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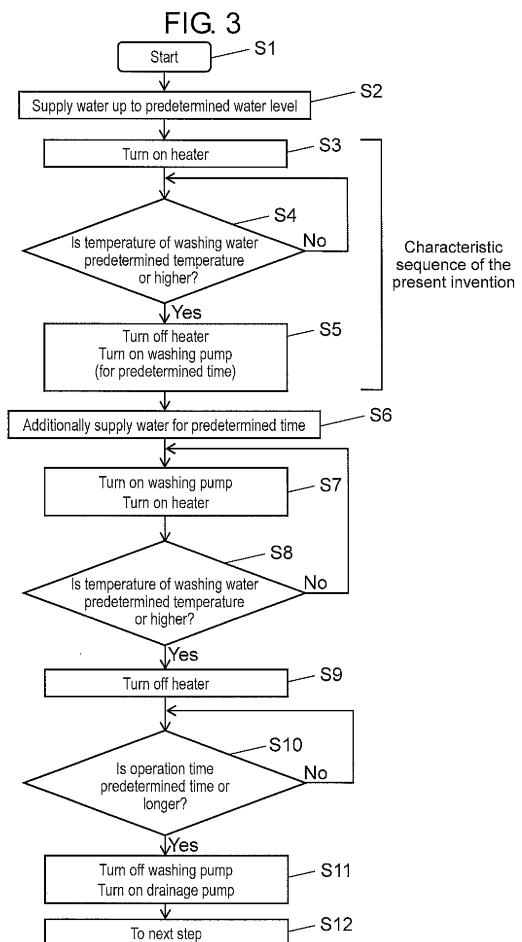
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(54) **Dishwasher**

(57) A dishwasher includes: a washing tub (3) that accommodates a washing object (7); a washing nozzle (6) that sprays washing water to the washing object (7); a heater (8) that heats the washing water; a water level detecting device (20) that detects a water level in the washing tub (3); a washing pump (5) that circulates the washing water in the washing tub (3); a water supply valve (15) that supplies water into the washing tub (3); and a control device (21) that controls respective steps of washing, rinsing and drying.

The control device (21) performs a control for opening the water supply valve (15) to start water supply, closing the water supply valve (15) to finish the water supply by receiving information indicating that the water level reaches a detection water level, detected by the water level detecting device (20), and heating the washing water by the heater (8) before the washing pump (5) is operated.

Accordingly, it is possible to realize a dishwasher that performs washing with high detergency from the start of a washing step using a liquid detergent with the same amount of detergent.



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a dishwasher that washes dishes or the like. More particularly, the present invention relates to a technique that heats a smaller amount of water than during washing before the dishwasher starts washing and obtains washing water with high temperature and high concentration to obtain high detergency from the start of washing.

2. Background Art

[0002] A dishwasher in the related art includes an input device that sets an operation course or the like, and a control device that sequentially controls steps of washing, rinsing, drying and the like on the basis of setting of the input device. The control device controls various electronic components such as a washing pump, a heater, a water supply valve and an air blowing fan to execute the respective steps of washing, rinsing and drying.

[0003] Here, in the dishwasher in the related art, in the washing step, water supply is firstly stopped at a water level lower than a water level during later washing, and the washing pump is operated. Thereafter, additional water is supplied for a predetermined time up to a predetermined washing water level. Then, the washing pump starts up approximately at the same time when electricity is supplied to the heater, to thereby start washing. Such a dishwasher is disclosed in Japanese Patent Unexamined Publication No. 2003-174994 (hereinafter, referred to as Patent Document 1), for example.

[0004] Hereinafter, a configuration of a dishwasher in the related art will be described with reference to Fig. 9.

[0005] Fig. 9 is a side sectional view of a built-in type dishwasher in the related art.

[0006] As shown in Fig. 9, in the dishwasher in the related art, first, a user holds grip 18 and draws washing tub 3 in a front direction from main body 1. Then, the user puts washing object 7 such as a dish into washing tub 3 through opening 2 provided in an upper portion of washing tub 3.

[0007] Then, the user pushes washing tub 3 into main body 1, and opening 2 is closed by lid 11.

[0008] In this state, the user starts the operation of the dishwasher. Here, the dishwasher operates washing pump 5 that is driven by a motor, and sprays washing water pressurized by washing pump 5 through washing nozzle 6. Thus, washing and rinsing steps of washing object 7 are performed.

[0009] Here, the washing water for washing washing object 7, used in the washing and rinsing steps is supplied through water supply valve 15 attached to a rear portion of main body 1, and is reserved in water reserving section 4 of a bottom portion of washing tub 3. Further, auxiliary

water tub 16 guides the washing water reserved in water reserving section 4 of the bottom portion of washing tub 3 into water level detecting device 20 that includes washing water level detecting device 20a and overflow water level detecting device 20b. Washing water level detecting device 20a detects that a reference amount of water is reserved in washing tub 3. On the other hand, overflow water level detecting device 20b detects that there is a possibility of overflow in a case where the water level in washing tub 3 reaches a predetermined water level or higher.

[0010] Further, washing tub 3 is provided with kitchen waste collecting section 10 that includes a detachable kitchen waste collecting filter (not shown) and a loose drainage filter (not shown), at the lowest position in water reserving section 4. Kitchen waste collecting section 10 is also used as a drainage port from washing tub 3 to washing pump 5.

[0011] Further, control device 21 is provided in main body 1, and controls various electronic components such as washing pump 5, heater 8, water supply valve 15 and air blowing fan 17 to execute the respective steps of washing, rinsing and drying.

[0012] Hereinafter, an operation of the washing step of the dishwasher in the related art will be briefly described with reference to Fig. 10.

[0013] Fig. 10 is a flowchart illustrating the operation of the washing step of the dishwasher in the related art.

[0014] As shown in Fig. 10, first, a user sets an operation course using input device 19. Thus, control device 21 starts the operation of the dishwasher on the basis of the setting of input device 19 (step S1). Here, in a case where the user sets a standard course in input device 19, control device 21 accurately performs water supply to washing tub 3 up to a predetermined amount of water (for example, a reference water level) according to detection information of washing water level detecting device 20a (step S2).

[0015] Then, control device 21 operates washing pump 5 for a predetermined time (step S3). Thereafter, electricity is supplied to water supply valve 15 for a predetermined time to add make-up water into washing tub 3 (step S4). Thus, the amount of the washing water in washing tub 3 is adjusted to a necessary and sufficient amount of water for washing.

[0016] Then, when the water supply is finished, control device 21 supplies electricity to washing pump 5 and heater 8 (step S5) to turn them on. Thus, the washing water is sprayed from washing nozzle 6 while dissolving a detergent that is inserted in advance in washing tub 3 to wash washing object 7.

[0017] On the other hand, in a case where the user sets a high concentration course through input device 19, control device 21 performs water supply so that the water level becomes a water level lower than the water level of the standard course (step S2). When the water supply is finished, control device 21 operates washing pump 5 once for a predetermined time (step S3). Further,

a washing step of spraying the washing water from washing nozzle 6 while dissolving the detergent inserted in washing tub 3 in advance to wash washing object 7 is performed. Here, since the amount of the washing water in washing tub 3 is small, the concentration of the detergent in the washing water increases even though the same rated amount of detergent is inserted. Thus, in the dishwasher set to the high concentration course, it is possible to obtain an excellent washing effect, for example, in a case where contamination of cookware or the like is severe.

[0018] Next, as shown in Fig. 10, control device 21 supplies electricity to water supply valve 15 for a predetermined time to add make-up water into washing tub 3 (step S4). Thus, the amount of washing water in washing tub 3 is adjusted to a necessary and sufficient amount of water in a main washing operation.

[0019] Then, when the water supply is finished, control device 21 supplies electricity to washing pump 5 and heater 8 (step S5) to turn them on. Thus, the washing water is sprayed from washing nozzle 6 while dissolving the detergent inserted in advance in washing tub 3 to wash washing object 7.

[0020] Thereafter, although not described, steps S6 to S9 are executed to perform the washing step that is the main washing operation. Thus, the washing step is finished, and a rinsing step, a drying step and the like that are the next steps executed.

[0021] Accordingly, the washing operation of the dishwasher is finished.

[0022] Here, the washing effect of the inserted detergent is gradually increased according to a temperature increase. Particularly, the maximum active temperature (optimum temperature) of ingredient enzyme included in the detergent used in the dishwasher is about 40°C to 60°C. That is, by setting the temperature of the washing water to 40°C to 60°C, it is possible to increase the activity of the enzyme of the detergent.

[0023] However, in a general home environment, the temperature of the washing water supplied into washing tub 3 is about 20°C. Thus, the detergency of the detergent at the start of the operation is suppressed, except for a case where water heated by a hot-water heater is supplied.

[0024] That is, in the dishwasher in the related art, even though the concentration of the detergent in the washing water is high at the start of the operation, the detergency of the detergent is low compared with a case where the temperature of water is high. Further, even at the last half of the washing operation in which the temperature of the washing water increases due to heating of heater 8, the concentration of the detergent ingredient becomes noticeably thin due to make-up water supplied for a predetermined time or reaction with contaminant ingredients, which reduces the washing effect of the detergent. Thus, it is difficult to wash a washing object with the maximum washing effect.

SUMMARY OF THE INVENTION

[0025] According to an aspect of the present invention, there is provided a dishwasher including: a washing tub that includes a dish basket for accommodating a washing object and a water reserving section for reserving washing water in an inner bottom portion thereof; a washing nozzle that is provided in the washing tub to spray the washing water to the washing object; a heater that is provided in the water reserving section to heat the washing water; a water level detecting device that is provided to be connected to the washing tub to detect a level of the washing water; a washing pump that supplies the washing water to the washing nozzle through a drainage port provided in the water reserving section and circulates the washing water in the washing tub; a water supply valve that supplies water into the washing tub; and a control device that controls respective steps of washing, rinsing and drying. The control device performs a control for opening the water supply valve to start water supply, closing the water supply valve to finish the water supply when the water level detecting device detects a predetermined water level, and heating the washing water by the heater before the washing pump is operated.

[0026] With this configuration, it is possible to increase the temperature of the washing water before the washing pump is operated to increase a dissolution speed of the detergent, and to easily obtain the washing water with high concentration and high temperature. Further, by activating ingredients of the detergent, it is possible to wash the washing object with an excellent washing effect from the start of the operation of the washing pump in the main washing operation of a washing step. Consequently, it is possible to realize a dishwasher having high detergency without an increase in the amount of detergent.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

Fig. 1 is a side sectional view of a dishwasher according to a first exemplary embodiment of the present invention.

Fig. 2 is a plan view illustrating a configuration of an inner bottom portion of a washing tub of the dishwasher according to the first exemplary embodiment.

Fig. 3 is a flowchart illustrating an operation of a washing step of the dishwasher according to the first exemplary embodiment.

Fig. 4A is a diagram illustrating a control sequence of a washing step of a dishwasher in the related art. Fig. 4B is a diagram illustrating a control sequence of the washing step of the dishwasher according to the first exemplary embodiment.

Fig. 5 is a side sectional view of a dishwasher according to a second exemplary embodiment of the present invention.

Fig. 6 is a front sectional view of the dishwasher according to the second exemplary embodiment.

Fig. 7 is a front sectional view of a main part of an inner bottom portion of a washing tub of the dishwasher according to the second exemplary embodiment.

Fig. 8 is a plan view of the main part of the dishwasher according to the second exemplary embodiment.

Fig. 9 is a side sectional view of a built-in type dishwasher in the related art.

Fig. 10 is a flowchart illustrating an operation of the washing step of the dishwasher in the related art.

DETAILED DESCRIPTION OF THE INVENTION

[0028] Hereinafter, exemplary embodiments of the present invention will be described with reference to the accompanying drawings, but the present invention is not limited to these exemplary embodiments.

(FIRST EXEMPLARY EMBODIMENT)

[0029] Hereinafter, a configuration of a built-in type dishwasher according to a first exemplary embodiment of the present invention will be described with reference to Figs. 1 and 2.

[0030] Fig. 1 is a longitudinal sectional view of a dishwasher according to the first exemplary embodiment. Fig. 2 is a plan view illustrating a configuration of an inner bottom portion of a washing tub of the dishwasher according to the first exemplary embodiment.

[0031] As shown in Figs. 1 and 2, the built-in type dishwasher according to the present exemplary embodiment has a configuration in which at least washing tub 3, washing pump 5, washing nozzle 6, heater 8, kitchen waste collecting section 10, dish basket 13, detergent inserting section 14, control device 21 and the like are provided in main body 1.

[0032] Washing tub 3 includes water reserving section 4 in an inner bottom portion thereof, and kitchen waste collecting section 10 is provided on a drainage port side in the vicinity of the center of the inner bottom portion. Further, opening 2 through which washing object 7 is put in and out is provided in an upper portion of washing tub 3. Further, inside washing tub 3, dish basket 13 that sets washing object 7 such as a dish is disposed to be put in and out through opening 2. Dish basket 13 includes, for example, dish basket 13a that contains glass objects, dish basket 13b that contains dishes or bowls, dish basket 13c that contains long and narrow cutleries such as chopsticks or spoons, and the like.

[0033] Further, opening 2 of washing tub 3 is closed by lid 11 when washing tub 3 is accommodated in main body 1, and is opened by pulling out washing tub 3 from main body 1. Here, lid 11 moves up and down by a door opening/closing mechanism (not shown) using a latch and link mechanism 12, and closes opening 2 when washing tub 3 is accommodated in main body 1. Specif-

ically, lid 11 seals opening 2 of washing tub 3 in a water-tight manner by being in contact with a seal member (not shown).

[0034] Washing nozzle 6 is provided in a lower portion in washing tub 3, and sprays washing water to washing object 7 set in dish basket 13 for washing.

[0035] Washing pump 5 is disposed in a lower portion outside the bottom portion of washing tub 3 to supply the washing water to washing nozzle 6 for ejection, to thereby circulate the washing water in washing tub 3. Here, washing pump 5 is configured to include a motor (not shown) that is rotatable forward or backward. Further, washing pump 5 performs an original operation of the washing pump (the circulating operation of the washing water) when rotated forward, and is operated as a drainage pump that discharges the washing water in washing tub 3 to the outside when rotated backward.

[0036] Heater 8 is provided in water reserving section 4 of the inner bottom portion of washing tub 3, and heats the washing water reserved in water reserving section 4 in washing tub 3. Further, the periphery of heater 8 is surrounded and protected by heater protecting component 9 made of, for example, stainless steel or the like so that even though small things such as chopsticks or spoons fall, the small things are not directly in contact with heater 8. Further, with this configuration, it is possible to prevent the kitchen waste from being caught.

[0037] Further, as shown in Figs. 1 and 2, detergent inserting section 14 is provided integrally with dish basket 13 that contains the above-mentioned small objects such as chopsticks, spoons or the like, for example, at a position above heater protecting component 9. Further, detergent inserting section 14 leads the inserted detergent to be above heater 8. To this end, detergent inserting section 14 is provided at a position above heater 8 on the side of front surface 3a of washing tub 3 that is an upper stream side of the flow of the washing water in the inner bottom portion of washing tub 3, instead of a position above heater 8 on the side of kitchen waste collecting section 10 that is the side of the drainage port. Generally, the inner bottom portion of washing tub 3 has a conical shape, and the periphery of the inner bottom portion is higher. Thus, the washing water flows from the periphery of the inner bottom portion of washing tub 3 to kitchen waste collecting section 10. That is, the peripheral side of the inner bottom portion of washing tub 3 corresponds to the upstream side of the flow of the washing water. Thus, it is possible to prevent the inserted detergent from being in contact with washing object 7 set in dish basket 13. Further, it is possible to guide the inserted detergent to a position close to the upstream side in the vicinity of heater 8 through detergent inserting section 14.

[0038] Further, as shown in Figs. 1 and 2, above-described water reserving section 4 is provided in inner bottom portion of washing tub 3. Further, water reserving section 4 is disposed in a midway position of a path that connects heater 8 and washing pump 5 on the outside of washing tub 3. Further, kitchen waste collecting sec-

tion 10 (drainage port) that includes a kitchen waste collecting filter (not shown) that collects kitchen waste washed off from washing object 7 and a loose drainage filter (not shown) is provided in water reserving section 4.

[0039] Water supply valve 15 is provided at a rear portion of main body 1. Further, when control device 21 operates water supply valve 15, tap-water or the like is supplied into washing tub 3 through a pipe as washing water.

[0040] Auxiliary water tub 16 is provided on a rear side surface in the vicinity of the bottom portion of washing tub 3, for example. Water level detecting device 20 connected to a lower part of kitchen waste collecting section 10 (drainage port) through a pipe is provided in auxiliary water tub 16. Water level detecting device 20 includes washing water level detecting device 20a and overflow water level detecting device 20b. Washing water level detecting device 20a detects that a reference amount of water is reserved in washing tub 3 as a predetermined detection water level (for example, reference water level). On the other hand, overflow water level detecting device 20b detects that there is a possibility of overflow in a case where the water level in washing tub 3 reaches a predetermined water level or higher.

[0041] A temperature detecting unit (not shown) is fixedly provided to the outside of the bottom portion of washing tub 3 to detect the temperature of the washing water in washing tub 3.

[0042] Control device 21 is provided in main body 1, and controls various electrical components such as washing pump 5, heater 8, water supply valve 15 and an air blowing fan 17 to operate the dishwasher. Further, control device 21 controls the various electrical components on the basis of input information about on and off of electric power input from input device 19, course selection, operation start and the like, detection information from water level detecting device 20, the temperature detecting unit (not shown) or the like, and commands from a control program, to thereby execute respective steps of washing, rinsing and drying.

[0043] As described above, the dishwasher of the present exemplary embodiment is configured.

[0044] Hereinafter, operations and effects of the dishwasher of the present exemplary embodiment will be described. Since basic operations and effects of the dishwasher are the same as in the described-above dishwasher in the related art, description thereof will be omitted.

[0045] Thus, a control sequence of generating washing water with high temperature and high concentration at the start of operation of the dishwasher, which is a characteristic point of the present exemplary embodiment, will be described below with reference to Figs. 1 and 2, using Figs. 3 to 4B.

[0046] Fig. 3 is a flowchart illustrating an operation of a washing step of the dishwasher according to the present exemplary embodiment. Fig. 4A is a diagram illustrating a control sequence of a washing step of a dishwasher in the related art. Fig. 4B is a diagram illustrating

a control sequence of the washing step of the dishwasher according to the present exemplary embodiment.

[0047] Here, control device 21 controls various electrical components according to commands from the control program. Thus, control device 21 controls the operation of the dishwasher during washing.

[0048] First, a user sets washing object 7 such as dishes in dish basket 13 before operation for the operation start of the dishwasher. Further, the user inserts a detergent to above heater 8 on the side of front surface 3a of washing tub 3 through detergent inserting section 14 shown in Figs. 1 and 2.

[0049] Further, as shown in Figs. 3 to 4B, control device 21 starts the washing operation of the dishwasher on the basis of an input by the user through input device 19 (step S1).

[0050] Then, first, control device 21 operates washing pump 5 to discharge the washing water in washing tub 3, thereby making washing tub 3 enter a non-water state. Here, washing pump 5 is operated as a drainage pump. Thereafter, water supply valve 15 is operated to perform water supply up to a predetermined water level in washing tub 3 until washing water level detecting device 20a provided in water level detecting device 20 is operated by detecting the washing water from the non-water state (step S2). Further, when washing water level detecting device 20a detects a detection water level that is a reference water level, control device 21 finishes the water supply (main water supply) is finished on the basis of the detection information. Here, the detection water level that is the reference water level of the washing water in washing tub 3 is set to be lower than the water level of the washing water in the main washing operation of the washing step to be performed later.

[0051] Then, in the state of a water level lower than the water level of the washing water in the main washing, control device 21 supplies electricity to heater 8 to turn on, and operates heater 8 for a predetermined time (step S3). Here, control device 21 does not operate washing pump 5. Thus, the temperature of the washing water accumulated in washing tub 3 increases. Further, according to the temperature increase of the washing water, dissolution of the detergent inserted through detergent inserting section 14 to the upstream side of the flow of the washing water above heater 8 is facilitated.

[0052] Then, it is determined whether the temperature of the washing water is increased to a predetermined temperature (for example, 40°C to 60°C) or higher within a predetermined time (step S4). If the temperature of the washing water does not reach the predetermined temperature (No in step S4), the electricity supply to heater 8 is continued until the temperature of the washing water becomes the predetermined temperature. This operation is performed particularly considering that the maximum active temperature (optimum temperature) of ingredient enzyme included in the detergent used in the dishwasher is about 40°C to 60°C. That is, by setting the temperature of the washing water to 40°C to 60°C, it is possible to

increase the activity of the enzyme of the detergent, and to effectively wash dirt attached to the dishes that can be decomposed by the enzyme.

[0053] On the other hand, if the temperature of the washing water is the predetermined temperature or higher (Yes in step S4), control device 21 turns off heater 8 to finish the heating of the washing water, and operates washing pump 5 by an intermittent operation under the condition of ON for 5 seconds and OFF for 5 seconds, for example, to perform a prewashing (step S5). Thus, washing pump 5 sprays the washing water with the detergent of high concentration and with high temperature to washing object 7 or the like. In this case, washing pump 5 is not necessarily operated by the intermittent operation, but may be operated by a continuous operation.

[0054] Here, it is necessary to set the amount of water in washing tub 3 in the main washing operation of the washing step to be performed later in consideration of dirt attached to washing object 7 or bubbles due to the detergent ingredients. Thus, it is possible to reduce the influence on air entertainment sound or performance through the series of washing operations.

[0055] Thus, in the dishwasher of the present exemplary embodiment, control device 21 operates washing pump 5 for a predetermined time. Then, make-up water is added to washing tub 3 by supplying electricity to water supply valve 15 for a predetermined time, similarly to the related art (step S6). Thus, the amount of water in washing tub 3 is adjusted to a necessary and sufficient amount of water in the main washing operation of the washing step.

[0056] Then, similarly to the related art, the main washing operation of the washing steps of steps S7 to S11 is performed.

[0057] Further, the procedure goes to the rinsing step that is the next step (step S12).

[0058] As described above, the operation of the washing step of the dishwasher of the present exemplary embodiment is executed.

[0059] That is, in the dishwasher of the present exemplary embodiment, in the washing step, even though the temperature of the washing water supplied in washing tub 3 is low, by heating the washing water by heater 8 in advance without operation of washing pump 5, it is possible to sufficiently dissolve the inserted detergent into the washing water. Thus, it is possible to spray the washing water with high concentration and high temperature from washing nozzle 6 from the start of the washing operation to wash washing object 7.

[0060] Further, in the present exemplary embodiment, in particular, the inserted detergent is sufficiently dissolved in the small amount of washing water in washing tub 3 before the make-up water is added thereto. Consequently, it is possible to perform washing with the washing water with high concentration and high temperature from the start of the washing operation.

[0061] Further, in the dishwasher of the present exemplary embodiment, detergent inserting section 14 is dis-

posed to guide the detergent in the vicinity of heater 8. Specifically, detergent inserting section 14 is disposed at the position where the detergent can be inserted above heater 8 of the upstream portion of the flow of the washing water in the inner bottom portion of washing tub 3, on the opposite side to the drainage output (kitchen waste collecting section 10). With such a configuration, the washing water passes through the vicinity of heater 8, in a high temperature state due to heating, according to the operation of washing pump 5. Accordingly, the dissolution of the detergent is further facilitated. Thus, it is possible to sufficiently dissolve the inserted detergent in the small amount of washing water in washing tub 3 before the make-up water is added thereto. Consequently, it is possible to spray the washing water with high concentration and high temperature from washing nozzle 6 to wash washing object 7 from the start of the washing operation.

[0062] Further, in the dishwasher of the present exemplary embodiment, heater 8, kitchen waste collecting section 10 (drainage port) and detergent inserting section 14 are disposed so that the inserted detergent is guided in the vicinity of heater 8 and in a water path that connects heater 8 and kitchen waste collecting section 10 (drainage port). That is, the water path is disposed so that the inserted detergent flows in the inner bottom portion of washing tub 3 along the flow of the washing water when washing pump 5 is operated. With such a configuration, it is possible to immediately pull the washing water with high concentration and high temperature generated in the vicinity of heater 8 into washing pump 5 by operation of washing pump 5. Thus, it is possible to obtain the washing water with high concentration and high temperature by sufficiently dissolving the detergent in the washing water before the washing water is sprayed from washing nozzle 6. Consequently, it is possible to wash washing object 7 with high detergency from the start of the washing operation.

[0063] As described above, according to the configuration of the dishwasher of the present exemplary embodiment, it is possible to obtain the washing water with high detergent concentration and high temperature by heating the small amount of washing water at an appropriate temperature before washing pump 5 is operated. Further, it is possible to spray the pure washing water with high detergent concentration and high temperature to washing object 7 such as dishes for a predetermined time before being mixed with the washing water contaminated by washing of the washing object. Thus, it is possible to realize a dishwasher with a higher washing effect than the dishwasher in the related art with the same detergent amount (or with the same water amount).

(SECOND EXEMPLARY EMBODIMENT)

[0064] Hereinafter, a configuration of a dishwasher according to a second exemplary embodiment of the present invention will be described with reference to Figs. 5 to 8. More specifically, a configuration of a tabletop

dishwasher will be described as an example.

[0065] Fig. 5 is a side sectional view of the dishwasher according to the second exemplary embodiment of the present invention. Fig. 6 is a front sectional view of the dishwasher according to the second exemplary embodiment. Fig. 7 is a front sectional view of a main part of an inner bottom portion of a washing tub of the dishwasher according to the second exemplary embodiment. Fig. 8 is a plan view of the main part of the dishwasher according to the second exemplary embodiment.

[0066] As shown in Figs. 5 and 6, the tabletop dishwasher of the present exemplary embodiment has a configuration in which at least washing tub 31, washing pump 36, washing nozzle 35, temperature detecting unit 38, heater 37, kitchen waste collecting section 41, dish basket 32, detergent inserting section 48, control device 45 and the like are provided in main body 30.

[0067] Washing tub 31 accommodates washing object 46 such as dishes inside main body 30 of the dishwasher. Further, inside washing tub 31, dish basket 32 that sets washing object 46 is disposed to be put in or out through opening 33. Further, opening 33 of washing tub 31 is closed or opened by door 34. Washing nozzle 35 is provided in a lower portion in washing tub 31, and sprays washing water to washing object 46 set in washing basket 32 for washing. Washing pump 36 is disposed on the outside of a rear lower portion of washing tub 31 to send the washing water in washing tub 31 to washing nozzle 35 by pressure. Heater 37 is provided in washing tub 31 and heats the washing water. Further, the periphery of heater 37 is surrounded by heater protecting component 39 made of, for example, stainless steel or the like and fan case 40 including an air blowing path, to thereby protect heater 8. Temperature detecting unit 38 is configured by a thermistor or the like, and is provided on the outside of the lower portion of washing tub 31 to detect the temperature of the washing water.

[0068] As shown in Figs. 5 and 6, detergent inserting section 48 is provided integrally with dish basket 32, for example, at a position above detergent receiving section 47 (to be described later). Further, detergent inserting section 48 leads the inserted detergent to be above detergent receiving section 47.

[0069] Water reserving section 31a is provided in the inner bottom portion of washing tub 31. Kitchen waste collecting section 41 (drainage port) that includes a kitchen waste collecting filter that collects kitchen waste washed off from washing object 46 is provided in water reserving unit 31a.

[0070] Water supply valve 42 is provided at a rear portion of main body 30 of the dishwasher. Further, when control device 45 operates water supply valve 42, tap-water or the like is supplied into washing tub 31 through a pipe as washing water.

[0071] As shown in Fig. 6, auxiliary water tub 43 is provided on a lower right side of washing tub 31, for example. Water level detecting device 44 connected to a lower part of kitchen waste collecting section 41 through a pipe is

provided in auxiliary water tub 43. Water level detecting device 44 detects that a reference amount of water is reserved in washing tub 31 as a predetermined detection water level (for example, reference water level).

[0072] Control device 45 is provided below door 34. Control device 45 controls washing nozzle 35, washing pump 36, heater 37 and the like on the basis of detection information of temperature detecting unit 38 and input information input by a user through an input unit (not shown), according to a program that stores a control sequence. Thus, for example, respective steps of washing, rinsing, rinsing with heat, drying and the like are performed.

[0073] Further, as shown in Figs. 6 to 8, fan case 40 includes detergent receiving section 47. Further, detergent receiving section 47 receives detergent S inserted through detergent inserting section 48 provided in dish basket 32. Here, as shown in Fig. 7, detergent receiving section 47 is provide position that is higher than heater 37 and at a position that is lower than a predetermined detection water level (for example, reference water level). Further, detergent receiving section 47 includes retaining section 47a, standing section 47b, flowing water section 47c, water passing section 47d and the like. Further, in detergent receiving section 47, as shown in Fig. 8, retaining section 47a and flowing water section 47c are disposed in an approximately L shape (including an L shape) in a plan view. Retaining section 47a of detergent receiving section 47 is provided under detergent inserting section 48, and receives and retains detergent S inserted from detergent inserting section 48. Standing section 47b of detergent receiving section 47 is provided around retaining section 47a, and prevents detergent S from overflowing to the periphery thereof.

[0074] Further, as shown in Fig. 8, flowing water section 47c of detergent receiving section 47 is provided at a position above heater 37, deviated from a lower portion of detergent inserting section 48 without formation of standing section 47b. Thus, the heated washing water may smoothly flow into and out of detergent receiving section 47, and may dissolve detergent S to obtain a liquid detergent, and may cause the liquid detergent to easily flow out. Water passing section 47d of detergent receiving section 47 is provided at a position lower than flowing water section 47c, at the position of retaining section 47a of detergent receiving section 47. Thus, the washing water and the liquid detergent may easily flow in and out through passing water section 47d, similarly to flowing water section 47c.

[0075] In the present exemplary embodiment, an example in which both of retaining section 47a and flowing water section 47c of detergent receiving section 47 are formed above heater 37 has been described, but the present invention is not limited thereto. For example, at least flowing water section 47c may be provided above the heater. In this case, it is similarly preferable that a majority of retaining section 47a of detergent receiving section 47 be formed above heater 37.

[0076] Further, it is preferable that detergent receiving section 47 have a configuration in which the washing water may smoothly flow in and out as much as possible. Thus, for example, a plurality of portions for inflow and outflow such as flowing water section 47c and water passing section 47d of detergent receiving section 47 may be provided. Here, particularly, it is preferable that the heights of flowing water section 47c and water passing section 47d be different from each other. Accordingly, it is possible to convect the washing water, the liquid detergent or the like between detergent receiving section 47 and the outside for effective use. Consequently, it is possible to facilitate dissolution of the detergent.

[0077] Further, standing section 47b of detergent receiving section 47 is not necessarily vertically provided, and it is sufficient as long as retaining section 47a is formed so that inserted detergent S does not overflow. Further, upper end 47b1 of standing section 47b may be provided at a position higher than the predetermined detection water level (for example, reference water level).

[0078] As described above, the dishwasher of the present exemplary embodiment is formed.

[0079] Hereinafter, operations and effects of the dishwasher of the present exemplary embodiment will be described with reference to Figs. 3 to 4B. Since basic operations and effects of the dishwasher are the same as in the dishwasher in the related art, description thereof will be omitted.

[0080] Thus, a control sequence of generating washing water with high temperature and high concentration at the start of the operation of the dishwasher, which is a characteristic point of the present exemplary embodiment, will be particularly described.

[0081] Here, control device 45 controls various electrical components according to commands from the control program. Thus, control device 45 controls the operation during washing of the dishwasher.

[0082] First, a user sets a washing object such as dishes in dish basket 32 before the start of the operation of the dishwasher. Further, the user inserts a detergent to detergent receiving section 47 from detergent inserting section 48 shown in Figs. 5 and 6.

[0083] Then, as shown in Figs. 3 to 4B, control device 45 starts the washing operation of the dishwasher on the basis of an input by the user through an input device (not shown) (step S1).

[0084] Then, control device 45 operates washing pump 36, to discharge the washing water in washing tub 31, thereby making washing tub 3 enter a non-water state. Here, washing pump 36 is operated as a drainage pump. Thereafter, water supply valve 42 is operated to perform water supply up to a predetermined water level in washing tub 31 until water level detecting device 44 is operated by detecting the washing water from the non-water state (step S2). Further, control device 45 finishes, when water level detecting device 44 detects a detection water level that is a reference water level, water supply (main water supply) is finished on the basis of the detec-

tion information. Here, the detection water level that is the reference water level of the washing water in washing tub 31 is set to be lower than the water level of the washing water in a main washing operation of the washing step to be executed later.

[0085] Then, in the state of a water level lower than the water level of the washing water in the main washing, control device 45 supplies electricity to heater 37 to turn on, and operates heater 37 for a predetermined time (step S3). Here, control device 45 does not operate washing pump 36. Thus, the temperature of the washing water accumulated in washing tub 31 increases.

[0086] In this case, in the present exemplary embodiment, the detergent is set in advance in detergent receiving section 47 before operation. Further, as shown in Fig. 7, detergent receiving section 47 is provided at the position above heater 37 and at the position lower than the detection water level (for example, reference water level) of the washing water. Thus, the washing water heated by heater 37 rises due to a convection phenomenon. Here, the detergent inserted in detergent receiving section 47 is exposed to the washing water with high temperature in convection. Thus, as the temperature of the washing water increases, dissolution of the detergent retained in detergent receiving section 47 on the upstream side of the flow of the washing water above heater 37 is facilitated. Consequently, it is possible to obtain a liquid detergent with high temperature and high concentration as the washing water in a short time.

[0087] Then, it is determined whether the temperature of the washing water is increased to a predetermined temperature (for example, 40°C to 60°C) or higher within a predetermined time (step S4). If the temperature of the washing water does not reach the predetermined temperature (No in step S4), the electricity supplied to heater 37 is continued until the temperature of the washing water becomes the predetermined temperature (step S4).

[0088] On the other hand, if the temperature of the washing water is the predetermined temperature or higher (Yes in step S4), control device 45 turns off heater 37 to finish the heating of the washing water, and operates washing pump 36 by an intermittent operation under the condition of ON for 5 seconds and OFF for 5 seconds, for example, to perform prewashing (step S5). Thus, washing pump 36 sprays the washing water with the detergent of high concentration and with high temperature to washing object 46 or the like. In this case, washing pump 36 is not necessarily operated by the intermittent operation, but may be operated by a continuous operation.

[0089] Here, it is necessary to set the amount of water in washing tub 31 in the main washing operation of the washing step to be performed later in consideration of dirt attached to washing object 46 or bubbles due to the detergent ingredient. Thus, it is possible to reduce the influence on air entertainment sound or performance through the series of washing operations.

[0090] Thus, in the dishwasher of the present exem-

play embodiment, control device 45 operates washing pump 36 for a predetermined time. Then, make-up water is added to washing tub 31 by supplying electricity to water supply valve 15 for a predetermined time, similarly to the related art (step S6). Thus, the amount of water in washing tub 31 is adjusted to a necessary and sufficient amount of water in the main washing operation of the washing step.

[0091] Then, similarly to the related art, the main washing operation of the washing steps of steps S7 to S11 is performed.

[0092] Further, the procedure goes to the rinsing step that is the next step (step S12).

[0093] As described above, the washing step of the dishwasher of the present exemplary embodiment is executed.

[0094] That is, in the dishwasher of the present exemplary embodiment, in the washing step, even though the temperature of the washing water supplied in washing tub 31 is low, by heating the washing water by heater 37 in advance without operation of washing pump 36, it is possible to sufficiently dissolve the inserted detergent into the washing water. Thus, it is possible to spray the washing water with high concentration and high temperature from washing nozzle 35 from the start of the washing operation to wash washing object 46.

[0095] Further, in the present exemplary embodiment, in particular, the inserted detergent is sufficiently dissolved in the small amount of washing water in washing tub 31 before the make-up water is added thereto. Consequently, it is possible to perform washing with the washing water with high concentration and high temperature from the start of the washing operation.

[0096] Further, in the dishwasher of the present exemplary embodiment, detergent receiving section 47 that holds the detergent is disposed in the vicinity of heater 37. Specifically, detergent receiving section 47 is disposed on the upstream side of the flow of washing water from heater 37, particularly, on the opposite side to kitchen waste collecting section 41. With such a configuration, the washing water passes through the periphery of heater 37 in a high temperature state due to heating according to the operation of washing pump 36. Here, the dissolution of the detergent is further facilitated. Thus, it is possible to sufficiently dissolve the inserted detergent in the small amount of washing water in washing tub 31 before the make-up water is added thereto. Consequently, it is possible to spray the washing water with high concentration and high temperature from washing nozzle 35 from the start of the washing operation to wash washing object 46.

[0097] Further, detergent receiving section 47 is provided with a slope from fan case 40 when the washing water is sprayed. Thus, it is possible to further facilitate the dissolution of the detergent by the flow of the washing water that flows in through the slope. Thus, in a case where the amount of detergent is larger than a specified value, or in a case where the dissolution condition of the

detergent is poor, for example, in the case of a detergent that is barely dissolved, it is possible to efficiently dissolve the detergent by an agitating effect or the like due to the washing water that flows into detergent receiving section 47 through the slope, to thereby improve washing performance.

[0098] As described above, according to the configuration of the dishwasher of the present exemplary embodiment, by heating the small amount of washing water at an appropriate temperature before washing pump 36 is operated, it is possible to obtain washing water with high concentration and high temperature. Further, it is possible to spray pure washing water with high concentration and high temperature before being mixed with contaminated washing water due to washing of the washing object to washing object 46 such as dishes for a predetermined time. Thus, it is possible to provide a dishwasher having an excellent washing effect compared with the dishwasher in the related art with the same amount of detergent (or with the same amount of water).

[0099] In the dishwasher of the above-described each exemplary embodiment, an example in which in the addition of the make-up water, water supply valve 15 is operated for a predetermined time to supply all the amount of water once has been described, but the present invention is not limited thereto. For example, all the make-up water is not necessarily be supplied once, but the water may be supplied over a plurality of times at necessary timings, using a washing operation time, a temperature increase value of the washing water or the like as a mark. Specifically, a configuration may be used in which a detection water level before the addition of the make-up water described in the present exemplary embodiment is used as a first washing detection water level, and a second washing detection water level, a third washing detection water level and the like are separately provided to detect the water level of the washing water. Thus, it is possible to more correctly adjust the amount of the supplied washing water. Further, in the dishwasher of the present exemplary embodiment, the amount of the inserted detergent is uniform over the entirety of the washing steps. Thus, by detecting the water level of the washing water over a plurality of stages to supply the water, it is possible to effectively perform washing by the liquid detergent with high concentration and high temperature for a long time from the start of the washing operation. That is, by setting the water level of the washing water to the plurality of stages, it is possible to dissolve the detergent into a smaller amount of washing water to thereby perform washing with higher concentration.

[0100] Further, in the dishwasher of each exemplary embodiment, an example in which the detergent inserting section is provided in the dish basket has been described, but the present invention is not limited thereto. That is, the detergent inserting section may be provided at any arbitrary place as long as the place that guides the detergent to the upstream side of the flow of the washing water from the heater in the vicinity of the heater.

[0101] As described above, according to the dishwasher of the present invention, the dishwasher includes: a washing tub that includes a dish basket for accommodating a washing object and a water reserving section for reserving washing water in an inner bottom portion thereof; a washing nozzle that is provided in the washing tub to spray the washing water to the washing object; a heater that is provided in the water reserving section to heat the washing water; a water level detecting device that is provided to be connected to the washing tub to detect a level of the washing water; a washing pump that supplies the washing water to the washing nozzle through a drainage port provided in the water reserving section and circulates the washing water in the washing tub; a water supply valve that supplies water into the washing tub; and a control device that controls respective steps of washing, rinsing and drying. Further, the control device may perform a control for opening the water supply valve to start water supply, closing the water supply valve to finish the water supply when the water level detecting device detects a predetermined water level, and heating the washing water by the heater before the washing pump is operated.

[0102] With this configuration, it is possible to increase the temperature of the washing water before the washing pump is operated to increase a dissolution speed of the detergent, and to easily obtain the washing water with high concentration and high temperature in a short time. Further, by activating ingredients of the detergent, it is possible to enhance the washing effect from the start of the operation of the washing pump in the main washing operation. Consequently, it is possible to realize a dishwasher with high detergency without an increase in the amount of the detergent.

[0103] Further, according to the dishwasher of the present invention, the control device may stop the water supply valve at a detection water level lower than a water level in the main washing operation, and may perform an operation of heating the washing water by the heater before the washing pump is operated.

[0104] With this configuration, it is possible to increase the temperature of the washing water to increase the dissolution speed of the detergent before the washing pump is operated. Consequently, in a small amount of washing water before make-up water is added for the main washing operation, it is possible to easily obtain the washing water with higher concentration and high temperature in a short time. Further, by activating the ingredients of the detergent, it is possible to efficiently wash the washing object with an excellent washing effect from the start of the operation of the washing pump in the main washing operation of the washing step. Consequently, it is possible to realize a dishwasher with high detergency with a small amount of detergent without increase in the amount of detergent.

[0105] Further, according to the dishwasher of the present invention, the control device may operate the heater for a predetermined time so that the temperature

of the washing water heated by the heater is 40°C to 60°C.

[0106] With this configuration, it is possible to further activate the detergent by dissolving the ingredients of the detergent at the maximum active temperature (optimum temperature). Thus, in particular, it is possible to effectively wash dishes to which dirt decomposed by the enzyme is attached, using the further activated detergent. Consequently, it is possible to realize a dishwasher having high detergency with the washing water of the same detergent concentration.

[0107] Further, according to the dishwasher of the present invention, the control device may perform a control so that the washing pump is not operated until the washing water is heated by the heater to reach a predetermined temperature.

[0108] With this configuration, it is possible to collectively use heat from the heater for dissolution of the detergent. Further, it is possible to prevent the detergent from being mixed with the washing water contaminated by being sprayed to the washing object. That is, at the start of the operation of the washing step, it is possible to obtain a pure liquid detergent with high concentration and high temperature. Consequently, it is possible to realize a dishwasher with high detergency against firm dirt or the like from the start of the main washing operation of the washing step.

[0109] Further, according to the dishwasher of the present invention, the dishwasher may further include a detergent inserting section that is provided in the washing tub to guide an inserted detergent in the vicinity of the heater.

[0110] With this configuration, it is possible to guide the detergent in the vicinity of the heater, and to facilitate the dissolution of the detergent in the small amount of washing water in the washing tub due to heating of the heater. Further, it is possible to obtain a liquid detergent with high temperature and high concentration in a short time without circulating the washing water using the washing pump. Consequently, it is possible to realize a dishwasher capable of washing the washing object using the liquid detergent with high concentration and high temperature from the start of the main washing operation of the washing step.

[0111] Further, according to the dishwasher of the present invention, the detergent inserting section may be provided to guide the detergent to a front surface side on an upstream side in the washing tub, above the heater, in the vicinity of the heater.

[0112] With this configuration, it is possible to pull in and circulate the washing liquid with high concentration generated in the vicinity of the heater while passing the washing water through the periphery of the high temperature heater by the operation of the washing pump. Further, it is possible to obtain the washing liquid with high concentration and high temperature obtained by sufficiently dissolving the detergent. Consequently, it is possible to realize a dishwasher capable of washing the

washing object with higher detergency from the start of the main washing operation of the washing step.

[0113] Further, according to the dishwasher of the present invention, the detergent inserting section may be provided in the dish basket. With this configuration, it is possible to guide the detergent above the heater without waste while preventing the detergent from being attached to the washing object. Consequently, it is possible to prevent non-dissolution of the detergent in advance.

[0114] Further, according to the dishwasher of the present invention, the washing tub may further include a detergent receiving section that guides the detergent, and the detergent receiving section may be provided at a position that is higher than the heater and is lower than the predetermined detection water level.

[0115] With this configuration, it is possible to cause the washing water heated by the heater to rise due to a convection phenomenon, and to expose the detergent inserted in the detergent receiving section to the washing water with high temperature. Thus, it is possible to obtain a liquid detergent with high temperature and high concentration in a short time. Consequently, it is possible to realize a dishwasher capable of washing the washing object using the liquid detergent with high concentration and high temperature from the start of the main washing operation of the washing step.

[0116] Further, according to the dishwasher of the present invention, the washing tub may be configured to guide an inserted detergent in the vicinity of the heater and in a water path that connects the heater and the drainage port.

[0117] With this configuration, it is possible to operate the washing pump to pull the washing liquid with high concentration and high temperature generated in the vicinity of the heater into the washing pump at one time. Thus, it is possible to obtain the washing liquid with high concentration and high temperature by sufficiently dissolving the detergent before the washing water is sprayed through the washing nozzle. Consequently, it is possible to realize a dishwasher capable of washing with higher detergency from the start of the main washing operation of the washing step.

Claims

1. A dishwasher comprising:

a washing tub that includes a dish basket for accommodating a washing object and a water reserving section for reserving washing water in an inner bottom portion thereof;
a washing nozzle that is provided in the washing tub to spray the washing water to the washing object;
a heater that is provided in the water reserving section to heat the washing water;
a water level detecting device that is provided

to be connected to the washing tub to detect a level of the washing water;

a washing pump that supplies the washing water to the washing nozzle through a drainage port provided in the water reserving section and circulates the washing water in the washing tub;
a water supply valve that supplies water into the washing tub; and

a control device that controls respective steps of washing, rinsing and drying, wherein the control device performs a control for opening the water supply valve to start water supply, closing the water supply valve to finish the water supply when the water level detecting device detects a predetermined water level, and heating the washing water by the heater before the washing pump is operated.

2. The dishwasher of claim 1, wherein the control device stops the water supply at a detection water level lower than a water level in a main washing operation, and performs an operation of heating the washing water by the heater before the washing pump is operated.

3. The dishwasher of claim 1, wherein the control device operates the heater for a predetermined time so that the temperature of the washing water heated by the heater is 40°C to 60°C.

4. The dishwasher of claim 1, wherein the control device performs a control so that the washing pump is not operated until the washing water is heated by the heater to reach a predetermined temperature.

5. The dishwasher of claim 1, further comprising:

a detergent inserting section that is provided in the washing tub to guide an inserted detergent in the vicinity of the heater.

6. The dishwasher of claim 5, wherein the detergent inserting section is provided to guide the detergent to a front surface side on an upstream side in the washing tub, above the heater, in the vicinity of the heater.

7. The dishwasher of claim 5, wherein the detergent inserting section is provided in the dish basket.

8. The dishwasher of claim 5, wherein the washing tub further includes a detergent receiving section that guides the detergent, and wherein the detergent receiving section is provided at a position that is higher than the heater and is lower than the predetermined detection water level.

9. The dishwasher of claim 1,
wherein the washing tub is configured to guide an
inserted detergent in the vicinity of the heater and in
a water path that connects the heater and the drain-
age port.

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FIG. 1

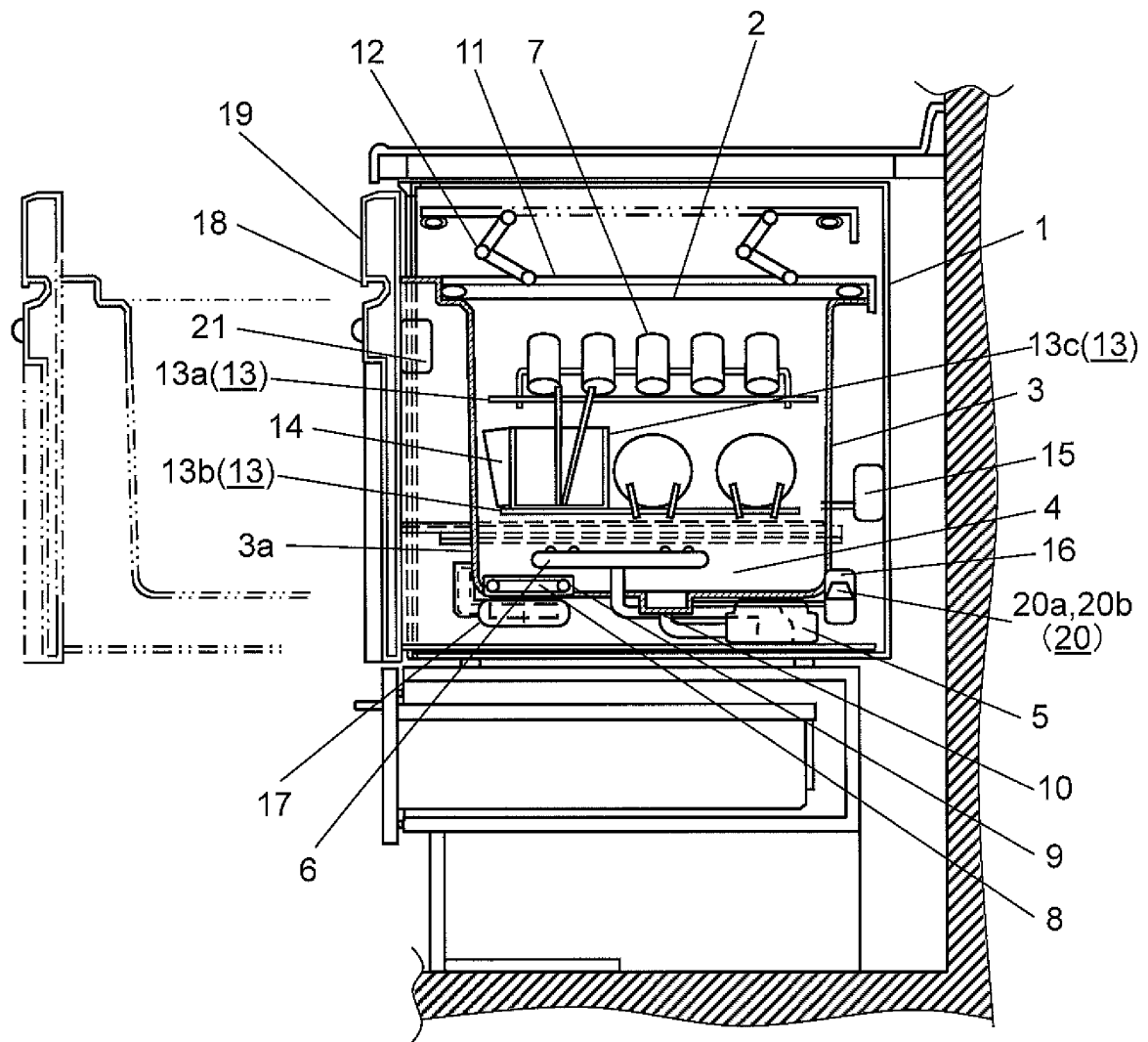


FIG. 2

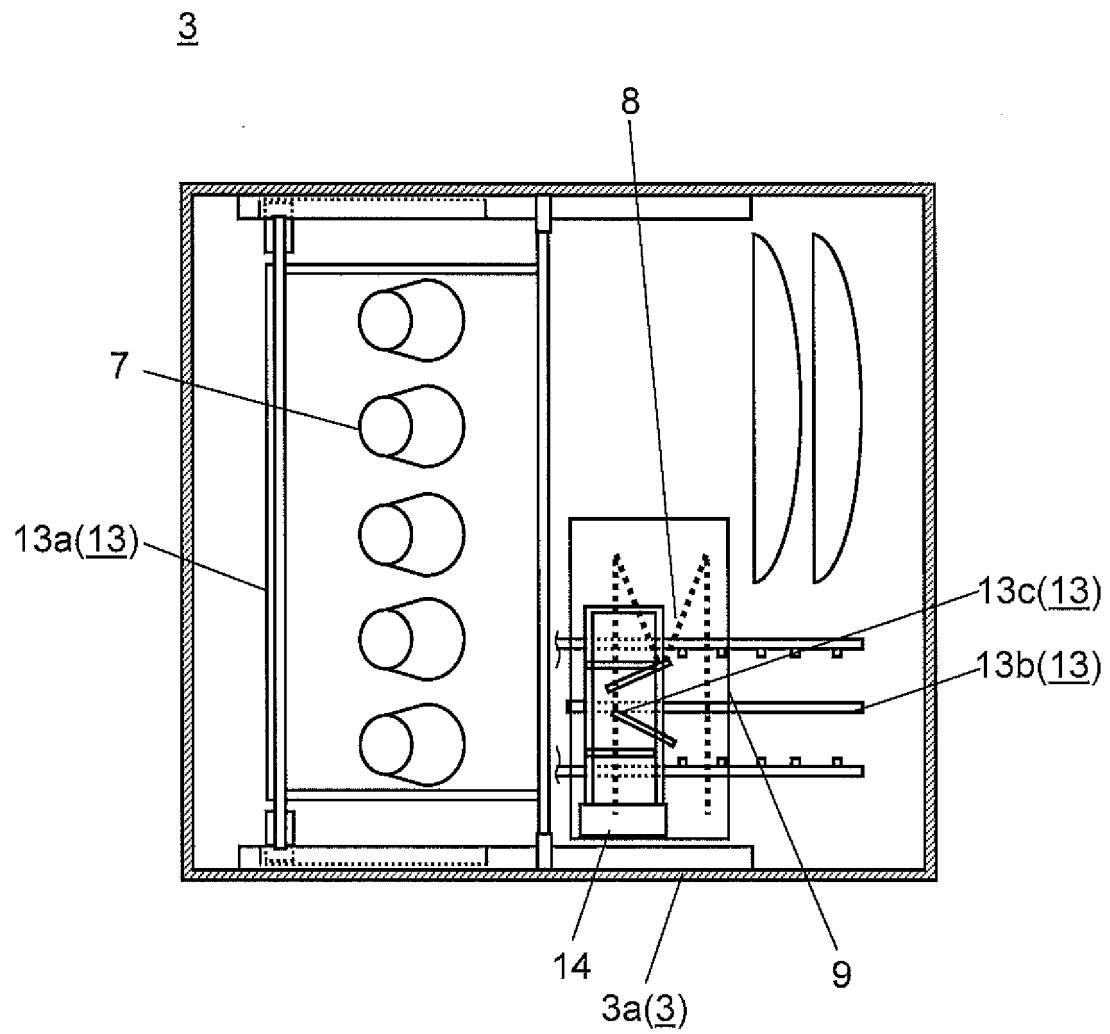


FIG. 3

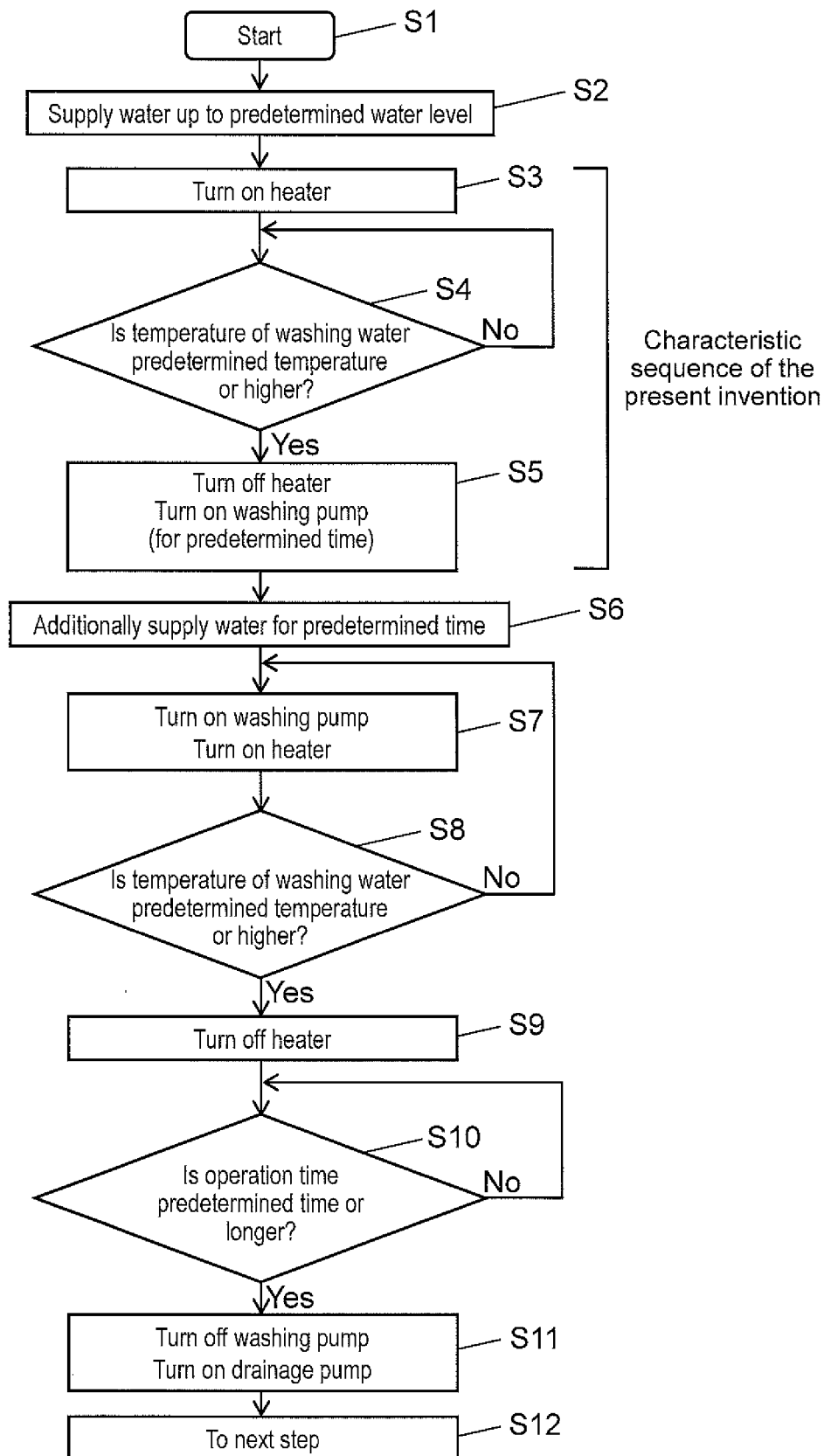


FIG. 4A

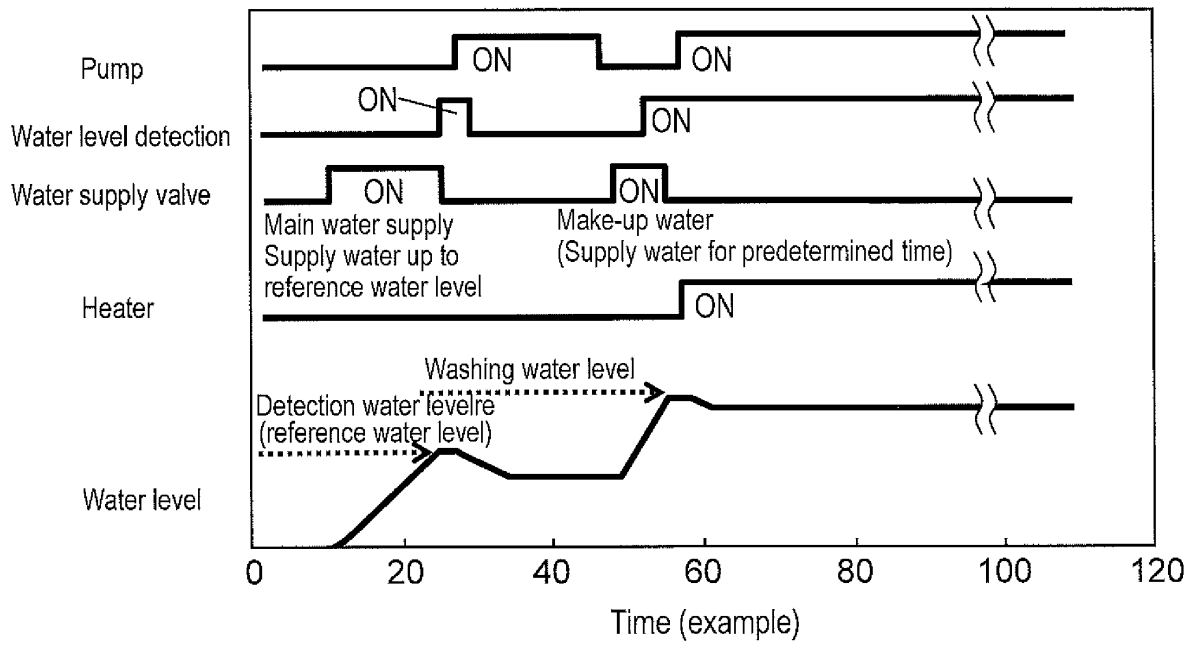


FIG. 4B

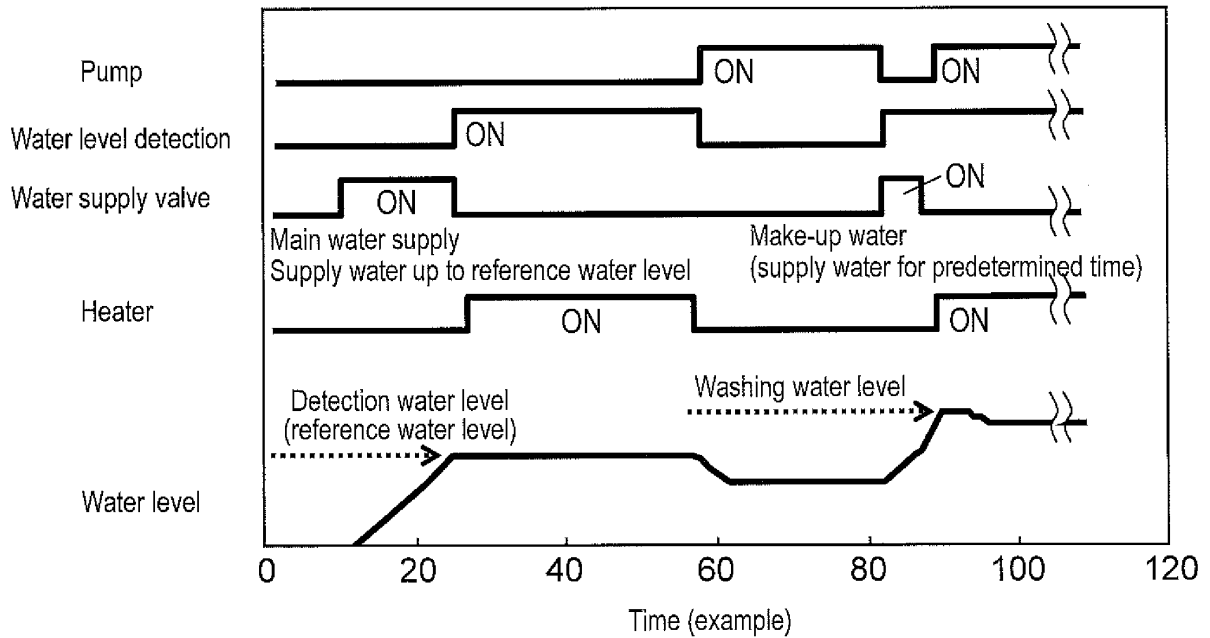


FIG. 5

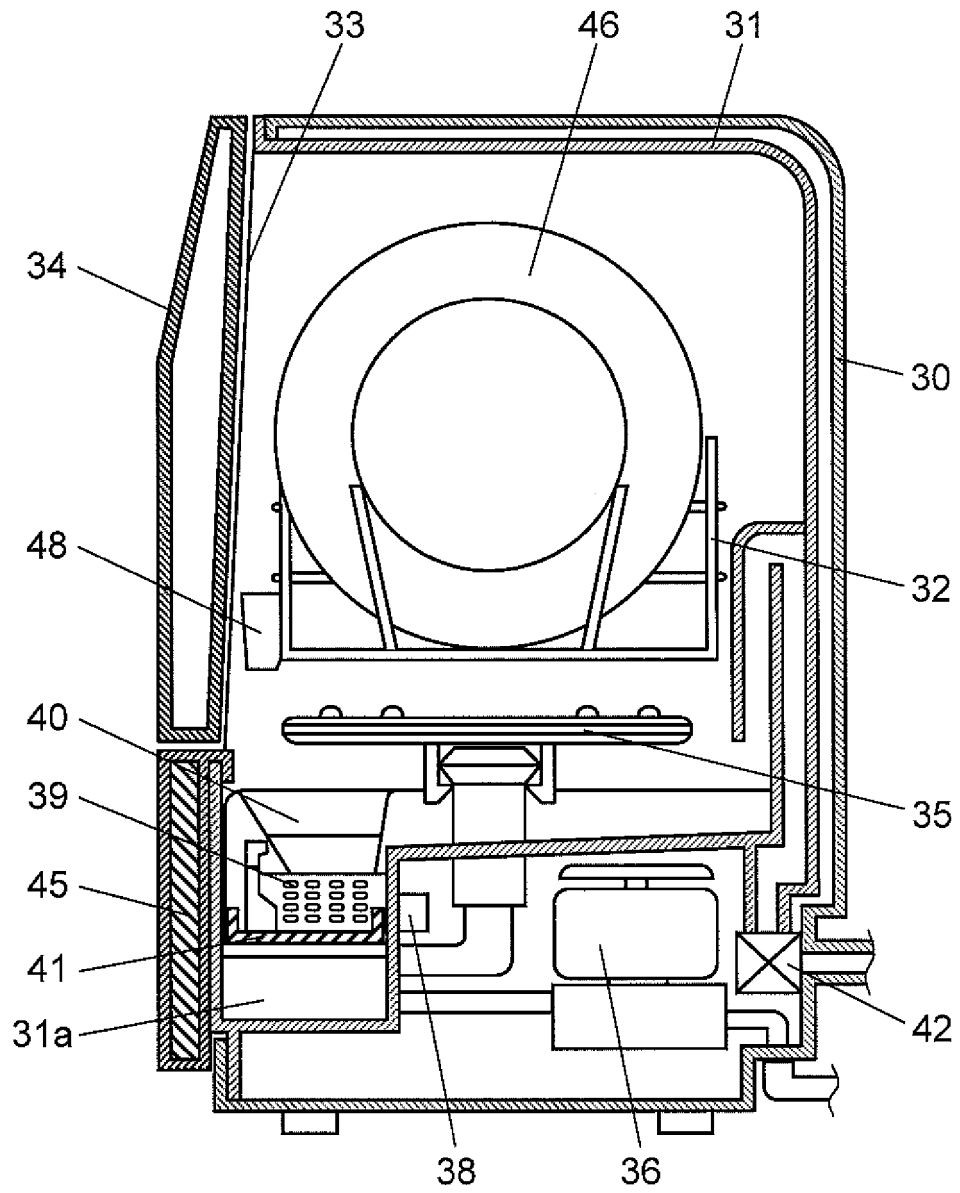


FIG. 6

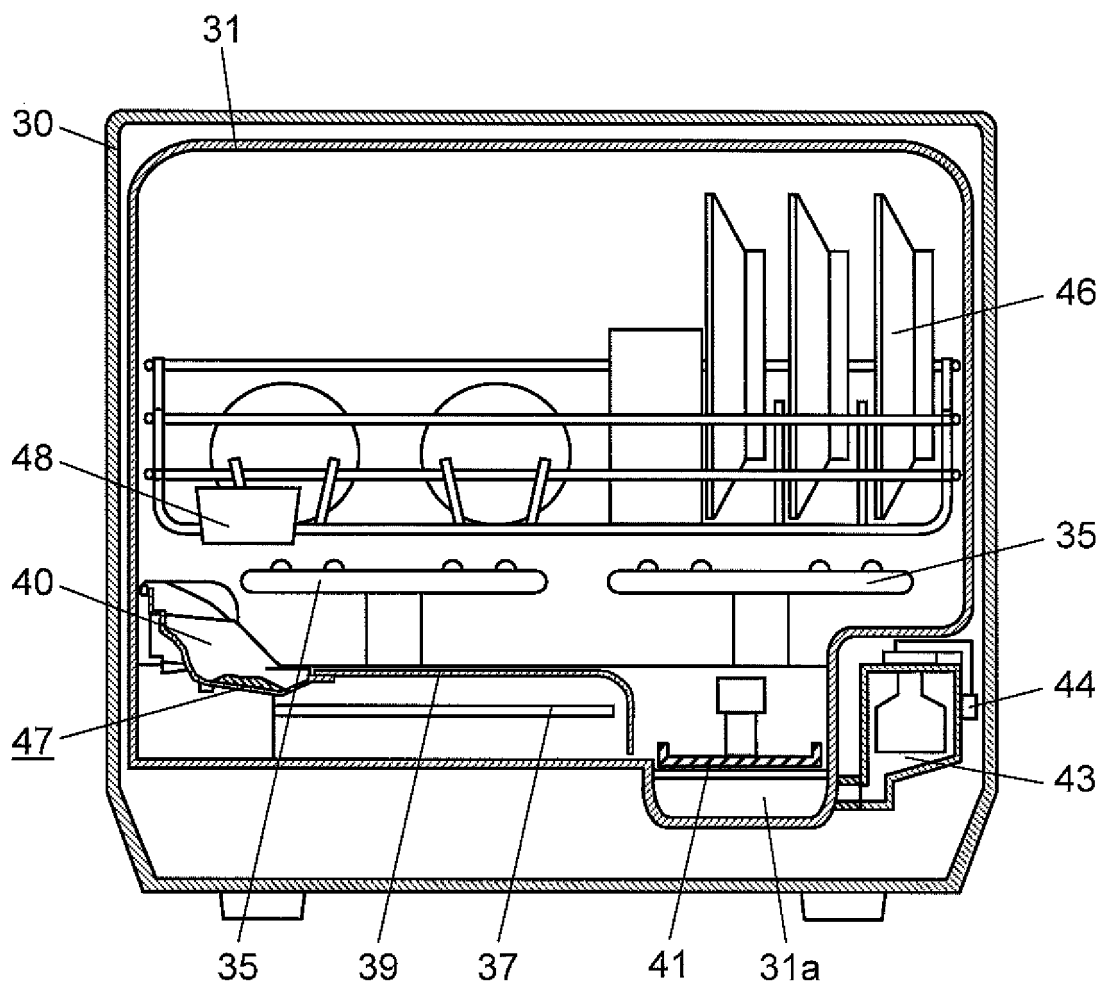


FIG. 7

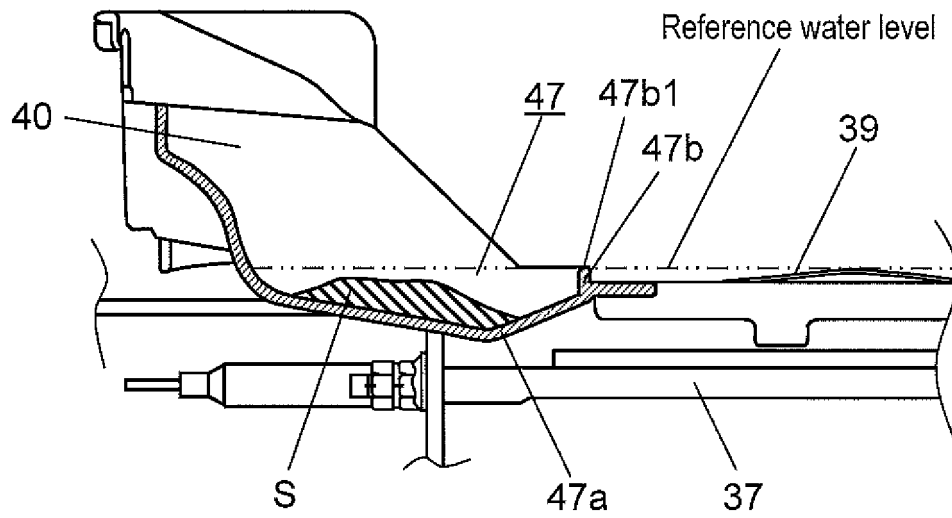


FIG. 8

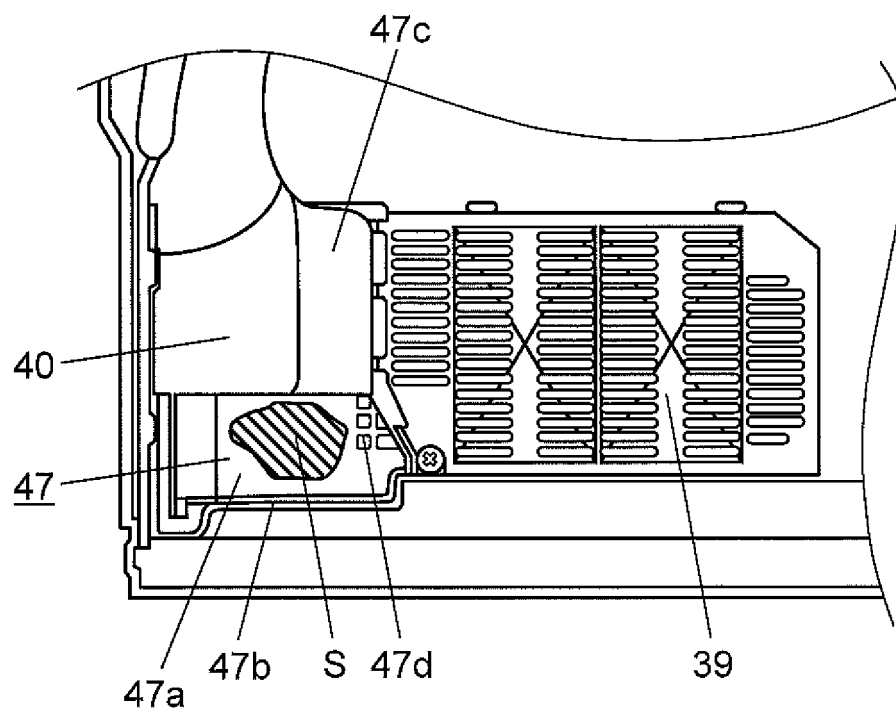


FIG. 9

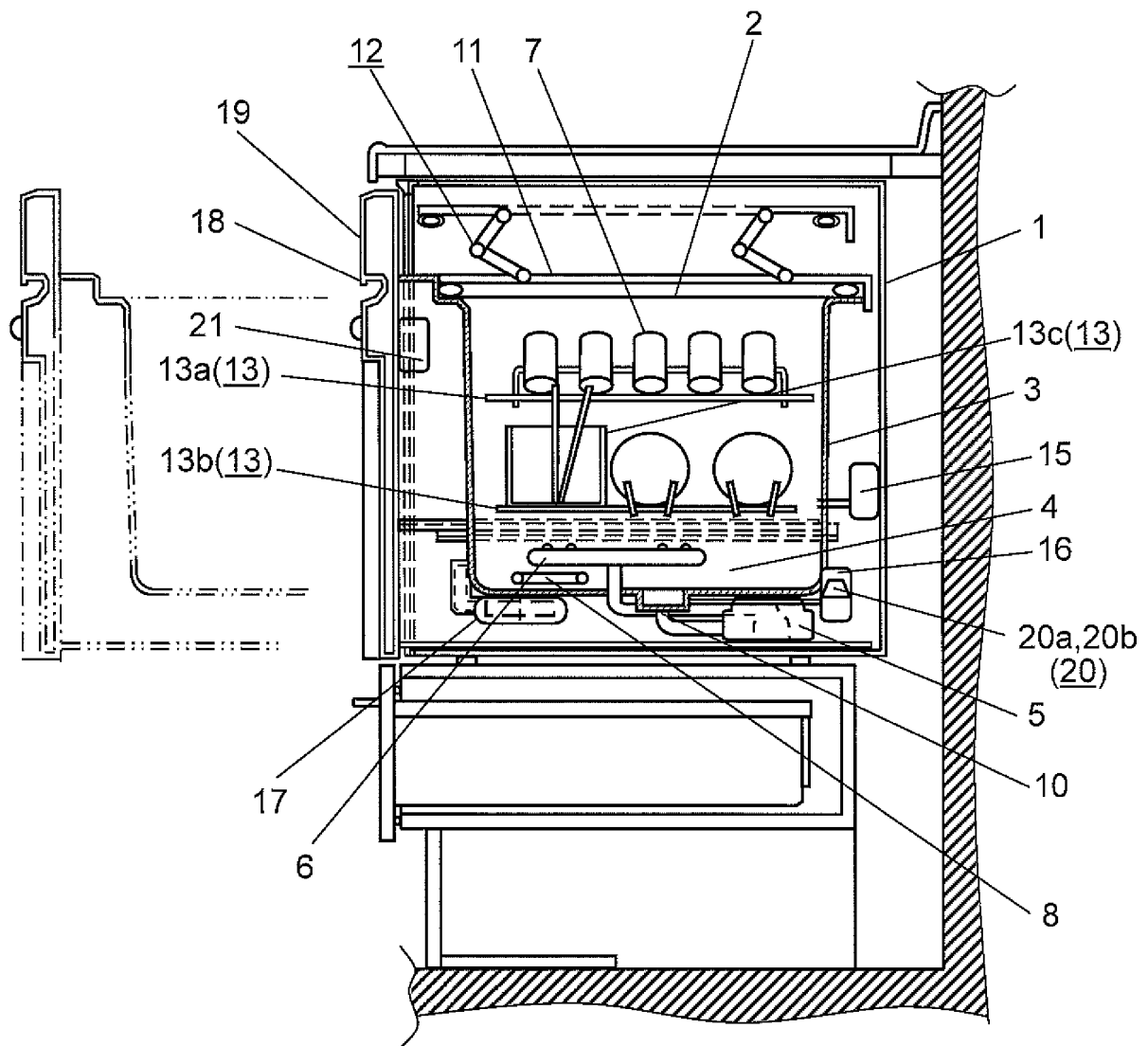
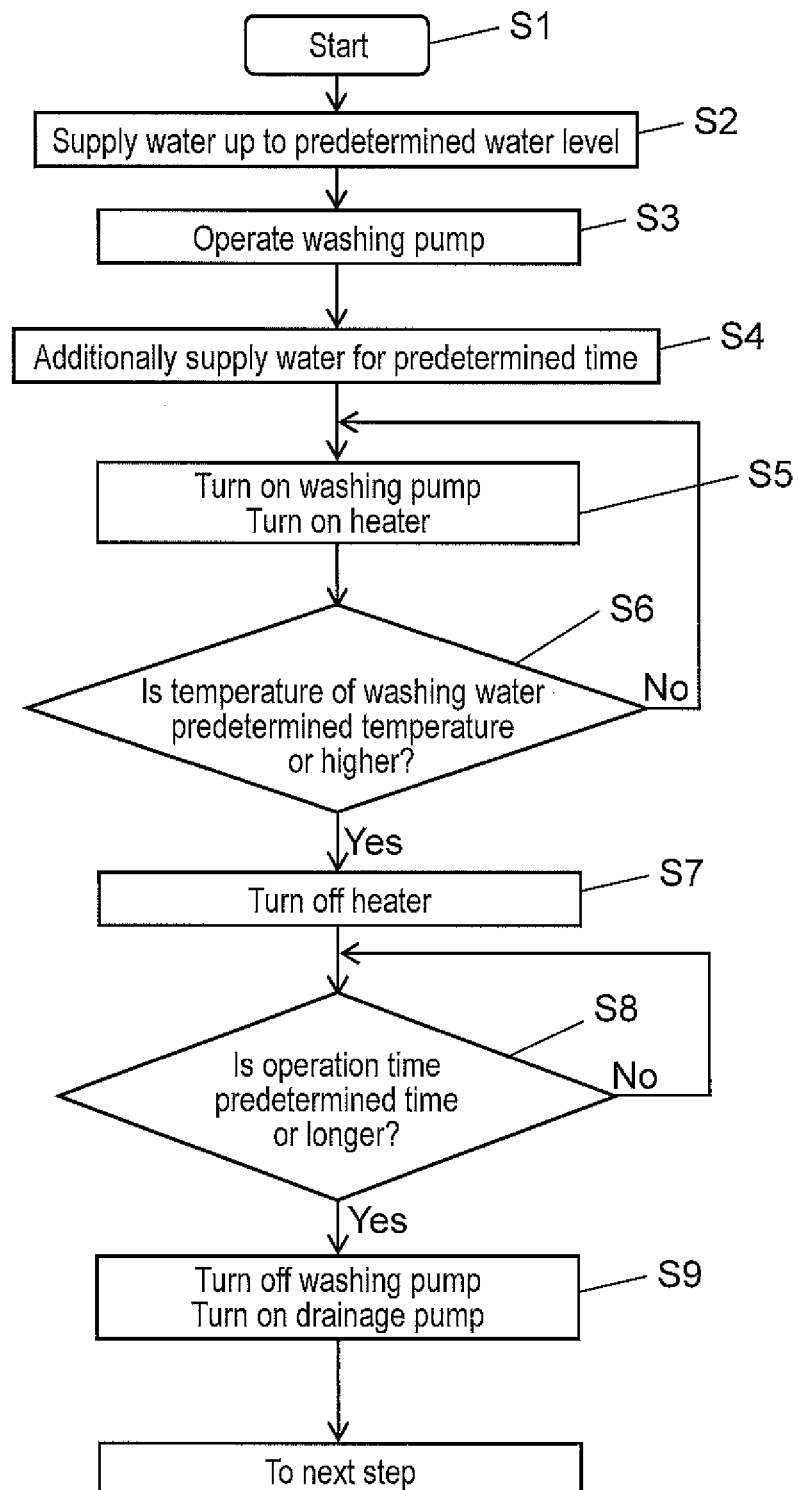


FIG. 10



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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