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(54) **STEAM GENERATOR AND WASHING MACHINE HAVING THE SAME**

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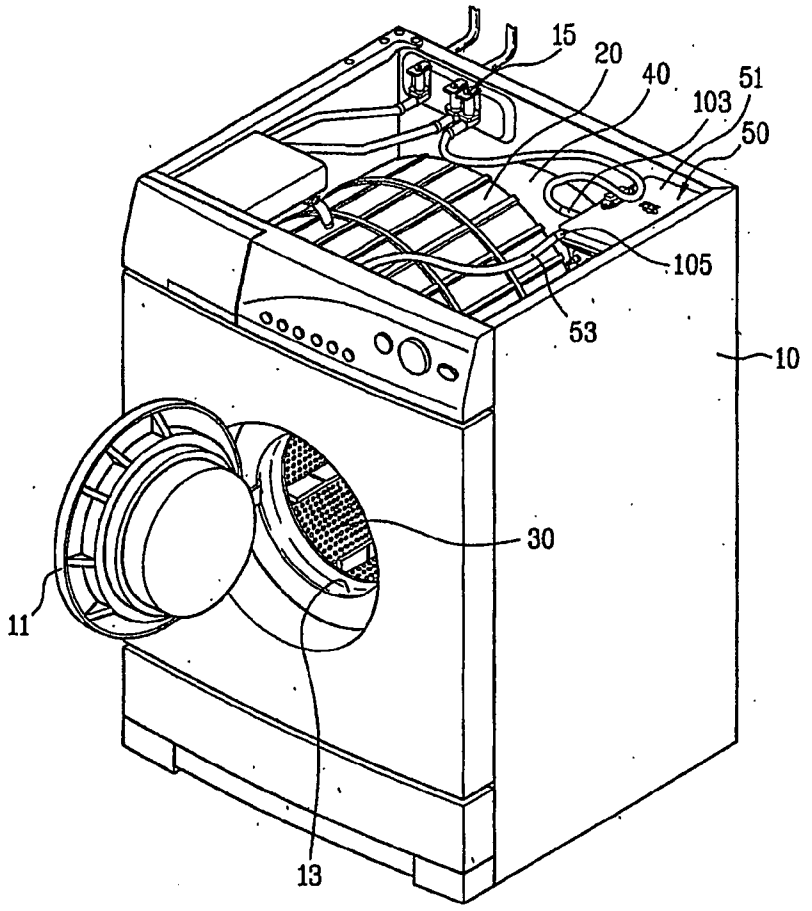
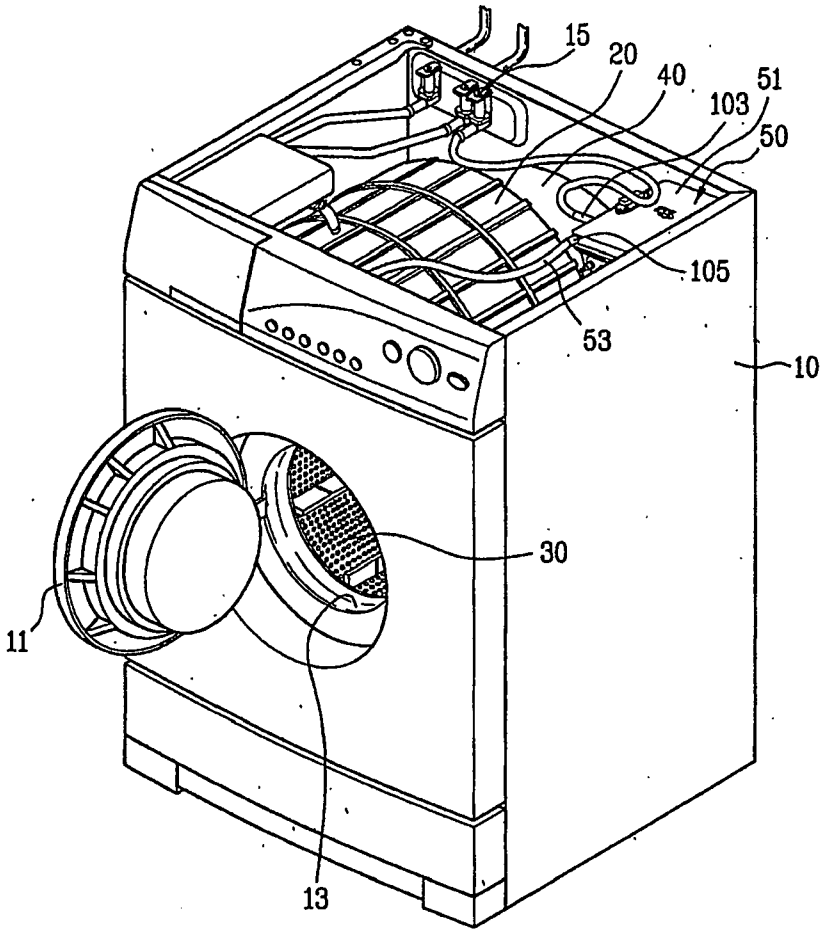
(57) **ABSTRACT**

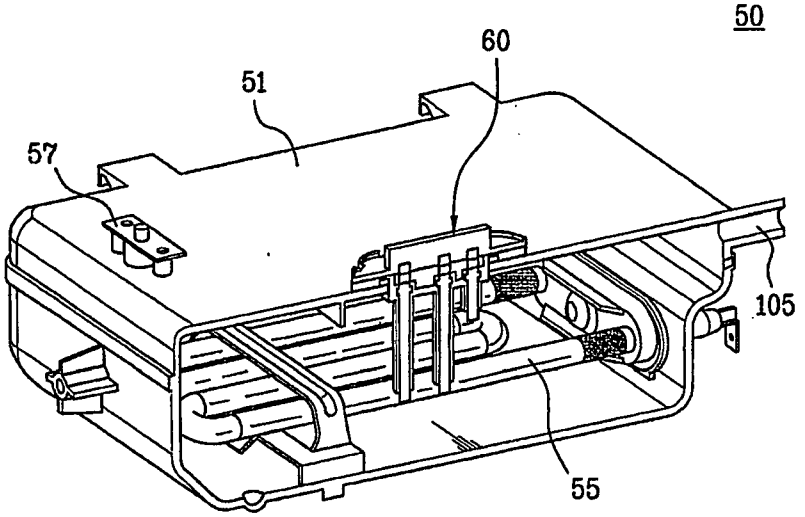
A steam generator having an improved structure to change water supplied into the steam generator into steam within a short period of time and a drum type washing machine having the same are disclosed. The washing machine includes a tub mounted in a cabinet, which constitutes the external appearance of the washing machine, for storing wash water, a drum rotatably mounted in the tub, and a steam generator mounted in the cabinet for supplying steam into the drum. The steam generator includes a case having a space for receiving a predetermined amount of water, the case being provided at one side thereof with an inlet port and an outlet port, a heater case disposed in the case such that the heater case communicates with the interior of the case, the heater case having an additional space, into which some of the water supplied into the case is introduced and a steam heater disposed in the heater case for heating the water introduced into the heater case so as to generate steam.



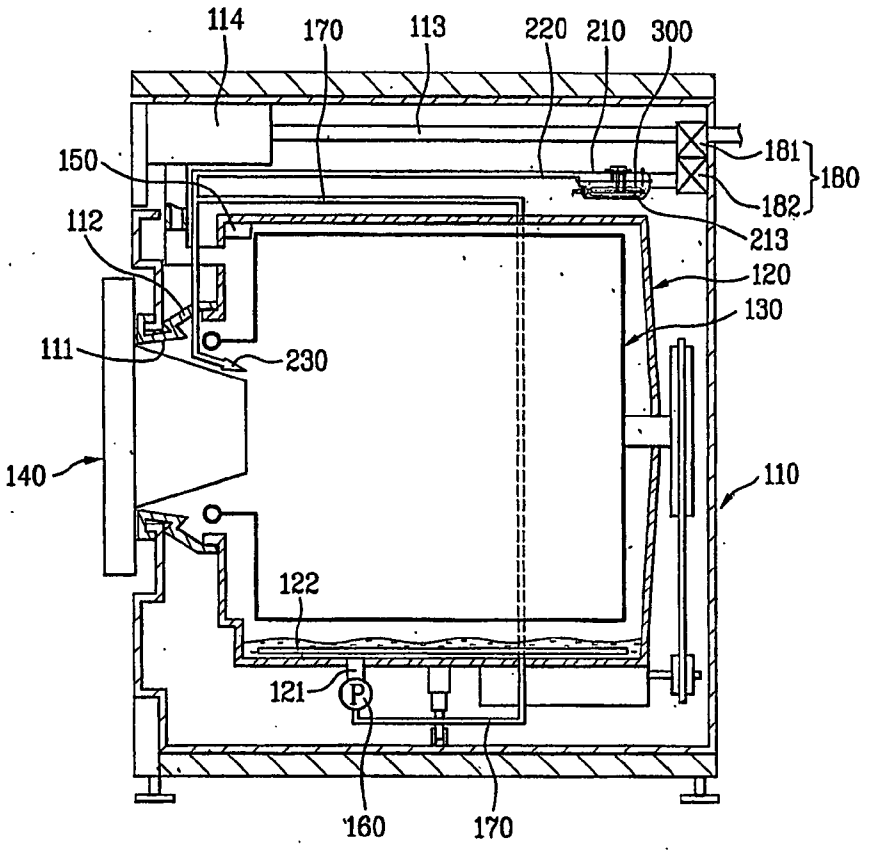
[Fig. 1]



[Fig. 2]



[Fig. 3]


114
170
113
220
210
300
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182
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120
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111
230
140
110
122
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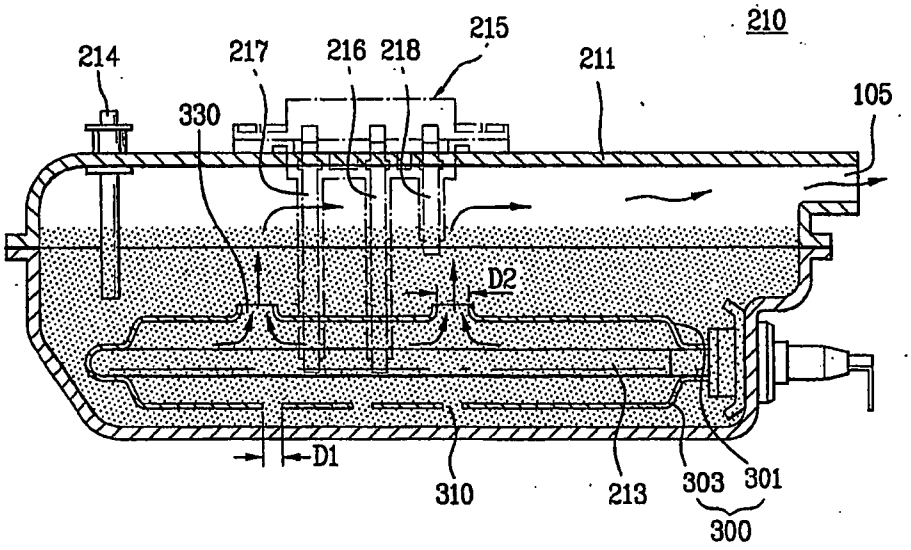
P
160
170

[Fig. 4]


210
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216
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D2
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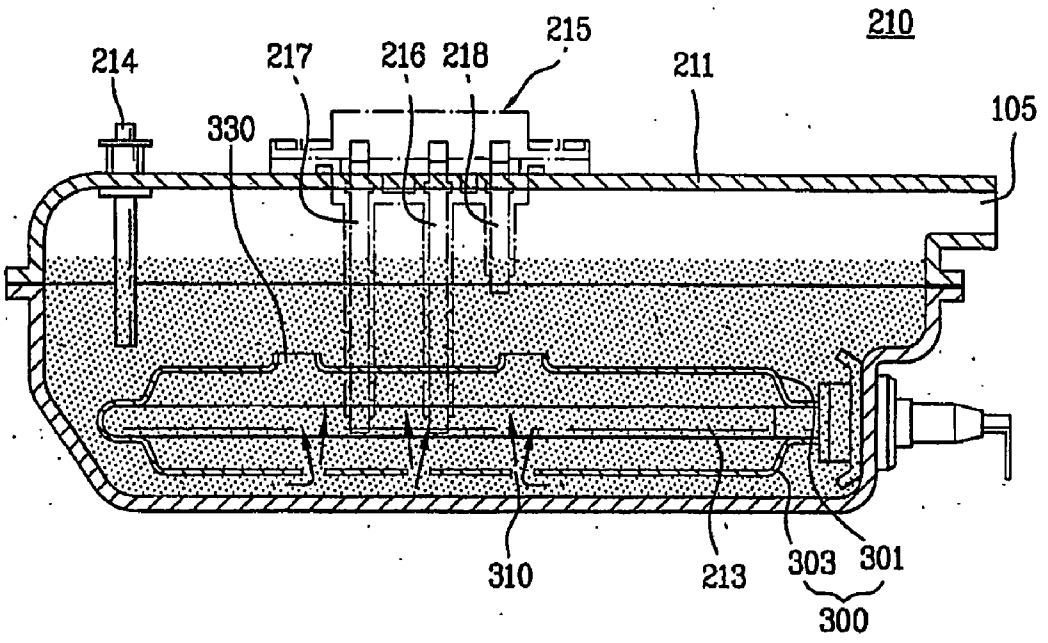
[Fig. 5]



STEAM GENERATOR AND WASHING MACHINE HAVING THE SAME

TECHNICAL FIELD

[0001] The present invention relates to a drum type washing machine, and more particularly, to a drum type washing machine having a steam generator for rapidly, supplying steam into a drum.

BACKGROUND ART

[0002] Generally, washing machines are classified into a pulsator type washing machine, which performs a washing operation using water stream generated by the rotation of a plate-shaped pulsator, and a drum type washing machine, which performs a washing operation using falling of wash water and laundry and a friction force between the wash water and the laundry generated in a horizontally disposed drum by the rotation of the drum.

[0003] The drum type washing machine has been increasingly used since the drum type washing machine has advantages superior to the pulsator type washing machine in that the amount of wash water and detergent used during the washing operation is small, damage to the laundry is minimized, and the laundry is minimally tangled.

[0004] The structure of a conventional drum type washing machine will be described hereinafter with reference to FIG. **1**.

[0005] As shown in FIG. **1**, the conventional drum type washing machine includes a cabinet **10** constituting the external appearance of the drum type washing machine, a cylindrical tub **20** horizontally supported in the cabinet for storing wash water, a drum **30** rotatably mounted in the tub **20**, the drum **30** being provided with through-holes, through which wash water and steam are introduced into the drum **30**, a driving motor **40** for driving the drum **30**, and at least one steam generator **50** for supplying steam into the drum **30**.

[0006] At the front part of the cabinet **10** is formed a laundry opening **13**, which communicates with the interior of the drum **30** such that laundry can be put into or removed from the drum **30** through the laundry opening **13**. A door **11** is hingedly mounted to the cabinet **10** adjacent to the laundry opening **13** for opening and closing the laundry opening **13**.

[0007] Along the inner circumference of the laundry opening **13** is mounted a gasket (not shown) for preventing hot air from leaking through the connection between the door **11** and the tub **20**.

[0008] At one side of the drum type washing machine is provided a water supply valve **15**, which is connected to an external water pipe (not shown) for supplying wash water into the tub **20** or supplying water into the steam generator **50**.

[0009] The steam generator **50** is connected with the water supply valve **15** such that the water supplied from the water supply valve **15** can be introduced into the steam generator **50**. The steam generator **50** heats the water supplied from the water supply valve **15** to generate steam, and supplies the generated steam into the drum **30**.

[0010] As shown in FIG. **2**, the steam generator **50** includes a case **51** constituting the external appearance of the steam generator, a water level detecting sensor **60** for detecting the water level of water supplied into the case **51**, a heater **55** for heating the water supplied into the case **51**, and a temperature detecting sensor **57** for detecting the temperature of the heated water.

[0011] The case **51** is provided at one side thereof with an inlet port **103** (see FIG. **1**), which is connected to the water supply valve **15** (see FIG. **1**) for allowing water to be introduced from the water supply valve **15** through the inlet port **103**. The case **51** is also provided at one side thereof with an outlet port **105**, through which steam generated in the case **51** is discharged to the drum **30** side.

[0012] Also, the steam generator **50** is provided at one side thereof with a steam supply pipe **53** (see FIG. **1**), which is a passage for guiding and injecting the steam generated by the steam generator **50** into the drum **30** through the outlet port **105**.

[0013] However, the conventional drum type washing machine with the above-stated construction has the following problem.

[0014] The amount of water supplied into the case **51** of the conventional steam generator **50** during the generation of steam is large, and therefore, time necessary to heat the water supplied into the case **51** into steam is increased. Consequently, power consumption is increased.

DISCLOSURE OF INVENTION

Technical Problem

[0015] An object of the present invention devised to solve the problem lies on a steam generator having an improved structure to change water supplied into the steam generator into steam within a short period of time and a drum type washing machine having the same.

Technical Solution

[0016] The object of the present invention can be achieved by providing a steam generator comprising: a case having a space for receiving a predetermined amount of water, the case being provided at one side thereof with an inlet port and an outlet port; a beater case disposed in the case such that the heater case communicates with the interior of the case, the heater case having an additional space, into which some of the water supplied into the case is introduced; and a steam heater disposed in the heater case for heating the water introduced into the heater case so as to generate steam.

[0017] Preferably, the heater case is mounted in the case such that the heater case is spaced apart from the bottom of the case.

[0018] Preferably, the heater case comprises: an introduction part having at least one introduction hole, through which some of the water supplied into the case is introduced into the heater case; and a discharge part having at least one discharge hole, through which steam generated in the heater case is discharged.

[0019] Preferably, the introduction part is formed at the lower surface of the heater case.

[0020] Preferably, the discharge part is formed at the upper surface of the heater case.

[0021] Preferably, the at least one introduction hole has a diameter less than that of the at least one discharge hole.

[0022] The steam generator may further comprise: a temperature detecting sensor disposed in the case for detecting the temperature of the steam discharged from the heater case.

[0023] The steam generator may further comprise: a water level detecting sensor disposed in the case for detecting the water level of the water received in the case.

[0024] In another aspect of the present invention, provided herein is a washing machine including a tub mounted in a

cabinet, which constitutes the external appearance of the washing machine, for storing wash water, a drum rotatably mounted in the tub, and a steam generator mounted in the cabinet for supplying steam into the drum, wherein the steam generator comprises: a case having a space for receiving a predetermined amount of water, the case being provided at one side thereof with an inlet port and an outlet port; a heater case disposed in the case such that the heater case communicates with the interior of the case, the heater case having an additional space, into which some of the water supplied into the case is introduced; and a steam heater disposed in the heater case for heating the water introduced into the heater case so as to generate steam.

[0025] Preferably, the heater case is mounted in the case such that the heater case is spaced apart from the bottom of the case.

[0026] Preferably, the heater case comprises: an introduction part having at least one introduction hole, through which some of the water supplied into the case is introduced into the heater case; and a discharge part having at least one discharge hole, through which steam generated in the heater case is discharged.

[0027] Preferably, the introduction part is formed at the lower surface of the heater case.

[0028] Preferably, the discharge part is formed at the upper surface of the heater case.

[0029] Preferably, the at least one introduction hole has a diameter less than that of the at least one discharge hole.

[0030] The washing machine may further comprise: a temperature detecting sensor dispose d in the case for detecting the temperature of the steam discharged from the heater case.

[0031] The washing machine may further comprise: a water level detecting sensor disposed in the case for detecting the water level of the water received in the case.

Advantageous Effects

[0032] The steam generator with the above-stated construction has the following effects.

[0033] According to the present invention, the heater case, which is constructed such that a predetermined amount of water can be introduced into the heater case, is mounted in the case of the steam generator. Consequently, a small amount of water is instantaneously heated, and therefore, time necessary to generate steam is reduced.

[0034] As the time necessary to generate steam is reduced power consumption is decreased.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] The accompanying drawings, which are included to provide a further understanding of the invention, illustrate embodiments of the invention and together with the description serve to explain the principle of the invention.

[0036] In the drawings:

[0037] FIG. **1** is a perspective view schematically illustrating the structure of a conventional drum type washing machine.

[0038] FIG. **2** is a schematic view illustrating the internal structure of a conventional steam generator.

[0039] FIG. **3** is a longitudinal sectional view illustrating the structure of a drum type washing machine according to an embodiment of the present invention.

[0040] FIGS. **4** and **5** are schematic views illustrating the internal structure of a steam generator according to an embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0041] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0042] FIG. **3** is a longitudinal sectional view illustrating the structure of a drum type washing machine according to an embodiment of the present invention, and FIGS. **4** and **5** are schematic views illustrating the internal structure of a steam generator according to an embodiment of the present invention.

[0043] As shown in FIG. **3**, the washing machine according to the present invention includes a machine case **110**, a tub **120**, a drum **130**, a steam supply unit, a temperature sensor **150**, a circulating pump **160**, a circulating channel **170**, and a water level sensor (not shown) for detecting the water level of the wash water in the tub **120**. In this embodiment, the washing machine is a drum type washing machine.

[0044] The machine case **110** constitutes the external appearance of the drum type washing machine. At the front part of the machine case **110** is formed a laundry opening **111**.

[0045] A door **140** is mounted to the machine case **110** adjacent to the laundry opening **111** for opening and closing the laundry opening **111**. At the inner circumference of the laundry opening **111** is mounted a gasket **112**, which accomplishes sealing between the door **140** and the laundry opening **111**.

[0046] Also, the machine case **110** is provided with a wash water supply pipe **113** for supplying wash water into the tub **120**. On the pipe line of the wash water supply pipe **113** is mounted a detergent box **114**.

[0047] The tub **120** is mounted in the machine case **110** in a supported state.

[0048] To the bottom of the tub **120** is connected a drainage channel **121** for draining wash water.

[0049] At the lower end of the tub **120** is mounted a wash water heater **122** for heating wash water supplied into the tub **120**.

[0050] The drum **130** is rotatably mounted in the tub **120**, and is disposed such that the open side of the drum **130** is directed to the laundry opening **111** of the machine case **110**.

[0051] At the circumference of the drum **130** are formed a plurality of through-holes, through which wash water and steam supplied into the tub **120** are introduced into the drum **130**.

[0052] The steam supply unit is constructed to supply a predetermined amount of steam into the tub **120** and/or the drum **130**. In this embodiment, at least one steam supply unit is provided.

[0053] The circulating pump **160** is mounted on the drainage channel **121**, which is connected to the tub **120**, and is operated to pump the wash water supplied into the tub **120** such that the wash water can be circulated.

[0054] The circulating channel **170** is a pipe line which is connected to the circulating pump **160** for guiding the circulating movement of the wash water pumped by the circulating pump **160**.

[0055] Preferably, the end of the circulating channel **170**, i.e., the wash water discharging side, extends through the gasket **112** such that the end of the circulating channel **170** is

directed to the inside wall of the drum **130**. In this embodiment, the end of the circulating channel **170** is connected to the steam supply pipe **220** as shown in the accompanied drawings. Alternatively, the end of the circulating channel **170** may be connected to the inside of the drum **130** without being connected to the steam supply pipe **220**.

[0056] The temperature sensor **150** is mounted at a predetermined position in the tub **120** for detecting the interior temperature of the tub **120**.

[0057] The temperature detected by the temperature sensor **150** may be used to operate the steam supply unit and to control the wash water heater **122**.

[0058] Meanwhile, unexplained reference numeral **180** indicates a water supply valve assembly **180** for selectively supplying wash water introduced from the outside to the detergent box **114** or the steam supply unit, reference numeral **181** indicates a wash water supply valve for controlling the supply of wash water into the tub **120** through the detergent box **114**, and reference numeral **182** indicates a water-for-steam supply valve for controlling the supply of water into the steam supply unit.

[0059] The steam supply unit is constructed to evaporate water, using high-temperature hot air, into steam and to supply the steam into the tub **120** and/or the drum **130**. The steam supply unit includes a steam generator (SG) **210** for generating high-temperature hot air to evaporate water into steam, a steam supply pipe **220**, through which steam generated from the water evaporation by the steam generator **210** flows, and an injection nozzle **230** for injecting the steam flowing through the steam supply pipe **220** into the tub **120** and/or drum **130**.

[0060] The injection nozzle **230** is constructed in the shape of a nozzle such that the steam can be smoothly injected through the nozzle. Preferably, the end of the injection nozzle **230**, through which the steam is discharged, extends through the gasket **112** such that the end of the injection nozzle **230** is directed to the interior of the drum **130**.

[0061] Hereinafter, the structure and the operation of the steam generator **210** according to an embodiment of the present invention will be described in more detail with reference to FIGS. **4** and **5**. Arrows shown in FIG. **4** indicate discharge of steam generated in a heater case, and arrows shown in FIG. **5** indicate introduction of water into the heater case.

[0062] According to the present invention, the steam generator **210** includes a case **211**, a heater case **300**, a steam heater **213**, a steam side temperature sensor **214**, and a water level sensor **215**.

[0063] The case **211** may be constructed in the shape of a rectangular box, which Institutes the external appearance of the steam generator **210** and forms a steam generation space.

[0064] The case **211** is provided at one side thereof with an inlet port **103** (see FIG. **1**), which is connected to the water supply valve **182** for allowing water to be introduced into the case **211** through the inlet port **103**. The case **211** is provided at the other side thereof with an outlet port **105**, which is connected to the steam supply pipe **220** for allowing steam generated in the case **211** to be supplied into the drum **130** through the outlet port **105**.

[0065] The heater case **300** is disposed in the case **211** such that the heater case **300** communicates with the interior of the case **211**. The heater case **300** has an additional space, into which some of the water supplied into the case **211** is introduced.

[0066] The heater case **300** serves to heat the water introduced from the case **211** to generate steam and discharge the generated steam into the drum **130** through the case **211**.

[0067] Preferably, the heater case **300** is mounted in the case **211** such that the heater case **300** is spaced apart from the bottom of the case **211**. This construction is necessary to form an introduction part, which will be described below, at the bottom of the heater case **300**.

[0068] Meanwhile, the steam heater **213** is mounted in the heater case **300**. The steam heater **213** serves to heat water introduced into the heater case **300**, through the heat generation of the steam heater **213**, into steam.

[0069] The steam heater **213** may be constructed using a sheath heater. Although not shown in the drawings, a fuse is mounted in the steam heater **213** for interrupting the supply of power when the steam generator **210** is overheated so as to protect the steam generator **210**.

[0070] Meanwhile, the heater case **300** comprises an upper case part **301** and a lower case part **303**.

[0071] Preferably, an introduction part having at least one introduction hole **310**, through which some of the water supplied into the case **211** is introduced into the heater case **300**, is formed at the bottom of the lower case **303** of the heater case **300**.

[0072] Also preferably, a discharge part having at least one discharge hole **330**, through which the steam generated by the steam heater **213** in the heater case **300** is discharged, is formed at one side of the upper case **301** of the heater case **300**.

[0073] More preferably, the at least one discharge hole **330** is located at the upper surface of the upper case **301**.

[0074] According to the present invention, it is preferable that the diameter D**1** of the at least one introduction hole **310** be less than the diameter D**2** of the at least one discharge hole **330**.

[0075] In this case, the speed of the water introduced through the at least one introduction hole **310** is less than that of the steam discharged through the at least one discharge hole **330**.

[0076] Meanwhile, the steam side temperature sensor **214** is disposed in the case **211**, and is electrically connected to a controller (not shown) of the washing machine. The steam side temperature sensor **214** serves to detect the interior temperature of the case **211** when the heat is generated from the steam heater **213**.

[0077] Also, the water level sensor **215** is disposed in the case **211**. The water level sensor **215** includes three electrodes, i.e., a common electrode **216**, a long electrode **217**, and a short electrode **218**.

[0078] The water level sensor **215** serves to detect the water level of the water supplied into the case **211**. The water level sensor **215** is electrically connected to the controller (not shown) of the washing machine, which controls all operations of the components of the washing machine, including the water supply valve assembly **180** and the steam heater **213**.

[0079] The common electrode **216** and the long electrode **217** are formed such that the terminals of the common electrode **216** and the long electrode **217** are exposed approximately at the height set as the minimum water level of the water necessary to generate steam. The short electrode **218** is shorter than the common electrode **216** and the long electrode **217**, and is formed such that the terminal of the short electrode **218** is exposed approximately at the height set as the maximum water level of the water necessary to generate steam.

[0080] Preferably, the height at which the terminals of the long electrode **217** and the common electrode **216** are exposed is a height at which the steam heater **213** is fully submerged in the water.

[0081] Hereinafter, the operation and effects of the steam generator with the above-stated construction will be described.

[0082] First, when electric power is supplied to the drum type washing machine, the controller (not shown) of the drum type washing machine controls the water supply valve **181** of the water supply valve assembly **180** to supply wash water into the tub **120** to a predetermined water level, controls the circulating pump **160** to circulate the wash water in the tub **120** to the upper part of the drum **130** along the outside of the tub **120**, and controls the drum **130** to be rotated such that a laundry wetting process is carried out.

[0083] At this time, the controller controls the water-for-steam water supply valve **182** of the water supply valve assembly **180** to supply a predetermined amount of water into the case **211** of the steam generator **210**.

[0084] After the water is supplied into the case **211**, the water level of the water supplied into the case **211** is detected by the steam side water level sensor **215**, as previously described.

[0085] Meanwhile, some of the water supplied into the case **211** is introduced into the heater case **300** through the introduction holes **310** formed at the lower case **303** of the heater case **300**.

[0086] At this time, the water introduced into the heater case **300** is heated by the steam heater **213** such that the water is changed into steam.

[0087] Meanwhile, the interior pressure of the heater case **300** is higher than the pressure outside the heater case **300**, i.e., the interior pressure of the case **211**, due to the heat generated from the steam heater **213**, and therefore, the steam generated in the heater case **300** is discharged into the case **211**.

[0088] Since the interior pressure of the heater case **300** is higher than that of the case **211** while the steam is generated in the heater case **300**, and is then discharged from the heater case **300**, no water is introduced into the heater case **300** through the introduction holes **310**.

[0089] Subsequently, the steam discharged into the case **211** is guided along the steam supply pipe **220**, which is connected to the case **211** and the drum **130**, and is then discharged into the drum **130**, in which laundry is received such that the steam is directed to the laundry.

[0090] After the steam generated in the heater case **300** is discharged for a predetermined period of time, the water level of water in the heater case **300** is lowered and the interior pressure of the heater case **300** becomes lower than the pressure outside the heater case **300**, i.e., the interior pressure of the case **211**.

[0091] At this time, the discharge of steam is interrupted and water is reintroduced into the heater case **300** through the introduction holes **310** formed at the lower side of the heater case **300**.

[0092] After a predetermined amount of water is introduced into the heater case **300**, the water is heated by the steam heater **213**. As a result, the interior temperature and the interior pressure of the heater case **300** are increased, and therefore, steam is discharged again.

[0093] The steam generator **210** repeatedly performs the above-described procedure, whereby the steam is supplied into the drum **130**.

[0094] While the laundry is wetted by the resupply of water into the tub **120**, the rotation of the drum **130**, and the operation of the circulating pump **160**, as described above, high-temperature steam is rapidly injected into the drum **130** by the steam generator **210** according to the present invention, whereby the interior of the drum **130** is controlled to reach a predetermined temperature which can achieve the greatest washing efficiency of the washing machine.

[0095] The laundry wetting process and the steam supply process through the steam generator **210** are carried out until the temperature detected by the temperature sensor **150** reaches a target temperature.

[0096] When the temperature detected by the temperature sensor **150** reaches a target temperature, the supply of steam through the steam generator **210** is interrupted and the wash water supply valve **181** is controlled to supply water into the tub **120** to the predetermined water level. After that, the drum **130** is alternately rotated in the clockwise and counterclockwise directions such that a post washing process is carried out according to a predetermined program.

[0097] During the post washing process, the wash water heater **122** may be used to heat the wash water in the tub **120** to a predetermined temperature, or the circulating pump **160** may be operated by predetermined periods of time to circulate the wash water.

[0098] After the post washing process is completed selected operations, such as a rinsing operation and a spin-drying operation, are successively carried out.

[0099] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

INDUSTRIAL APPLICABILITY

[0100] According to the present invention, a small amount of water is instantaneously heated in the heater case, which is disposed in the case of the steam generator. As a result, time necessary to generate steam is reduced and therefore, power consumption resulting from the operation of the steam generator is decreased. Consequently, the present invention has considerably high industrial applicability.

1. A steam generator comprising:

a case having a space for receiving a predetermined amount of water, the case being provided at one side thereof with an inlet port and an outlet port;

a heater case disposed in the case such that the heater case communicates with the interior of the case, the heater case having an additional space, into which some of the water supplied into the case is introduced; and

a steam heater disposed in the heater case for heating the water introduced into the heater case so as to generate steam.

2. The steam generator according to claim **1**, wherein the heater case is mounted in the case such that the heater case is spaced apart from the bottom of the case.

3. The steam generator according to claim 1, wherein the heater case comprises:

an introduction part having at least one introduction hole, through which some of the water supplied into the case is introduced into the heater case; and

a discharge part having at least one discharge hole, through which steam generated in the heater case is discharged.

4. The steam generator according to claim 3, wherein the introduction part is formed at the lower surface of the heater case.

5. The steam generator according to claim 3, wherein the discharge part is formed at the upper surface of the heater case.

6. The steam generator according to claim 3, wherein the at least one introduction hole has a diameter less than that of the at least one discharge hole.

7. The steam generator according to claim 1, further comprising:

a temperature detecting sensor disposed in the case for detecting the temperature of the steam discharged from the heater case.

8. The steam generator according to claim 1, further comprising:

a water level detecting sensor disposed in the case for detecting the water level of the water received in the case.

9. A washing machine including a tub mounted in a cabinet, which constitutes the external appearance of the washing machine, for storing wash water, a drum rotatably mounted in the tub, and a steam generator mounted in the cabinet for supplying steam into the drum, wherein the steam generator comprises:

a case having a space for receiving a predetermined amount of water, the case being provided at one side thereof with an inlet port and an outlet port;

a heater case disposed in the case such that the heater case communicates with the interior of the case, the heater case having an additional space, into which some of the water supplied into the case is introduced; and

a steam heater disposed in the heater case for heating the water introduced into the heater case to generate steam.

10. The washing machine according to claim 9, wherein the heater case is mounted in the case such that the heater case is spaced apart from the bottom of the case.

11. The washing machine according to claim 9, wherein the heater case comprises:

an introduction part having at least one introduction hole, through which some of the water supplied into the case is introduced into the heater case; and

a discharge part having at least one discharge hole, through which steam generated in the heater case is discharged.

12. The washing machine according to claim 11, wherein the introduction part is formed at the lower surface of the heater case.

13. The washing machine according to claim 11, wherein the discharge part is formed at the upper surface of the heater case.

14. The washing machine according to claim 11, wherein the at least one introduction hole has a diameter less than that of the at least one discharge hole.

15. The washing machine according to claim 9, further comprising:

a temperature detecting sensor disposed in the case for detecting the temperature of the steam discharged from the heater case.

16. The washing machine according to claim 9, further comprising:

a water level detecting sensor disposed in the case for detecting the water level of the water received in the case.

* * * * *