



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.11.2018 Bulletin 2018/46

(51) Int Cl.:
D06F 58/24 (2006.01)
D06F 25/00 (2006.01)
D06F 58/28 (2006.01)

(21) Application number: **18165294.2**

(22) Date of filing: **30.03.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Candy S.p.A.**
20900 Monza (MB) (IT)

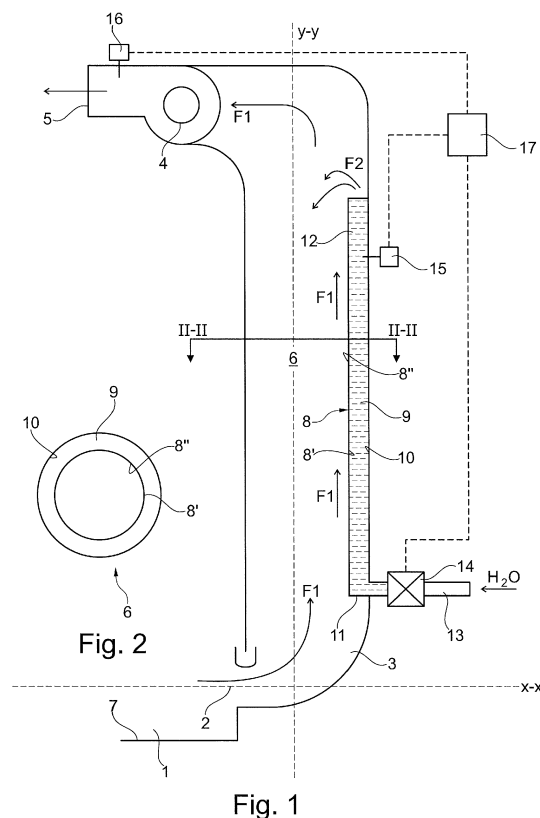
(72) Inventor: **Fumagalli, Aldo**
20900 Monza (MB) (IT)

(74) Representative: **Perani & Partners S.p.A.**
Piazza Armando Diaz, 7
20123 Milano (IT)

(30) Priority: **08.05.2017 IT 201700049412**

(54) **AN IMPROVED LAUNDRY WASHER-DRYER**

(57) The present invention relates to a laundry washer-dryer comprising a duct (3) conveying a moist air stream (F1) from a bottom (7) of a tub (1) which is adapted to contain laundry during drying, said bottom extending in a first direction of extension (Y-Y), said duct (3) having one section (6) extending in a second direction of extension (Y-Y) which is transverse to said first direction of extension (X-X). The machine is characterized in that it comprises a tank (9) having a preset volume, which extends in said first direction of extension (Y-Y) and is located within said duct (3) with the moist air stream (F1) flowing therethrough, said tank (9) being closed at a bottom end (11) and open at a top end (12) thereof, a connection (13) located at said lower end (11) of said tank (9) to introduce water from the water supply system into the volume of said tank (9).



Description*Technical field*

[0001] The present invention relates to an improved laundry washer-dryer as defined in the preamble of claim 1.

Background of the invention

[0002] In the prior art, the vapor in the drying air stream, which is circulated by an electric fan through a duct that extends from the bottom of the tub containing the drum with the laundry to be dried once it has been washed in a laundry washer-dryer, is condensed by introducing a given amount of cold water in spray form into the duct and hence into the moist air stream, by drawing water from the water supply system of the place in which the machine is installed.

[0003] In the prior art, water is introduced into the moist air stream at one point of the stream duct which is located at the end of one vertical section thereof and upstream of the electric exhaust fan.

[0004] The cold water from the water supply system, which typically has a temperature of 15°C, encounters the vapor entrained by the moist air stream from the laundry being dried which typically has a temperature ranging from 65 to 70°C and causes condensation of the vapor entrained by the air stream, thereby converting it into water droplets.

[0005] These water droplets, whose temperature is approximately 45°C, fall by gravity toward the bottom of the vertical section of the duct and flow back toward the tub of the machine.

[0006] US 2015/176194, EP 2891743 and EP 25554740 disclose prior art laundry washers-dryers.

Problem of the prior art

[0007] The condensation mode as discussed above was found in practice to lead to massive consumption of cold water from the water supply system, to an amount substantially equal to the amount of water required for the washing stage, i.e. about 55 liters for a machine that can handle 8 kg of laundry.

Object of the Invention

[0008] The present invention has the object to afford a reduction of the amount of water that is used for the condensation stage.

SUMMARY OF THE INVENTION

[0009] According to the present invention, the above mentioned technical purpose and objects are fulfilled by a laundry washer-dryer as defined in claim 1 below.

Advantages

[0010] The present invention provides a laundry washer-dryer that affords improved efficiency, due to a more efficient utilization of the frigories of the cold water that is used for condensing the vapor contained in the drying air low and, as a result, reduces the required amount of water.

10 **BRIEF DETAILS OF THE DRAWINGS**

[0011] The invention will be now described in greater detail with reference to a preferred embodiment thereof, given by way of illustration and without limitation, and shown in the annexed drawings, in which:

- Figure 1 is a schematic view of a portion of the laundry washer-dryer of the invention;
- Figure 2 is a sectional view of the laundry washer-dryer of Figure 1, as taken along line II - II.

DETAILED DESCRIPTION

[0012] Even when this is not expressly stated, the individual features as described with reference to the particular embodiments shall be intended as auxiliary to and/or interchangeable with other features described with reference to other exemplary embodiments.

[0013] Referring to the aforementioned figures, numeral 1 designates a portion of a tub of a laundry washer-dryer at its connection 2 with the suction duct 3 that draws in the drying air.

[0014] Air is drawn in by a conventional electric fan, referenced 4, which is located proximate to the outlet 5 of the duct 3 toward the environment outside the machine.

[0015] Between the connection 2 with the tub 1 and the electric fan 4 of the laundry washer-dryer, the duct 1 has a section 6 that extends in a direction of extension Y-Y transverse, preferably perpendicular (a vertical direction) to the direction of extension X-X of the bottom 7 of the tub 1 extends.

[0016] In one aspect, the machine comprises a tank 9 having a preset volume, which extends in the aforementioned direction of extension Y-Y.

[0017] The tank extends at least partially over the length of the section 6 of the duct 3, which means that its extent may be equal to or smaller than the extent of the section 6.

[0018] In one aspect, the tank 9 is made of a material that is able to afford efficient transfer of frigories, as more clearly explained hereinbelow.

[0019] The tank 9 is closed at a lower end 11 thereof and is open at an upper end 12 thereof.

[0020] In order to introduce water into the tank 9, a water inlet point is provided in the section 6 of the duct 3.

[0021] Namely, such inlet point includes a fluid connection 13, which is located at the lower end 1 of the tank

9.

[0022] The fluid connection 13 is configured to be able to be coupled to a water supply system and is located at the end 1 of the tank 9 for feeding water into the volume (i.e. the gap) using a solenoid valve 14 in a manner that will be better explained hereinbelow.

[0023] In a preferred embodiment, also referring to Figure 2, the tank 9 is composed of a wall 8 which extends into said duct 3 through which the moist air stream F1 flows.

[0024] In other words, the wall 8 is placed in said vertical section 6 and forms the gap having the preset volume, which extends parallel to the outer wall 10 of the duct.

[0025] Namely, the gap, i.e. the volume of the tank 9 is delimited on one side by the outer surface 8' of the wall 8 and on the other side by the inner surface 10 of the duct 3 in its vertical section 6.

[0026] It shall be noted that the inner surface is intended as the surface that faces the interior of the laundry washer-dryer, and the outer surface is intended as the surface that faces the exterior of the laundry washer-dryer.

[0027] Preferably, the wall 8 extends parallel to an inner surface 10 that defines the duct 1 in its vertical section 6.

[0028] In other words, in the preferred embodiment, the water introduced from the supply system into the volume of the tank 9, i.e. the gap, is confined on one side by the outer surface 8' of the wall 8 and on the other side by the inner surface 10 of the duct 3 in its vertical section 6.

[0029] In a further aspect, the wall 8 has its inner surface 8", i.e. the surface that contacts the moist air stream F1, configured to maximize heat exchange between the water accumulated in the gap and the moist air stream F1.

[0030] Namely, the inner surface 8" is corrugated, to increase the heat exchange surface.

[0031] In an alternative embodiment, the tank 9 has a toroidal shape and the water introduced from the supply system into its volume is confined by the inner surface 8", whereas the outer surface 8' contacts with the moist air stream F1.

[0032] In this embodiment the outer surface 8' must be configured to maximize heat exchange between the water accumulated in the volume and the moist air stream F1. This alternative embodiment also has a corrugated inner surface 8" of the toroid, to increase the heat exchange area.

[0033] In one aspect, the material that forms the wall 8 of the tank 9 is either a metal material or a plastic material.

[0034] The probe of a first temperature sensor 15 is placed in the tank 9, proximate to its upper end 12, to sense the temperature attained by the water in the tank 9, and a second temperature sensor, referenced 16, is placed proximate to the outlet 5 for the drying air stream, downstream from the electric fan 4 for its probe to sense

the temperature attained by the air stream that flows out of the machine.

[0035] Finally, the washer-dryer comprises an electronic control unit, referenced 17, which is connected with the temperature sensors 15 and 16 as well as with a solenoid valve 14 to open and close the latter according to the temperature difference that is sensed by the aforementioned sensors.

[0036] Referring to the schematic view of Figure 1, in which the laundry-drying moist air from the tub 1 is indicated by the arrows F1, the operation of the machine of the invention will be now described.

[0037] As the moist air stream F1 is moved by the electric fan 4 toward the outlet 5, it typically has a temperature that ranges from 65°C to 70°C. It flows along the wall 8 of the tank 9 which is supplied with cold water, typically at a temperature of about 15°C, from the water supply system, through the solenoid valve 14.

[0038] Therefore, the moist air stream F1 is first cooled due to the frigories removed from the water in the tank 9, through its wall 8.

[0039] The flow rate of the cold water is given by the opening degree of the valve 14 as controlled by the control unit 17, and once it has released a first amount of frigories through the wall 8, it overflows (as shown by arrows F2) from the open upper end 12 of the tank 9 and falls through the vertical duct section 6 toward the tub 1, and impinges upon the vapor contained in the moist air stream F1.

[0040] Although the water from the supply system has a higher temperature, it still causes the stream F1 to be further cooled, and the vapor contained therein to be condensed.

[0041] The droplets of condensed vapor fall by gravity with the water that overflows from the tank 9 into the tub 1.

[0042] The flow rate of the water supplied to the tank 9 from the water supply system is controlled, as mentioned above, by the solenoid valve 14, which is opened and closed by the control unit 17 that receives the temperature signals of the sensors 12 and 16.

[0043] The flow rate of water to be supplied to the tank 9 is controlled in response to the difference value between the temperature as detected by the sensor 16 on the air stream that flows out of the duct 6 and the temperature as detected by the sensor 15 in the water in the tank 9.

[0044] The present disclosure affords efficient use of the frigories provided by the water supplied from the water supply system, which is used to condense the vapor in the laundry-drying stream, because water remains in the duct that ejects the moist air stream for a longer time, as compared with the prior art, in which water is sprayed and quickly flows through the air stream to fall by gravity on the bottom of the tub.

[0045] Thus, with the same amount of water as the known system that is discussed in the background, the laundry washer-dryer of the invention can achieve a greater reduction of vapor in the moist drying stream,

thereby potentially reducing the time and power consumption required for drying.

[0046] Those skilled in the art will obviously appreciate that a number of changes and variants may be made to the arrangements as described hereinbefore to meet incidental and specific needs. All of these variants and changes fall within scope of the invention, as defined in the following claims.

Claims

1. A combination laundry washer-drier, comprising:

- a duct (3) conveying a moist air stream (F1) from a bottom (7) of a tub (1) which is adapted to contain laundry during drying, said bottom extending in a first direction of extension (X-X), said duct (3) having one section (6) extending in a second direction of extension (Y-Y) which is transverse to said first direction of extension (X-X),
- a tank (9) having a preset volume, which extends in said second direction of extension (Y-Y) and is located within said duct (3) with the moist air stream (F1) flowing therethrough, said tank (9) being closed at a bottom end (11) and open at a top end (12) thereof,
- a connection (13) located at said bottom end (11) of said tank (9) for introducing mains water into the volume of said tank (9),

characterized in that it comprises:

- an electric fan (4) placed in said duct for drawing in the moist air stream (F1) proximate to the outlet (5) of said duct (3), toward the environment outside the machine,
- a first temperature sensor (15) located in said tank (9) and
- a second temperature sensor (16) located in the duct (3) at the electric fan (4) for drawing the moist air stream (F1);
- said first sensor (15) being configured to detect the temperature of water in said tank (9) and said second sensor (16) being configured to detect the temperature of the air stream (F1) proximate to the outlet (5).

2. A combination laundry washer-dryer as claimed in claim 1, wherein said tank (9) at least partially extends along the length of said section (6) of the duct (3).

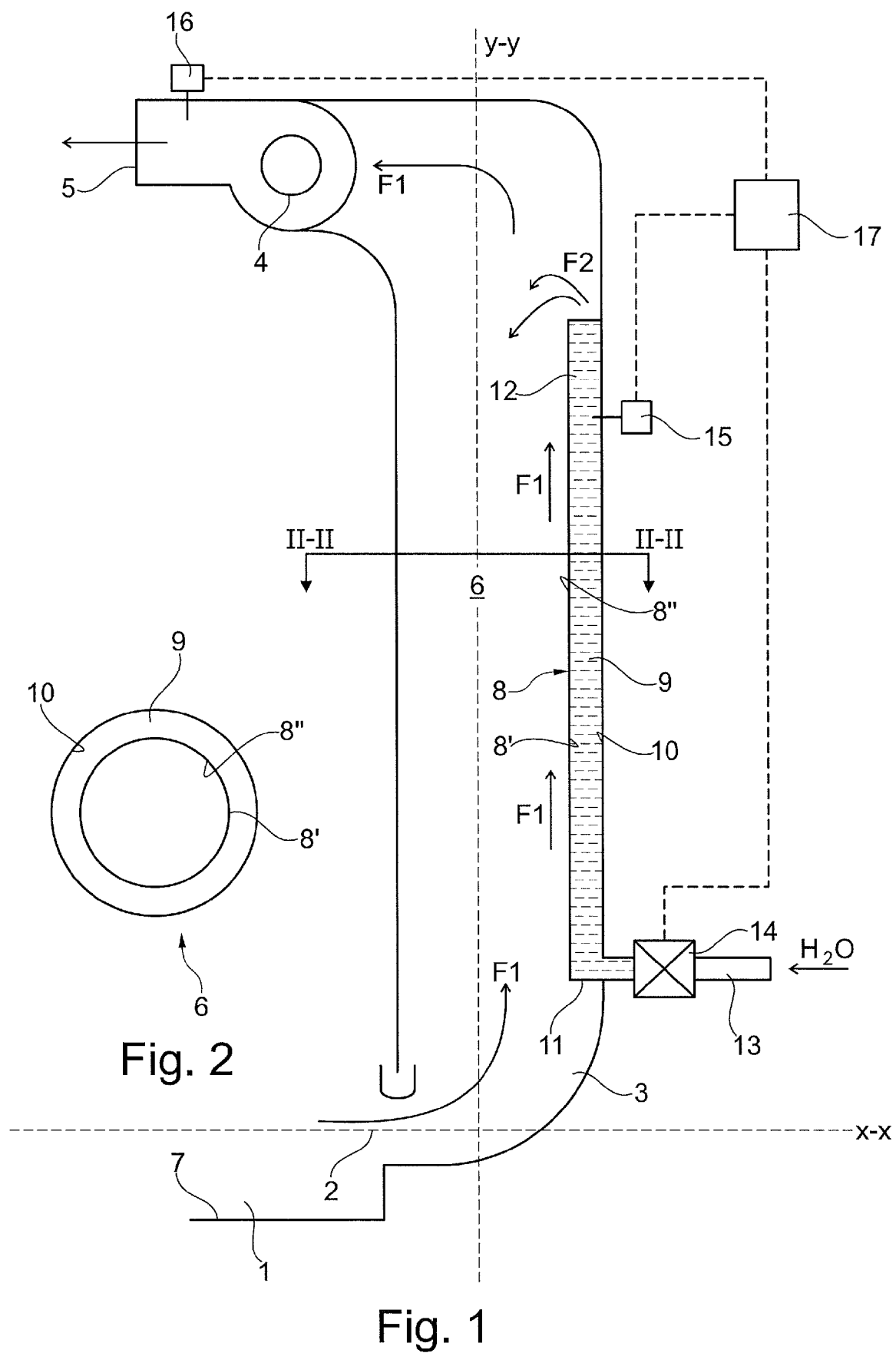
3. A combination laundry washer-dryer as claimed in claim 1 or 2, wherein said tank (9) comprises a wall (8) which extends in said second direction of extension (Y-Y) parallel to an inner wall (10) which defines the duct (3) in its section (6) to thereby define a gap.

4. A laundry washer-dryer as claimed in any of the preceding claims, wherein said tank (9) is made of a metal or plastic material.

5. A combination laundry washer-dryer as claimed in claim 1, wherein said connection (13) for introducing mains water from the outside into said tank (9) comprises a solenoid valve (14) for opening and closing water filling.

6. A laundry washer-dryer as claimed in claim 1, comprising an electronic control unit (17) for controlling said solenoid valve (14) according to the difference value between the temperatures detected by said sensors (15, 16).

7. A laundry washer-dryer as claimed in claim 1, wherein said first temperature sensor (15) is placed in the tank (9) proximate to the upper end thereof (12).





EUROPEAN SEARCH REPORT

Application Number
EP 18 16 5294

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2015/176194 A1 (PARK JONG WON [KR]) 25 June 2015 (2015-06-25) * paragraph [0029] - paragraph [0042] * * paragraphs [0060], [0112] * * figures 1-6 *	1-7	INV. D06F58/24 D06F58/28 D06F25/00
A	EP 2 891 743 A1 (DONGBU DAEWOO ELECTRONICS CORP [KR]) 8 July 2015 (2015-07-08) * paragraph [0009] - paragraph [0010] * * paragraph [0064] - paragraph [0080] * * paragraph [0086] - paragraph [0090] * * figures 1-9 *	1-7	
A	EP 2 554 740 A2 (SAMSUNG ELECTRONICS CO LTD [KR]) 6 February 2013 (2013-02-06) * paragraph [0004] - paragraph [0013] * * paragraph [0018] - paragraph [0019] * * paragraph [0025] - paragraph [0032] * * paragraph [0127] - paragraph [0133] * * figures 1-14 *	1-7	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 22 August 2018	Examiner Bermejo, Marco
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 16 5294

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-08-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2015176194 A1	25-06-2015	CN 104727061 A	24-06-2015
		KR 20150073395 A	01-07-2015
		US 2015176194 A1	25-06-2015
EP 2891743 A1	08-07-2015	CN 104727113 A	24-06-2015
		EP 2891743 A1	08-07-2015
		KR 20150074597 A	02-07-2015
		US 2015176168 A1	25-06-2015
EP 2554740 A2	06-02-2013	EP 2554740 A2	06-02-2013
		US 2013031798 A1	07-02-2013
		WO 2013019054 A1	07-02-2013

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 2015176194 A [0006]
- EP 2891743 A [0006]
- EP 25554740 A [0006]