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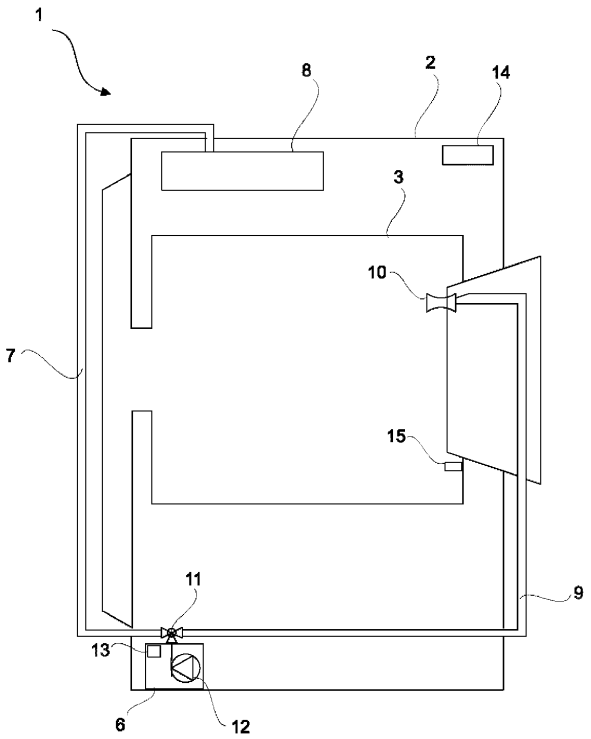
(71) Applicant: **Arçelik Anonim Sirketi**
34445 Istanbul (TR)

(72) Inventors:
- **SIR, Gokhan**
  34445 ISTANBUL (TR)
- **BEDIR, Ersin**
  34445 ISTANBUL (TR)
- **ERGUN, Muhammed**
  34445 ISTANBUL (TR)
- **GEZE, Emre**
  34445 ISTANBUL (TR)
- **GOK, Salih**
  34445 ISTANBUL (TR)

(54) A LAUNDRY DRYER

(57) The present invention relates to a laundry dryer (1) comprising a body (2); a drum (3) which is disposed in the body (2) and wherein the laundry is loaded; an air circulation duct (4) which provides the delivery of the drying air into the drum (3); a heat exchanger (5) which is provided on the air circulation duct (4) and which condenses the humidity in the air; a collection receptacle (6) wherein the water condensed by the heat exchanger (5) is collected; a water tank (8) which is connected to the collection receptacle (6) in fluid communication by means of a delivery line (7); a spraying line (9) which extends between the collection receptacle (6) and the drum (6); at least one nozzle (10) which is provided at the end of the spraying line (9) and which enables the water to be sprayed into the drum (3); a valve (11) which connects the collection receptacle (6) and the delivery line (7) as well as the collection receptacle (6) and the spraying line (9) to each other; and a pump (12) which provides the delivery of the water in the collection receptacle (6) to the water tank (8) and/or the nozzle (10).

Figure 2



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Description

[0001] The present invention relates to a laundry dryer having the feature of spraying water into the drum.

[0002] The laundry dryers may have wrinkle-reduction functions as an additional feature. One of the methods to reduce the wrinkles in the laundry in the drum is to spray water into the drum at certain intervals. The certain amount of water required to be sprayed into the drum during the program must be stored at a region of the laundry dryer. The stored water is delivered into the drum by means of a pump, delivery lines and nozzles. In the state of the art laundry dryers, the water generally condensed from the air circulation duct by means of the heat exchanger is collected in a collection receptacle. By means of the pump, the water collected in the collection receptacle is delivered into the water tank which can be emptied of the water by being manually removed from the body of the laundry dryer by the user. In some of the laundry dryers wherein water is sprayed into the drum, the water in the water tank is delivered to the nozzle. In some of the laundry dryers, there is a reservoir separate from the water tank and the collection receptacle. The water is delivered into the reservoir from the water tank or the collection receptacle. The water in the reservoir is transferred to the nozzle to be sprayed into the drum. The cost of these systems is very high since more than one pump is used.

[0003] In the International Patent Application No. WO2020015914, a laundry dryer is disclosed, wherein the condensate is sprayed into the drum.

[0004] The aim of the present invention is the realization of a laundry dryer wherein the condensate is controlled in an effective and cost-efficient manner and water is sprayed into the drum.

[0005] The laundry dryer of the present invention comprises a body; a drum which is disposed in the body; an air circulation duct which provides the delivery of air into the drum; a heat exchanger which is provided on the air circulation duct and which dehumidifies the drying air delivered onto the laundry; a collection receptacle wherein the water condensed in the air circulation duct is collected; a water tank which can be manually removed from the body and emptied of water by the user; a delivery line which extends between the water tank and the collection receptacle; a nozzle which enables the water to be sprayed into the drum; a spraying line which extends between the collection receptacle and the nozzle such that the water is delivered to the nozzle; a valve which connects the spraying line and the collection receptacle or the delivery line and the collection receptacle to each other; and a pump which is disposed in the collection receptacle.

[0006] The laundry dryer of the present invention further comprises a liquid level sensor which measures the level of the liquid in the collection receptacle, and a control unit which controls the valve and the pump so as to send the water in the collection receptacle to the water tank when the data received from the liquid level sensor is equal to a threshold value predetermined by the producer or exceeds said first threshold value. Depending on the humidity of the laundry loaded into the drum, the amount of water condensed during the drying process varies. When the amount of water in the collection receptacle reaches a first threshold value predetermined by the producer, the control unit activates the pump and controls the valve such that the collection receptacle is in fluid communication with the water tank. The amount of water above the first threshold value is delivered to the water tank. The pump is operated until the liquid level falls below the first threshold value. Thus, the water in the collection receptacle is prevented from overflowing from the receptacle in a manner to reach the components in the laundry dryer, and the safety of the laundry dryer is improved.

[0007] In an embodiment of the present invention, the laundry dryer comprises a humidity sensor. When the value received from the humidity sensor falls below a predetermined value, the control unit decides that the laundry in the drum is dry, and the drying process is terminated. After the drying process is terminated, the control unit activates the pump, and simultaneously, the valve is controlled such that the collection receptacle is in fluid communication only with the delivery line. The pump is operated until the amount of water in the collection receptacle reaches a third threshold value. Thus, the water in the collection receptacle is prevented from being kept therein in a manner to get dirty. Consequently, the problems of hygiene which may occur as a result of spraying the old water into the drum during the next drying process are prevented.

[0008] In an embodiment of the present invention, the laundry dryer comprises the control unit which controls the valve so as to allow liquid passage between the collection receptacle and the spraying line when the amount of water only in the collection receptacle is equal to the third threshold value or exceeds the third threshold value. The third threshold value can be a constant value.

[0009] In an embodiment of the present invention, the laundry dryer comprises the control unit which activates the pump when the amount of water only in the collection receptacle is equal to the third threshold value or exceeds the third threshold value. Thus, the insufficient amount of water is prevented from being sprayed into the drum when the amount of water collected in the collection receptacle is below the third threshold value.

[0010] By means of the present invention, a laundry dryer is realized, wherein the water condensed in the air circulation duct is enabled to be delivered into the drum or stored in a suitable place in a cost-efficient manner.

[0011] The advantages of the laundry dryer of the present invention will be disclosed with the detailed description of the embodiments with reference to the accompanying figure, where:

Figure 1 - is the schematic view of the laundry dryer

in an embodiment of the present invention.

Figure 2 - is the schematic view of the laundry dryer in an embodiment of the present invention.

[0012] The following numerals are referred to in the description of the present invention:

1. Laundry dryer
2. Body
3. Drum
4. Air circulation duct
5. Heat exchanger
6. Collection receptacle
7. Delivery line
8. Water tank
9. Spraying line
10. Nozzle
11. Valve
12. Pump
13. Liquid level sensor
14. Control unit
15. Humidity sensor

[0013] The laundry dryer (1) comprises a body (2); a drum (3) which is disposed in the body (2) and wherein the laundry is loaded; an air circulation duct (4) which provides the delivery of the drying air into the drum (3); a heat exchanger (5) which is provided on the air circulation duct (4) and which condenses the humidity in the air; a collection receptacle (6) wherein the water condensed by the heat exchanger (5) is collected; a water tank (8) which is connected to the collection receptacle (6) in fluid communication by means of a delivery line (7); a spraying line (9) which extends between the collection receptacle (6) and the drum (6); at least one nozzle (10) which is provided at the end of the spraying line (9) and which enables the water to be sprayed into the drum (3); a valve (11) which connects the collection receptacle (6) and the delivery line (7) as well as the collection receptacle (6) and the spraying line (9) to each other; and a pump (12) which provides the delivery of the water in the collection receptacle (6) to the water tank (8) and/or the nozzle (10). The heated drying air is sent onto the humid laundry loaded into the drum (3). The drying air dehumidifies the laundry, thus performing the drying process. When passed over the heat exchanger (5) with a cold surface, the humid drying air condenses and lose some of its humidity. The water condensed in the air circulation duct (4) is collected in a collection receptacle (6). The laundry dryer (1) comprises a water tank (8) which is disposed in the body (2) and which can be emptied of water therein by the user. The water tank (8) is connected to the collection receptacle (6) by means of a delivery line (7). A spraying line (9) extends between the collection receptacle (6) and the drum (3). By means of the nozzle (10) provided at the end of the spraying line (9), the water collected in the collection receptacle (6) is sprayed into the drum (3) at the times determined according to the selected drying program. In the preferred version of the present invention, the valve (11) is a three-way valve (11). When the pump (12) is activated as the valve (11) closes the connection between the collection receptacle (6) and the spraying line (9) while opening the connection between the collection receptacle (6) and the delivery line (7), the water in the collection receptacle (6) is delivered to the water tank (8). When the pump (12) is activated as the valve (11) closes the connection between the collection receptacle (6) and the delivery line (7) while opening the connection between the collection receptacle (6) and the spraying line (9), the water in the collection receptacle (6) is delivered to the nozzle (10).

[0014] The laundry dryer (1) of the present invention comprises a liquid level sensor (13) which measures the level of the water in the collection receptacle (6), and a control unit (14) which controls the valve (11) and the pump (12) so as to deliver the water in the collection receptacle (6) to the water tank (8) or the nozzle (10) and which controls the valve (11) and the pump (12) so as to deliver the water from the collection receptacle (6) to the water tank (8) when the liquid level in the collection receptacle (6) exceeds a first threshold value predetermined by the producer. The pump (12) and the valve (11) are controlled by the control unit (14). Thus, the water collected in the collection receptacle (6) can be delivered to the water tank (8) and the nozzle (10) by means of a single pump (12) and a single valve (11). In the collection receptacle (6), a liquid level sensor (13) is provided, which measures the liquid level therein. When the liquid level in the collection receptacle (6) exceeds a first threshold value predetermined by the producer, the control unit (14) controls the valve (11) so as to connect the collection receptacle (6) to the delivery line (7) and operates the pump (12). The valve (11) and the pump (12) are controlled such that the water in the collection receptacle (6) is delivered to the water tank (8) until the liquid level in the collection receptacle (6) falls below the first threshold value. The water collected in the collection receptacle (6) is kept in the collection receptacle (6) during the drying process until the liquid level reaches the first threshold value. Thus, it is ensured that the water to be delivered to the nozzle (10) when the water is required to be sprayed into the drum (3) depending on the type of the selected program is kept ready in the collection receptacle (6). The amount of water to be sprayed into the drum (3) varies depending on the fabric type and amount of the laundry loaded into the drum (3). Depending on the fabric type entered via the control panel by the user and the weight of the laundry, the control unit (14) determines the amount of water to be delivered into the drum (3) during the drying process. In a preferred embodiment of the present invention, the first threshold value is equal to or above the highest amount of water possible determined by the control unit (14) depending on the fabric type and the weight. In a version of the present invention, the first threshold value is selected to correspond to a volume of approximately 300 milliliters.

[0015] In another embodiment of the present invention, the laundry dryer (1) comprises a humidity sensor (15) which is provided in the body (2), and the control unit (14) which terminates the drying process when the humidity value received from the humidity sensor (15) falls below a predetermined value, which, after the termination of the drying process, processes the data received from the liquid level sensor (13) and operates the pump (12) until the amount of water in the collection receptacle (6) falls below a predetermined second threshold value and which closes the valve (11) between the collection receptacle (6) and the spraying line (9) and controls the valve (11) such that the collection receptacle (6) is in fluid communication with the delivery line (7). The humidity sensor (15) is positioned so as to face the inner volume of the drum (3) and to contact the laundry. By using the data received from the humidity sensor (15), the humidity of the laundry is determined. When the humidity of the laundry falls below a certain level, the control unit (14) terminates the drying process. After the termination of the drying process, the control unit (14) controls the valve (11) so as to close the connection between the collection receptacle (6) and the spraying line (9) while allowing liquid passage between the collection receptacle (6) and the delivery line (7), and operates the pump (12). The pump (12) is operated until the water level in the collection receptacle (6) falls below a second threshold value predetermined by the producer. In a preferred version of the present invention, the second threshold value is selected as 0 or as a value close to 0. Thus, it is ensured that no water remains in the collection receptacle (6) after the end of the drying process. Consequently, the generation of bad odors in the laundry dryer (1) is prevented by keeping no water in the collection receptacle (6).

[0016] In another embodiment of the present invention, the laundry dryer (1) comprises the control unit (14) which controls the valve (11) so as to interrupt the fluid communication between the collection receptacle (6) and the spraying line (9) until the liquid level in the collection receptacle (6) reaches a third threshold value predetermined by the producer. The third threshold value corresponds to the amount of water to be sprayed into the drum (3) depending on the selected program. The third threshold value is calculated by the control unit (14) depending on the type of the program selected by the user via the control panel and/or the weight of the laundry. For example, when the user wants to dry a single cotton shirt, the amount of water to be sprayed into the drum (3) is 40 ml. In this case, the third threshold value is 40 ml. The valve (11) is controlled so as to interrupt the fluid communication between the collection receptacle (6) and the spraying line (9) until the amount of water in the collection receptacle (6) reaches 40 ml. Thus, sufficient amount of water for the selected program is ensured to be sprayed into the drum (3).

[0017] In an embodiment of the present invention, the control unit (14) prevents the operation of the pump (12) until the liquid level in the collection receptacle (6) reaches a third threshold level predetermined by the producer. When sufficient amount of water to be sprayed into the drum (3) depending on the selected program is not present in the collection receptacle (6), the control unit (14) does not activate the pump (12). Thus, it is ensured to spray sufficient amount of water into the drum (3).

[0018] By means of the present invention, a laundry dryer (1) is realized, wherein the condensate collected in the collection receptacle (6) is delivered to the nozzle (10) so as to be sprayed into the drum (3) or to the water tank (8) so as to be emptied by means of the control unit (14) controlling a single pump (12) and a single valve (11) according to the data received from the liquid level sensor (13).

Claims

1. A laundry dryer (1) comprising a body (2); a drum (3) which is disposed in the body (2) and wherein the laundry is loaded; an air circulation duct (4) which provides the delivery of the drying air into the drum (3); a heat exchanger (5) which is provided on the air circulation duct (4) and which condenses the humidity in the air; a collection receptacle (6) wherein the water condensed by the heat exchanger (5) is collected; a water tank (8) which is connected to the collection receptacle (6) in fluid communication by means of a delivery line (7); a spraying line (9) which extends between the collection receptacle (6) and the drum (6); at least one nozzle (10) which is provided at the end of the spraying line (9) and which enables the water to be sprayed into the drum (3); a valve (11) which connects the collection receptacle (6) and the delivery line (7) as well as the collection receptacle (6) and the spraying line (9) to each other; and a pump (12) which provides the delivery of the water in the collection receptacle (6) to the water tank (8) and/or the nozzle (10), **characterized by** a liquid level sensor (13) which measures the level of the water in the collection receptacle (6), and a control unit (14) which controls the valve (11) and the pump (12) so as to deliver the water in the collection receptacle (6) to the water tank (8) or the nozzle (10) and which controls the valve (11) and the pump (12) so as to deliver the water from the collection receptacle (6) to the water tank (8) when the liquid level in the collection receptacle (6) exceeds a first threshold value predetermined by the producer.

2. A laundry dryer (1) as in Claim 1, **characterized by** a humidity sensor (15) which is provided in the body (2), and the control unit (14) which terminates the drying process when the humidity value received from the humidity sensor (15) falls below a predetermined value, which, after the termination of the drying process, processes the data received from the liquid level sensor (13) and operates the pump (12)

until the amount of water in the collection receptacle (6) falls below a predetermined second threshold value and which, when the pump (12) is operated, closes the valve (11) between the collection receptacle (6) and the spraying line (9) and controls the valve (11) such that the collection receptacle (6) is in fluid communication with the delivery line (7).

3. A laundry dryer (1) as in any one of the above claims, **characterized by** the control unit (14) which controls the valve (11) so as to interrupt the fluid communication between the collection receptacle (6) and the spraying line (9) until the liquid level in the collection receptacle (6) reaches a third threshold value predetermined by the producer.

4. A laundry dryer (1) as in Claim 3, **characterized by** the control unit (14) which prevents the operation of the pump (12) until the liquid level in the collection receptacle (6) reaches a third threshold level.

Figure 1

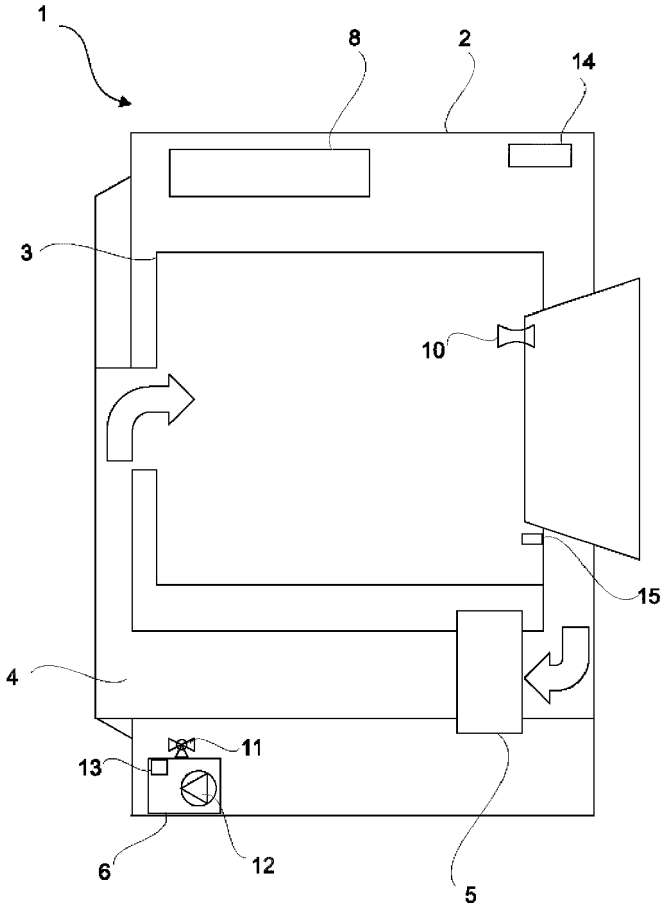
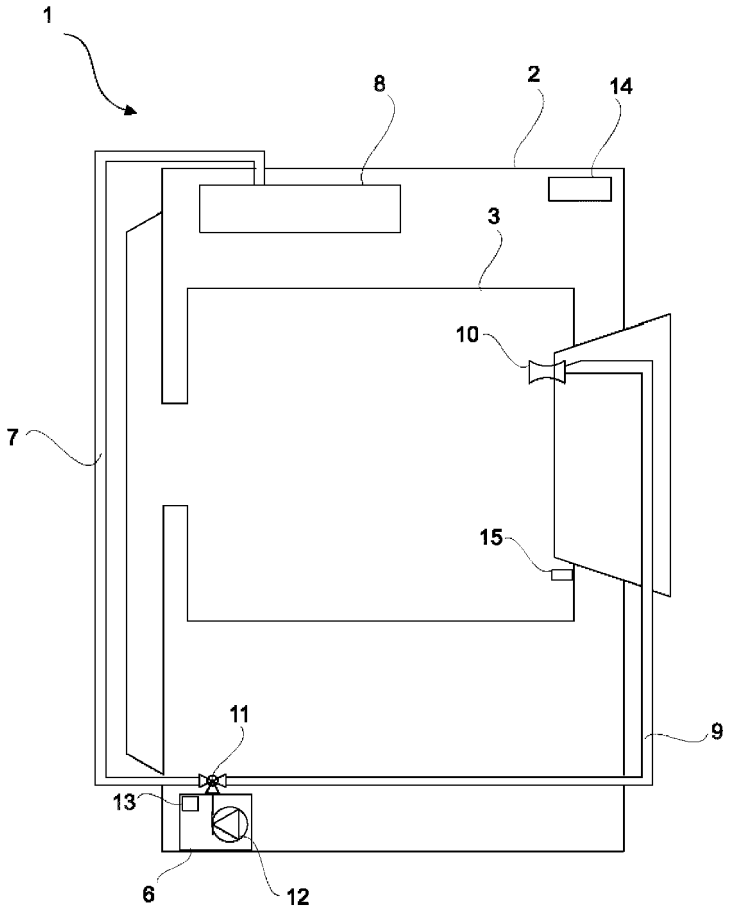


Figure 2



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EUROPEAN SEARCH REPORT

Application Number
EP 21 17 6426

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 2 520 706 A2 (MIELE & CIE [DE]) 7 November 2012 (2012-11-07) * paragraph [0021] - paragraph [0022]; claims 1-2; figure 1 *	1	INV. D06F58/24 ADD. D06F103/42 D06F103/58 D06F105/22 D06F105/62 D06F58/20
Y	DE 10 2011 089112 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 20 June 2013 (2013-06-20) * paragraph [0027] - paragraph [0028]; figures 1-2 *	1	
A	DE 42 12 965 A1 (BAUKNECHT HAUSGERAETE [DE]) 21 October 1993 (1993-10-21) * the whole document *	1-4	

TECHNICAL FIELDS SEARCHED (IPC)
D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	23 July 2021	Diaz y Diaz-Caneja

CATEGORY OF CITED DOCUMENTS

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23-07-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2520706 A2	07-11-2012	EP 2520706 A2	07-11-2012
		ES 2543700 T3	21-08-2015
		PL 2520706 T3	30-10-2015
DE 102011089112 A1	20-06-2013	DE 102011089112 A1	20-06-2013
		WO 2013092384 A2	27-06-2013
DE 4212965 A1	21-10-1993	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2020015914 A **[0003]**