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(54) **A LAUNDRY WASHER/DRYER CONTROL METHOD WITH HYGIENE PROGRAM**

(57) The present invention relates to a laundry washer/dryer control method which is suitable for a laundry washer/dryer comprising a drum wherein the laundry is loaded, a water receptacle, a water heater heating the water in the water receptacle, an air heater and at least one fan, and which comprises the steps of taking the

water into the water receptacle, heating and thus evaporating the water by activating the water heater, deactivating the water heater and activating the air heater and the fan when the water heater is deactivated such that vapor and hot air are transferred into the drum at the same time.

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Description

[0001] The present invention relates to a laundry washer/dryer control method with a hygiene program.

[0002] Various hygiene programs are used in laundry washers/dryers. The main purpose of using hygiene programs is to eliminate the microbial load and bad odor on the laundry without the need for daily washing and to allow their reuse. Thus, by saving both time and energy, user satisfaction is maximized.

[0003] In the state of the art hygiene programs, the textile is exposed to the hot air heated to approximately 90°C by means of an air heater for approximately one hour. In this embodiment, the length of the hygiene program and the temperature of 90°C cause textile damage, resulting in user dissatisfaction. Moreover, when the hygiene program ends, the textile in the laundry washer/dryer cannot be taken out of the laundry washer/dryer immediately due to high temperatures and is kept therein until it cools down. This causes wrinkles in the textile. Such problems cause both time and energy loss and textile damage for users.

[0004] In the state of the art German Patent Application No. DE19743508, a laundry washer/dryer is disclosed, having a hygiene program where the water heater and the air heater are operated at the same time. Thus, while the water heater evaporates the water, the air heater heats the environment and distributes the hot humid air over the load.

[0005] The state of the European Patent Application No. EP2603629 discloses that the laundry in the drum is heated with hot air before getting into contact with water vapor and the water is heated with said heated air.

[0006] Another state of the art embodiment is disclosed in the International Patent Application No. WO2021246115. The laundry washer/dryer disclosed in this document comprises a steam generator.

[0007] The aim of the present invention is the realization of a laundry washer/dryer control method with a hygiene program.

[0008] The laundry washer/dryer control method realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, is suitable for a laundry washer/dryer comprising a drum wherein the laundry is loaded, a water receptacle, a water heater heating the water in the water receptacle, an air heater and at least one fan, and comprises the steps of taking the water into the water receptacle, heating and thus evaporating the water by activating the water heater, deactivating the water heater and activating the air heater and the fan when the water heater is deactivated such that vapor and hot air are transferred into the drum at the same time. Thus, a control method is developed, which enables the performance of a hygiene program with less energy and in less time, without compromising hygiene performance, by applying steam and hot air sequentially.

[0009] In the first step of the method of the present

invention, water is gradually taken from the detergent box and delivered to the water receptacle without getting into contact with the laundry. Afterwards, the water heater is activated and the water in the water receptacle is heated to generate vapor preferably at 80°C. In this embodiment of the present invention, the temperature of the water is controlled by an NTC. In these first two processes, it is critical that the laundry is prevented from getting into contact with water, the generated vapor is homogeneously distributed in the drum and the condensation of the vapor is prevented. In an embodiment of the present invention, by preventing the discharge of water in the water receptacle, the vapor is transferred only to the laundry in the drum, thus keeping the same therein.

[0010] In the second step of the control method of the present invention, the water heater is deactivated and the air heater is activated. By activating the air heater, hot air is generated and the hot air is blown into the drum by means of the fan, thus enabling the same to be distributed homogeneously and meet the vapor in the drum. Thus, while the condensation of vapor on the laundry in the drum is prevented, the air with high enthalpy (sum of dry air enthalpy and water vapor enthalpy) formed by the combination of hot air and vapor is brought into contact with the laundry in the drum. At this stage, the temperature range reached by the laundry is approximately 70 - 80 °C. In order to keep the temperature obtained in the laundry stable, the hysteresis range is determined as 3°C and the ambient temperature is controlled accordingly. The most important advantage in this step of the control method in the hygiene program is that the temperature range to which the textile is exposed is lower than the state of the art embodiments. On the other hand, air with high enthalpy contacts the laundry with higher energy, and it is ensured that the hygiene program is applied at lower temperatures and in a shorter time - for example, 30 minutes - compared to the state of the art embodiments. By means of the method of the present invention, wherein vapor and hot air are applied sequentially, a 50% time advantage is provided in the laundry cycle without compromising the "hygienic ventilation" performance.

[0011] In another embodiment of the present invention, the control method comprises a step of detecting the amount of load in the drum and optimizing the vapor generation temperature and application time according to the determined load amount. In this embodiment of the present invention, for example, in a situation where low load is detected, approximately 1.8 liters of water is taken in the water intake step, and then the water heater is activated such that the water is heated to approximately 80 °C. If a high load is detected, 1 liter of water is first taken and then the water heater is activated. Then, approximately halfway to the hygiene program, another 1 liter of water is taken, and the water heater heats the water to approximately 80 °C, this time for one-third of a minute. Thus, by means of the method of the present invention, the hygiene program is performed effectively in both load capacities.

[0012] In another embodiment of the present invention, the control method comprises the step of deactivating the air heater and performing rapid cooling. In this embodiment of the present invention, after the air heater is deactivated, water is gradually taken and the drum is cooled rapidly. By preventing the water from getting into contact with the laundry in the drum, the pump and the discharge group are operated in communication with each other, thus ensuring the rapid cooling of the drum and the laundry therein. Thus, it is ensured that the door of the laundry washer/dryer can be opened quickly and the humid air in the environment is prevented from condensing on the laundry.

[0013] By means of the present invention, a control method is developed, which enables the hygiene program to be operated for a shorter time and at lower temperatures without compromising hygiene performance. By means of the control method of the present invention, wherein vapor and hot air are applied sequentially, a sterilization process called humid air sterilization and wherein hot water vapor is used as a sterilization agent is provided. By means of this method, an effective sterilization is provided at lower temperatures in a short time by treating the load in the laundry washer/dryer with hot air saturated with moisture and having high enthalpy. The hot water vapor used in this method better penetrates the textile to be sterilized, and the microbial load and spores of microorganisms are enabled to be eliminated quickly. On the other hand, in order to prevent the condensation of the applied vapor upon contact with the lower temperature surfaces of the laundry washer/dryer, the surfaces are enabled to be heated by means of the hot air applied simultaneously and thus the formation of condensation is prevented. By means of the present invention, a hygiene program is developed, which provides hygienic ventilation at lower temperatures in a short time in laundry washer/dryers.

[0014] Moreover, by means of the present invention, a hygiene program control method is implemented, which can be operated at lower temperatures and in shorter periods of time without compromising "hygienic ventilation" performance, which is climate-friendly, sustainable and which fully meets user expectations. Moreover, since the load detection step is also applied, the vapor application time and vapor generation temperature are optimized according to the amount of load, and the rapid cooling step ensures that the laundry is taken out of the laundry washer/dryer without wrinkles.

[0015] The laundry washer/dryer control method is suitable for a laundry washer/dryer comprising a drum wherein the laundry is loaded, a water receptacle, a water heater heating the water in the water receptacle, an air heater and at least one fan, and comprises the steps of taking the water into the water receptacle, heating and thus evaporating the water by activating the water heater, deactivating the water heater and activating the air heater and the fan when the water heater is deactivated such that vapor and hot air are transferred into the drum at the

same time. Thus, a control method is developed, which enables the performance of a hygiene program with less energy and in less time, without compromising hygiene performance, by applying steam and hot air sequentially.

[0016] In the first step of the control method of the present invention, water is gradually taken from the detergent box and delivered to the water receptacle without getting into contact with the laundry. Afterwards, the water heater is activated and the water in the water receptacle is heated to generate vapor preferably at 80°C. In this embodiment of the present invention, the temperature of the water is controlled by an NTC. In these first two processes, it is critical that the laundry is prevented from getting into contact with water, the generated vapor is homogeneously distributed in the drum and the condensation of the vapor is prevented. In an embodiment of the present invention, by preventing the discharge of water in the water receptacle, the vapor is transferred only to the laundry in the drum, thus keeping the same therein.

[0017] In the second step of the control method of the present invention, the water heater is deactivated and the air heater is activated. By activating the air heater, hot air is generated and the hot air is blown into the drum by means of the fan, thus enabling the same to be distributed homogeneously and meet the vapor in the drum. Thus, while the condensation of vapor on the laundry in the drum is prevented, the air with high enthalpy (sum of dry air enthalpy and water vapor enthalpy) formed by the combination of hot air and vapor is brought into contact with the laundry in the drum. At this stage, the temperature range reached by the laundry is approximately 70 - 80 °C. In order to keep the temperature obtained in the laundry stable, the hysteresis range is determined as 3°C and the ambient temperature is controlled accordingly. The most important advantage in this step of the control method in the hygiene program is that the temperature range to which the textile is exposed is lower than the state of the art embodiments. On the other hand, air with high enthalpy contacts the laundry with higher energy, and it is ensured that the hygiene program is applied at lower temperatures and in a shorter time - for example, 30 minutes - compared to the state of the art embodiments. By means of the method of the present invention, wherein vapor and hot air are applied sequentially, a 50% time advantage is provided in the laundry cycle without compromising the "hygienic ventilation" performance.

[0018] In another embodiment of the present invention, the control method comprises a step of detecting the amount of load in the drum and optimizing the vapor generation temperature and application time according to the determined load amount. In this embodiment of the present invention, in case low load is detected, the amount of water determined by the manufacturer is taken into the water receptacle and this water is heated with the water heater. If a high load is detected, the hygiene program is divided into two. In the first part of the hygiene program, first some water is taken, and then the water

heater is activated such that the water is heated to approximately 80 °C. In the last part of the hygiene program, the remaining water is taken and the water heater is operated for a shorter time than the first part such that the water is heated to approximately 80 °C. In this embodiment of the present invention, the amount of water taken when a high load is detected is higher than when a low load is detected. In this embodiment of the present invention, for example, in a situation where low load is detected, approximately 1.8 liters of water is taken in the water intake step, and then the water heater is activated such that the water is heated to approximately 80 °C. If a high load is detected, 1 liter of water is first taken and then the water heater is activated. Then, approximately halfway to the hygiene program, another 1 liter of water is taken, and the water heater heats the water to approximately 80 °C, this time for one-third of a minute. Thus, by means of the method of the present invention, the hygiene program is performed effectively in both load capacities.

[0019] In another embodiment of the present invention, the control method comprises the step of deactivating the air heater and performing rapid cooling. In this embodiment of the present invention, after the air heater is deactivated, water is gradually taken and the drum is cooled rapidly. By preventing the water from getting into contact with the laundry in the drum, the pump and the discharge group are operated in communication with each other, thus ensuring the rapid cooling of the drum and the laundry therein. Thus, it is ensured that the door of the laundry washer/dryer can be opened quickly and the humid air in the environment is prevented from condensing on the laundry.

[0020] By means of the present invention, a control method is developed, which enables the hygiene program to be operated for a shorter time and at lower temperatures without compromising hygiene performance. By means of the control method of the present invention, wherein vapor and hot air are applied sequentially, a sterilization process called humid air sterilization and wherein hot water vapor is used as a sterilization agent is provided. By means of this method, an effective sterilization is provided at lower temperatures in a short time by treating the load in the laundry washer/dryer with hot air saturated with moisture and having high enthalpy. The hot water vapor used in this method better penetrates the textile to be sterilized, and the microbial load and spores of microorganisms are enabled to be eliminated quickly. On the other hand, in order to prevent the condensation of the applied vapor upon contact with the lower temperature surfaces of the laundry washer/dryer, the surfaces are enabled to be heated by means of the hot air applied simultaneously and thus the formation of condensation is prevented. By means of the present invention, a hygiene program is developed, which provides hygienic ventilation at lower temperatures in a short time in laundry washer/dryers.

[0021] Moreover, by means of the present invention,

a hygiene program control method is implemented, which can be operated at lower temperatures and in shorter periods of time without compromising "hygienic ventilation" performance, which is climate-friendly, sustainable and which fully meets user expectations. Moreover, since the load detection step is also applied, the vapor application time and vapor generation temperature are optimized according to the amount of load, and the rapid cooling step ensures that the laundry is taken out of the laundry washer/dryer without wrinkles.

Claims

1. A laundry washer/dryer control method which is suitable for a laundry washer/dryer comprising a drum wherein the laundry is loaded, a water receptacle, a water heater heating the water in the water receptacle, an air heater and at least one fan **characterized by** comprising the steps of taking the water into the water receptacle, heating and thus evaporating the water by activating the water heater, deactivating the water heater and activating the air heater and the fan when the water heater is deactivated such that vapor and hot air are transferred into the drum at the same time.
2. A laundry washer/dryer control method as in Claim 1, **characterized by** comprising the step of detecting the amount of load in the drum and optimizing the vapor generation temperature and application time according to the determined load amount.
3. A laundry washer/dryer control method as in Claim 2, **characterized by** comprising the steps of taking the amount of water determined by the manufacturer into the water receptacle in case low load is detected and heating this water once with the water heater.
4. A laundry washer/dryer control method as in Claim 2, **characterized by** comprising the step of dividing the hygiene program into two if a high load is detected.
5. A laundry washer/dryer control method as in Claim 4, **characterized by** comprising the steps of first taking some water in the first part of the hygiene program, and then activating the water heater and heating the water to approximately 80 °C.
6. A laundry washer/dryer control method as in Claim 4, 5, **characterized by** comprising the steps of taking the remaining water in the last part of the hygiene program, and operating the water heater for a shorter time than the first part and heating the water to approximately 80 °C.
7. A laundry washer/dryer control method as in any one

of Claims 3 to 6, **characterized in that** the amount of water taken when a high load is detected is higher than when a low load is detected.

8. A laundry washer/dryer control method as in Claim 1, **characterized by** comprising the step of deactivating the air heater and performing rapid cooling. 5
9. A laundry washer/dryer control method as in Claim 8, **characterized by** gradually taking water after the air heater is deactivated, and cooling the drum rapidly. 10

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EUROPEAN SEARCH REPORT

Application Number

EP 23 20 0532

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 112 239 935 A (QINGDAO HAIER WASHING MACH CO; HAIER SMART HOME CO LTD) 19 January 2021 (2021-01-19) * paragraph [0060] - paragraph [0062]; claims 8-9; figure 2 *	1-9	INV. D06F33/65 ADD. D06F25/00 D06F103/16 D06F103/32 D06F105/40
X	WO 2022/217657 A1 (WUXI LITTLE SWAN ELECTRIC CO LTD [CN]) 20 October 2022 (2022-10-20) * paragraph [0063] - paragraph [0080]; figures 1-3 *	1	
A	WO 2020/102918 A1 (V ZUG AG [CH]) 28 May 2020 (2020-05-28) * page 9, line 15 - page 12, line 23; figures *	1-9	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F

The present search report has been drawn up for all claims

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Place of search

Munich

Date of completion of the search

4 March 2024

Examiner

Diaz y Diaz-Caneja

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ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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04-03-2024

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 19743508 [0004]
- EP 2603629 A [0005]
- WO 2021246115 A [0006]