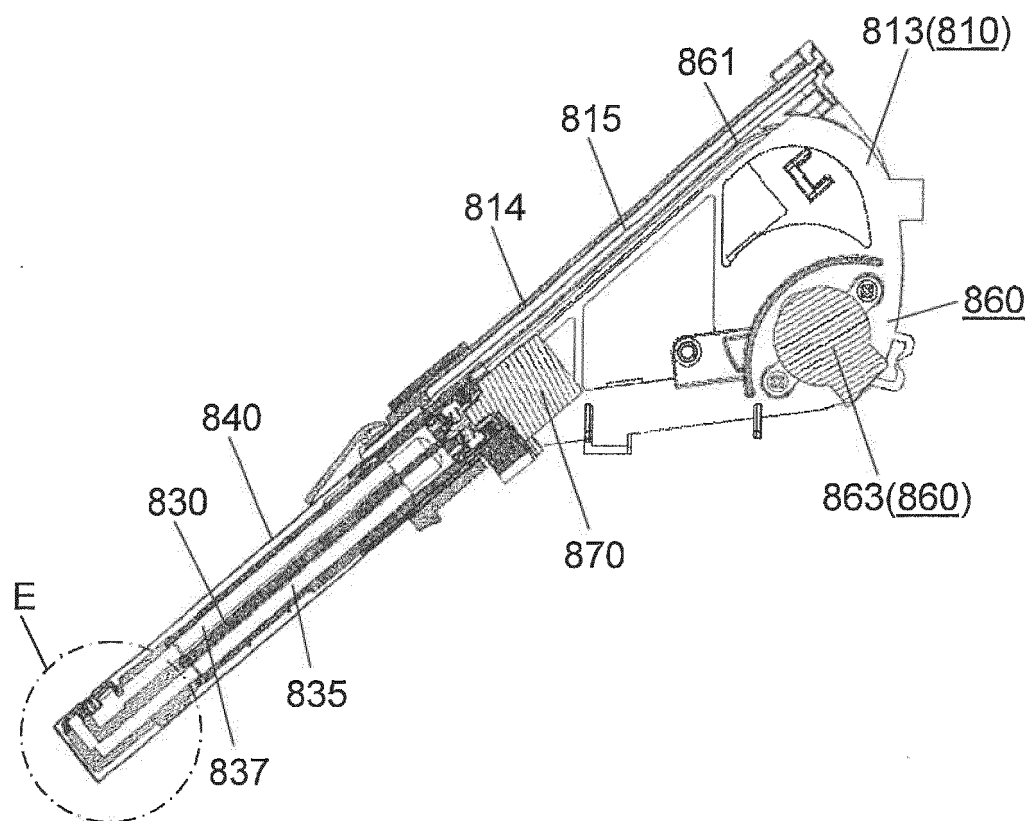


FIG. 28

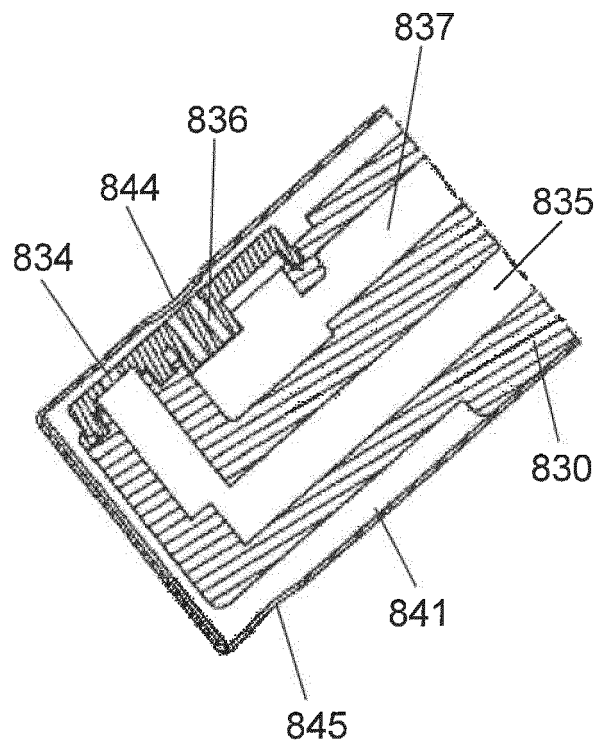


FIG. 29

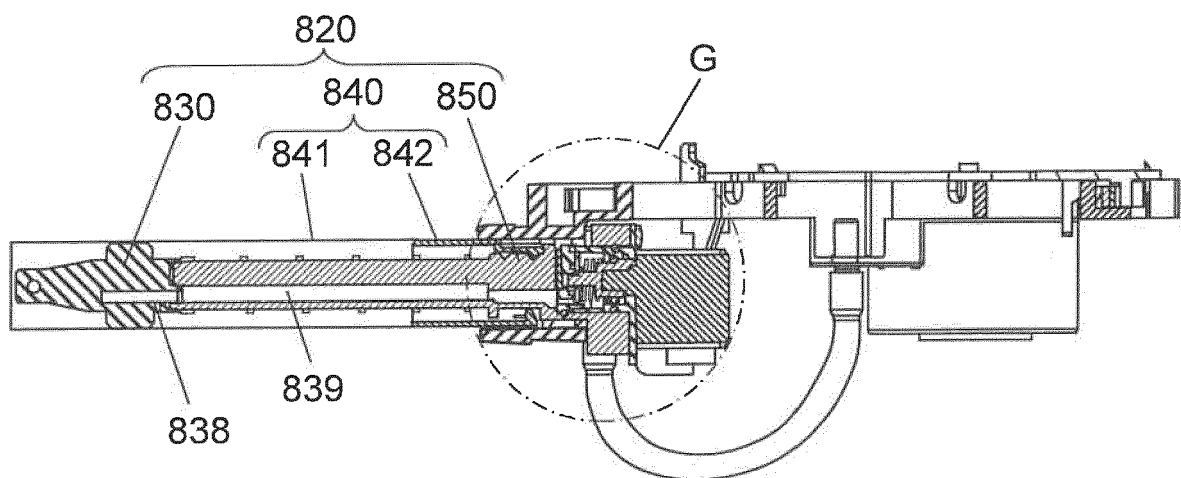


FIG. 30

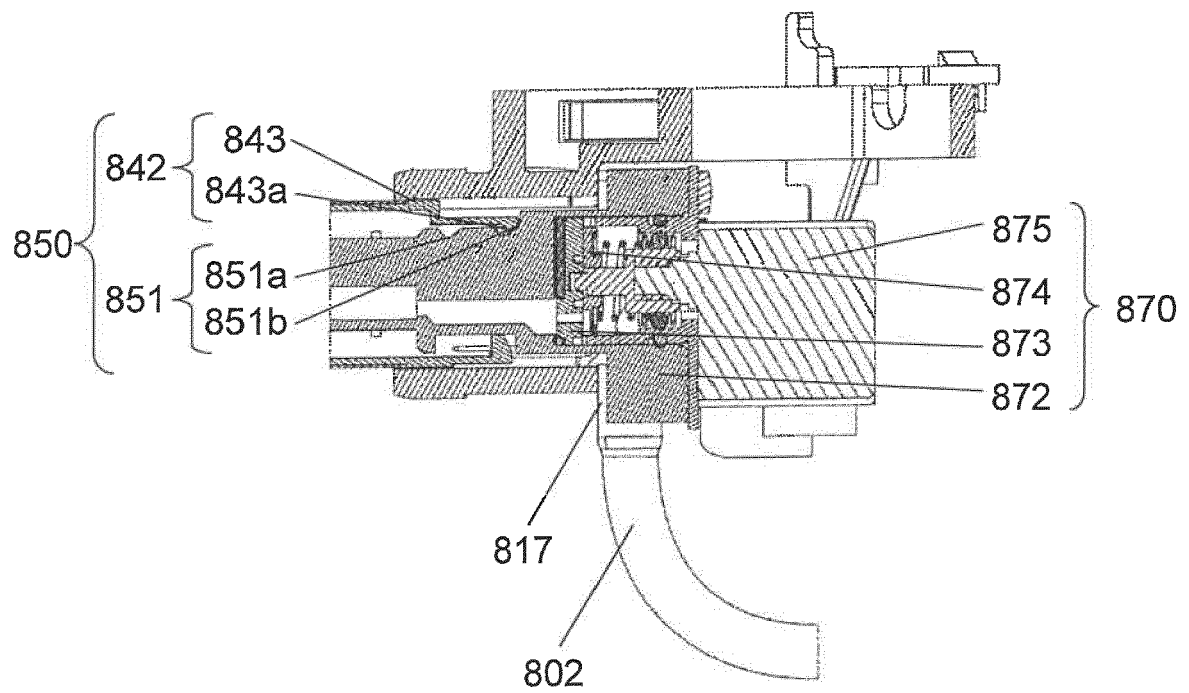


FIG. 31

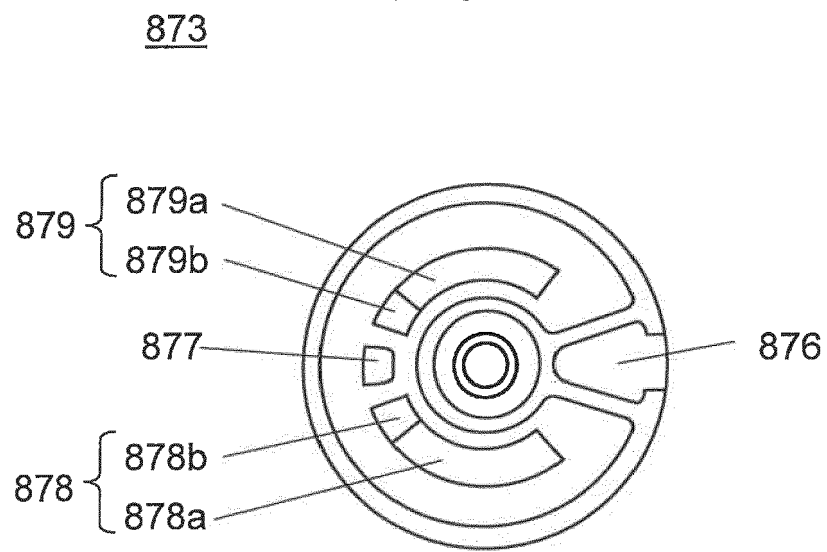


FIG. 32

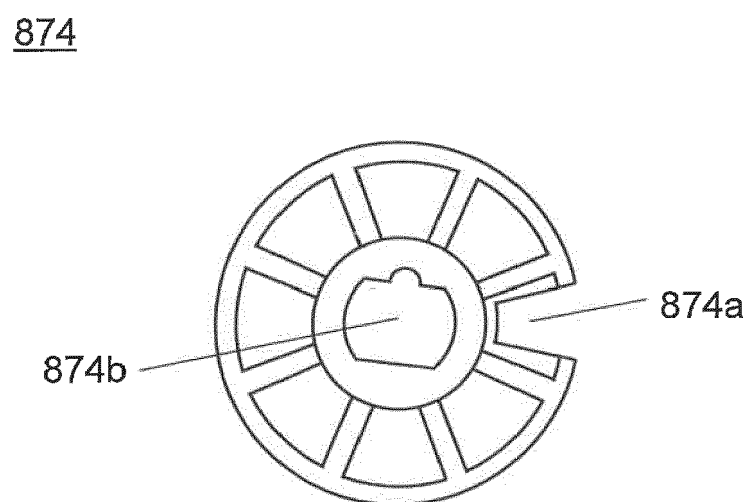


FIG. 33

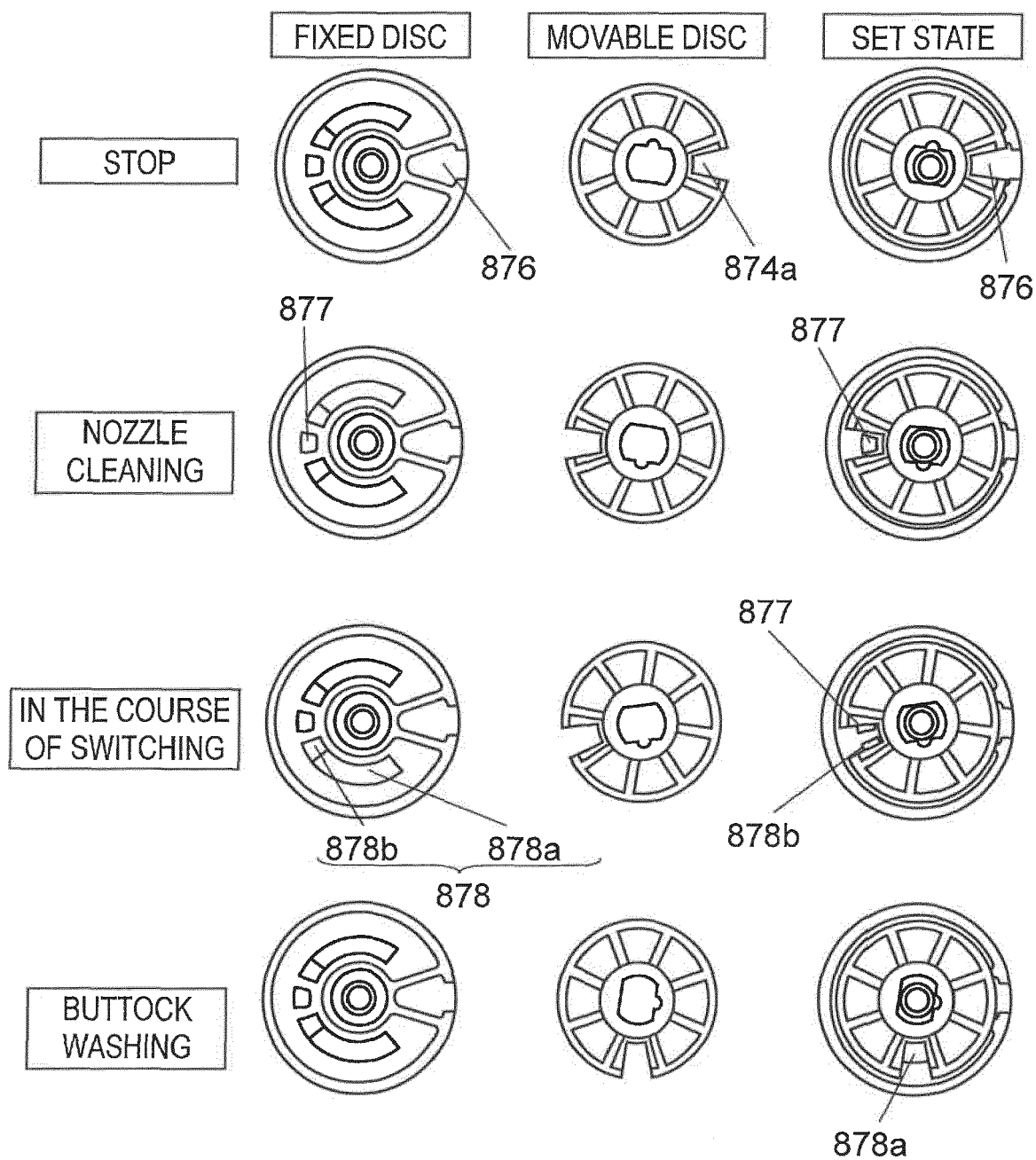


FIG. 34

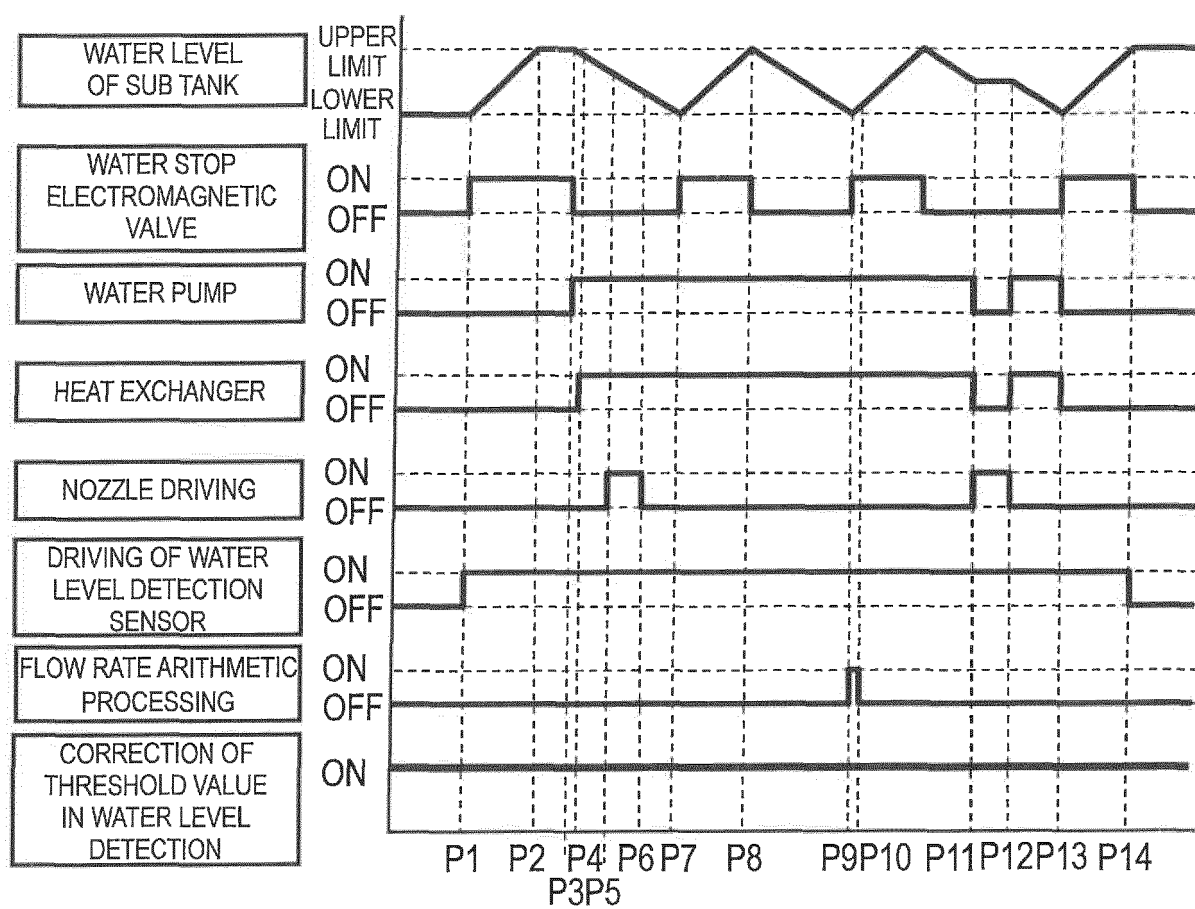


FIG. 35

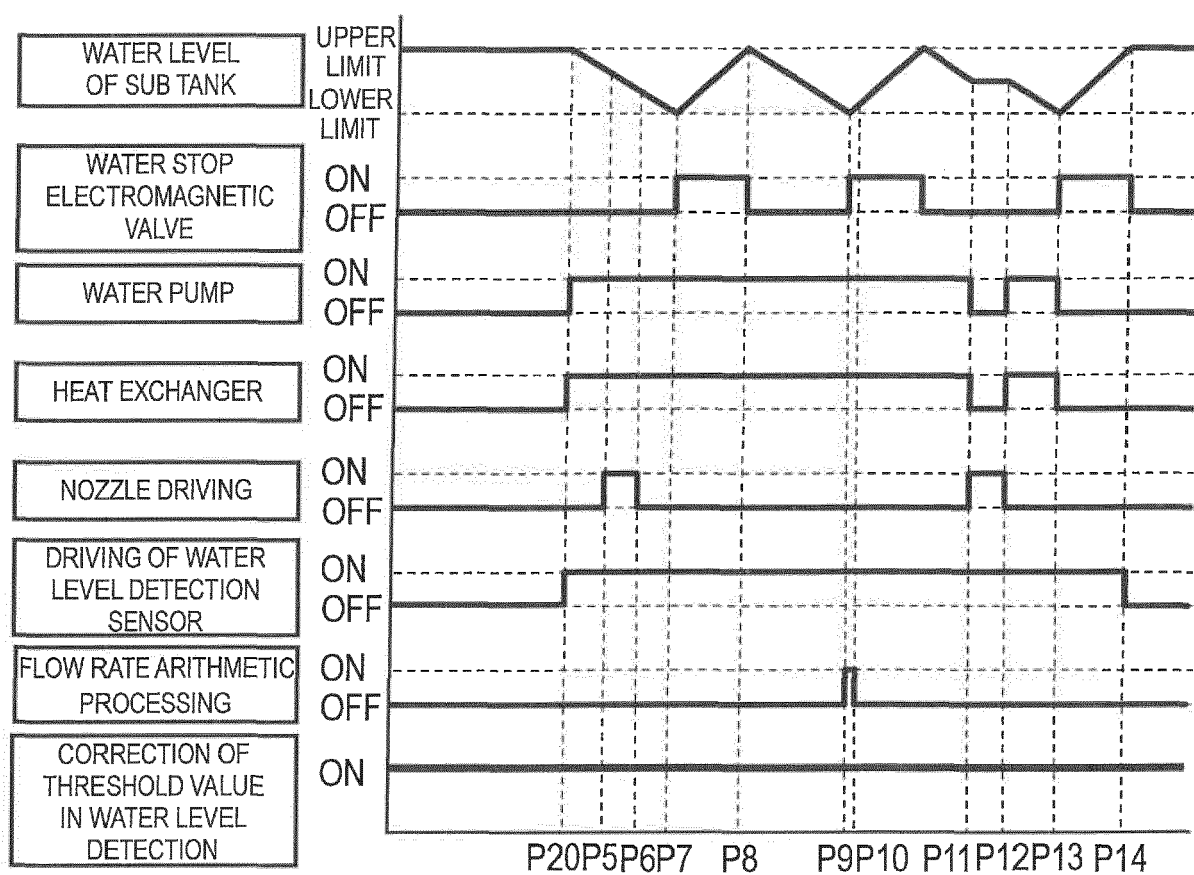
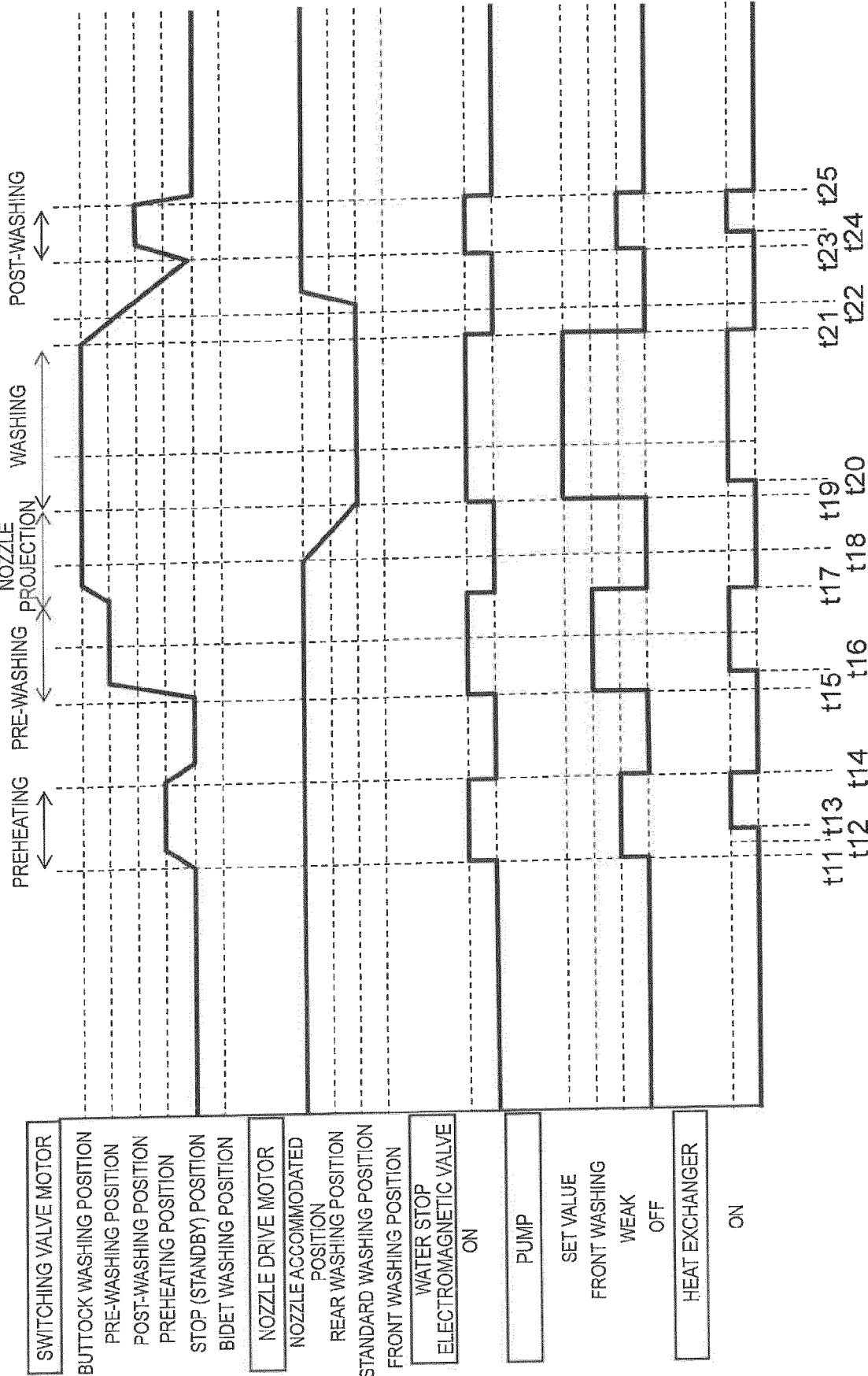


FIG. 36



REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- JP 2008275283 A [0013]