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• **TANIGUCHI, Yutaka**
Chuo-ku
Osaka 540-6207 (JP)
• **HIROMATSU, Naoki**
Chuo-ku
Osaka 540-6207 (JP)

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(71) Applicant: **Panasonic Corporation**
Osaka 571-8501 (JP)

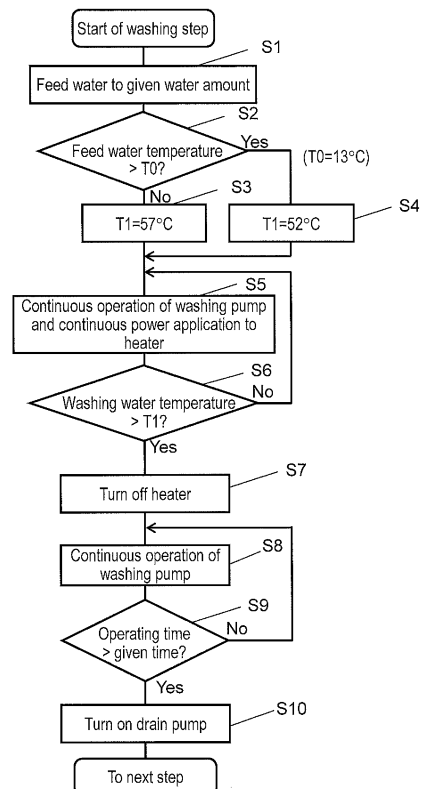
(74) Representative: **Schwabe - Sandmair - Marx**
Patentanwälte
Stuntzstraße 16
81677 München (DE)

(72) Inventors:
• **UESAKI, Masayoshi**
Chuo-ku
Osaka 540-6207 (JP)

(54) **DISHWASHER**

(57) A dishwasher includes a washing tub disposed inside the main body, a dish basket for accommodating tableware to-be-washed, a washing nozzle for spraying washing water to wash the tableware, a heater for heating washing water, a washing-water temperature sensor unit (thermistor) for measuring the temperature of washing water, and a control unit for controlling operation. The dishwasher sprays the heated washing water to wash the tableware. The dishwasher further includes a feed-water temperature sensor unit (thermistor) for measuring feed water temperature of the washing water led into the washing tub. The control unit, when the feed water temperature is higher than a given temperature, changes the setting so that the target temperature at which heating of the washing water during washing is stopped becomes lower than the temperature in the case where the feed water temperature is lower than the given temperature.

FIG. 3



Description

TECHNICAL FIELD

[0001] The present invention relates to a dishwasher that, while heating washing water stored in the washing tub, sprays the washing water from the washing nozzle toward tableware to wash it.

BACKGROUND ART

[0002] A description is made of the structure of a dishwasher according to the conventional technology. FIG. 6 is a sectional side view of the conventional dishwasher. FIG. 7 is a block diagram illustrating the control structure of the conventional dishwasher. FIG. 8 is a flowchart illustrating operation of the washing step of the conventional dishwasher. FIG. 9 is an explanatory diagram illustrating the temperature of washing water and operation conditions of the conventional dishwasher.

[0003] Conventionally, this type of dishwasher has the structure as shown in FIG. 6 (refer to patent literature 1 for instance). Hereinafter, the structure is described. As shown in FIG. 6, main body 20 of the dishwasher is provided therein with washing tub 21. The bottom of washing tub 21 is provided therein with drain opening 3. Washing pump 5 driven by washing motor 4 is placed in the pump chamber communicatively connected to drain opening 3. Washing pump 5 circulates the washing water inside washing tub 21. The circulation is performed through the following path. First, the washing water is suctioned into washing pump 5 from drain opening 3. Next, the washing water is fed from washing pump 5 to washing nozzle 6 rotatably placed on the inner bottom of washing tub 21. Finally, the washing water is sprayed from washing nozzle 6 toward tableware 7 to wash tableware 7, and then returns to drain opening 3.

[0004] Heater 8 for heating the washing water is placed between washing nozzle 6 and the bottom of washing tub 21. Control unit 22 indirectly senses that the temperature of the washing water has reached a given temperature from the temperature at the bottom of washing tub 21 by means of thermistor 23 that is a washing-water temperature sensor unit and stops applying power to heater 8. Dish basket 11 is placed above washing nozzle 6. Dish basket 11 allows tableware 7 to be arranged in an orderly manner, thereby effectively spraying the washing water onto tableware 7 for efficiently washing tableware 7.

[0005] Washing tub 21 is open to the front, and its front surface has lid 12 freely opened and closed attached thereto. Drain pump 13 suctions the washing water from drain opening 3 and drains the washing water outside the dishwasher through drain hose 14.

[0006] The washing water stored inside washing tub 21 is fed from feed hose 15. When water level sensor unit 16 communicatively connected with washing tub 2 senses that the washing water has reached a given water

level, control unit 22 closes water feed valve 17 to stop feeding the washing water.

[0007] Blowing fan 18 for drying sends air from the outside of the dishwasher to the inside of washing tub 21 to discharge vapor generated from surfaces of tableware 7 and other parts to the outside of the dishwasher through air outlet 19 provided in lid 12, thereby drying tableware 7.

[0008] Control unit 22 and each load are connected as shown in FIG. 7 and operation of the dishwasher is controlled by control unit 22. As shown in FIGs. 8 and 9, the operation step of the dishwasher is composed of the four steps: the washing step, rinsing step, heating and rinsing step, and drying step. In the washing step, control unit 22 feeds washing water to a given water amount from water supply through feed water hose 15 (step S21). Subsequently, control unit 22 applies power to washing pump 5 and heater 8 to continue operation until the temperature of the washing water reaches a first given temperature (e.g., 57°C) (steps S22 and S23). When the washing water temperature reaches the first given temperature, control unit 22 stops applying power to heater 8 (step S24). Subsequently, control unit 22 makes washing pump 5 continuously operate until the operating time reaches a given time to perform washing (steps S25 and S26). Then, control unit 22 makes drain pump 13 operate to drain washing water inside washing tub 2 (step S27) and advances the process flow to the next step (rinsing step).

[0009] In the rinsing step, after drain pump 13 drains washing water soiled until then, control unit 22 repeats the operation twice in which control unit 22 stores clean washing water inside washing tub 21 and rinses tableware 7 for a given time while applying power only to washing pump 5 (not to heater 8). In the heating and rinsing step, after drain pump 13 drains washing water soiled until then, control unit 22 stores clean washing water inside washing tub 21; applies power to washing pump 5 and heater 8; and performs operation until the washing water temperature reaches a second given temperature (e.g., 70°C) to rinse tableware 7. In the drying step, after drain pump 13 drains washing water, control unit 22 intermittently applies power to heater 8 for a given time while applying power to blowing fan 18 for drying.

[0010] With a conventional dishwasher structured as above, its operation program is uniquely determined for each operation course by the manufacturer. Hence, the dishwasher is operated according to an operation program with the same temperature setting regardless of the temperature of feed water led into washing tub 21.

Citation List

Patent Literature

[0011] PTL 1 Japanese Patent Unexamined Publication No. 2003-47585

SUMMARY OF THE INVENTION

[0012] A dishwasher of the present invention includes a washing tub disposed inside the main body, a dish basket for accommodating tableware to-be-washed; a washing nozzle for spraying washing water to wash the tableware; a heater unit for heating the washing water; a washing-water temperature sensor unit for measuring temperature of the washing water; and a control unit for controlling the operation. The dishwasher sprays the heated washing water to wash the tableware. The dishwasher further includes a feed-water temperature sensor unit for measuring feed water temperature of the washing water fed into the washing tub. When the feed water temperature is higher than a given temperature, the control unit changes the setting so that the target temperature at which heating of the washing water during washing is stopped becomes lower than the temperature in the case where the feed water temperature is lower than the given temperature.

[0013] Resultingly, when the feed water temperature is relatively high, the target temperature of the washing water is lowered and the operation program is automatically changed to the energy-saving mode, thereby providing an energy-saving, easy-to-use dishwasher.

BRIEF DESCRIPTION OF DRAWINGS

[0014]

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

FIG. 2 is a block diagram illustrating the control structure of the dishwasher according to the first exemplary embodiment of the present invention.

FIG. 3 is a flowchart illustrating operation of the washing step of the dishwasher according to the first exemplary embodiment of the present invention.

FIG. 4 is an explanatory diagram illustrating the temperature of washing water and operation conditions of the dishwasher according to the first exemplary embodiment of the present invention.

FIG. 5 is a front view illustrating the operation unit of the dishwasher according to the first exemplary embodiment of the present invention.

FIG. 6 is a sectional side view of a conventional dishwasher.

FIG. 7 is a block diagram illustrating the control structure of the conventional dishwasher.

FIG. 8 is a flowchart illustrating operation of the washing step of the conventional dishwasher.

FIG. 9 is an explanatory diagram illustrating the temperature of washing water and operation conditions of the conventional dishwasher.

DESCRIPTION OF EMBODIMENTS

[0015] Hereinafter, a description is made of an exemplary embodiment of the present invention with reference to the related drawings. This exemplary embodiment does not limit the scope of the present invention.

FIRST EXEMPLARY EMBODIMENT

[0016] Hereinafter, a description is made of a dishwasher according to the first exemplary embodiment of the present invention. A component same as that of the dishwasher as a conventional example described in reference to FIGs. 6 through 9 is given the same reference mark to omit its description. FIG. 1 is a sectional side view of a dishwasher according to the first exemplary embodiment of the present invention. FIG. 2 is a block diagram illustrating the control structure of the dishwasher according to the first exemplary embodiment of the present invention. FIG. 3 is a flowchart illustrating operation of the washing step of the dishwasher according to the first exemplary embodiment of the present invention. FIG. 4 is an explanatory diagram illustrating the temperature of washing water and operation conditions of the dishwasher according to the first exemplary embodiment of the present invention. FIG. 5 is a front view illustrating the operation unit of the dishwasher according to the first exemplary embodiment of the present invention.

[0017] Main body 1 of the dishwasher of the first exemplary embodiment is provided therein with washing tub 2 as shown in FIGs. 1 through 4. Washing tub 2 is provided therein with dish basket 11. Rotatable washing nozzle 6 sprays the washing water onto tableware 7 accommodated in dish basket 11 to wash tableware 7. The washing water is heated by heater 8 as the heater unit provided on the bottom of washing tub 2.

[0018] Washing tub 2 has thermistor 9 as the washing-water temperature sensor unit for measuring the temperature of washing water inside washing tub 2, attached to the back side of the bottom surface of washing tub 2. Thermistor 9 measures the temperature of the washing water indirectly from the temperature of the bottom surface of washing tub 2. In the first exemplary embodiment, thermistor 9 also serves as a feed-water temperature sensor unit for measuring the temperature of water fed from water supply. Control unit 10 senses output voltage from thermistor 9. Control unit 10 integrally includes indicator unit 24 to display information for a user by light emission of LEDs.

[0019] Next, a description is made of operation and effects of the dishwasher of the first exemplary embodiment. The basic operation of the dishwasher using washing pump 5, washing nozzle 6, heater 8, and other components is the same as that of the dishwasher as a conventional example. Hereinafter, a detailed description is made of operation and effects related to the characteristic components different from those of the conventional dishwasher.

[0020] When the dishwasher starts its operation of the washing step, control unit 10 applies power to water feed valve 17 to feed the washing water from water supply to washing tub 2 through feed water hose 15. When water level sensor unit 16 senses that the washing water has been stored to a given water amount, control unit 22 stops applying power to water feed valve 17 to stop feeding the washing water (step S1).

[0021] Control unit 10 measures the temperature of feed water according to output voltage from thermistor 9 when given time (e.g., 1 minute) has elapsed after the wash operation started, and sets the value as the this time feed water temperature. Why feed water temperature is measured after given time has elapsed is that some time is required for the temperature of the washing water led into washing tub 2 to transmit to thermistor 9 through the wall of washing tub 2.

[0022] When the feed water temperature of the washing water is equal to given temperature T0 (e.g., 13°C) or lower (No at step S2), control unit 10 sets target temperature T1 (at which heating the washing water is stopped) to the first target temperature (e.g., 57°C) (step S3). Meanwhile, when the feed water temperature of the washing water is higher than given temperature T0 (e.g., 13°C) (Yes at step S2), control unit 10 sets target temperature T1 (at which heating the washing water is stopped) to the second target temperature (e.g., 52°C) (step S4). Subsequently, control unit 10 applies power to heater 8 and washing motor 4 to drive washing pump 5 while heating the washing water, thereby performing wash operation (step S5).

[0023] When the washing water temperature is equal to target temperature T1 or lower (No at step S6), the process flow returns to step S5, where control unit 10 continues applying power to heater 8 and washing motor 4. Meanwhile, when the washing water temperature is higher than target temperature T1 (Yes at step S6), control unit 10 stops applying power to heater 8 (step S7). Subsequently, control unit 10 continues operating washing pump 5 until the operating time reaches a given time (steps S8 and S9). When the operating time of washing pump 5 reaches the given time, control unit 10 activates drain pump 13 to drain the washing water in washing tub 2 (step S10) and advances the process flow to the next step (rinsing step).

[0024] A higher washing water temperature makes soil deposited on tableware 7 softer and further activates the effect of enzymes contained in a detergent input by a user, resulting in higher wash performance. Hence, when feed water hose 15 feeds the washing water of relatively high temperature into washing tub 2, soil deposited on tableware 7 is to be washed by the washing water with high wash performance from the beginning. Accordingly, even a low target temperature (at which heating of the washing water is stopped) provides sufficient wash performance.

[0025] Resultingly, a feed water temperature higher than the given temperature lowers power consumption

in the washing step, which allows the dishwasher to perform energy-saving operation.

[0026] In the first exemplary embodiment, the feed-water temperature sensor unit also serves as thermistor 9 that is a washing-water temperature sensor unit inside washing tub 2, thereby eliminating the need for newly incorporating a feed-water temperature sensor unit, which allows the dishwasher to perform more energy-saving operation.

[0027] Control unit 10 makes LED 25 for indicating "energy saving" on indicator unit 24 flash from the start of the operation until determination of feed water temperature to indicate that feed water temperature is being measured. When the feed water temperature is higher than given temperature T0 and control unit 10 sets target temperature T1 to a lower value than that of the case where the feed water temperature is lower than given temperature T0, control unit 10 lights LED 25 until the operation ends. In other words, when power consumption in the washing step is lowered and thus energy-saving operation is performed, control unit 10 lights LED 25 until the operation ends. This allows a user to be informed that the dishwasher is checking for a possibility of energy-saving operation and that the dishwasher is performing energy-saving operation. This allows the user to understand that the dishwasher saves more energy when operated with the feed water temperature higher (e.g., daytime) than lower (e.g., early morning), which encourages energy-saving operation.

[0028] As described, a dishwasher of the present invention includes a washing tub disposed inside the main body, a dish basket for accommodating tableware to be washed; a washing nozzle for spraying washing water to wash the tableware; a heater unit for heating washing water; a washing-water temperature sensor unit for measuring the temperature of the washing water; and a control unit for controlling the operation. The dishwasher sprays the heated washing water to wash the tableware. The dishwasher further includes a feed-water temperature sensor unit for measuring feed water temperature of the washing water fed into the washing tub. When the feed water temperature is higher than a given temperature, the control unit changes the setting so that the target temperature at which heating of the washing water during washing is stopped becomes lower than a temperature in a case where the feed water temperature is lower than the given temperature.

[0029] Resultingly, when the feed water temperature is relatively high, the target temperature of the washing water is lowered and the operation program is automatically changed to the energy-saving mode, thereby providing an energy-saving, easy-to-use dishwasher.

[0030] In a dishwasher of the present invention, its feed-water temperature sensor unit also serves as a washing-water temperature sensor unit for measuring the temperature of washing water inside the washing tub. This results in also serving as a washing-water temperature sensor unit incorporated in a dishwasher according

to the conventional technology, thereby eliminating the need for newly incorporating a feed-water temperature sensor unit. This allows more energy-saving operation of the dishwasher without an excessive cost.

[0031] The dishwasher of the present invention further includes an indicator unit, and the control unit indicates that, due to a fact that the feed water temperature measured is higher than a given temperature, the control unit has set the target temperature (at which heating of washing water during washing is stopped) to a lower value than that of the case where the feed water temperature is higher than the given temperature.

[0032] This informs a user that the dishwasher is performing energy-saving operation, allowing the user to understand that the dishwasher saves more energy when operated with the feed water temperature higher, which encourages energy-saving operation of the dishwasher.

[0033] In the dishwasher of the present invention, the control unit indicates on the indicator unit that the feed-water temperature sensor unit is measuring the temperature of feed water. This informs a user that the dishwasher is checking for a possibility of energy-saving operation, which encourages energy-saving operation of the dishwasher.

INDUSTRIAL APPLICABILITY

[0034] As described above, a dishwasher according to the present invention automatically changes its operation program to the energy-saving mode when the feed water temperature is relatively high, and thus widely applicable to easy-to-use dishwashers.

REFERENCE MARKS IN THE DRAWINGS

[0035]

- | | | |
|----|---|----|
| 1 | Main body | |
| 2 | Washing tub | |
| 6 | Washing nozzle | 40 |
| 7 | Tableware | |
| 8 | Heater (heater unit) | |
| 9 | Thermistor (feed-water temperature sensor unit also serving as washing-water temperature sensor unit) | 45 |
| 10 | Control unit | |
| 11 | Dish basket | |
| 24 | Indicator unit | |

Claims

1. A dishwasher comprising:

- | | |
|---|----|
| a washing tub disposed inside a main body; | 55 |
| a dish basket for accommodating tableware to be washed; | |
| a washing nozzle for spraying washing water to | |

wash the tableware;

a heater unit for heating the washing water;

a washing-water temperature sensor unit for measuring temperature of the washing water; and

a control unit for controlling operation, the dishwasher spraying the heated washing water to wash the tableware, and further comprising a feed-water temperature sensor unit for measuring feed water temperature of the washing water fed into the washing tub, wherein, when the feed water temperature is higher than a given temperature, the control unit changes the setting so that a target temperature at which heating of the washing water during washing is stopped becomes lower than a temperature in a case where the feed water temperature is lower than the given temperature.

2. The dishwasher of claim 1, wherein the feed-water temperature sensor unit also serves as the washing-water temperature sensor unit.

3. The dishwasher of claim 1 or 2, further comprising an indicator unit, wherein the control unit makes the indicator unit indicate that the control unit has set the target temperature lower than the temperature of the case in which the feed water temperature is lower than the given temperature due to a fact that the feed water temperature measured is higher than the given temperature.

4. The dishwasher of claim 3, wherein the control unit makes the indicator unit indicate that the feed-water temperature sensor unit is measuring feed water temperature.

FIG. 1

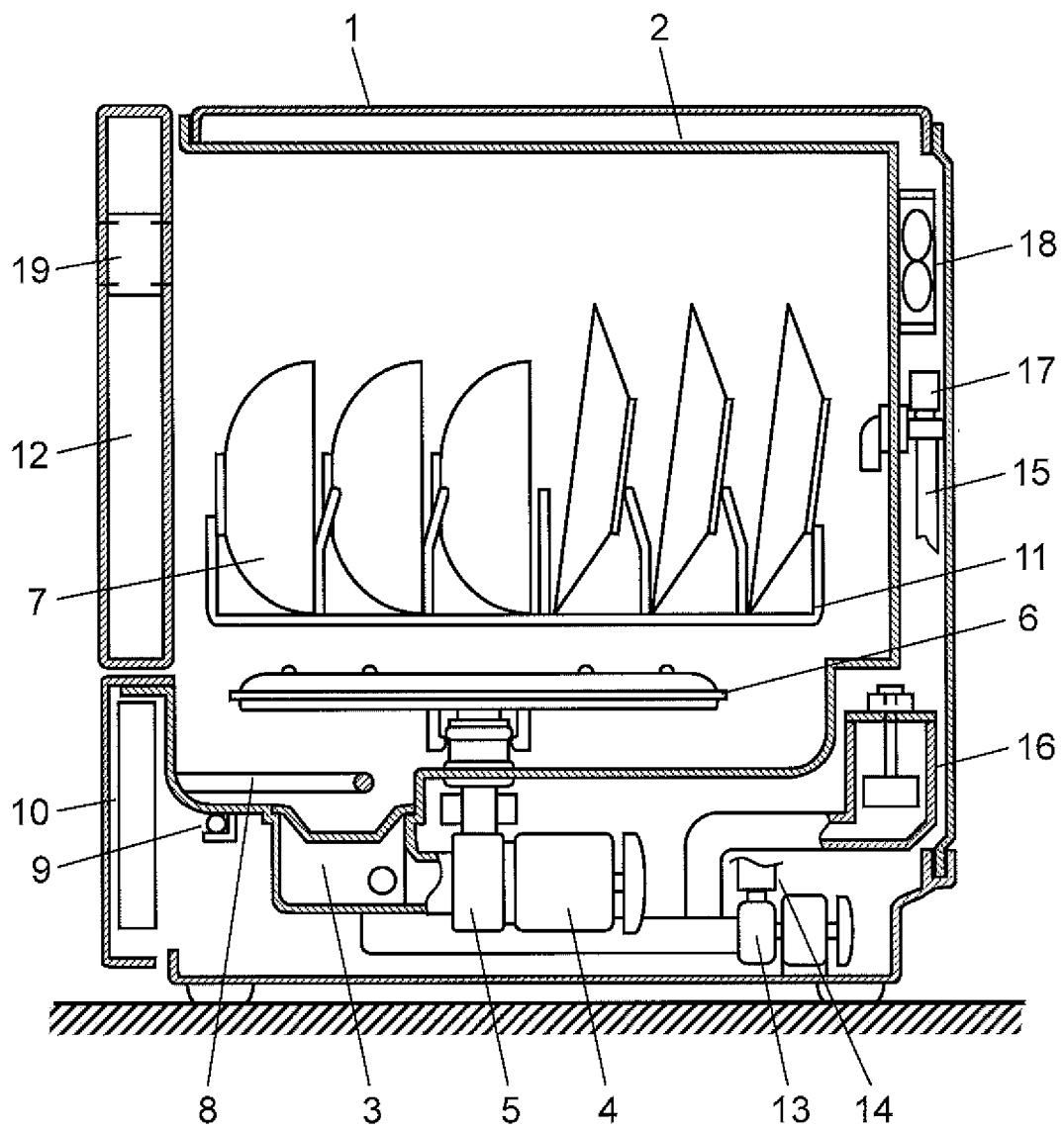


FIG. 2

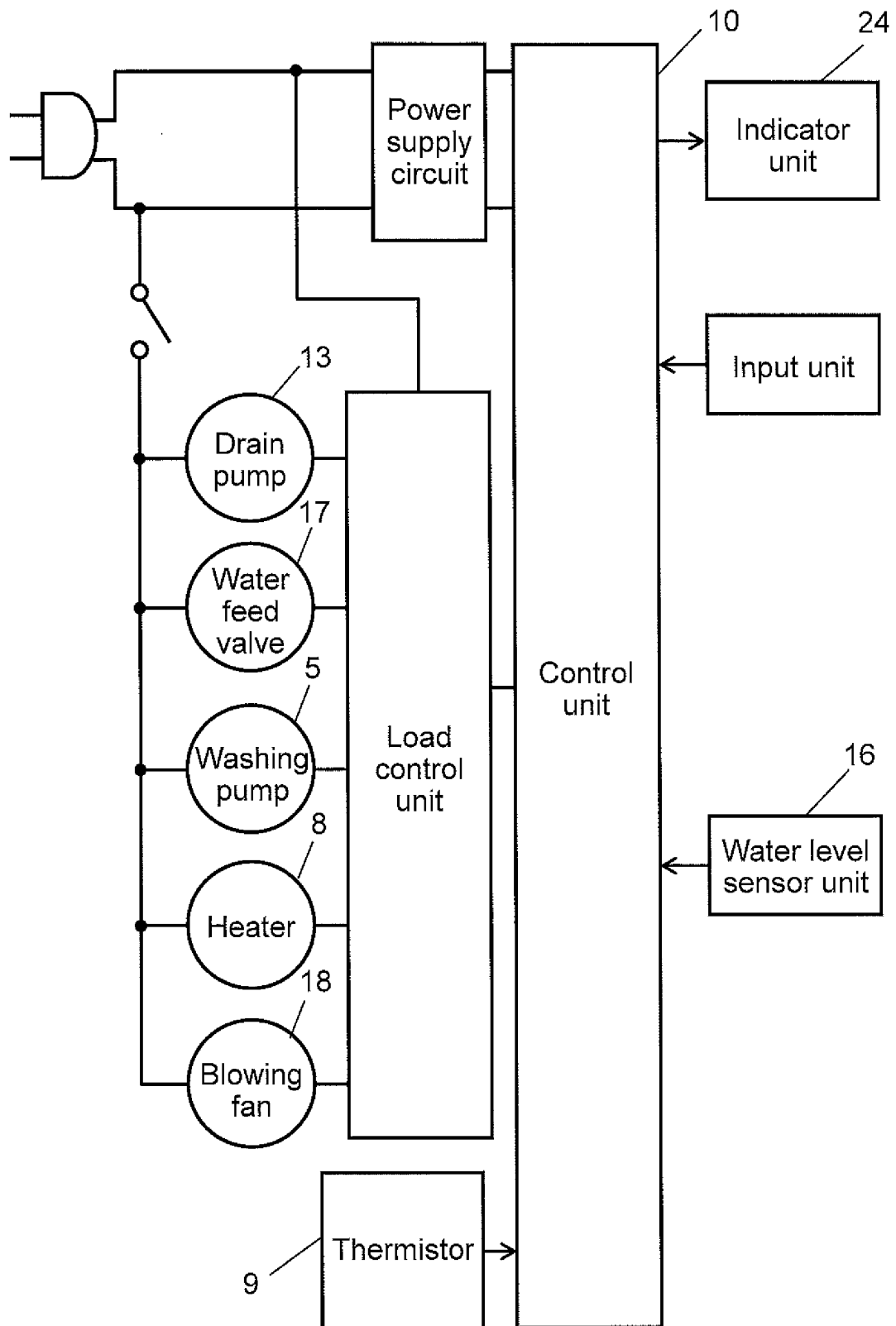


FIG. 3

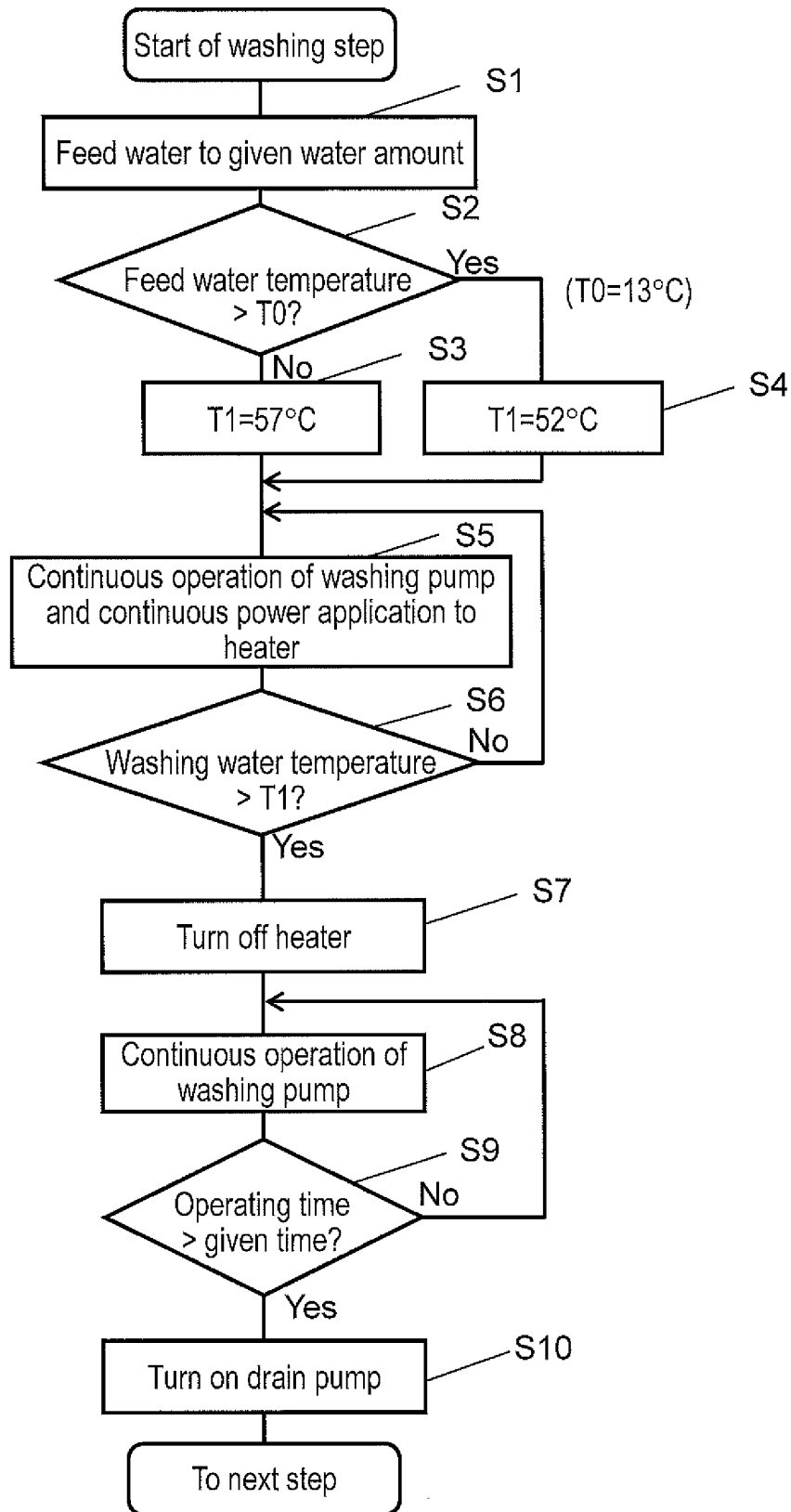


FIG. 4

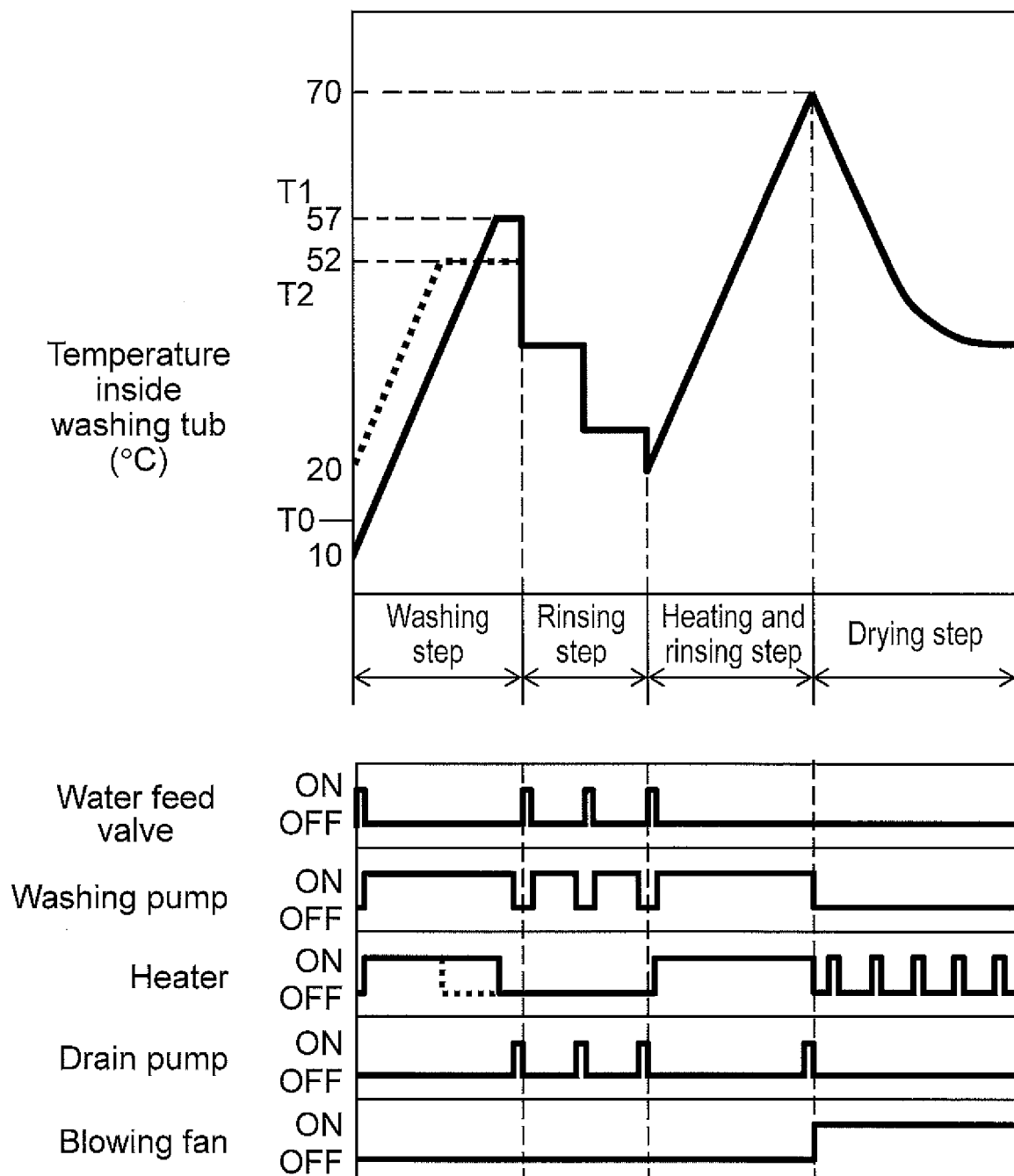


FIG. 5

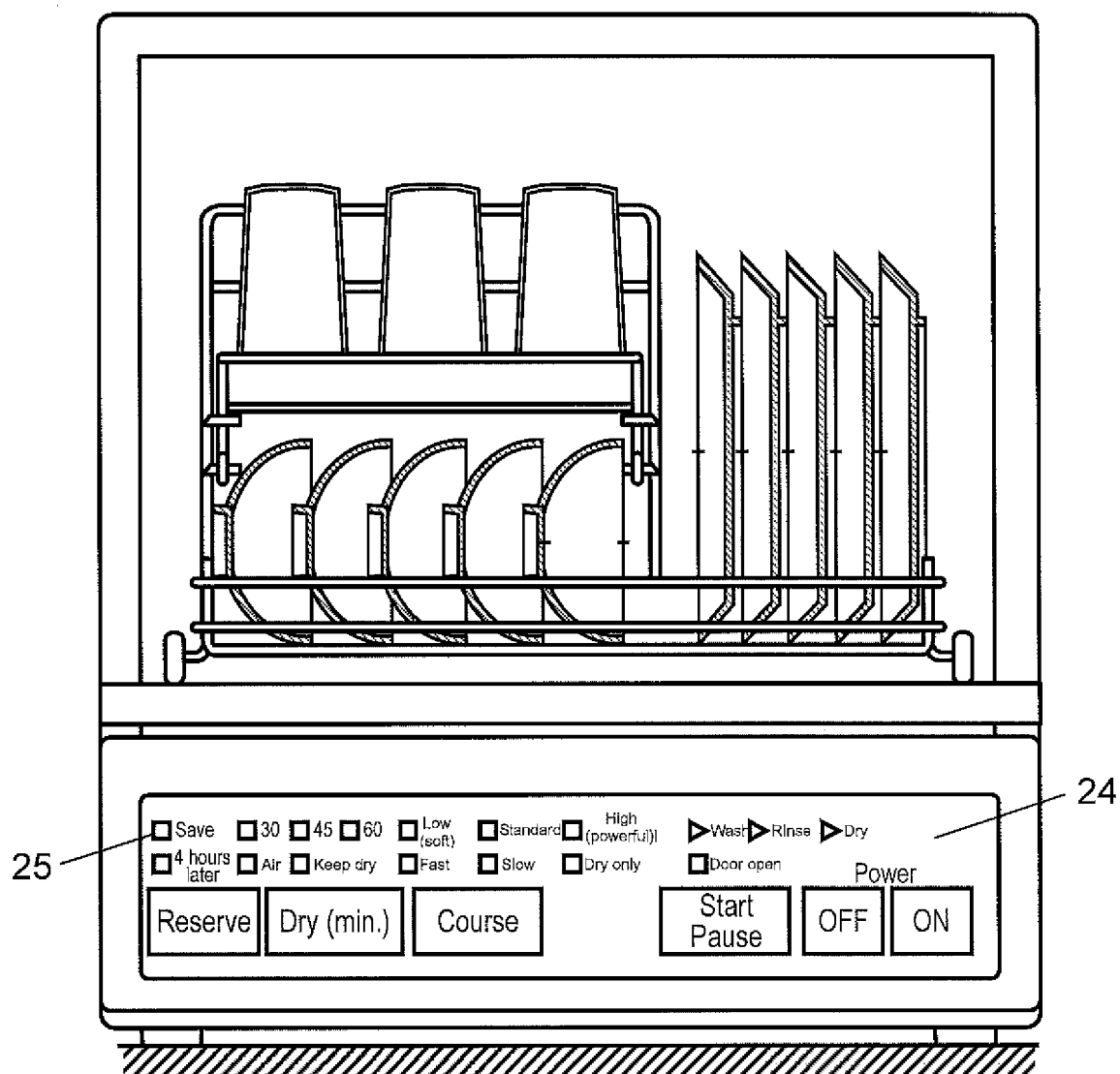


FIG. 6

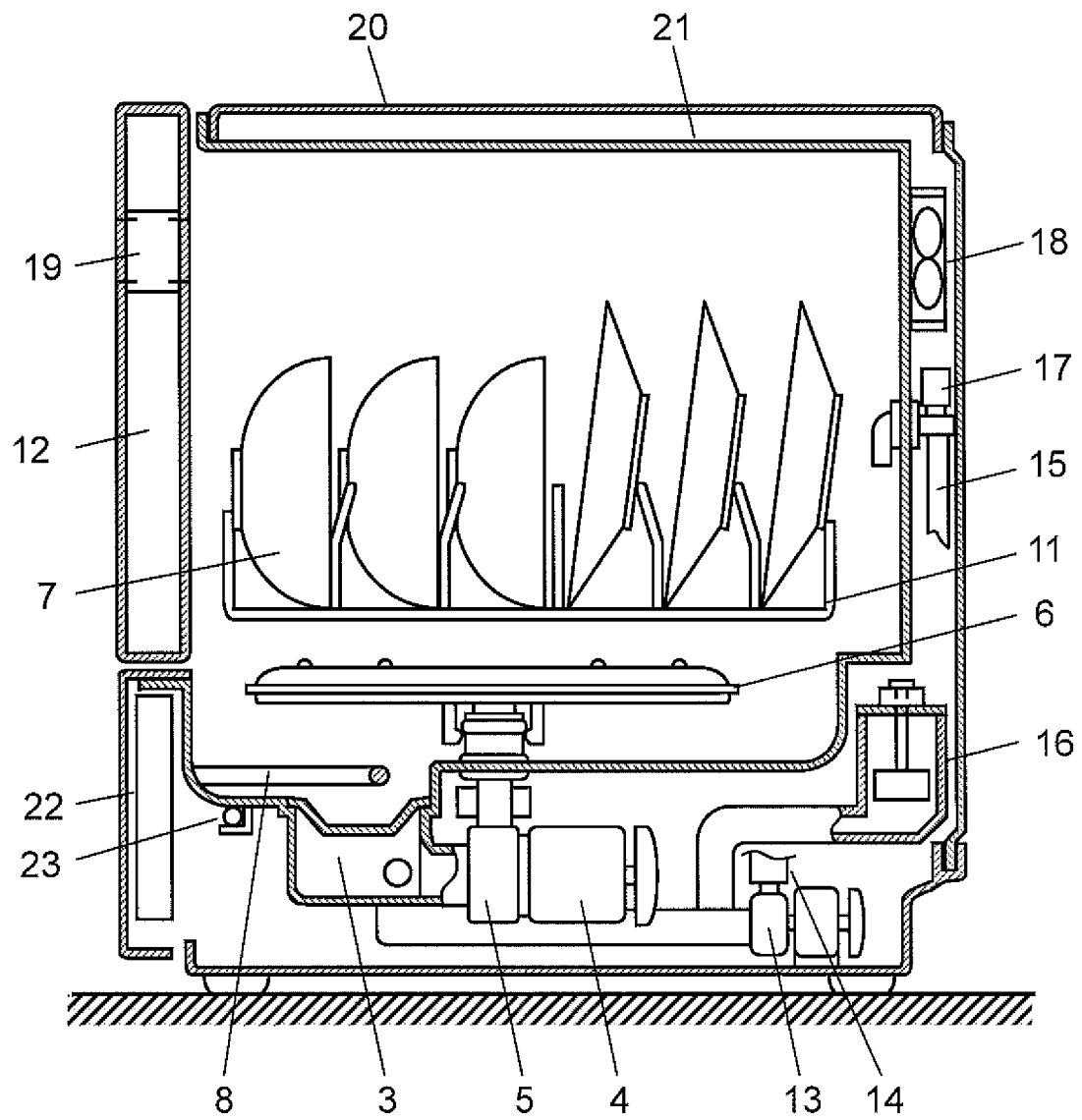


FIG. 7

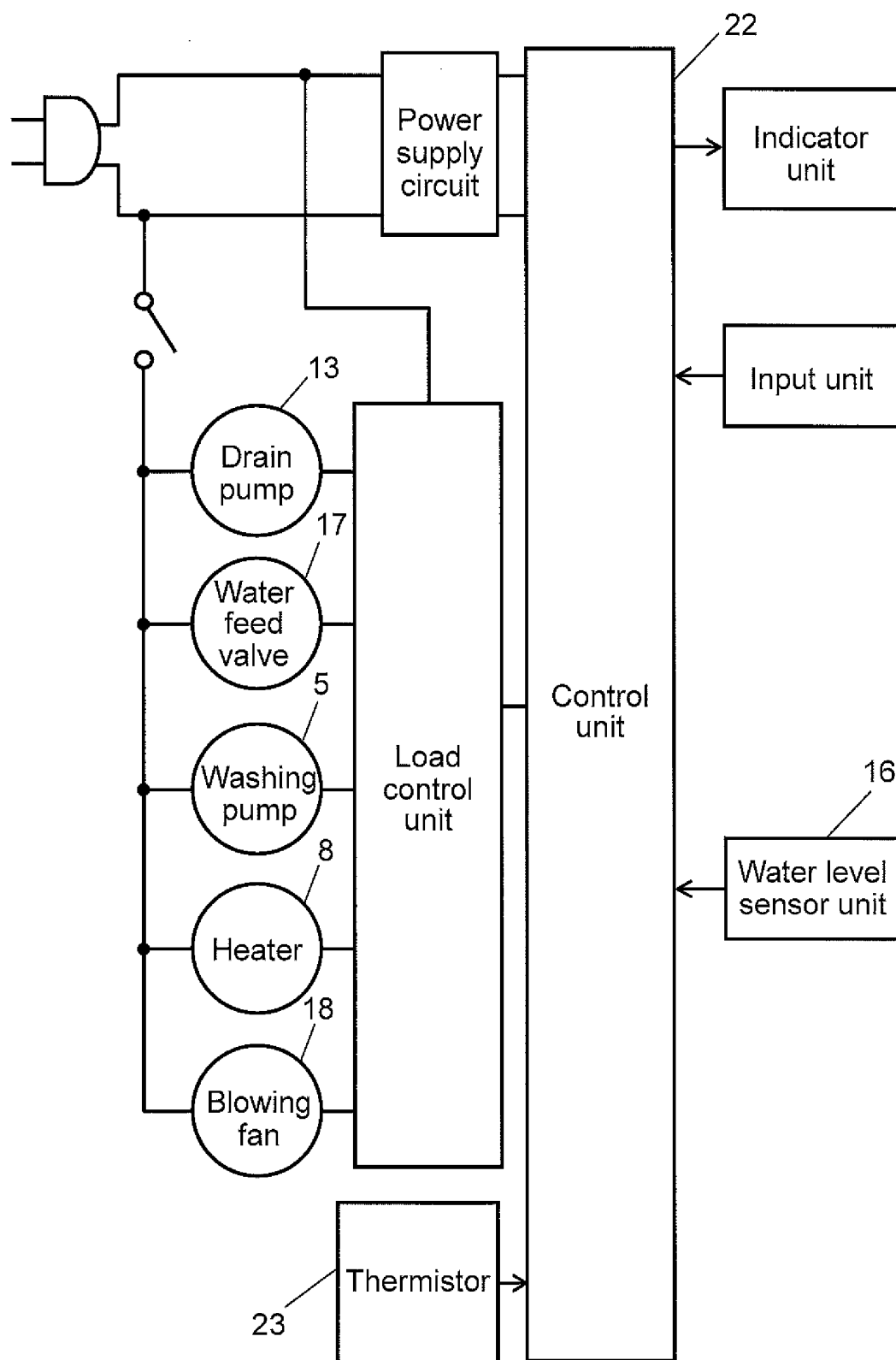


FIG. 8

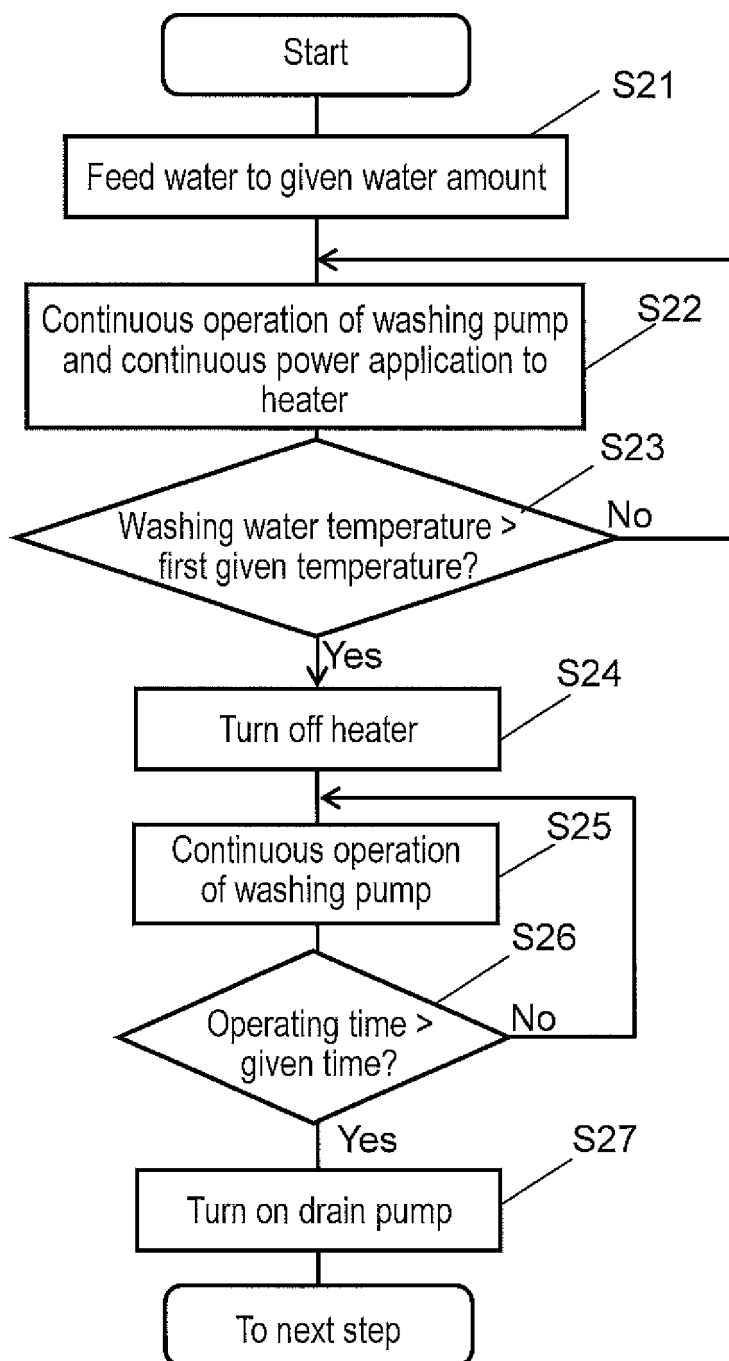
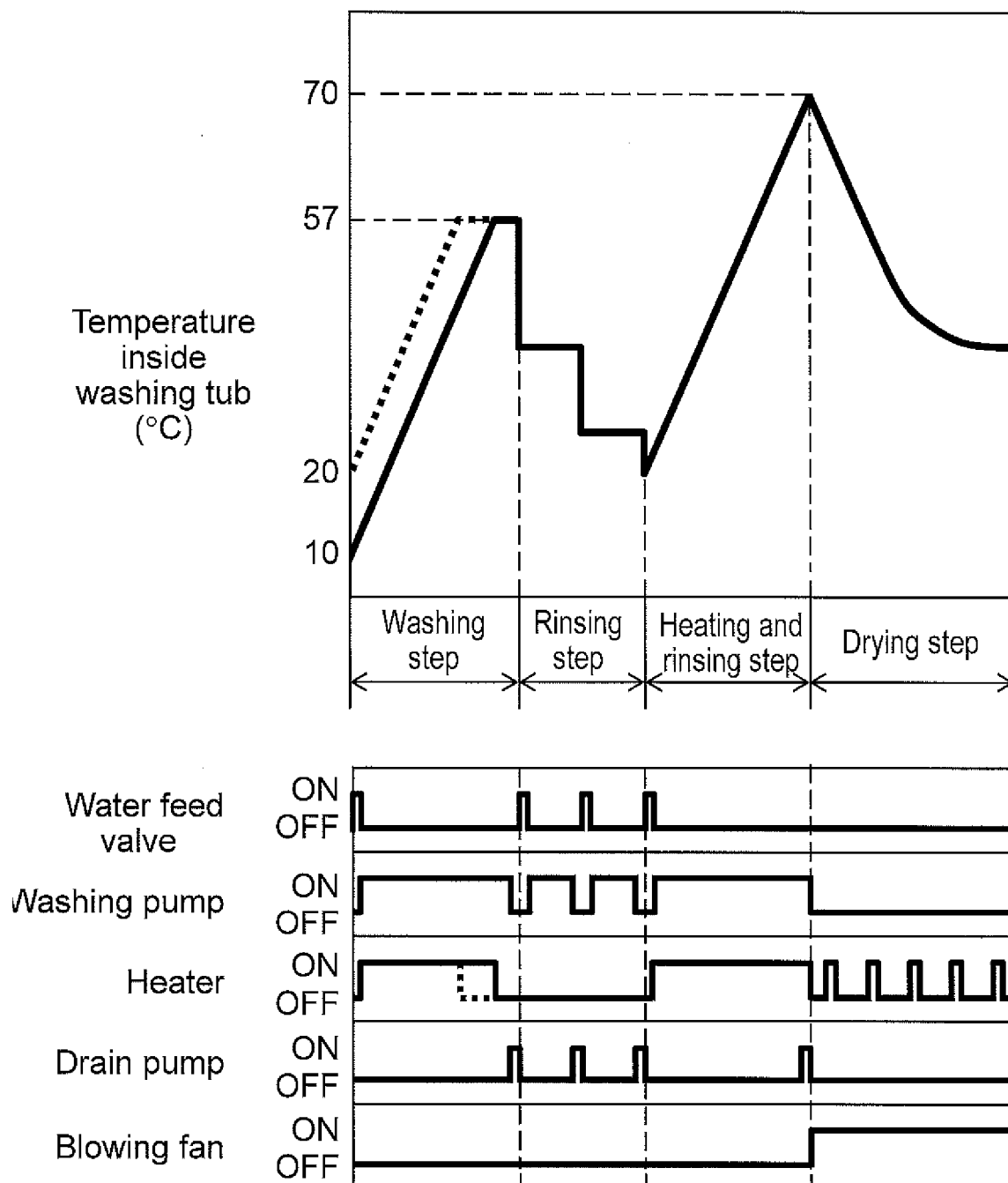


FIG. 9



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/006904

A. CLASSIFICATION OF SUBJECT MATTER

A47L15/46(2006.01) i, A47L15/42(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47L15/46, A47L15/42

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	JP 2010-227496 A (Mitsubishi Electric Corp.), 14 October 2010 (14.10.2010), (Family: none)	1-4
A	JP 2003-47585 A (Matsushita Electric Industrial Co., Ltd.), 18 February 2003 (18.02.2003), (Family: none)	1-4
A	JP 2904640 B2 (Hitachi, Ltd.), 14 June 1999 (14.06.1999), (Family: none)	1-4



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search
16 January, 2013 (16.01.13)Date of mailing of the international search report
29 January, 2013 (29.01.13)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

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Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/006904

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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REFERENCES CITED IN THE DESCRIPTION

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