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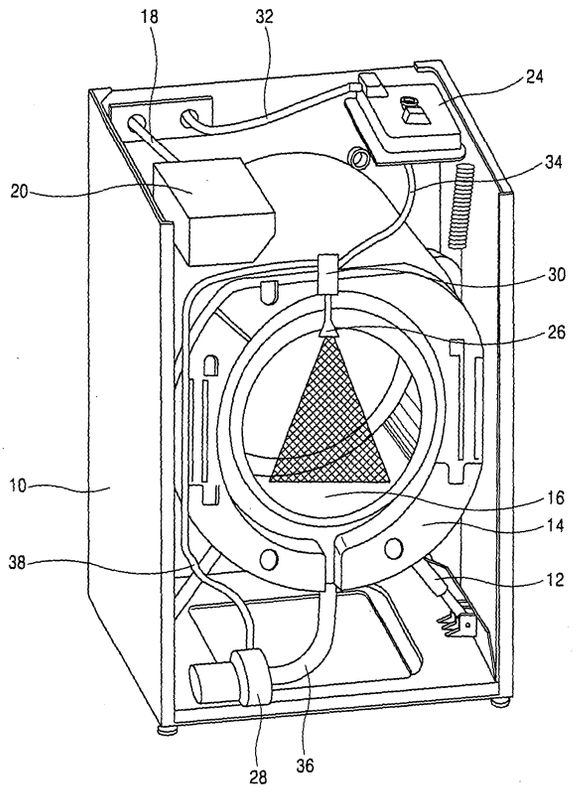
(54) Heating apparatus of washing machine and control method thereof

(57) A heating apparatus of a washing machine comprises: a steam generator for generating steam; and a spray nozzle for spraying steam generated from the steam generator into a tub, in which a water level sensor for detecting a level of water supplied for steam generation step by step is mounted at the steam generator. According to this, an entire size of the washing machine is reduced, an amount of washing water is reduced, and a water level inside the steam generator is detected more accurately, thereby enhancing a performance of the heating apparatus.

FIG. 2



EP 1 507 031 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a heating apparatus for heating laundry of a washing machine, and more particularly, to a heating apparatus for heating laundry by directly spraying steam into the laundry and a control method thereof.

2. Description of the Conventional Art

[0002] Figure 1 is a sectional view of a washing machine in accordance with the conventional art.

[0003] The drum washing machine according to the conventional art comprises: a cabinet 102 for forming an appearance; a tub 104 arranged in the cabinet 102 for storing washing water; a drum 106 rotatably arranged in the tub 104 for washing and dehydrating laundry; and a driving motor 110 connected to the drum 106 by a driving shaft 108 for rotating the drum 106.

[0004] The tub 104 is shock-absorbingly supported in the cabinet 102 by dampers 120 and 122, and a heater 130 for heating washing water stored in the tub 104 is installed at a lower portion of the tub 104.

[0005] A lower portion of the tub 104 has to be provided with enough space for mounting the heater 130, and water level more than a certain height has to be maintained in the tub 104 so that the heater 130 can be sufficiently soaked by washing water.

[0006] Operation of the conventional drum washing machine will be explained. First, once the washing machine is operated, washing water is supplied into the tub 104. Then, if the water level of the tub 104 reaches a set level, the heater 130 is operated thus to heat the washing water. At the same time, a driving motor 110 is driven with a forward rotation or a reverse rotation thus to perform a washing operation. According to this, when temperature of the washing water reaches a set temperature, the heater 130 becomes off.

[0007] However, in the conventional washing machine, a space for accommodating the heater 130 which heats laundry has to be provided at the lower portion of the tub 104, so that an entire size of the washing machine becomes large. Besides, since washing water has to be also provided at the space for accommodating the heater 130, waste of washing water becomes great.

[0008] Furthermore, washing water is heated by the heater 130 thus to increase a consumption electric power of the heater, to increase a detergent amount, and to lengthen washing time.

SUMMARY OF THE INVENTION

[0009] Therefore, an object of the present invention is to provide a heating apparatus of a washing machine capable of reducing an entire size of the washing machine, reducing an amount of washing water, minimizing a consumption electric power, and reducing washing time by heating laundry by directly spraying steam into the laundry by a steam generator provided at the washing machine.

[0010] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided a heating apparatus of a washing machine comprising: a steam generator for generating steam; and a spray nozzle for spraying steam generated from the steam generator into a drum.

[0011] The steam generator is provided with a water level sensor for detecting a level of water supplied for steam generation step by step.

[0012] The steam generator comprises: a hermetic container to which a water supply tube for supplying water and a steam exhaustion tube for exhausting generated steam are respectively connected; a heater arranged at a bottom of the hermetic container for heating water supplied into the hermetic container; and a water level sensor mounted in the hermetic container for detecting a level of water supplied into the hermetic container step by step.

[0013] The water level sensor comprises: one common electrode bar; a plurality of water level detecting electrode bars of different lengths; and a supporting member for mounting the common electrode bar and the plurality of water level detecting electrode bars with an insulated state.

[0014] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is also provided a heating method of a washing machine comprising: a first step of supplying water into a steam generator; a second step of detecting whether a level of water supplied into the steam generator has reached a set level; a third step of generating steam by turning on a heater when the level of water has reached a set level in the second step; and a fourth step of performing a washing operation when steam generated from the steam generator has been supplied into a drum and thereby temperature inside the drum has reached a set temperature in the third step.

[0015] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the

principles of the invention.

[0017] In the drawings:

Figure 1 is a sectional view of a washing machine in accordance with the conventional art;

Figure 2 is a perspective view showing an opened front surface of a washing machine according to the present invention;

Figure 3 is a partially-cut perspective view of a steam generator of the washing machine according to the present invention;

Figure 4 is a perspective view of a water level sensor according to the present invention;

Figure 5 is a block diagram showing a heating method of a heating apparatus of the washing machine according to the present invention; and

Figure 6 is a flow chart showing the heating method of the washing machine according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0019] Figure 2 is a perspective view showing an opened front surface of a washing machine according to the present invention.

[0020] The washing machine according to one embodiment of the present invention comprises: a cabinet 10 for forming an appearance thereof; an outer tub 14 shock-absorbingly supported by a damper 12 in the cabinet 10 for storing washing water; an inner tub (drum) 16 rotatably arranged in the outer tub 14 for washing and dehydrating laundry; and a heating unit arranged at an upper side of the cabinet 10 for spraying steam into laundry received into the inner tub 16.

[0021] A detergent box 20 connected to a water supply tube 18 is installed at an upper side of the outer tub 14 thus to supply detergent with washing water into the outer tub 14.

[0022] The heating unit is composed of a steam generator 24 arranged at an upper side of the cabinet 10 for generating steam, and a spray nozzle 26 for spraying steam generated from the steam generator 24 into the inner tub 16. Also, a circulation pump 28 for pumping water exhausted from the outer tub 16 and thereby resupplying into the inner tub 16 through the spray nozzle 26 is installed at a lower side of the cabinet 10.

[0023] Herein, a diverge unit 30 for preventing circulation water circulated by a pumping power of the circulation pump 28 from being mixed with steam generated from the steam generator 24 is installed at the spray nozzle 26.

[0024] The steam generator 24 is connected to a water supply tube 32 thus to receive water from outside, and connected to the diverge unit 30 by a steam supply tube 34. Herein, at one side of the water supply tube 32, a water supply valve 40 for opening and closing the water supply tube 32 is mounted. The circulation pump 28 is connected to an exhaustion pipe 36 for exhausting washing water stored in the outer tub 14, and is connected to the diverge unit 30 by a circulation tube 38.

[0025] Also, a temperature sensor 42 for detecting temperature inside the inner tub 16 at the time of spraying steam into the inner tub 16 through the spray nozzle 26 is installed in the inner tub 16.

[0026] Figure 3 is a partially-cut perspective view of the steam generator of the washing machine according to the present invention.

[0027] The steam generator 24 comprises: a hermetic container 50 to which a water supply tube 32 and a steam exhaustion tube 34 are respectively connected; a heater 52 arranged at a bottom of the hermetic container 50 for heating water supplied into the hermetic container 50; and a water level sensor 54 mounted in the hermetic container for detecting a level of water supplied into the hermetic container 50 step by step.

[0028] An upper container 56 and a lower container 58 of the hermetic container 50 are hermetically mounted with a certain space therein. A water supply port 60 connected to the water supply tube 32 is formed at one side of the upper container 56, and a steam exhaustion port 62 connected to the steam supply tube 34 for exhausting steam generated in the hermetic container 50 is formed at the lower container 58.

[0029] As shown in Figure 4, the water level sensor 54 comprises: one common electrode bar 70; a plurality of water level detecting electrode bars 72 and 74 of different lengths; and a supporting member 76 hermetically mounted at the hermetic container 50 and for mounting the common electrode bar 70 and the plurality of water level detecting electrode bars 72 and 74 with an insulated state.

[0030] Among the common electrode bar 70 and the plurality of water level detecting electrode bars 72 and 74, the common electrode bar 70 is the longest. Also, the water level detecting electrode bars 72 and 74 have a different length each other in order to detect a water level step by step. Under this state, if the common electrode bar 70 and one of the water level detecting electrode bars 72 and 74 are in contact with water, the common electrode bar 70 is electrically connected to one of the water level detecting electrode bars thus to generate a voltage. At this time, voltages generated from the water level detecting electrode bars 72 and 74 are different each other, thereby detecting a water level by a voltage difference.

[0031] The water level detecting electrode bars 72 and 74 are composed of a first electrode 72 for detecting a lowest water level L1 supplied into the hermetic container 50, and a second electrode 74 for detecting a highest water level L2.

[0032] The water level detecting electrode bars are not limited to the first electrode 72 and the second elec-

trode 74, but can be constituted as plural electrodes in order to detect a middle water level.

[0033] Herein, the first electrode 72 has a length for detecting the lowest water level L1 that the heater 52 can be immersed in water. Also, the second electrode 74 has a certain length for maintaining a minimum space inside the hermetic container 50 capable of generating steam.

[0034] The supporting member 76 is formed of material for insulation and a hermetic state, and is hermetically mounted at the upper container 56. The common electrode bar 70 and the plurality water level detecting electrode bars 72 and 74 are vertically mounted at the supporting member 76 with an insulated state.

[0035] Operation of the water level sensor 54 will be explained.

[0036] When water is supplied into the hermetic container 50 under a state that a direct current voltage is applied between the common electrode bar 70 and the first and second electrode bars 72 and 74, water is first in contact with the longest common electrode bar 70. Then, when the first electrode bar 72 is in contact with water as water is gradually supplied, the common electrode bar 70 and the first electrode bar 72 are electrically connected to each other thus to generate a low voltage and thereby to detect the lowest water level L1. Also, when the second electrode bar 74 is in contact with water as water is further supplied into the hermetic container 50, the common electrode bar 70 and the second electrode bar 74 are electrically connected to each other thus to generate a high voltage and thereby to detect the highest water level L2.

[0037] Figure 5 is a block diagram showing a heating method of a heating apparatus of the washing machine according to the present invention. As shown, the heating apparatus comprises a temperature sensor 42 installed at one side of the inner tub for detecting temperature of the inner tub, a water level sensor 54 installed in the steam generator 24 for detecting a level of water supplied into the steam generator 24 step by step, and a controller 80 for controlling an operation of the water supply valve 40 and the heater 52 according to a signal applied from the temperature sensor 42 and the water level sensor 54.

[0038] The heating apparatus for heating laundry by steam can be applied not only the drum washing machine aforementioned as the preferred embodiment but also any washing machine.

[0039] Operation of the heating apparatus of the washing machine according to the present invention will be explained as follows.

[0040] Figure 6 is a flow chart showing the heating method of the washing machine according to the present invention.

[0041] First, laundry is put into the inner tub 16 and then a driving signal of the washing machine is applied, thereby supplying washing water into the outer tub 14. Then, when a laundry heating mode is inputted by a user, the controller 80 switches-on the water supply valve (S10).

[0042] According to this, water is supplied into the steam generator 24 through the water supply tube 32 (S20).

[0043] Then, it is judged whether a level of water supplied into the steam generator 24 has reached a first setting level T1 (S3). That is, when water is supplied into the hermetic container 50 of the steam generator 24 and thereby the second electrode bar 74 of the water level sensor 54 is in contact with water, the common electrode 70 and the second electrode bar 74 are electrically connected to each other by water thus to generate a voltage. The generated voltage is detected by the controller 80 and thereby a water level is judged.

[0044] In said step, if it is judged that the water level has reached the first setting level T1, water supply is stopped and the heater 52 is turned on (S40 and S50). That is, the controller 80 switches-off the water supply valve 40 thus to stop water supply and applies a power source into the heater 52.

[0045] According to this, the water which has been supplied into the hermetic container 50 is heated by the heater 52 thus to generate steam, and the steam generated in the hermetic container 50 is supplied into the inner tub 16 through the steam supply tube 34 thus to heat the laundry.

[0046] Then, it is judged whether a water level inside the hermetic container 50 is lower than a second setting level T2 (S60). That is, it is judged whether a water level inside the hermetic container 50 is lower than the lowest water level that the first electrode bar 72 is not in contact with water.

[0047] In said step, if the water level is judged to be lower than the second setting level T2, the heater is turned off (S70). Then, it is judged whether temperature inside the inner tub 16 has reached a set temperature (S80). That is, the controller 80 compares a set temperature selected by the user with a temperature inside the inner tub 16 applied from the temperature sensor 42.

[0048] In said step, if the temperature inside the inner tub 16 is judged to be more than the set temperature, a washing operation is performed. On the contrary, if the internal temperature of the inner tub 16 is judged to be lower than the set temperature, water is supplied into the hermetic container 50 and the above steps are repeated thus to spray steam into the inner tub 16.

[0049] In the heating apparatus of the washing machine according to the present invention, the steam generator is provided and the laundry is heated by spraying steam into the tub, thereby reducing an entire size of the washing machine, reducing an amount of washing water, minimizing a consumption electric power, and reducing washing time.

[0050] Besides, the water level sensor for detecting a level of water supplied into the steam generator is constituted with the plurality of electrode bars thus to detect a water level inside the steam generator more accurate-

ly, thereby enhancing a performance of the heating apparatus.

[0051] As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.

Claims

1. A heating apparatus of a washing machine comprising:

a steam generator for generating steam; and
a spray nozzle for spraying steam generated from the steam generator into a tub,

in which a water level sensor for detecting a level of water supplied for steam generation step by step is mounted at the steam generator.

2. The apparatus of claim 1, wherein the steam generator comprises:

a hermetic container to which a water supply tube for supplying water and a steam exhaustion tube for exhausting generated steam are respectively connected;
a heater arranged at a bottom of the hermetic container for heating water supplied into the hermetic container; and
a water level sensor mounted in the hermetic container for detecting a level of water supplied into the hermetic container step by step.

3. The apparatus of claim 2, wherein the water level sensor comprises:

one common electrode bar;
a plurality of water level detecting electrode bars of different lengths; and
a supporting member for mounting the common electrode bar and the plurality of water level detecting electrode bars with an insulated state.

4. The apparatus of claim 3, wherein the water level detecting electrode bars comprises:

a first electrode for detecting a lowest water level; and
a second electrode for detecting a highest water level.

5. The apparatus of claim 4, wherein the first electrode bar has a length for detecting a level of water supplied into the hermetic container that a heater can be immersed in water.

6. The apparatus of claim 4, wherein the second electrode has a length for detecting a water level having a space at an upper portion of the hermetic container in order to generate steam by heating water by the heater.

7. A heating method of a washing machine comprising:

a first step of supplying water into a steam generator;
a second step of detecting whether a level of water supplied into the steam generator has reached a set level;
a third step of turning on a heater and thereby generating steam when the water level has reached a set level in the second step; and
a fourth step of performing a washing operation when steam generated from the steam generator has been supplied into a tub and thereby temperature inside the tub has reached a set temperature in the third step.

8. The method of claim 7, wherein the set level is a highest level of water supplied into the steam generator.

9. The method of claim 8, wherein a voltage between a common electrode bar and a second electrode bar is applied into a controller when the second electrode bar of a water level sensor is in contact with water in the second step.

10. The method of claim 7, further comprising a step of turning off the heater when a water level inside the steam generator is lower than a lowest water level.

11. The method of claim 10, wherein the lowest water level is a water level that a first electrode bar of a water level is in contact with water.

12. The method of claim 7, wherein the set temperature is temperature inside a tub selected by a user.

FIG. 1

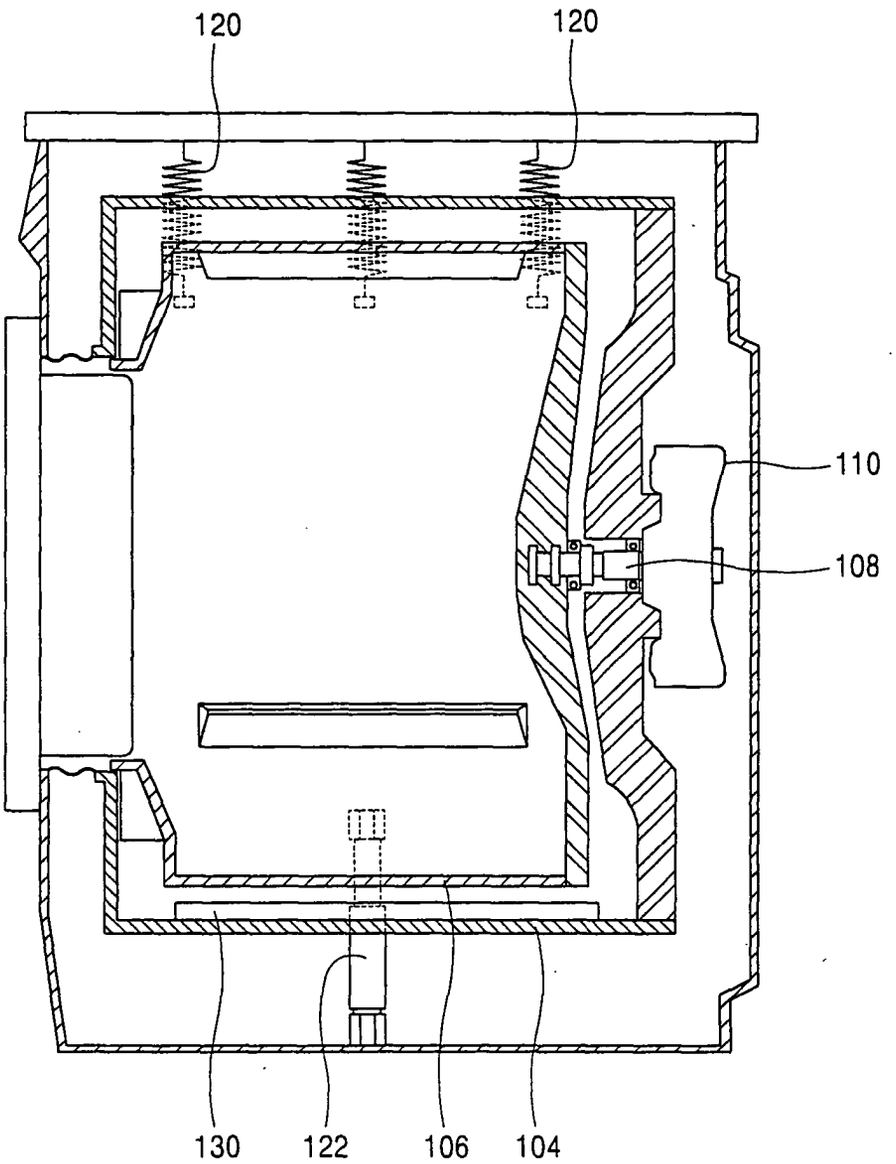


FIG. 2

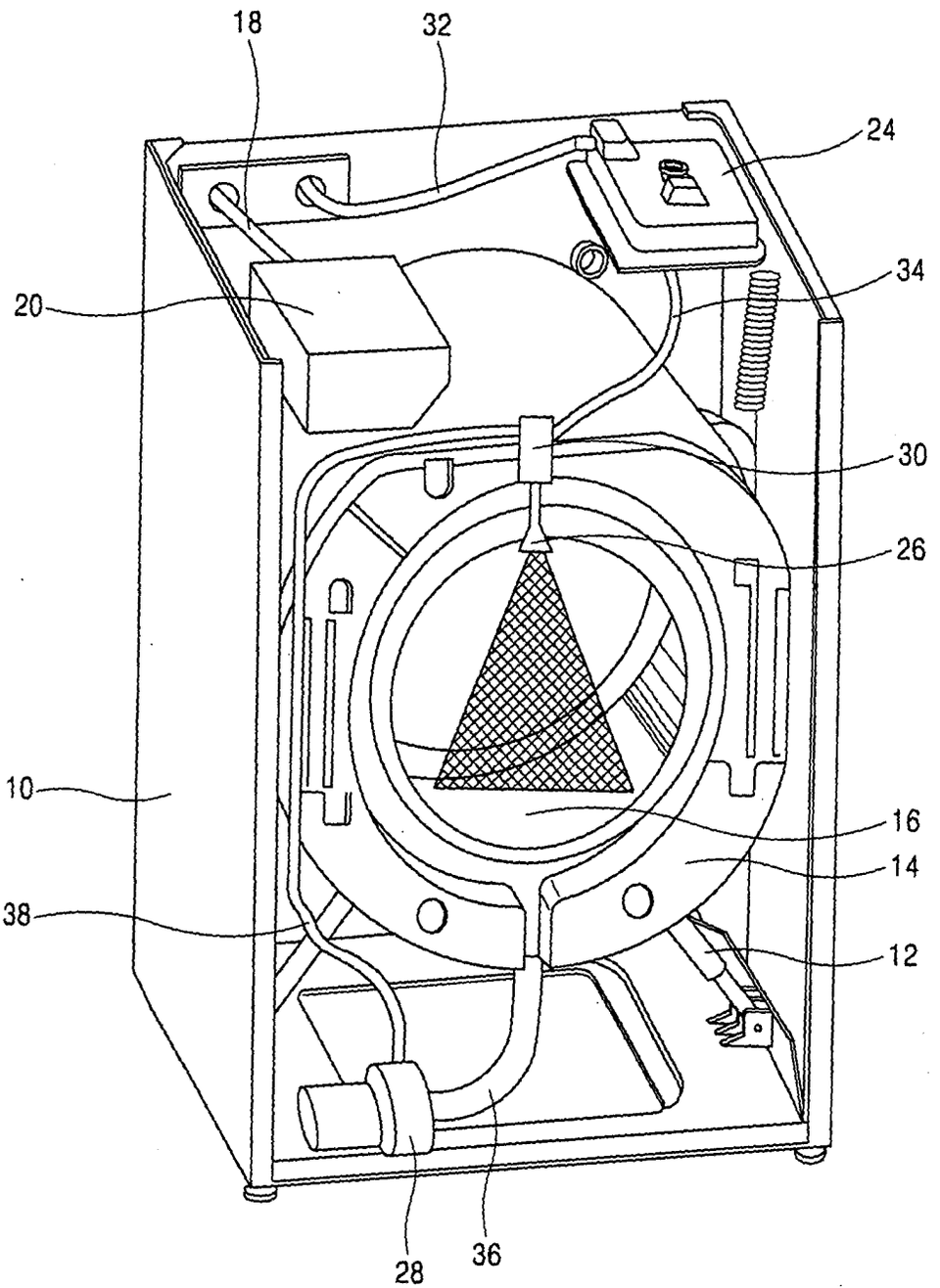


FIG. 3

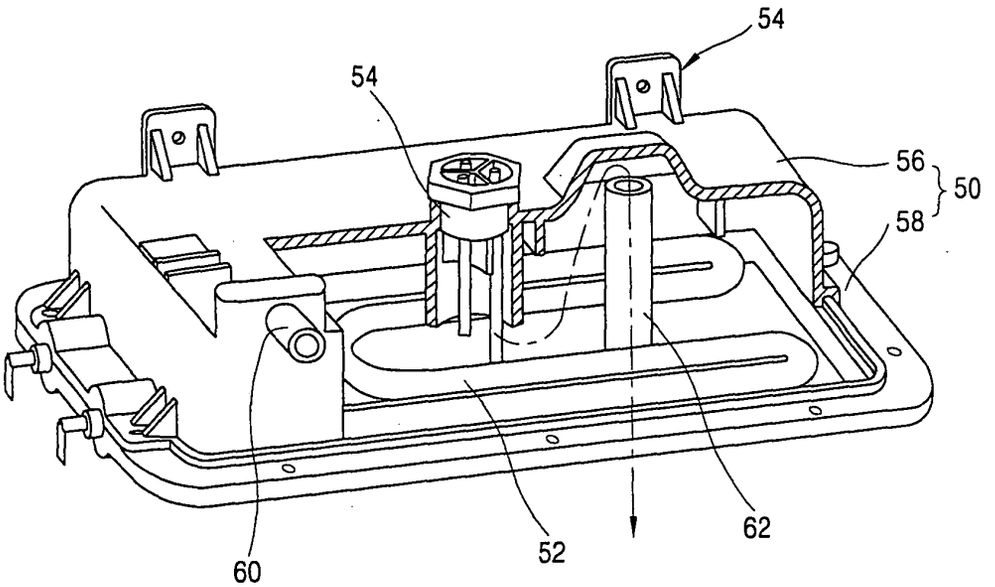


FIG. 4

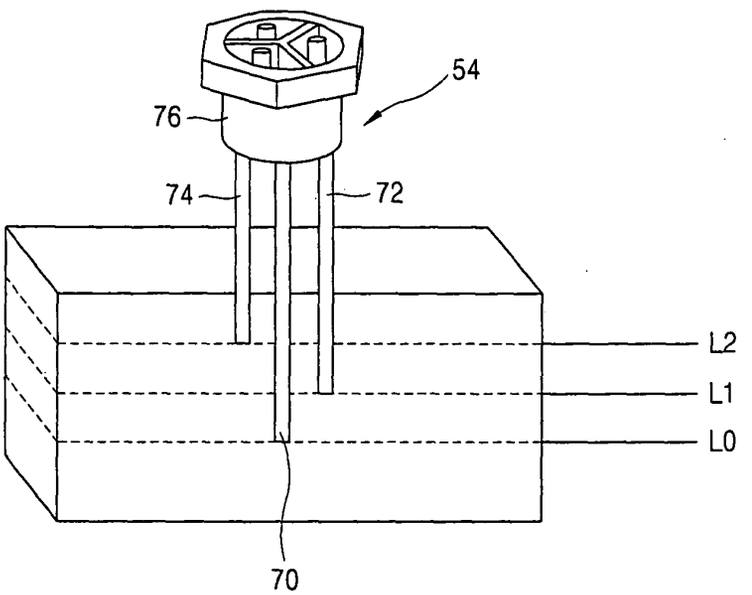


FIG. 5

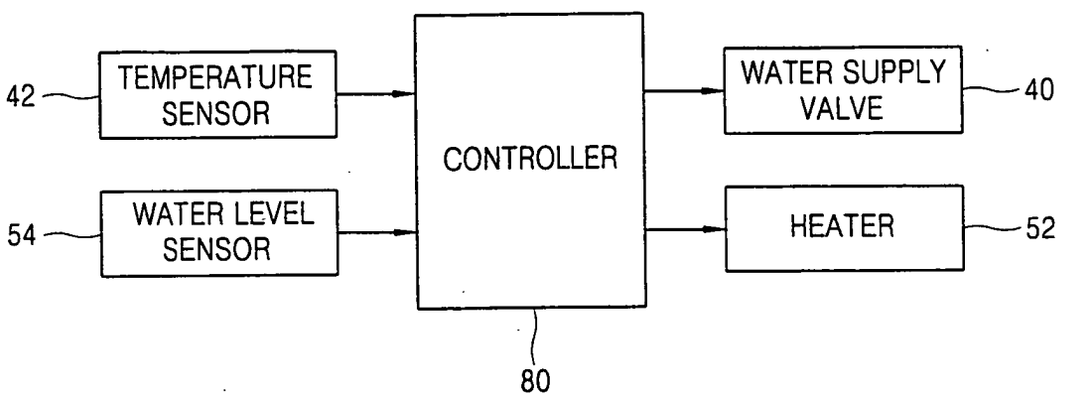
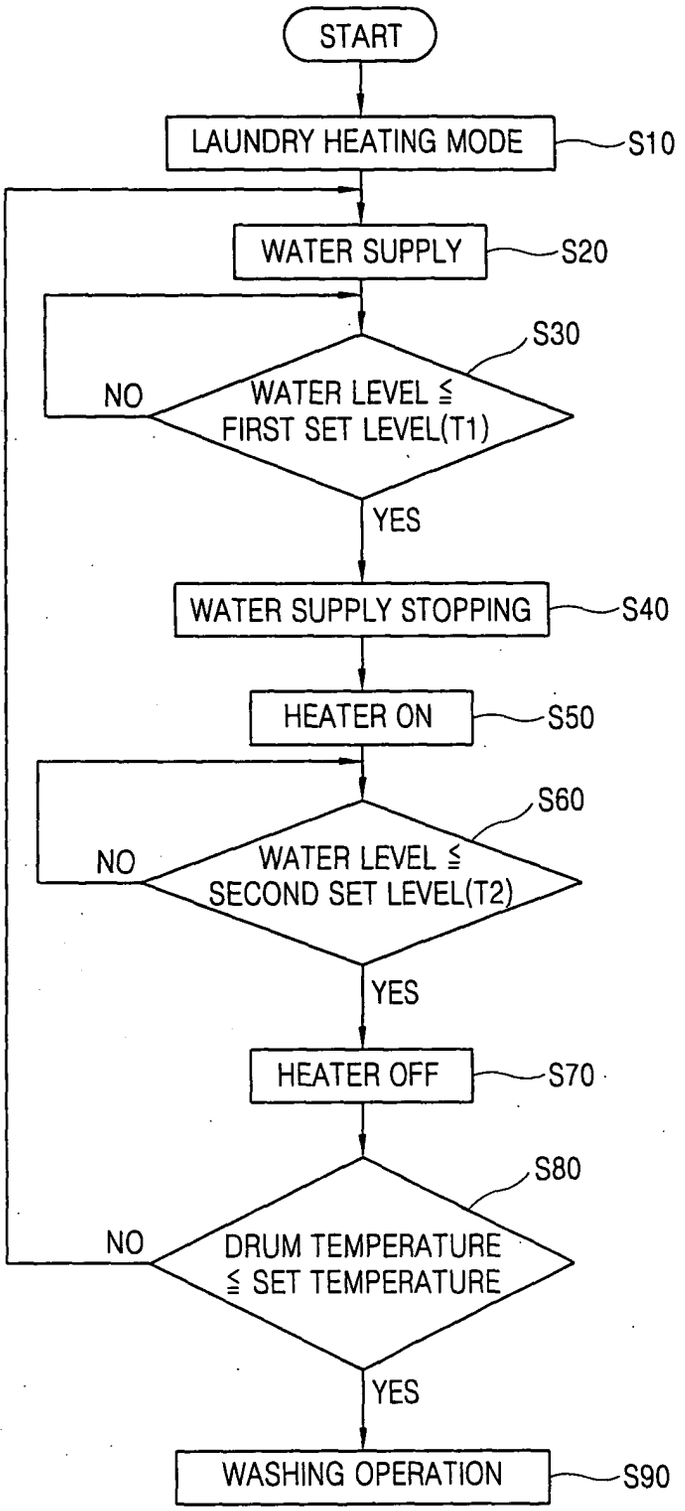

42
TEMPERATURE SENSOR
54
WATER LEVEL SENSOR
CONTROLLER
80
WATER SUPPLY VALVE
40
HEATER
52

FIG. 6


START
LAUNDRY HEATING MODE
S10
WATER SUPPLY
S20
S30
NO
WATER LEVEL ≦
FIRST SET LEVEL(T1)
YES
WATER SUPPLY STOPPING
S40
HEATER ON
S50
S60
NO
WATER LEVEL ≦
SECOND SET LEVEL(T2)
YES
HEATER OFF
S70
S80
NO
DRUM TEMPERATURE
≦ SET TEMPERATURE
YES
WASHING OPERATION
S90

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EUROPEAN SEARCH REPORT

Application Number
EP 04 00 2018

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 December 2004	Spitzer, B

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

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

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