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(54) LAUNDRY DRYING MACHINE COMPRISING A TEMPERATURE DETECTING DEVICE

WASCHTROCKNER MIT TEMPERATURFÜHLER

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Description

[0001] The present invention relates to a laundry drying machine, comprising a process air circulation circuit, a condensing device disposed within the process air circulation circuit and comprising at least one condensing passage, a temperature detecting device which comprises a head portion for sensing a temperature of the process air and a base portion connected therewith, wherein the temperature detecting device is mounted in the process air circulation circuit and at least a portion of which is disposed below the condensing device.

[0002] A laundry drying machine of this general type is disclosed in DE 195 22 307 C2.

[0003] A device to adjust a relative humidity in solid bodies comprising a humidity sensor which is placed in a shielding chamber covered by a separating layer having a time constant for permeating humidity which is approximately equal to the respective time constant of the solid bodies is disclosed in DE 31 38 915 A1.

[0004] A conventional laundry-drying machine generally includes a rotary drum rotatably mounted within an outer drum that receives and holds laundry in need of drying, a heating device for heating the process air to a certain temperature in order to remove moisture contained in the laundry, a blowing device that drives the process air circulation, and a condensing device condensing the moisture carried in the process air.

[0005] When the machine operates, the process air is heated by means of said heating device to a system-preset temperature. Then, under the effect of the blowing device, the process air is delivered to within the rotary drum where it comes into extensive contact with laundry that was placed in the rotary drum. After heat exchange with the laundry has been effected, the moisture carried in the process air is condensed into water and then discharged by means of a pump. Then, the process air flowing through said condensing device, under effect of said blowing device, is drawn into said heating device and reheated. It then enters the next cycle.

[0006] To implement precise control over the level of laundry dryness and to prevent damage to laundry caused by excessive drying, a sensor is generally required to measure the temperature of the process air prior to entering the condensing device and after completion of the heat exchange. In this way, the level of laundry drying is accurately controlled.

[0007] There are very few positions between the machine's outer drum and the condensing device that are suitable for installing a sensor. Generally, the sensor is installed near the inlet to the condensing device, which affects the precision of sensor measurement results and thereby affects control over laundry dryness.

[0008] In addition, process air from the rotary drum often will carry some lint, that is, small particulates like residuals of fibres, dirt or detergent. When flowing through the sensor, some lint will adhere to the sensor surface. Over a long period of time, accumulated lint will ultimately affect sensor precision.

[0009] With reference to the above problem, the object of the present invention is to provide a laundry drying machine that will overcome the defect described above and thereby ensure accurate drying levels.

[0010] With this object and other objects in view, there is provided, in accordance with the present invention, a laundry drying machine as defined in the attached independent claim. Preferred embodiments of this laundry drying machine are defined in dependent claims as well as in the subsequent description.

[0011] The present invention achieves the aforesaid object through the following: A laundry drying machine, comprising a process air circulation circuit, a condensing device disposed within the process air circulation circuit and comprising a condensing passage; a temperature detecting device comprising a head portion for sensing temperature of the process air and a base portion connected therewith. The temperature detecting device is mounted on the process air circuit, and at least a portion of the temperature detecting device is disposed below the condensing passage. A shield is mounted above the head portion of the temperature detecting device, and the shield comprises an opening portion adjacent to a bottom side of said head portion of the temperature detecting device.

[0012] In accordance with the present description, terms like "below" and "above" relate to a direction of gravity, which is the direction of an object moving freely under sole influence of gravity, at the location of the subject laundry drying machine.

[0013] In accordance with the present description, the term "laundry drying machine" refers to a machine that is dedicated to drying laundry solely as well as to a machine that is dedicated to other functions involving laundry besides drying laundry, with washing laundry being a prominent example of such other function. An according machine dedicated both to washing and drying laundry is commonly referred to as washer-dryer.

[0014] It is apparent that an advantage of the present invention is given that a shield is mounted above the head portion of the temperature detecting device, the condensed water flowing down through the condensing passage cannot come into contact with the temperature detecting device, thereby ensuring the measurement precision of the temperature detecting device and further ensuring precise control over laundry dryness.

[0015] In accordance with the invention said opening portion is adjacent to the bottom of said head portion so as to expose the area under said head portion to the air. Given that the area under the head portion of the temperature detecting device is exposed to the air, the large water flow drawn into the flushing device will, after reaching the bottom of the connecting duct, splash and spray onto the head portion of the temperature detecting device, thereby washing lint from the surface of the temperature detecting device. As the spraying by the flushing device generally occurs when the drying procedure has

ended or has nearly ended it lasts for a very short period of time. Therefore, it will not negatively affect the precision of required data.

[0016] In a preferred embodiment of the present invention, a flushing device is disposed above said condensing device, said temperature detecting device is mounted on a connecting duct which is connected to the condensing device and close to the bottom of said connecting duct.

[0017] In another preferred embodiment of the present invention, said shield has a plurality of holes. Air flow is unobstructed because of these holes.

[0018] In a further preferred embodiment of the present invention, said shield comprises a side wall portion. Said holes are formed on said side wall portion. As the holes are disposed on the side wall, it is not easy for the water to flow across and enter the shield interior and from there drop onto the temperature detecting device.

[0019] In yet another embodiment of the present invention, each of said holes comprises a bottom wall which is inclined downwards along a direction from the inner side to the outer side. These inclined bottom walls can divert outwards the flow of water that has dropped onto their surfaces and prevent water drops from entering the shield interior and dropping from there onto the temperature detecting device.

[0020] Preferred embodiments of the invention are now explained in more detail with reference to the Figures of the attached drawing. In the drawing,

FIG. 1 is a structural cross-section diagram of the laundry drying machine;
FIG. 2 is a structural drawing of the condensing device and its connecting duct;
FIG. 3 is a magnified view of part of FIG. 2; and
FIG. 4 is a cut-away view of FIG. 3 in the A-A direction.

[0021] With reference to FIG. 1 and FIG. 2, a laundry drying machine 1 includes a rotatable drum 2 whose walls are provided with perforations and which is held in an outer drum 3 or tub 3. The top of the outer drum 3 is provided with a heating tube assembly 4, in which is provided a heating device 5. A condensing device 6 is provided behind the outer drum 3. One end of the heating tube assembly 4 connects to an air inlet 7 provided on the outer drum 3. One end of the condensing device 6 connects by means of a connecting duct 13 and a corrugated hose 9 to an air outlet 8 provided on the outer drum 3. Another end of the heating tube assembly 4 connects to another end of the condensing device 6. Thus, the heating tube assembly 4, the outer drum 3, the rotary drum 2, the condensing device 6, the connecting passage 13, and the corrugated hose 9 form an air circulation circuit.

[0022] It is noted that this laundry drying,machine 1 is also dedicated to washing laundry before drying; yet, this is not a necessary prerequisite for the advantageous developments to be described in detail subsequently.

[0023] A connecting duct 13 connects to the underside of the condensing device 6. The other end of the connecting duct 13 connects to the corrugated hose 9 and through the latter further connects to the air outlet 8. To cause process air to flow in the circulation circuit, a blowing device 10 is provided between the condensing device 6 and the heating tube device 5.

[0024] When the drying process is turned on, process air traversing the process air passage is first heated by means of said heating device 5 and then supplied into the rotary drum 2, where it comes into extensive contact with damp laundry placed therein and evaporates the moisture in the laundry. The steam-carrying process air then passes through the air outlet 8 on the outer drum 3 and enters the condensing device 6. In the condensing device 6, the moisture in the process air is condensed into water, which flows down the inner wall 14 (see FIG. 4) of the condensing device 6. Then, under the effect of the blowing device 10, the process air from which moisture has been separated is drawn into the heating tube assembly 4 again, where it is reheated by said heating device 5. It thereby enters the next cycle to extract more moisture from the damp laundry.

[0025] Laundry produces much lint during the drying process by fibrous particles and residuals of dirt and detergent being torn off by the process air. This lint, with the process air, enters the corrugated hose 9, the connecting duct 13, and the condensing device 6 and adheres to the inner walls of these components. In order to eliminate this lint, a flushing device 15 is mounted above the condensing device 6. It sprays water downward at set intervals to clean these components by washing off the lint which is in turn carried down into the outer drum 3 and discharged from there into a wastewater sink.

[0026] To measure process air temperature in real time, a temperature sensor 12 is mounted on the connecting duct 13 connected to the condensing device 6 and is near the bottom 19 of the connecting duct 13. A shield 11 is mounted above the temperature sensor 12 to avoid contact between condensation from the condensing device 6 and the temperature sensor 12.

[0027] With reference to FIG. 3 and FIG. 4, the condensing device 6 includes two condensing passages 16. The temperature sensor 12 includes a heat portion 17 that senses process temperature and a base portion 18 connected therewith. The head portion 17 is in part located under the condensing passage 16.

[0028] The shield 11 includes a mounting part 20, which is secured to the position-fixing frame 21 of the condensing device 6. The shield 11 also includes two side wall portions 22 extending downwards from the mounting part 20. The head portion 17 of the temperature sensor 12 is located between the two side wall portions 22. The bottoms of the side wall portions 22 are separate from each other, thus forming an opening portion 23. The opening portion 23 is nearly under the temperature sensor head portion 17. Thus, the underside of the head portion 17 is exposed to the air which is not encircled by the shield 11. Therefore, after the water sprayed by the

flushing device 15 reaches the bottom 19 of the connecting duct 13, it splashes and sprays the head portion 17 of the temperature sensor, washing off lint adhering to its surface.

[0029] Each of the two side wall portions 22 of the shield 11 has a plurality of holes 24 to facilitate passage of air inside and outside of the shield 11. Preferably, each hole 24 has a bottom wall 25 that is inclined downwards along a direction from the inner side to the outer side. These inclined bottom walls 25 can divert outwards the flow of water that has dropped onto their surfaces and prevent water drops from entering the shield 11 interior and dropping from there onto the temperature sensor 12.

[0030] The present invention permits many other embodiments. Equivalent changes made to the present invention by persons with ordinary skill in the art under the guidance of the present invention shall still be included within the scope asserted under the claims of the present invention.

Claims

1. Laundry drying machine (1), comprising a process air circulation circuit (2, 3, 4, 6, 9, 13), a condensing device (6) disposed within the process air circulation circuit (2, 3, 4, 6, 9, 13) and comprising at least one condensing passage (16), a temperature detecting device (12) which comprises a head portion (17) for sensing a temperature of the process air and a base portion (18) connected therewith, wherein the temperature detecting device (12) is mounted in the process air circulation circuit (2, 3, 4, 6, 9, 13) and at least a portion of which is disposed below the condensing device (16), **characterized in that** a shield (11) is mounted obove the head portion (17) of the temperature detecting device (12).

2. Laundry drying machine (1) according to claim 1, **characterized in that** a flushing device (15) is disposed above the condensing device (6), the temperature detecting device (12) is mounted in a connecting duct (13) which is connected to the condensing device (6) and is close to the bottom (19) of the connecting duct (13), and the shield (11) comprising an opening portion (23) adjacent to bottom side of said head portion (17) of the temperature detecting device (12).

3. Laundry drying machine (1) according to one of claims 1 and 2, **characterized in that** the shield (11) has plurality of holes (24).

4. Laundry drying machine (1) according to claim 3, **characterized in that** the shield (11) comprises a side wall portion (22), said holes (24) are formed on the side wall portion (22).

5. Laundry drying machine (1) according to claim 4, **characterized in that** each of the holes (24) comprises a bottom wall (25) which is inclined downwards along a direction from the inner side to the outer side of the shield (11).

Patentansprüche

1. Wäschetrocknungsmaschine (1), die einen Prozessluftumlaufkreis (2, 3, 4, 6, 9, 13), eine Kondensationseinrichtung (6), die in dem Prozessluftumlaufkreis (2, 3, 4, 6, 9, 13) angeordnet ist und wenigstens einen Kondensationsdurchlass (16) aufweist, und einen Temperaturfühler (12), der einen Kopfabschnitt (17) zum Abfühlen einer Temperatur der Prozessluft und einen Basisabschnitt (18), der damit verbunden ist, aufweist, umfasst, wobei der Temperaturfühler (12) in dem Prozessluftumlaufkreis (2, 3, 4, 6, 9, 13) montiert ist und wenigstens ein Abschnitt hiervon unter der Kondensationseinrichtung (16) angeordnet ist, **dadurch gekennzeichnet, dass** über dem Kopfabschnitt (17) des Temperaturfühlers (12) eine Abschirmung (11) angebracht ist.

2. Wäschetrocknungsmaschine (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** über der Kondensationseinrichtung (6) eine Spüleinrichtung (15) angeordnet ist, der Temperaturfühler (12) in einem Verbindungsrohrstutzen (13) angebracht ist, der mit der Kondensationseinrichtung (6) verbunden ist und sich in der Nähe des Bodens (19) des Verbindungsrohrstutzens (13) befindet, und die Abschirmung (11) in der Nähe der Unterseite des Kopfabschnitts (17) des Temperaturfühlers (12) einen Öffnungsabschnitt (23) aufweist.

3. Wäschetrocknungsmaschine (1) nach einem der Ansprüche 1 und 2, **dadurch gekennzeichnet, dass** die Abschirmung (11) mehrere Löcher (24) besitzt.

4. Wäschetrocknungsmaschine (1) nach Anspruch 3, **dadurch gekennzeichnet, dass** die Abschirmung (11) einen Seitenwandabschnitt (22) aufweist, wobei die Löcher (24) in dem Seitenwandabschnitt (22) ausgebildet sind.

5. Wäschetrocknungsmaschine (1) nach Anspruch 4, **dadurch gekennzeichnet, dass** jedes der Löcher (24) eine Bodenwand (25) aufweist, die in einer Richtung von der Innenseite zu der Außenseite der Abschirmung (11) nach unten geneigt ist.

Revendications

1. Sèche-linge (1) comprenant un circuit de circulation

d'air de processus (2, 3, 4, 6, 9, 13), un dispositif condensateur (6) disposé au sein du circuit de circulation d'air de processus (2, 3, 4, 6, 9, 13) et comprenant au moins un passage de condensation (16), un dispositif de détection de température (12) comprenant une partie frontale (17) pour capter la température de l'air de processus et une partie de base (18) connectée à celle-ci, dans lequel le dispositif de détection de température (12) est monté dans le circuit de circulation d'air de processus (2, 3, 4, 6, 9, 13) et au moins une partie de celui-ci est disposée en-dessous du dispositif condensateur (16), **caractérisé en ce qu'**une protection (11) est montée au-dessus de la partie frontale (17) du dispositif de détection de température (12).

2. Sèche-linge (1) selon la revendication 1, **caractérisé en ce qu'**un dispositif de rinçage (15) est disposé au-dessus du dispositif de condensation (6), le dispositif de détection de température (12) est monté dans un conduit de raccordement (13) qui est raccordé au dispositif de condensation (6) et est proche du bas (19) du conduit de raccordement (13), et la protection (11) comprenant une partie ouvrante (23) adjacente au fond de ladite partie frontale (17) du dispositif de détection de température (12).

3. Sèche-linge (1) selon l'une des revendications 1 et 2, **caractérisé en ce que** la protection (11) possède une pluralité d'orifices (24).

4. Sèche-linge (1) selon la revendication 3, **caractérisé en ce que** la protection (11) comprend une partie de paroi latérale (22), lesdits orifices (24) étant formés sur la partie de paroi latérale (22).

5. Sèche-linge (1) selon la revendication 4, **caractérisé en ce que** chacun des orifices (24) comprend une paroi de fond (25) qui est inclinée vers le bas du côté intérieur vers le côté extérieur de la protection (11).

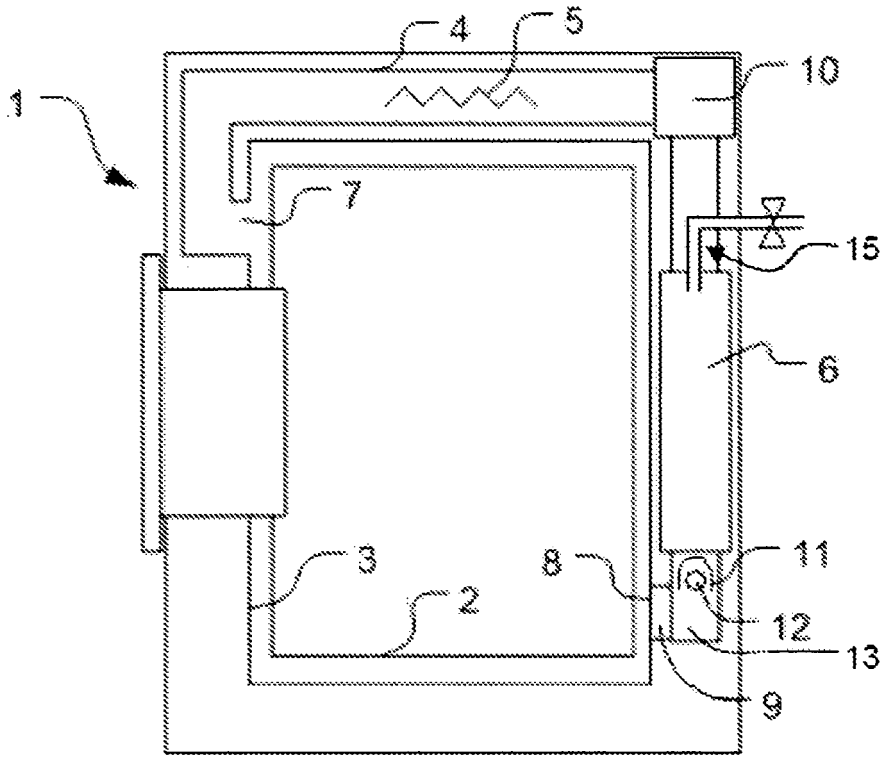

FIG. 1

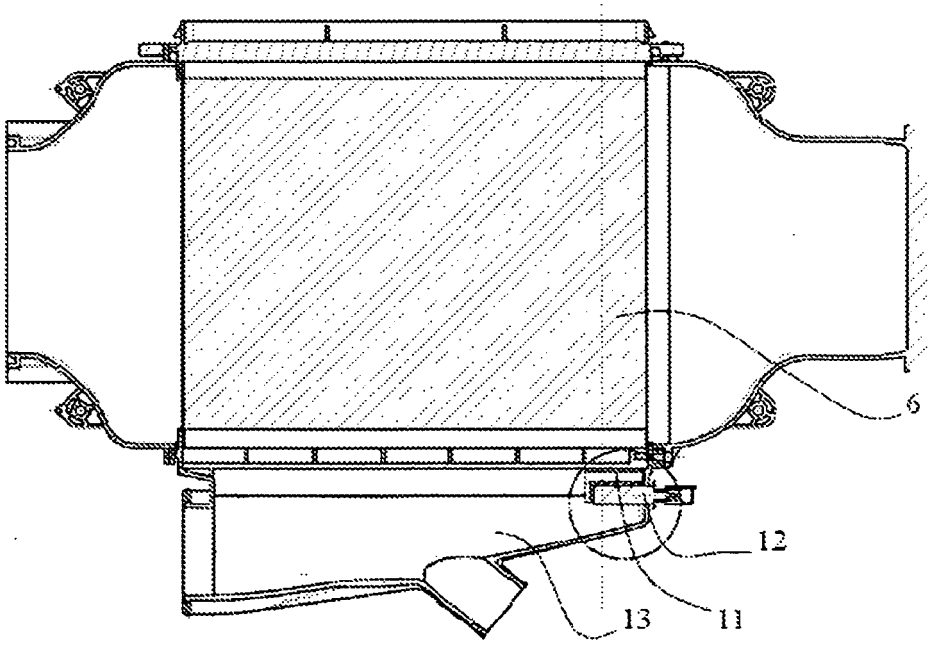

FIG. 2

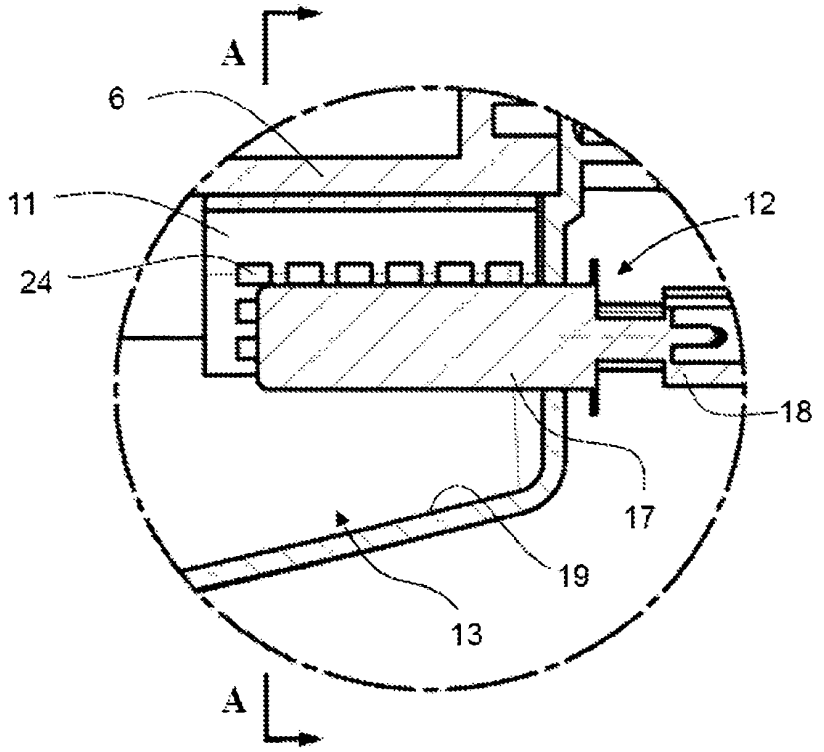

FIG. 3

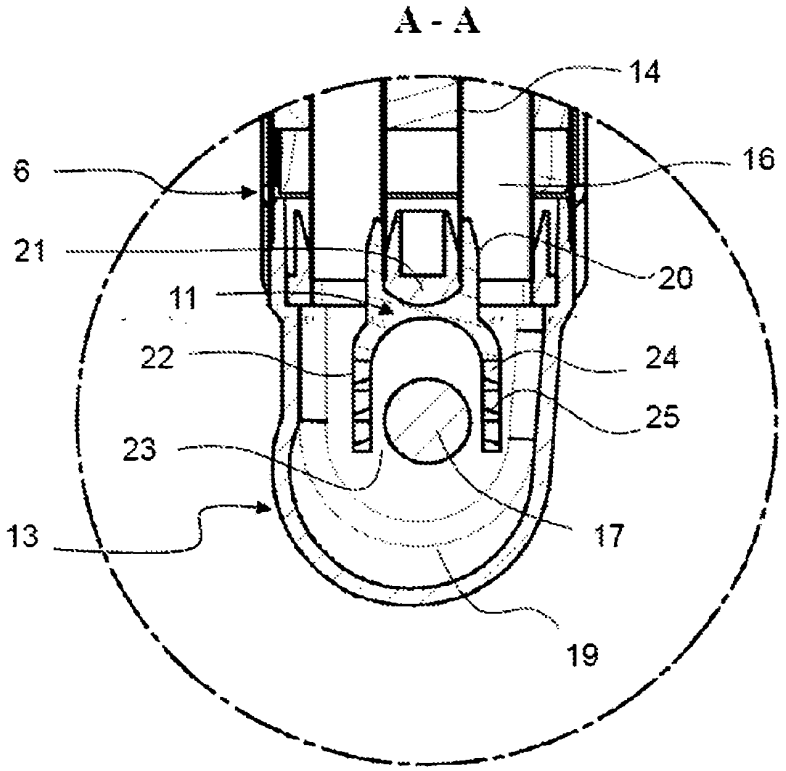

FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- DE 3138915 A1 **[0003]**