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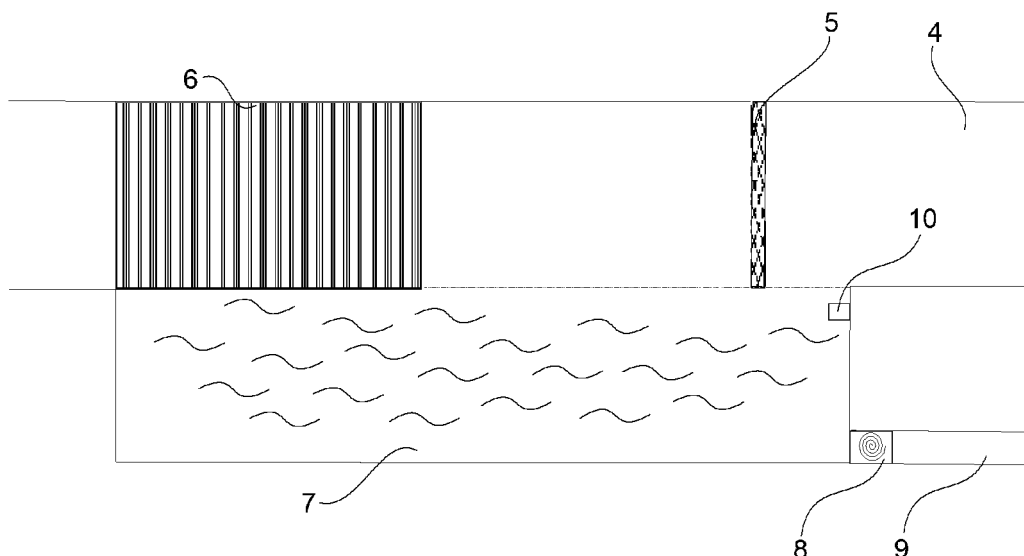
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(54) A LAUNDRY DRYER COMPRISING A FILTER

(57) The present invention relates to a laundry dryer (1) comprising body (2); a drum (3) wherein the laundry to be dried is placed; an air circulation duct (4) enabling the process air (PA) to be delivered onto the laundry inside the drum (3); a filter (5) that is disposed in the air circulation duct (4) and that holds the particles like fiber, lint etc. in the process air (PA) blown onto the laundry; a condenser (6) that is disposed in the air circulation duct

(4) and that enables the process air (PA) passing there-over to be condensed; a receptacle (7) that is disposed under the condenser (6) and wherein the water droplets forming on the surface of the condenser (6) accumulate, and a discharge line (9) that enables the water collected in the receptacle (7) to be carried to the filter (5) by means of a discharge pump (8).

Figure 2**EP 3 138 953 A1**

Description

[0001] The present invention relates to a laundry dryer comprising a filter that holds particles like fiber, lint, etc. in the drying air.

[0002] In heat pump laundry dryers wherein closed cycle drying process is performed and in laundry dryers wherein the condenser is cooled by air, the drying process is provided by the interaction of the cooling air and the process air that do not directly contact one another. The process air is heated by a heater and directed into the drum, contacts and dehumidifies the damp laundry and then is transferred to a condenser to be dehumidified. Meanwhile, the cooling air is delivered onto the condenser by means of a fan and thus, the moisture in the process air is enabled to be condensed by the condenser being cooled. After leaving its moisture on the condenser, the process air is heated by the heater and is delivered into the drum with high temperature and low relative humidity rate and is involved in the drying cycle again. During this cycle of the air, fiber particles come off the laundry, therefore a filter is disposed on the air circulation path in laundry dryers for holding the fibers. However, during the operation, the fibers gradually accumulate on the filter and make circulation of air difficult. As a result of this, the energy consumption of the dryer increases and the drying efficiency decreases.

[0003] In the state of the art European Patent Application No. EP2072660, a spraying device is described, providing the cleaning of the filter situated in the laundry dryer.

[0004] The aim of the present invention is the realization of a laundry dryer wherein the filter is effectively cleaned and the drying effectiveness is increased.

[0005] The laundry dryer realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises a body; a drum wherein the laundry to be dried is placed; an air circulation duct that provides delivery of process air onto the laundry inside the drum; a filter that is disposed in the air circulation duct and that holds the fibers and lint in the process air blown onto the laundry; a condenser that is disposed in the air circulation duct and that provides the condensation of the process air passing thereover; a receptacle that is disposed under the condenser and wherein the water droplets formed on the condenser surface are collected; a discharge line whereby the water collected in the receptacle is carried to the filter by a discharge pump, and a level sensor that is disposed in the receptacle and that detects the level of the water collected in the receptacle.

[0006] The laundry dryer of the present invention comprises a control unit that controls the discharge pump depending on the data received from the level sensor and that enables some of the water in the receptacle to be stored and used in the next drying cycle. When the level of water in the receptacle reaches an upper critical level predetermined by the producer, the control unit op-

erates the discharge pump and prevents the water collected in the receptacle from overflowing outside. Moreover, when the level of water in the receptacle reaches a lower critical level predetermined by the producer, the control unit interrupts the energy delivered to the discharge pump and enables the discharge pump to be stopped.

[0007] In an embodiment of the present invention, when the level detected by the level sensor reaches a limit level predetermined by the producer, the control unit enables the discharge pump to be stopped and the water left in the receptacle to be stored for using in the next drying cycle. In this embodiment, the discharge pump is stopped when the water level in the receptacle is at a limit level that is higher than the lower critical level predetermined by the producer. The control unit turns off the discharge pump before all the water in the receptacle is used and enables all the water under the limit level to be stored in the receptacle. After the water level in the receptacle reaches the limit level and the discharge pump is stopped, the control unit does not operate the discharge pump again until the drying cycle is completed and thus enables the water left to be stored until the next drying cycle. In this embodiment, the water stored in the receptacle under the limit level in the previous drying cycle, is used for cleaning the filter at the start of the drying cycle until condensation begins in the condenser. Thus, at the start of the drying cycle, in the time duration the water condensed in the condenser is carried from the condenser to the receptacle and stored in the receptacle, the water left from the previous drying cycle is used so that the receptacle is prevented from being dry and accordingly the filter is enabled to be cleaned effectively.

[0008] In another embodiment of the present invention, the laundry dryer comprises - an airing step wherein air is delivered onto the laundry for removing the odors thereon and

- a drying step wherein hot air is delivered onto the laundry for enabling the laundry to be dried,
- the control unit that enables the water stored in the receptacle to be delivered to the filter in the airing step. The cold process air delivered to the drum during the airing step performed before the drying step leaves the drum without dehumidifying the laundry, thus no condensation occurs on the condenser. The water left from the previous drying cycle is used in order to prevent the filter from being clogged by fibers and lint during the airing step. Thus, the filter is prevented from clogging and an efficient airing process is performed.

[0009] In another embodiment of the present invention, the control unit ends the airing step and starts the drying step depending on the data received from the level sensor. The control unit stops the discharge pump when the water level in the receptacle decreases to the lower critical level and starts the drying step after ending the airing

step. By continuing the airing step until all the water left in the receptacle from the previous drying cycle is consumed, both an effective airing process is performed and also the drying performance is improved by washing the filter continually during the airing and drying steps.

[0010] By means of the present invention, a laundry dryer is realized wherein the filter is effectively washed during the drying cycle by storing some of the water condensed in the condenser to be used in the next drying cycle.

[0011] The laundry dryer realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

Figure 1 - is the schematic perspective view of a laundry dryer.

Figure 2 - is the schematic view of the receptacle, the condenser and the filter in an embodiment of the present invention.

[0012] The elements illustrated in the figures are numbered as follows:

1. Laundry dryer
2. Body
3. Drum
4. Air circulation duct
5. Filter
6. Condenser
7. Receptacle
8. Discharge pump
9. Discharge line
10. Level sensor
11. Control unit

PA: Process air

[0013] The laundry dryer (1) comprises a body (2); a drum (3) wherein the laundry to be dried is placed; an air circulation duct (4) enabling the process air (PA) to be delivered onto the laundry inside the drum (3); a filter (5) that is disposed in the air circulation duct (4) and that holds the particles like fiber, lint etc. in the process air (PA) blown onto the laundry; a condenser (6) that is disposed in the air circulation duct (4) and that enables the process air (PA) passing thereover to be condensed; a receptacle (7) that is disposed under the condenser (6) and wherein the water droplets forming on the surface of the condenser (6) accumulate; a discharge line (9) that enables the water collected in the receptacle (7) to be carried to the filter (5) by means of a discharge pump (8), and a level sensor (10) that is disposed in the receptacle (7) and that detects the level of the water accumulated in the receptacle (7) (Figure 1 and Figure 2).

[0014] The laundry dryer (1) of the present invention comprises a control unit (11) that controls the discharge pump (8) depending on the data received from the level sensor (10) and that enables some of the water in the

receptacle (7) to be stored and used in the next drying cycle. The control unit (11) enables the discharge pump (8) to be operated such that the water level inside the receptacle (7) is between an upper critical level and a lower critical level predetermined by the producer. In the drying process the dryness rate of the laundry increases in the course of time and therefore the amount of water condensed at the condenser (6) decreases. Depending on the decrease in condensation amount, the level of water collected in the receptacle (7) also decreases in the course of time. The control unit (11) stops the discharge pump (8), thus preventing all the water in the receptacle (7) to be used and enables some of the water in the receptacle (7) to be stored.

[0015] Particles such as fiber, lint and fluff coming off the laundry and carried in the process air (PA) that circulates in the air circulation duct (4) disposed in the body (2) during the operation of the laundry dryer (1) accumulate in the course of time on the filter (5) disposed in front of the condenser (6). The process air (PA) reaches the filter (5) before the condenser (6). The water in the process air (PA) condensed by the condenser (6) accumulates in the receptacle (7) disposed under the condenser (6). The water accumulated in the receptacle (7) is delivered to the filter (5) by being transferred to the discharge line (9) by means of a discharge pump (8) and the fibers and lint collected on the filter (5) are enabled to be swept.

[0016] In an embodiment of the present invention, when the level detected by the level sensor (10) reaches a limit level (H_{lim}) predetermined by the producer, the control unit (11) enables the discharge pump (8) to be stopped and the water left in the receptacle (7) to be stored for using in the next drying cycle. During the drying cycle, the amount of water condensed on the condenser (6) changes depending on the amount of moisture removed from the laundry. Since water is not present in the receptacle (7) at the start of the drying cycle, delivery of water to the filter (5) and cleaning of the filter (5) cannot be performed until the water is collected in the receptacle (7). In this embodiment, the discharge pump (8) is stopped after the water level in the receptacle (7) reaches the limit level (H_{lim}), and the water below the limit level (H_{lim}) is stored in the receptacle (7) to be used in the next drying cycle. After the discharge pump (8) is stopped, when the water level in the receptacle (7) again goes above the limit level (H_{lim}) depending on the continuation of condensation in the condenser (6), the control unit (11) operates the discharge pump (8) again and stops the discharge pump (8) once more when the water level in the receptacle (7) goes down to the limit level (H_{lim}) again. Until the drying cycle is completed, the control unit (11) enables the discharge pump (8) to be operated and stopped intermittently so that the water level in the receptacle (7) does not rise above the limit level (H_{lim}). Thus, at the start of the next drying cycle, the water left from the previous drying cycle that is below the limit level (H_{lim}) is carried from the receptacle (7) to the filter (5) for

the aim of cleaning the filter (5).

[0017] In another embodiment of the present invention, the laundry dryer (1) comprises

- an airing step wherein air is delivered onto the laundry in the drum (3) for removing the odor thereon, and
- a drying step wherein hot air is delivered onto the laundry for enabling to dry the laundry,
- the control unit (11) that enables the water stored in the receptacle (7) to be delivered to the filter (5) in the airing step. In the airing step, cold process air (PA) is delivered onto the laundry in the drum (3) without operating the heater. Thus, the wet laundry waiting inside the drum (3) is aired and the odors accumulated thereon are removed. During the airing step, the laundry cannot be dehumidified since the process air (PA) is not heated. Therefore, condensation does not occur in the condenser (6) and water collection is not performed in the receptacle (7). Thus, during the airing step, cleaning of the filter (5) cannot be realized therefore fibers and lint carried on the laundry causes the filter (5) to be clogged. The control unit (11) enables the water below the limit level (H_{lim}) left in the receptacle (7) from the previous cycle to be delivered to the filter (5) during the airing step and prevents clogging of the filter (5) during the airing step.

[0018] In another embodiment of the present invention, the control unit (11) ends the airing step and starts the drying step depending on the data received from the level sensor (10). The airing step is continued for a time period predetermined by the producer. No condensation occurs in the condenser (6) during the airing step, the water collected in the receptacle (7) is delivered to the filter (5) by means of the discharge pump (8) for the aim of cleaning the filter (5) and thus the level of the water left in the receptacle (7) decreases gradually. In this embodiment, the control unit (11) controls the amount of water left in the receptacle (7) by means of the level sensor (10) and when the water collected in the receptacle (7) is finished, ends the airing step and enables the drying step to start. In the drying step, the heater is operated and the moisture removed from the laundry by means of the hot process air (PA) delivered to the drum (3) is condensed in the condenser (6) and collected in the receptacle (7). Thus, when all the water in the receptacle (7) left from the previous drying cycle is used, the airing step is ended and the drying step is started, water can be carried from the receptacle (7) to the filter (5) during the airing and drying steps and the filter (5) is enabled to be cleaned effectively and continuously.

[0019] In the laundry dryer (1) of the present invention, some of the water collected in the receptacle (7) is stored to be delivered to the filter (5) in the next drying cycle, thus the fibers and lint collected on the filter (5) are enabled to be cleaned effectively during the drying cycle.

Claims

1. A laundry dryer (1) comprising a body (2); a drum (3) wherein the laundry to be dried is placed; an air circulation duct (4) enabling the process air (PA) to be delivered onto the laundry inside the drum (3); a filter (5) that is disposed in the air circulation duct (4) and that holds the particles like fiber, lint etc. in the process air (PA) blown onto the laundry; a condenser (6) that is disposed in the air circulation duct (4) and that enables the process air (PA) passing thereover to be condensed; a receptacle (7) that is disposed under the condenser (6) and wherein the water droplets forming on the surface of the condenser (6) accumulate; a discharge line (9) that enables the water collected in the receptacle (7) to be carried to the filter (5) by means of a discharge pump (8), and a level sensor (10) that is disposed in the receptacle (7) and that detects the level of the water accumulated in the receptacle (7), **characterized by** a control unit (11)
 - that controls the discharge pump (8) depending on the data received from the level sensor (10) and
 - that enables some of the water in the receptacle (7) to be stored and used in the next drying cycle.
2. A laundry dryer (1) as in Claim 1, **characterized by** the control unit (11) that enables the discharge pump (8) to be stopped and the water left in the receptacle (7) to be stored for using in the next drying cycle when the level detected by the level sensor (10) reaches a limit level (H_{lim}) predetermined by the producer.
3. A laundry dryer (1) as in Claim 1 or 2, **characterized by**
 - an airing step wherein air is delivered onto the laundry in the drum (3) for removing the odor thereon and
 - a drying step wherein hot air is delivered onto the laundry for enabling to dry the laundry, and
 - that enables the water stored in the receptacle (7) to be delivered to the filter (5) in the airing step.
4. A laundry dryer (1) as in Claim 3, **characterized by** the control unit (11) that ends the airing step and starts the drying step depending on the data received from the level sensor (10).

Figure 1

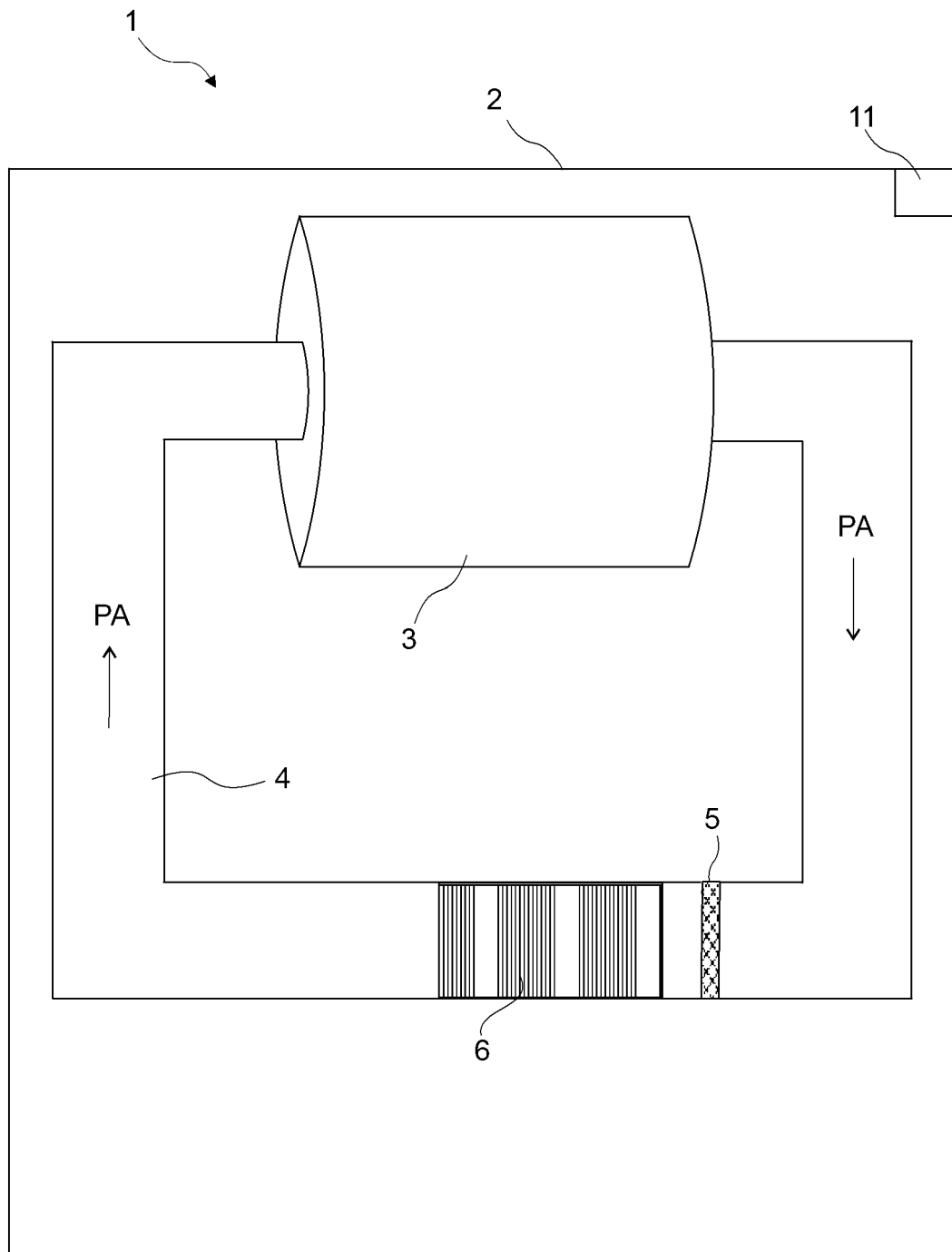
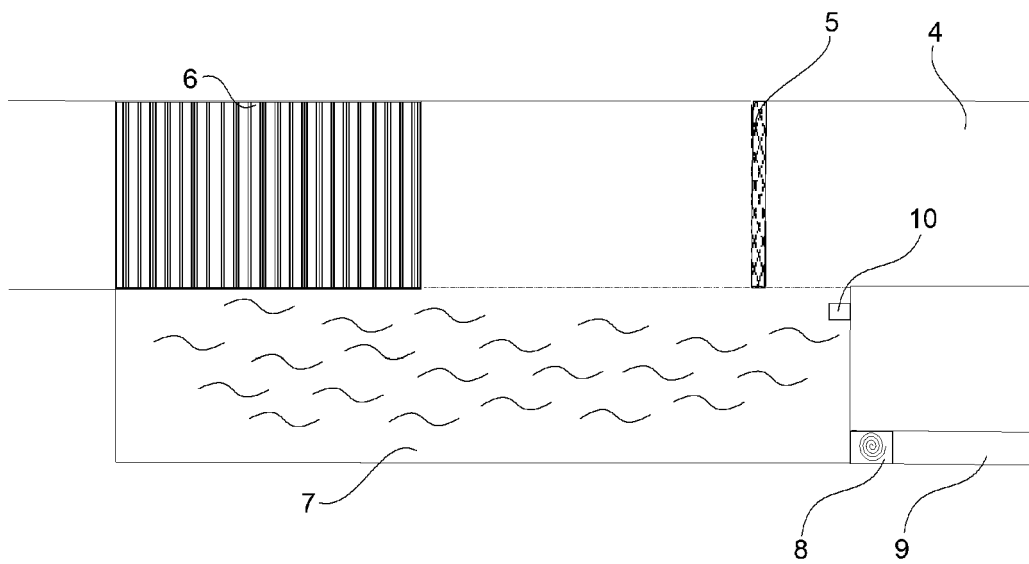


Figure 2





EUROPEAN SEARCH REPORT

Application Number
EP 16 18 6000

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Place of search Munich		Date of completion of the search 3 November 2016	Examiner Bermejo, Marco
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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