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(54) WASHING MACHINE

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(57) ABSTRACT

A washing machine, includes a drum; a condensing duct to condense air which flows in from the drum; a cooling water supplying unit to supply cooling water to the inside of the condensing duct so that the air flowing into the condensing duct from the drum is condensed; and a control unit to control the cooling water supplying unit so that the cooling water is supplied intermittently. Thus, a washing machine is provided that is capable of reducing the consumption amount of cooling water, increasing an efficiency of drying laundry and shortening the time for drying the laundry.

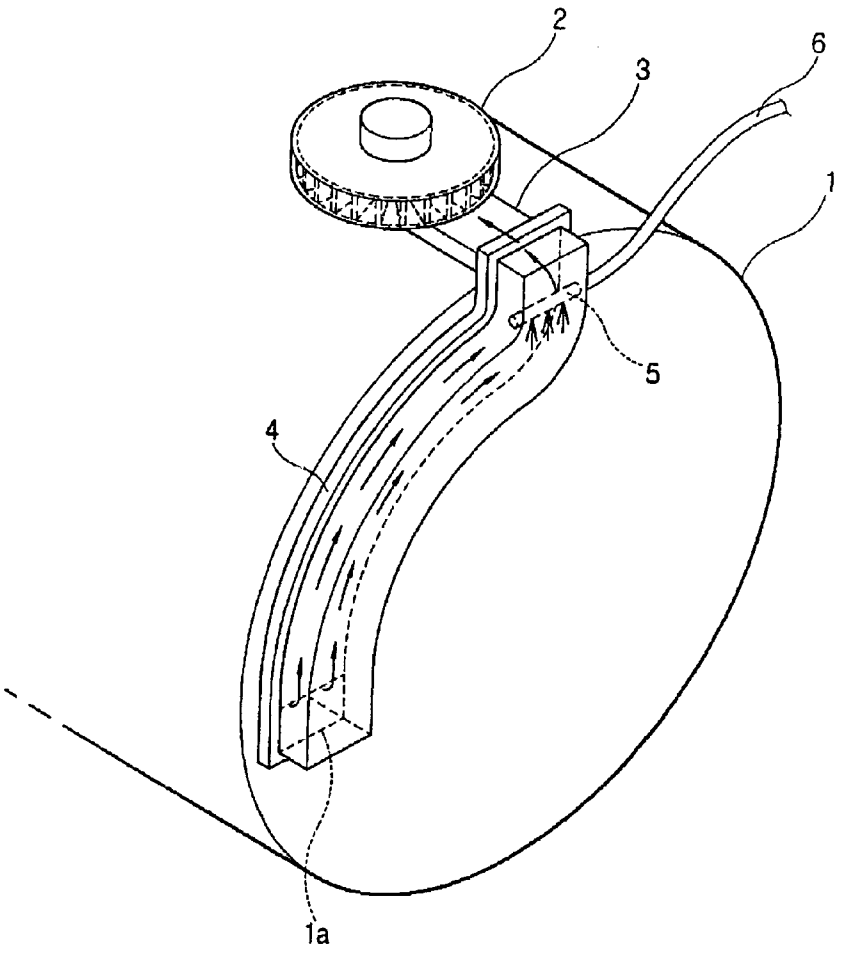


FIG. 1

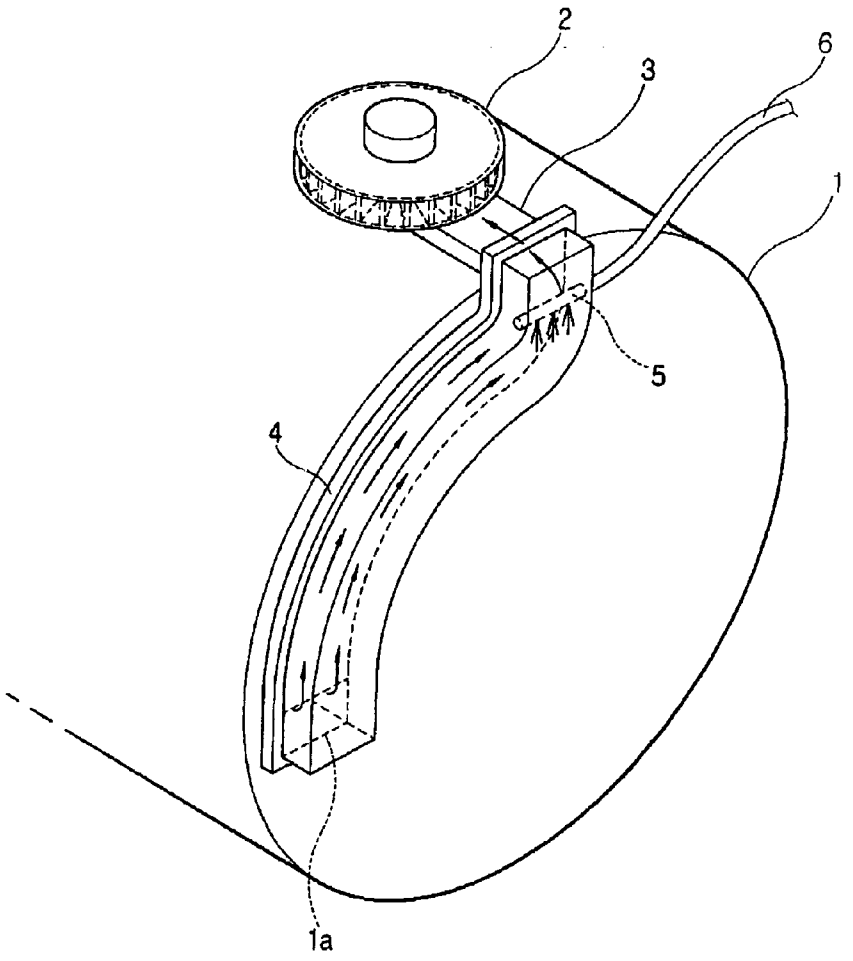


FIG. 2

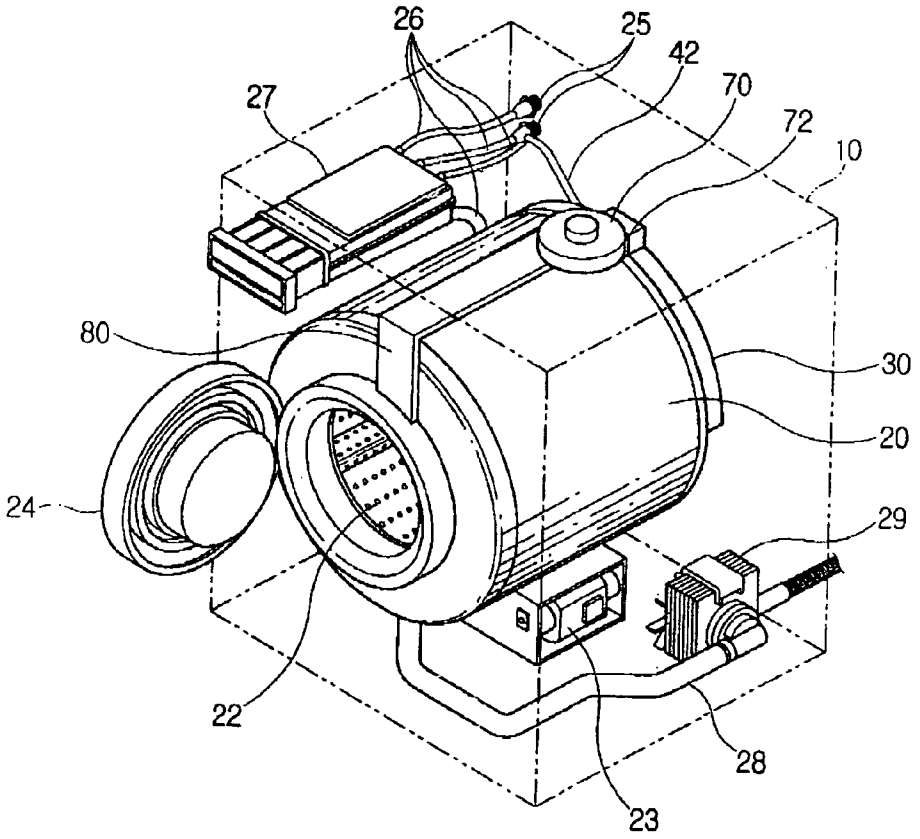


FIG. 3

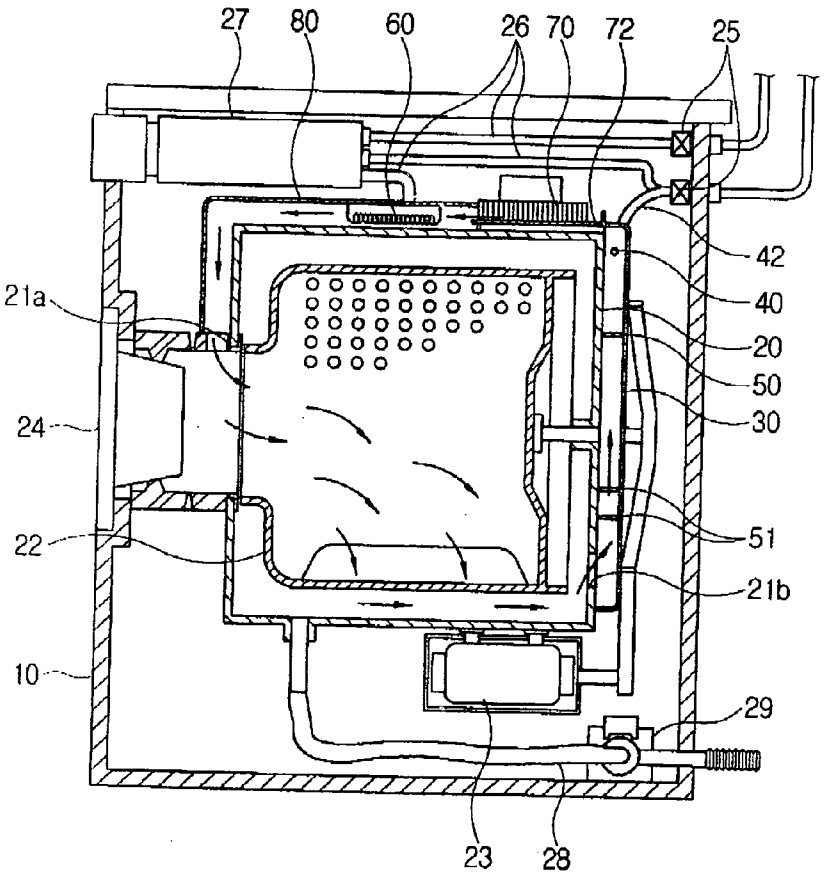


FIG. 4

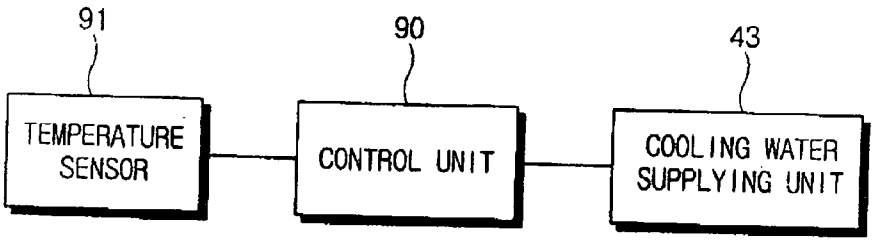

91
90
43
TEMPERATURE SENSOR
CONTROL UNIT
COOLING WATER SUPPLYING UNIT

FIG. 5

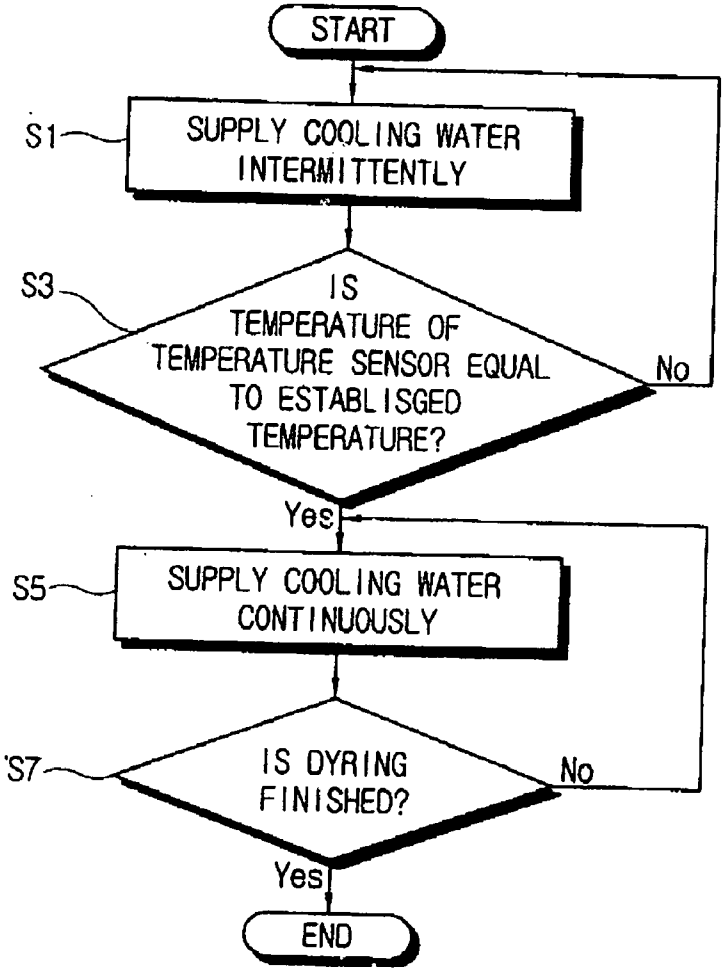

START
S1
SUPPLY COOLING WATER INTERMITTENTLY
S3
IS TEMPERATURE OF TEMPERATURE SENSOR EQUAL TO ESTABLISGED TEMPERATURE?
No
Yes
S5
SUPPLY COOLING WATER CONTINUOUSLY
S7
IS DYRING FINISHED?
No
Yes
END

FIG. 6

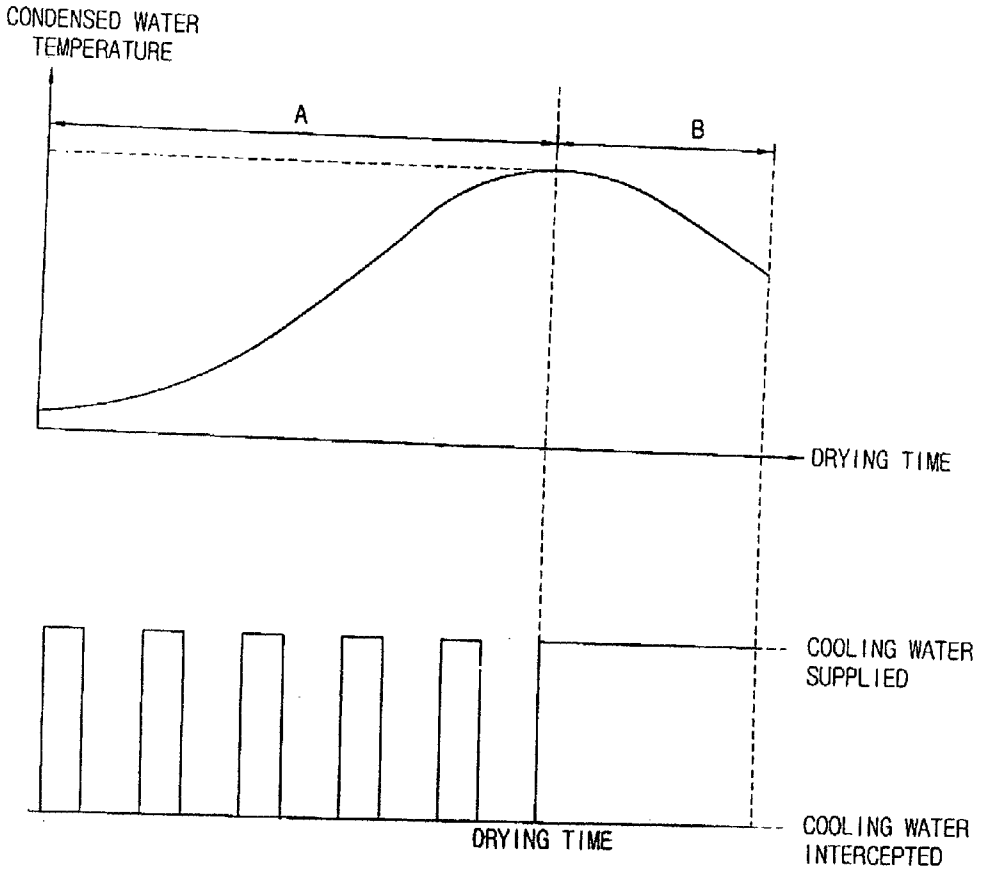
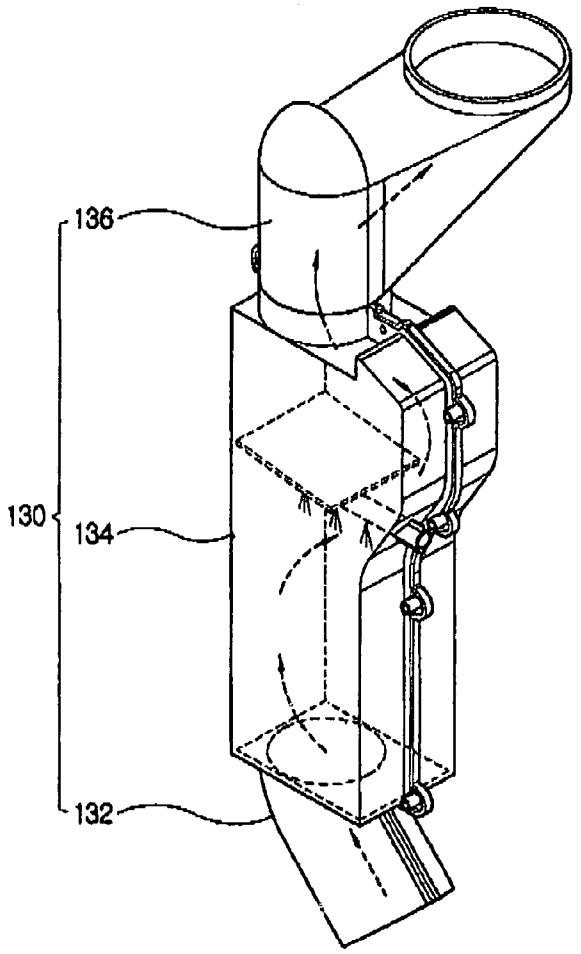

CONDENSED WATER TEMPERATURE
A
B
DRYING TIME
COOLING WATER SUPPLIED
DRYING TIME
COOLING WATER INTERCEPTED

FIG. 7



WASHING MACHINE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from Korean Patent Application No. 2004-0096831, filed on Nov. 24, 2004, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of Invention

[0003] The present invention relates to a washing machine and, more particularly, to a washing machine capable of supplying cooling water intermittently.

[0004] 2. Description of the Related Art

[0005] Generally a drum-type washing machine refers to a kind of washing machine, which washes the laundry with impacts generated when the pieces of laundry are dropped downward by rotating a washing tank at 360 degrees. In addition to a washing function, the drum-type washing machine has various functions such as rinsing, dehydrating, and drying.

[0006] When the drying function of the drum-type washing machine is performed, air heated by a heater is supplied to the inside of a drum to thereby heat the laundry therein, and the air at high temperature and high humidity generated in the course of heating the laundry passes through a condensing process to enhance a drying efficiency.

[0007] As illustrated in **FIG. 1**, a conventional drum-type washing machine comprises a drum **1**, a blowing fan **2** and a blowing fan duct **3** disposed on the outside of the drum **1**, a condensing duct **4** connecting the drum **1** and the blowing fan **3**, a jetting nozzle **5** mounted internally in the upper side of the condensing duct **4** and a cooling water supplying tube **6** supplying cooling water to the jetting nozzle **5**.

[0008] In the drum-type washing machine with this configuration, air at high temperature and high humidity having passed through a drying process is drawn into the inside of the condensing duct **4** through an air outlet **1***a* in the lower side of the drum **1**. The air at high temperature and high humidity drawn into the inside of the condensing duct **4** encounters cooling water jetted vertically downward by the jetting nozzle **5**, in the course of flowing into the blowing fan duct **3** through the condensing duct **4**, whereby the water contained in the air is condensed.

[0009] The conventional drum-type washing machine continuously supplies cooling water during the whole drying process (the beginning, middle and late period of drying) so as to increase the condensing efficiency, thereby consuming a large amount of cooling water.

[0010] In this respect, there is a need for a drum-type washing machine capable of reducing a consumption amount of cooling water, increasing a drying efficiency and shortening the time for drying.

SUMMARY OF THE INVENTION

[0011] Accordingly, it is an aspect of the present invention to provide a washing machine capable of reducing the consumption amount of cooling water, increasing an efficiency of drying laundry and shortening the time for drying the laundry.

[0012] The foregoing and/or other aspects of the present invention can be achieved by providing a washing machine, comprising a drum; a condensing duct, which communicates with the drum, to condense air which flows in from the drum; a cooling water supplying unit to supply cooling water to the inside of the condensing duct so that the air flowing into the condensing duct from the drum is condensed; and a control unit to control the cooling water supplying unit so that the cooling water is supplied intermittently.

[0013] According to an aspect of the present invention, the washing machine further comprises a temperature sensor to measure a temperature of condensed water condensed inside the condensing duct by the cooling water of the cooling water supplying unit, wherein the control unit controls the cooling water supplying unit so that the cooling water is intermittently supplied until a temperature of the condensed water measured by the temperature sensor reaches an established temperature.

[0014] According to an aspect of the present invention, the control unit controls the cooling water supplying unit so that the cooling water is continuously supplied, after the temperature of the condensed water measured by the temperature sensor has reached the established temperature.

[0015] According to an aspect of the present invention, the temperature sensor measures a temperature of the condensed water discharged from the condensing duct.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The above and/or other aspects and advantages of the present invention will become apparent and more readily appreciated from the following description of the exemplary embodiments, taken in conjunction with the accompany drawings, in which:

[0017] **FIG. 1** is a perspective view illustrating a structure of a condensing duct of a conventional drum-type machine;

[0018] **FIG. 2** is a perspective view illustrating a drum-type washing machine consistent with the present invention;

[0019] **FIG. 3** is a sectional view schematically illustrating the drum-type washing machine consistent with the present invention;

[0020] **FIG. 4** is a schematic control block diagram of the drum-type washing machine consistent with the present invention;

[0021] **FIG. 5** is a control flow diagram of the drum-type washing machine consistent with the present invention;

[0022] **FIG. 6** is a graph illustrating temperature of condensed water and a control state of a cooling water supplying unit; and

[0023] **FIG. 7** is a perspective view of a condensing duct according to another exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE ILLUSTRATIVE, NON-LIMITING EMBODIMENTS OF THE INVENTION

[0024] The present invention may be applied to various types of washing machines, but the present invention will be

described in association with a drum-type washing machine as an exemplary embodiment with reference to the accompanying drawings.

[0025] Referring to **FIGS. 2 and 3**, the drum-type washing machine according to the present invention comprises a main casing **10** shaped with a square frame, a cylinder-type drum **20** installed inside the main casing **10** in which the laundry is put, a cylinder-type washing tank **22** installed inside the main casing **10**, having dehydrating holes on the wall face thereof, a driving motor **23** provided below a lower unit of the drum **20**, rotating the washing tank **22** forwardly or backwardly, to thereby performing operations to wash, rinse and dehydrate the laundry, and a door **24** installed in front of the main casing **10**, opening and closing the main casing **10**.

[0026] Over the top of the drum **20** are provided a water supplying unit which supplies the water for washing into the drum **20** and as well dissolves the detergent in the course of supplying the water, the water supplying unit comprising a water supplying valve **25**, a water supplying tube **26** and a detergent dissolving unit **27**.

[0027] On the top of the drum **20** are also provided a drying unit to dry the laundry after the dehydrating operation has been completed. The drying unit comprises a blowing fan **70** and a blowing fan duct **72** mounted on the top of the drum **20**, a discharging duct **80** mounted between the blowing fan duct **72** and an air inlet **21***a* of the drum **20** so as to allow them to communicate with each other, a heater **60** mounted inside the discharging duct **80**, a condensing duct **30** mounted between an air outlet **21***b* of the drum **20** and the blowing fan duct **72** so as to allow them to communicate with each other, and a cooling water supplying unit **43** supplying cooling water into the condensing duct **30** so that air which flows into the condensing duct **30** from the inside of the drum **20** is condensed.

[0028] The cooling water supplying unit **43** comprises a cooling water supplying tube **42** branched from the water supplying valve **25**, and a cooling water jetting member **40** jetting the cooling water from the cooling water supplying tube **42** to the inside of the condensing duct **30**.

[0029] With this configuration, air blown through the blowing fan **70** is heated by the heater **60** while it is passing through the discharging duct **80** and is then supplied to the inside of the drum **20** through the air inlet **21***a*, thereby heating and drying the laundry. The air at high temperature and high humidity generated in the course of drying the laundry flows into the inside of the condensing duct **30** through the air outlet **21***b* of the drum **20**, and water contained in the air at high temperature and high humidity flowing into the inside of the condensing duct **30** is condensed by the cooling water jetted vertically downward through the cooling water jetting member **40** in the course of being drawn into the blowing fan **70** after having passed the condensing duct **30**.

[0030] Inside the condensing duct **30** are provided an elevation limiting projection **50** and a condensed water collecting projection **51**, whose shapes and installation positions may be modified in various ways, as necessary.

[0031] Below the lower part of the drum **20** is provided a draining unit including a draining tube **28** and a draining pump **29**, so as to drain the water after washing inside the drum **20**.

[0032] As illustrated in **FIG. 4**, the drum-type washing machine according to the present invention comprises a temperature sensor **91** measuring a temperature of the condensed water condensed by the cooling water of the cooling water supplying unit **43**, and a control unit **90** controlling supply of the cooling water according to the temperature of the condensed water measured by the temperature sensor **91**.

[0033] The temperature sensor **91** measures a temperature of the condensed water condensed by the cooling water of the cooling water supplying unit **43** and discharged to the outside of the condensing duct **30**. It is preferable, but not necessary, that the temperature sensor **91** is provided in the lower side of the condensing duct **30**, to measure the temperature of the condensed water discharged to a discharging unit (not shown) from the condensing duct **30**.

[0034] An established temperature to be compared with a temperature measured by the temperature sensor **91** is established in the control unit **90**, wherein the established temperature refers to the highest temperature of the condensed water depicted in **FIG. 6**.

[0035] The control unit **90** controls the cooling water supplying unit **43** so that the cooling water is supplied intermittently until the temperature measured in the temperature sensor **91** reaches the established temperature, and also controls the cooling water supplying unit **43** so that supply of the cooling water is continued after the temperature measured in the temperature sensor **91** has reached the established temperature.

[0036] Hereinbelow, an operation to dry the laundry in the drum-type washing machine with the configuration described above will be described.

[0037] As illustrated in **FIG. 3**, the air blown from the blowing fan **70** is heated by the heater **60** while it is passing through the discharging duct **80**, and then supplied into the inside of the drum **20** through the air inlet **21***a*. Accordingly, the laundry within the drum **20** is heated and dried.

[0038] The air at high temperature and high humidity generated in the course of drying the laundry flows into the inside of the condensing duct **30** through the air outlet **21***b* of the drum **20**, and the air at high temperature and high humidity flowing into the inside of the condensing duct **30** is drawn into the blowing fan duct **72** after having passed the condensing duct **30**.

[0039] When the air at high temperature and high humidity flowing into the inside of the condensing duct **30** passes through the condensing duct **30**, the water contained therein is condensed by the cooling water supplied through the cooling water supplying unit **43**. At this time and with reference to **FIG. 5**, the cooling water supplied through the cooling water supplying unit **43** is intermittently supplied according to control by the control unit **90** at operation S1.

[0040] As illustrated in **FIG. 6**, the control unit **90** controls the cooling water supplying unit **43** so that supply and interception of the cooling water can be repeated until the temperature of the condensed water measured by the temperature sensor **91** reaches the established temperature, that is, during the A region.

[0041] By the way, condensation forms inside the condensing duct **30** even while the cooling water is intermittently being supplied, as depicted in the A region of **FIG. 6**.

[0042] The condensed water is elevated by making use of an air current being elevated inside the condensing duct **30** but its elevation is limited by colliding against the elevation limiting projection **50** and forming water drops on the elevation limiting projection **50**. The water drops having formed on the elevation limiting projection **50** are dropped and collected in the condensed water collecting projection **51**, and the water drops collected in the condensed water collecting projection **51** are scattered and elevated again by the upward air current, and then collided against the elevation limiting projection **50**. This chain of processes is repeated. Since contact of the air current elevated with water is extended through these processes, condensation occurs within the condensing duct **30** while the cooling water is being intercepted.

[0043] Next, the temperature of the condensed water measured by the temperature sensor **91** is compared with the established temperature at operation S3. When the cooling water temperature measured by the temperature sensor **91** reaches the established temperature as depicted in **FIG. 6**, the control unit **90** controls the cooling water supplying unit **43** so that the cooling water having been supplied intermittently is continuously supplied at operation S5.

[0044] As depicted in **FIG. 6**, the control unit **90** continuously supplies the cooling water to the condensing duct **30** so as to allow the temperature of the condensed water to be lowered, after the temperature of the condensed water measured in the temperature sensor **91** reaches the established temperature, that is, during the B region.

[0045] Thereafter, the control unit **90** ascertains whether the drying operation is completed. If it is ascertained that the drying operation has been completed, the control unit **90** stops supply of the cooling water.

[0046] In the drum-type washing machine according to the present invention as described above, if supply of the cooling water to the condensing duct **30** and interception thereof are repeated, the condensed water temperature of the condensing duct **30** is increased as the drying time is increased. Accordingly, the temperature of the air returned to the inside of the drum **20** through the condensing duct **30** is also increased, thereby increasing the internal temperature of the drum **20**.

[0047] As the internal temperature of the drum **20** is increased due to the intermittent supply of the cooling water to the condensing duct **30**, an efficiency of vaporizing the water in the laundry can be improved and the drying time can be shortened. In addition, the amount of the cooling water consumed can be reduced.

[0048] In the above-described embodiment, the present invention has been applied to the condensing duct **30** as illustrated in **FIG. 3**. However, the present invention is not limited to this, but can be applied various types of condensing ducts. The present invention may also be applied to a condensing duct **130** illustrated in **FIG. 7**.

[0049] The condensing duct **130** illustrated in **FIG. 7** comprises an air inlet **132** through which internal air of the drum flows, a condensing unit **134** through which the air flowing through the air inlet **132** passes, and an air outlet **136** through which the air having passed through the condensing unit **134** is discharged.

[0050] The present invention has been described with reference to a drum-type washing machine, but can also be applied to a drying machine.

[0051] As described above, in a washing machine consistent with the present invention, the consumption amount of the cooling water can be reduced. In addition, the drying efficiency of the laundry can be improved and the drying time of the laundry can be shortened.

[0052] Although a few exemplary embodiments of the present invention have been shown and described, it will be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the appended claims and their equivalents.

What is claimed is:

1. A washing machine, comprising;

a drum;

a condensing duct, which communicates with the drum, to condense air which flows in from the drum;

a cooling water supplying unit to supply cooling water to the inside of the condensing duct so that the air flowing into the condensing duct from the drum is condensed; and

a control unit to control the cooling water supplying unit so that the cooling water is supplied intermittently.

2. The washing machine as claimed in claim 1, further comprising a temperature sensor to measure a temperature of condensed water condensed inside the condensing duct by the cooling water of the cooling water supplying unit,

wherein the control unit controls the cooling water supplying unit so that the cooling water is intermittently supplied until a temperature of the condensed water measured by the temperature sensor reaches an established temperature.

3. The washing machine as claimed in claim 2, wherein the control unit controls the cooling water supplying unit so that the cooling water is continuously supplied, after the temperature of the condensed water measured by the temperature sensor has reached the established temperature.

4. The washing machine as claimed in claim 3, wherein the temperature sensor measures a temperature of the condensed water discharged from the condensing duct.

5. The washing machine as claimed in claim 2, wherein the temperature sensor measures a temperature of the condensed water discharged from the condensing duct.

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