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(54) **Method for drying laundry contained in a laundry dryer and a laundry dryer implementing said method**

(57) Method for drying laundry contained in a laundry dryer (1) and a laundry dryer (1) implementing said method. The method for drying laundry comprises a drying phase in which an airflow (F) is forced to circulate through the inside of a rotary drum (2) while said drum (2) rotates initially according to a first rotational speed. The drying phase also comprises at least one speed scanning subphase where the drum (2) rotates at different speeds, and the moisture content of the exiting air corresponding to each speed being measured and recorded. At the end of said subphase, the drum (2) rotates according to the speed corresponding to the highest moisture content measured.

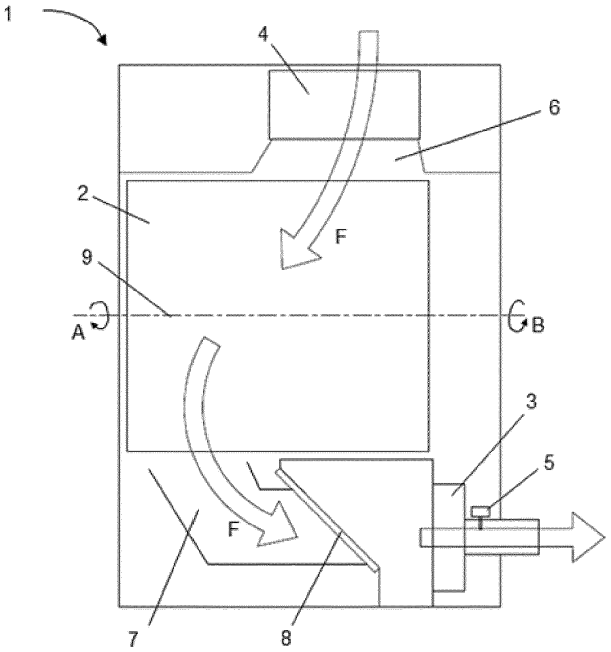

FIG.1

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Description

TECHNICAL FIELD

[0001] The present invention is related to methods for drying laundry in a laundry dryer comprising a rotary drum. It is also related to a laundry dryer implementing said method.

PRIOR ART

[0002] Laundry dryers comprising a rotary drum through which airflow is forced to circulate by means of a fan that extracts moisture from the laundry contained in the drum are known.

[0003] EP2468950 A1 discloses a laundry dryer comprising a rotary drum for containing laundry. Airflow, which is forced through a fan arranged close to the air inlet, circulates through the inside of said drum. It also comprises a temperature sensor arranged at the outlet of the drum and a moisture sensor arranged inside the drum. The dryer also comprises control means running a drying program comprising a drying phase in which the drum rotates according to a first rotational speed. During the drying phase, the control means monitor the temperature of the exiting air due to the temperature sensor and the moisture content of the laundry contained in the drum due to the moisture sensor. When the moisture sensor detects moisture content in the laundry which is equal to or less than a set threshold moisture value, the drum rotates according to a second rotational speed which is greater than the first speed. Said second rotational speed is equal to or greater than the minimum speed required to keep the laundry stuck to the walls of the drum.

DISCLOSURE OF THE INVENTION

[0004] The object of the invention is to provide a method of drying laundry in a laundry dryer and a laundry dryer implementing said method as described below.

[0005] One aspect of the invention is related to the method of drying laundry. Said method comprises a drying phase in which airflow is forced to circulate through the inside of a rotary drum which is suitable for containing laundry while said drum rotates initially according to a first predetermined rotational speed. The drying phase also comprises at least one speed scanning subphase in which the drum rotates at different speeds, the moisture content of the exiting air corresponding to each speed being measured and recorded. At the end of said scanning subphase, the rotary drum rotates according to the speed corresponding to the highest moisture content measured.

[0006] Another aspect of the invention is related to a laundry dryer. Said dryer comprises the rotary drum which is suitable for containing the laundry to be dried and through which forced airflow circulates. The dryer of the invention also comprises sensing means arranged at the outlet of the rotary drum for determining the moisture content of the airflow exiting the drum and control means associated with the sensing means. Said control means implement the method of drying as described in the preceding paragraph.

[0007] With the method and the laundry dryer of the invention, the cycle time of the drying phase is shortened because the extraction of water content from the laundry in the drum is optimized in a simple, effective and economical manner, thus contributing to enhance dryer efficiency. The scanning subphase allows establishing the optimal rotational speed of the drum so that the highest possible amount of moisture is extracted from the laundry contained in the drum. Since the conditions of the laundry vary throughout the drying phase (the amount of water and the weight of the laundry vary as the laundry gradually dries), the scanning subphase can be repeated throughout said drying phase to improve efficiency.

[0008] These and other advantages and features of the invention will become evident in view of the drawings and the detailed description of the invention.

DESCRIPTION OF THE DRAWINGS

[0009] Figure 1 shows a diagram of an embodiment of the laundry dryer according to the invention.

DETAILED DISCLOSURE OF THE INVENTION

[0010] The laundry dryer 1 according to the embodiment of the invention of Figure 1 comprises a rotary drum 2 which rotates according to an axial axis 9, as shown in the drawing, and through which forced airflow F circulates. Said drum 2 is suitable for containing laundry, preferably laundry that has been previously washed, for example in a washer, and thus contains certain moisture content. The laundry dryer 1 also comprises sensing means arranged at the outlet of the drum 2. Said sensing means comprise at least one moisture sensor 5 and determine the moisture content of the airflow F exiting the drum 2. Control means comprised in the dryer 1 and associated with said sensing means implement a method of drying as described below.

[0011] The method of drying laundry contained in the laundry dryer 1 comprises a drying phase in which the airflow F is forced to circulate through the inside of the rotary drum 2 while said drum 2 rotates initially according to a first predetermined rotational speed. Said drying phase comprises at least one speed scanning subphase in which the drum 2 rotates at different speeds, the moisture content of the exiting air corresponding to each speed being measured and recorded, and at the end of said at least one scanning subphase, the rotary drum 2 rotates according to the speed corresponding to the highest moisture content measured. The moisture values corresponding to each rotational speed are recorded in the control means to be able to determine the speed corresponding to the highest moisture content measured.

Therefore, the cycle time of the drying phase is shortened because the extraction of water content from the laundry contained in the drum 2 is optimized in a simple, effective and economical manner, thus contributing to enhance efficiency of the laundry dryer 1. The scanning subphase allows establishing the optimal rotational speed of the drum 2 so that the highest possible amount of moisture is extracted from the laundry in the drum 2. Since the conditions of the laundry vary throughout the drying phase (the amount of water and the weight of the laundry vary as the laundry gradually dries), the scanning subphase can be repeated throughout said drying phase so that the improvement is optimal, as described in detail below.

[0012] The drying phase also comprises a plurality of rotation steps wherein the rotary drum 2 rotates in opposite directions of rotation in successive rotation steps. In other words, if in one rotation step the drum 2 rotates according to a direction of rotation A, for example clockwise, in the successive rotation step the drum 2 will rotate according to the opposite direction of rotation B, i.e., counterclockwise. Each rotation step can last between about a minute and about a minute and a half. The successive rotation steps are separated from one another by a pause wherein the drum stops rotating long enough so that the drum can change the direction of rotation. Before and after changing the direction of rotation, the drum 2 rotates at the same speed, i.e., after changing the direction of rotation, the drum 2 starts to rotate according to the rotational speed of the rotation step before the change. Changes in rotation are advantageous to assure that the laundry contained in the rotary drum 2 does not clump together or stick to the walls of the drum 2.

[0013] The scanning subphase is carried out within a rotation step and during the drying phase said scanning subphase is repeated every two, three or four, preferably every three, successive rotation steps. Repeating the scanning subphase throughout the drying phase allows optimizing the extraction of water from the laundry contained in the drum 2 during the complete drying cycle, which allows improving the efficiency of the laundry dryer 1 and reducing the total cycle time, thus contributing to savings in the power consumption of the laundry dryer 1.

[0014] When the scanning subphase is carried out within the corresponding rotation step, once the rotation step has started is awaited a reasonable but not excessively long amount of time, for example between 6 and 10 seconds, before starting the scanning subphase to assure that said scanning subphase does not interfere with the change of the direction of rotation between successive steps.

[0015] The different speeds, i.e., the range of speeds, of the scanning subphase are chosen from a range of speeds between 20 and 80 revolutions per minute. There will be as many ranges of speeds as possible to assure that during the same rotation step the drum 2 can rotate according to all the speeds of said range of speeds, read the data relating to moisture content of the exiting airflow F corresponding to each rotational speed and record this value. In the preferred embodiment of the invention, the different rotational speeds are prefixed speeds. In a non-limiting example, the different rotational speeds could be seven different speeds, for example with the following values:

V_1= 24 rpm
V_2= 30 rpm
V_3= 34 rpm
V_4= 38 rpm
V_5= 45 rpm
V_6= 52 rpm
V_7= 64 rpm

[0016] Optionally, the first speed of the range of speeds of the scanning subphase of the corresponding rotation step could be a speed calculated in function of the moisture content of the exiting air and of the weight of the laundry contained in the drum 2, among others, and the other speeds of said subphase could be calculated by adding or subtracting a prefixed amount.

[0017] Either way, the control means of the laundry dryer 1 record the moisture content values measured by the moisture sensor 5, of the exiting airflow F corresponding to each speed of the range of speeds of the scanning subphase. The control means thus determine, at the end of each scanning subphase, the rotational speed in which the largest amount of water has been extracted from the laundry contained in the drum 2. During the scanning subphase, the drum 2 in each speed of the range of speeds rotates for the shortest time possible in which a reliable reading of the moisture content of the exiting airflow is assured.

[0018] The airflow F circulating through the inside of the drum 2 is forced by ventilation means arranged at the outlet of the drum 2. Said ventilation means comprise preferably a fan 3. The sensing means described above are arranged behind the ventilation means as seen in the diagram of Figure 1, although the possibility of arranging said means in front of the ventilation means is also contemplated.

[0019] The laundry dryer 1 comprises an air inlet conduit 6 where an end of said inlet conduit 6 is open to the atmosphere and the other end is communicated with the drum 2 through a side thereof, i.e., through the wall of the cylinder of the drum 2 corresponding to the upper portion of the laundry dryer 1. In other embodiments of the invention, the inlet conduit 6 could be communicated with the drum 2 through the wall of the cylinder of the drum 2 corresponding to one of the sides of the dryer 1, or to both sides, or even by the lower portion of the dryer 1. Therefore, in the embodiment of the invention, said inlet conduit 6 is suitable for providing a substantially radial airflow F to the drum. Said radial airflow F is so called because it enters the drum 2 according to the substantially radial direction of the drum 2. The side wall of the drum 2, i.e., the wall of the cylinder of the drum 2, com-

prises openings, preferably in the form of holes distributed over said wall which allow the entry of said airflow F into the drum 2. The laundry dryer 1 also comprises an air outlet conduit 7. One end of said outlet conduit 7 is communicated with the drum 2, said outlet conduit 7 being suitable for guiding the airflow F exiting the drum 2, through the openings in the walls of the drum 2, to the outside. Ventilation means, i.e., the fan 3, and the sensing means are placed in said air outlet conduit 7, the sensing means being arranged behind the ventilation means as described above. Optionally, the outlet conduit 7 can also comprise a filter 8 suitable for retaining fluff that the laundry contained in the drum 2 may release, thus preventing said fluff from getting out. Said filter 8 is preferably arranged before the fan 3, the risk of the fan 3 breaking down thus being reduced.

[0020] The drum 2 also comprises a rear wall, not shown in the drawings, whereas the front portion is open to allow putting laundry in or taking laundry out of the drum 2. Optionally, in another embodiment of the invention not shown in the drawings, the airflow F may enter the drum 2 through said rear wall according to a substantially axial direction. The possibility of the airflow entering the drum 2 being a mix between a radial and axial inlet is also contemplated. This configuration is particularly advantageous when the laundry dryer comprises a fresh air inlet and a recirculated air inlet. Likewise, the laundry dryer 1 comprises a door in the front portion (not shown in the drawings), preferably a drop or sectional one. Sectional door is understood as a door which is formed by sections connected to one another, preferably horizontally, the door being opened, preferably vertically, by sliding between guides. When the door is open, there is an access to the inside of the drum 2, the laundry being able to be put into or taken out of the drum 2. When the door is closed, it is possible for the control means to implement the described method of drying.

[0021] Optionally, the incoming airflow F can be previously heated to reduce the total drying cycle. To that end, the laundry dryer 1 can comprise heating means 4, such as resistive means, steam means or gas means, suitable for heating at least part of the airflow prior to entry into the drum 2. Said heating means are arranged in the inlet conduit 6.

[0022] The drying phase of the laundry dryer 1 of the embodiment of the invention ends when the moisture content of the exiting airflow exiting the rotary drum 2 stabilizes at a value less than a predefined moisture value.

Claims

1. Method for drying laundry contained in a laundry dryer (1), said laundry dryer (1) comprising a rotary drum (2) suitable for containing laundry and the method comprising a drying phase in which an airflow (F) is forced to circulate through the inside of said rotary drum (2) while the rotary drum (2) rotates initially according to a first predetermined rotational speed, **characterized in that** said drying phase comprises at least one speed scanning subphase in which the drum (2) rotates at different speeds, the moisture content of the exiting air corresponding to each speed being measured and recorded, and at the end of said at least one scanning subphase the rotary drum (2) rotates according to the speed corresponding to the highest moisture content measured.

2. Method according to claim 1, wherein the different speeds of the scanning subphase are chosen in a range of speeds between 20 and 80 revolutions per minute.

3. Method according to any of the preceding claims, wherein the drying phase comprises a plurality of rotation steps wherein the rotary drum (2), in successive rotation steps, rotates in opposite directions of rotation such that in one rotation step the drum (2) rotates according to one direction of rotation (A) and in the successive rotation step, the drum (2) rotates according to the opposite direction (B).

4. Method according to claim 3, wherein two contiguous rotation steps are separated by a pause, said pause being long enough so that the drum (2) stops rotating, changes the direction of rotation and starts to rotate according to the same speed of the preceding rotation step.

5. Method according to claim 3 or 4, wherein the scanning subphase is carried out within one rotation step.

6. Method according to any of claims 3 to 5, wherein during the drying phase the scanning subphase is repeated every two, three or four, preferably every three, rotation steps.

7. Method according to any of the preceding claims, wherein the drying phase ends when the moisture content of the airflow exiting the drum (2) is equal to or less than a predefined moisture value.

8. Method according to any of the preceding claims, wherein the airflow (F) which is forced to circulate through the inside of the drum (2) is previously heated.

9. Laundry dryer comprising a rotary drum (2) suitable for containing laundry and through which a forced airflow (F) circulates, and sensing means arranged at the outlet of the drum (2) determining the moisture content of the airflow exiting said drum (2), **characterized in that** it also comprises control means associated with said sensing means implementing a method of drying according to any of claims 1 to 8.

10. Laundry dryer according to claim 9, wherein the sensing means comprise at least one moisture sensor (5).

11. Laundry dryer according to claim 9 or 10 also comprising ventilation means, preferably a fan (3), suitable for forcing the circulation of the airflow (F), said ventilation means being arranged at the outlet of the drum (2).

12. Laundry dryer according to any of claims 9 to 11, wherein the laundry dryer (1) also comprises heating means (4), such as resistive means, gas means or a steam or thermal oil battery, suitable for heating at least part of the airflow prior to entry into the drum (2).

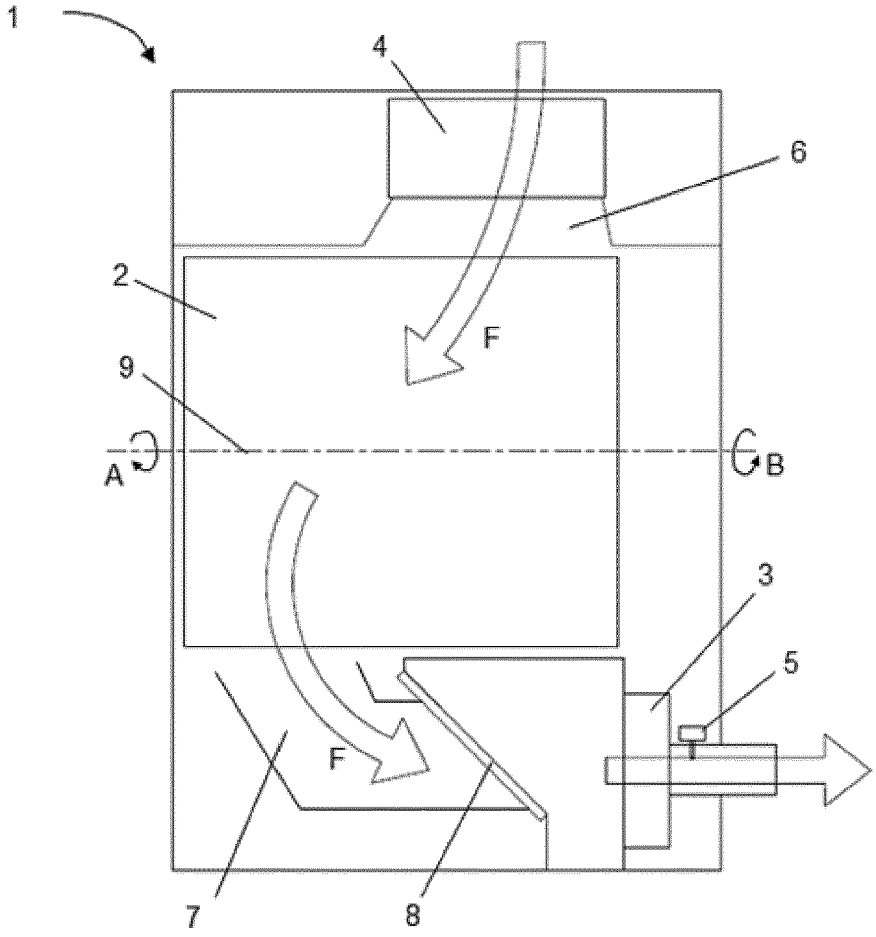

FIG.1

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EUROPEAN SEARCH REPORT

Application Number
EP 14 38 2047

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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	21 July 2014	Kising, Axel

CATEGORY OF CITED DOCUMENTS

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