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(54) Laundry drying device

(57) A laundry drying device is disclosed, which comprises an air inlet (2) and an air outlet (3) in communication with the ambient air, wherein between the air inlet and the air outlet, there is disposed successively a filter (4), an air-blasting device (5) for driving air to flow, and a condensing device (6) using air as a condensing medium, which are in communication with one another by way of an air flow pipeline (7); the laundry drying device further comprises a detecting device (8) for detecting the degree of blockage of the filter device. By way of the detecting device, the system can promptly inform a user to clean the filter, thus effectively avoiding the problem of reduced condensing effect caused by the blockage of the filter.

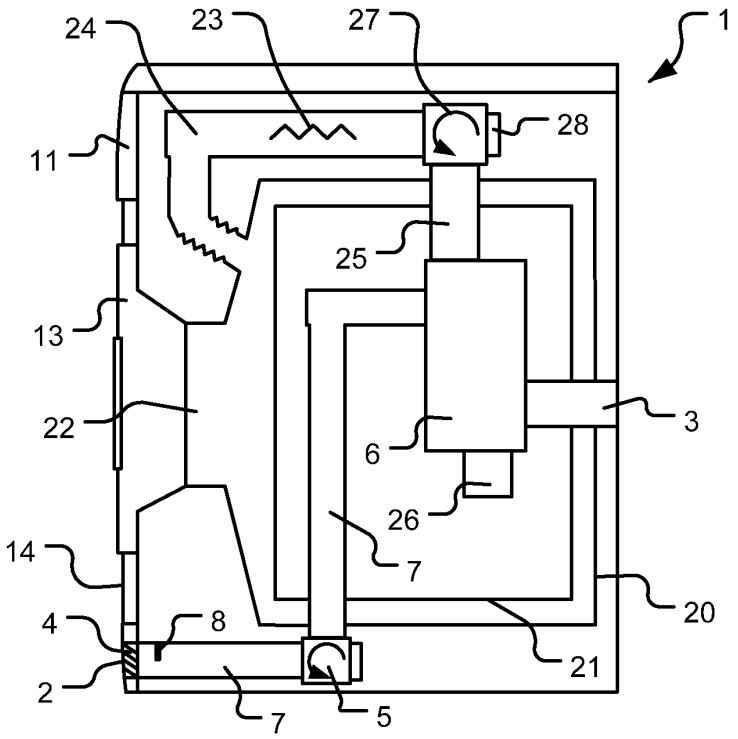

Fig.2

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Description

Technical Field

[0001] The present invention relates to a drying device for drying laundries, in particular to a laundry drying device by using air to condense.

Background Art

[0002] With the development of technology and the increasing pace of people's life, laundry drying devices with a drying function are becoming more and more popular with people; as for laundry drying devices for domestic use, drum-type washing and drying machines which incorporate the washing and drying functions into one body or drum-type drying machines which only have a drying function, are generally commonly known. Taking the drum-type washing and drying machine as an example below, it comprises a cabinet body, inside which are disposed a water tub and a rotatable drum disposed inside the water tub; a heating device for heating air and a drying channel for leading the heated air into the water tub and the interior of the drum is disposed above the water tub; a condensing pipeline and condensing device are disposed at one side of the water tub; an inlet of the condensing pipeline is connected with an air discharge opening of the water tub; and a fan is connected between the drying channel and the condensing pipeline. The fan rotates at high speed under the effects of a fan motor, thereby promoting the circulation of air. A laundry entry opening for the user to access the laundry is disposed at a substantially central position of a front side, i.e. the side facing the user, and the laundry entry opening is closed or opened by a glass door. A control panel for a user to operate and a detergent distributing box for releasing the detergent or softener are disposed above the glass door on the cabinet body; option buttons or knobs, a power switch, and an information display screen are disposed on the control panel, and the user can input a command by the buttons or knobs to select different program options, and then the system controls a washing or drying program according to the different options selected by the user, and at the same time the related information of the system is displayed on the information display screen.

[0003] During a user's operation, firstly he or she opens the glass door, puts the laundry to be dried into the drum, then closes the glass door, after that, a corresponding drying program is started to dry the laundry. In the event of drying, the system will start the heating device to heat air, so as to make it into dry hot air, which is transferred to the water tub and the interior of the drum via the drying channel; the drum rotates at high speed under the drive of the motor and drives the laundry to tumble up and down, thereby contact fully with the dry hot air, and the dry hot air carries the moisture contained in the wet laundry and becomes relatively humid air, which is discharged into the condensing pipeline via the air discharging opening, and then the moisture in the air is condensed by the condensing device, and the air is retransferred under the effect of the fan into the drying channel to be heated there, and enter the next circulation process thereby. With the continuous cycles, the moisture in the laundry is gradually evaporated, until being dried fully.

[0004] There are two common condensing modes, one of which is using water to condense and the other is using air to condense, and apparently the water-cooled mode will result in waste of water resources, therefore, under the premise of ensuring the condensing effect, the air-cooled mode is more advantageous in saving water. As for using air to condense, normally, an air inlet is disposed at one side of the cabinet body, and an air outlet is disposed at the other side, a ventilation pipe is connected between the air inlet and the air outlet, thus, the ambient air with a relatively low temperature is transferred to the ventilating pipe via the air inlet; a condensing pipeline is disposed in a suitable place on the ventilating pipe, and a heat exchange occurs in the condensing pipeline between the relatively low temperature air and the relatively humid hot air discharged from the water tub, and the moisture therein is condensed, thereby realize the condensing effect by the air. In order to prevent dust or other impurities in ambient air from entering the condensing pipeline and affecting the condensing effect, it is necessary to fit filter around the air inlet, and after a period of time, the user needs to clean the filter so as to avoid blockage. However, even if this is the case, the following problems still exist - firstly, the accumulation of dust and other impurities is highly random and sometimes it needs to be cleaned, but at other times it does not need to be cleaned, therefore this uncertainty will be somewhat inconvenient for the user; secondly, if it is not cleaned for a long time or the user forgets to clean it, it is possible for the excessive accumulation of the filtered dust and other impurities to cause an impeded air flow in the air inlet, or even to cause blockage of the air inlet, thereby affect the condensing effect significantly, and subsequently affect the drying efficiency.

Summary of The Invention

[0005] With the aim of solving the above problems, an object of the present invention is to provide a laundry drying device which can promptly inform a user to clean the filter.

[0006] In order to realize the above object of the present invention, the laundry drying device is realized as follows: a laundry drying device, comprising an air inlet and air outlet in communication with the ambient air, wherein between the air inlet and the air outlet, a filter device, an air-blasting device for driving air to flow, and a condensing device using air as a condensing medium are disposed, which are in communication with one another by way of an air flow pipeline; a detecting device

for detecting the degree of blockage of the filter device, a comparison device for comparing a signal value detected by the detecting device with a preset reference value, and a signal indicating device for displaying the degree of blockage of the filter device according to the comparison result of the comparison device; and the detecting device is disposed between the filter device and the air-blasting device. By way of the real-time detection of the detecting device, then the comparison device compares the detected signal value with the preset reference value of the system; when it is greater than the reference value, signal for indicating that the filter device need to be cleaned is displayed to warn the user by the signal indicating device, so as to promptly inform the user to clean the filter device, thus to effectively avoid the problem of reduced condensing effect caused by the blockage of the filter device.

[0007] In a preferred embodiment of the present invention, the detecting device is a self-heating thermistor, and the preset reference value is a temperature value.

[0008] In another preferred embodiment of the present invention, the detecting device is an impeller-type electric induction flow sensor, and the preset reference value is a voltage value.

[0009] In yet another preferred embodiment of the present invention, the detecting device is an impeller-type pulse output flow sensor, and the preset reference value is a pulse frequency value.

[0010] Preferably, the air inlet is disposed at the front side of the laundry drying device, and the air outlet is disposed at the rear side of the laundry drying device. This makes the maximum use of the ambient air flow, and ensures the condensing effect, while the practice of disposing the air outlet at the rear side of the laundry drying device can avoid the risk of harming the user due to the excessive temperature of air discharged from it.

[0011] More preferably, the signal indicating device is disposed on a control panel of the laundry drying device, so as to make the signal easy to be observed.

Description of the drawings

[0012] The present invention will be further described hereinbelow in combination with the drawings and embodiments.

Fig. 1 is a perspective view of a laundry drying device according to an embodiment of the present invention;

Fig. 2 is a schematic view of the interior of the laundry drying device according to the embodiment of the present invention;

Fig. 3 is a schematic view of detecting device according to a first embodiment of the present invention;

Fig. 4 is a schematic view of detecting device according to a second embodiment of the present invention; and

Fig. 5 is a schematic view of detecting device according to a third embodiment of the present invention.

Description of the preferred Embodiments

[0013] Fig. 1 shows a perspective view of a laundry drying device according to an embodiment of the present invention, and as shown in the figure, the laundry drying device 1 comprises a cabinet body 12, a front wall 14 fitted with a glass door 13, a door handle 15 by operating which a user opens and closes the glass door 13, a control panel 11 and a detergent distributing box 16 disposed above the glass door 13, a power switch 17, a program selecting knob 18 and a signal display 10 disposed on the control panel 11, and a top cover 19 disposed on the top of the cabinet body 12 and control panel 11. Referring further to Fig. 2, inside the space enclosed by the cabinet body 12, the front wall 14 and the top cover 19, a water tub 20 and a rotatable drum 21 disposed inside the water tub 20 are fitted; a laundry entry opening 22 for loading or unloading the laundry is disposed at one front side of the water tub 20 and the drum 21 in the direction facing the user, and the laundry entry opening 22 is opened and closed by the glass door 13 disposed on the front wall 14. Above the water tub 20, a heating device 23 for heating air into the dry hot air and a drying channel 24 for transferring the heated dry hot air to the water tub 20 and the interior of the drum are disposed; and on one side of the water tub 20, a condensing device 6 and a condensing channel 25 with one end of which being connected to an air discharge opening 26 of the water tub 20 and the other end being connected to the drying channel 24 via a fan 27 are disposed. The fan 27 rotates under the drive of a fan motor 28 so as to promote an air flow. During the drying course, air inside the drying channel 24 is heated by the heating device 23 into the dry hot air, which is then guided to the water tub 20 and the interior of the drum 21 by the drying channel 24, and contacts fully with the wet laundry and carries the moisture contained in the laundry thereby becomes relatively humid hot air. The relatively humid hot air is then discharged into the condensing channel 25 via the air discharge opening 26. Under the condensing effect of the condensing device 6, the moisture contained in the air is condensed into water. The air then flows into the drying channel 24 under the effect of the fan 27, and is heated again and enters the next cycle. After a number of cycles, the moisture in the laundry is gradually evaporated.

[0014] Still referring to Fig. 2, the embodiment according to the present invention uses air to condense, therefore on one side of the cabinet body 12, preferably, an air inlet 2 is disposed at a suitable position below the glass door 13 on the front wall 14, such that the ambient air at a relatively low temperature enters the interior of the cabinet body via the air inlet 2. On the other side of the cabinet body 12, preferably, an air outlet 3 is disposed at the rear of the cabinet body 12, and after heat ex-

change, the ambient air is discharged from the cabinet body via the air outlet 2. In order to prevent dust or other impurities from entering, a filter 4 is disposed adjacent the front wall 14 in front of the air inlet 2, and the air flow direction is guided by an air flow pipeline 7. In addition, in order to promote air circulation, an air-blasting device 5 is disposed at a suitable position in the air flow pipeline 7 after the filter 4; the air flow pipeline 7 communicates the condensing device 6 at a place that between the air-blasting device 5 and air outlet 2. Under the effects of the air-blasting device 5, ambient air at a relatively low temperature flows along the air flow pipeline 7 and has a heat exchange in the condensing device 6 with the relatively humid hot air which enters the condensing channel 25 via the air discharge opening 26 of the water tub 20, thus to condense the moisture contained in the hot air. Preferably, the air flow pipeline 7 is not in communication with the condensing channel 25. Therefore, after the condensing effects of the condensing device 6, air in the air flow pipeline 7 is discharged via the air outlet 2, and air in the condensing channel 25 will re-enter the drying channel 24 under the effects of the fan 27, and then enters the next cycle.

[0015] Since it is inevitable for the ambient air to carry some dust or other impurities, especially in the case of operating under relatively bad environment, therefore it is quite possible that the dust or other impurity attaches to the filter 4 which is disposed at the air inlet 2, which may cause blockage of the filter 4 and even blockage of the whole air flow pipeline 7, air condensing effects will thus be significantly affected, and results in low drying efficiency. Therefore it is necessary to promptly inform the user to clean the filter 4. According to the embodiment of the present invention, a detecting device 8 for detecting the degree of blockage of the filter 4 is disposed at a suitable position adjacent to the filter 4 between the filter 4 and the air-blasting device 5; the detecting device 8 is fitted inside the air flow pipeline 7 by a fixing support 29, and signal detected is transferred to a comparison device 9 via an output wire 30; and in the comparison device 9, the signal value detected by the detecting device 8 is compared with a preset reference value, and then determines the degree of blockage of the filter 4 according to the comparison result. At the same time, information of the degree of blockage of the filter 4 and whether it needs to be cleaned is displayed by the signal indicating device 10 disposed on the control panel 11.

[0016] Hereinbelow, different embodiments according to the present invention will be described in detail.

[0017] Fig. 3 shows a first embodiment according to the present invention, and as shown in the figure, the detecting device 8 are a self-heating thermistor. Normally, its work temperature is between 150°C and 200°C, and if the temperature is below this range, it will be heated by itself. When blockage of the filter 4 occurs, the air speed of the ambient air entering the air inlet 2 will change correspondingly, and then, the operation status of the self-heating thermistor will also change accordingly. When the air speed is relatively high, the self-heating thermistor is cooled by the ambient air to a relatively low temperature, while in order to maintain the constant temperature in its operation status, it needs to start self-heating, namely to increase the working electric current, and according to the comparison result of the change of operating current and a preset current value in the system, degree of blockage of the filter 4 will be determined.

[0018] Fig. 4 shows a second embodiment according to the present invention, and as shown in the figure, the detecting device 8 is an impeller-type electric induction flow sensor, which comprises an impeller 31 and a generator 32 which generates power when is driven by the impeller 31; an output end of the generator 32 is connected to the output wire 30. The ambient air introduced from the air inlet 2 drives the impeller 31 to rotate, which make the generator 32 to generate power; if the air speed is relatively high, then the output voltage of the generator 32 is high, which means that there is no blockage around the filter 4 or the blockage is comparatively slight; on the contrary, if the blockage is severe, then the air speed will be relatively low, therefore the output voltage of the generator 32 will also be relatively low. By detecting the output voltage of the generator 32 and by comparing the detected output voltage with preset reference voltage in the system by the comparison device 9, degree of blockage of the filter 4 can be determined, and the user can be promptly informed.

[0019] Fig. 5 shows a third embodiment according to the present invention, and as shown in the figure, the detecting device 8 is an impeller-type pulse output flow sensor. The impeller-type pulse output flow sensor comprises a number of impeller blades 31, on each of which a magnet 33 is fitted. A Hall integrated circuit module 34 is fitted on the fixing support 29, and an output end of the Hall integrated circuit module 34 is connected to the output wire 30; similar to the impeller-type electric induction flow sensor, when an impeller 31 rotates to an induction area of the Hall integrated circuit module 34, the Hall integrated circuit module 34 outputs a pulse. There is a preset reference pulse frequency value in the system. When the air speed at the air inlet 2 is relatively high, the frequency of output pulse is high, and the comparison device 9 compares this frequency with the reference pulse frequency, if is higher than the preset reference pulse frequency value, it indicates that there is no blockage around the filter 4 or the blockage is comparatively slight; while when it is lower than the preset reference pulse frequency value, it indicates that the air speed at the air inlet is relatively low, and the blockage of the filter 4 is comparatively severe. Therefore the degree of blockage of the filter 4 can be determined according to the frequency of output pulse of the Hall integrated circuit module 34.

[0020] In summary, within the scope of the basic technical concept of the present invention, all forms of variations by those skilled in the art relevant to the technical field of the present invention as disclosed herein are with-

in the protection scope of this patent application for the present invention.

Claims

1. A laundry drying device (1), comprising
an air inlet (2) and an air outlet (3) in communication with surrounding air,
a filter (4), an air-blasting device (5), and a condensing device (6) are disposed between the air inlet (2) and the air outlet (3), and are connected by an air flow pipeline (7),
characterized in that:

   further comprises a detecting device(8) for detecting degree of blockage of the filter (4), comparison device (9) for comparing a signal value detected by the detecting device(8) with a preset reference value, and a signal indicating device (10) for displaying the degree of blockage of the filter (4) according to comparison result of the comparison device (9); and the detecting device (8) is disposed between the filter (4) and the air-blasting device(5).

2. The laundry drying device (1) as claimed in claim 1, **characterized in that** the detecting device (8) is a self-heating thermistor, and the preset reference value is a temperature value.

3. The laundry drying device (1) as claimed in claim 1, **characterized in that** the detecting device (8) is an impeller-type electric induction flow sensor, and the preset reference value is a voltage value.

4. The laundry drying device (1) as claimed in claim 1, **characterized in that** the detecting device (8) is an impeller-type pulse output flow sensor, and the preset reference value is a pulse frequency value.

5. The laundry drying device (1) as claimed in one of claims 1 to 4, **characterized in that** the air inlet (2) is disposed at the front side of the laundry drying device (1), and the air outlet (3) is disposed at the rear side of the laundry drying device (1).

6. The laundry drying device (1) as claimed in one of claims 1 to 4, **characterized in that** the signal indicating device (10) is disposed on a control panel (11).

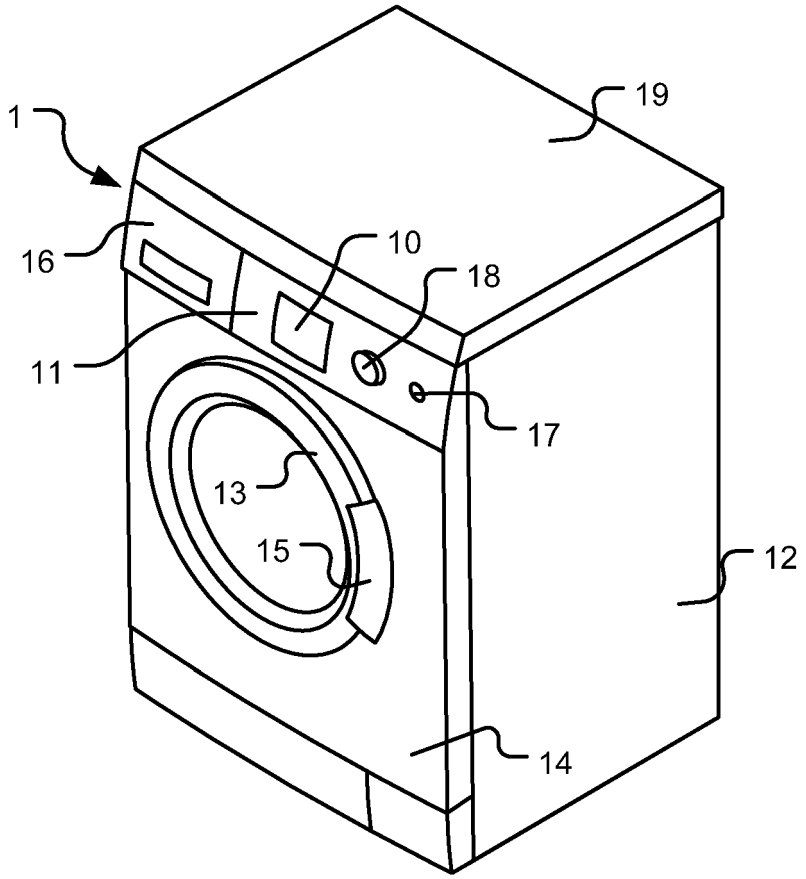

Fig.1

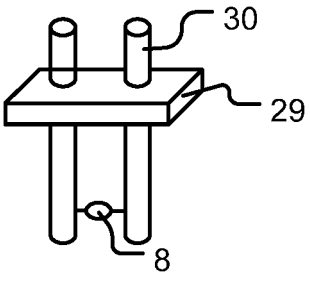

Fig.3

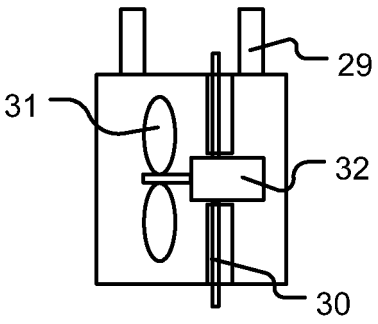

Fig.4

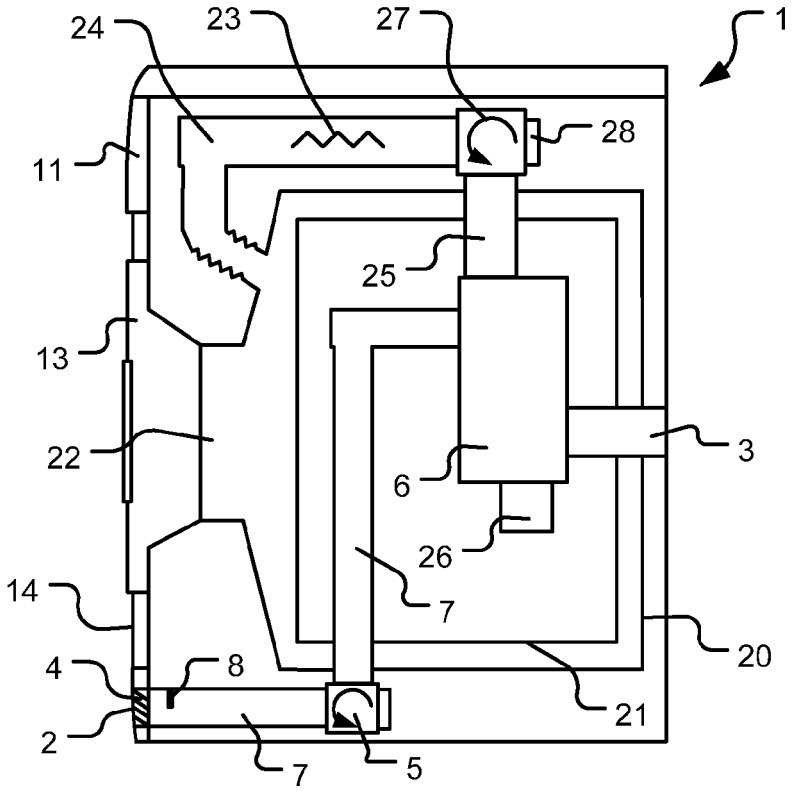

Fig.2

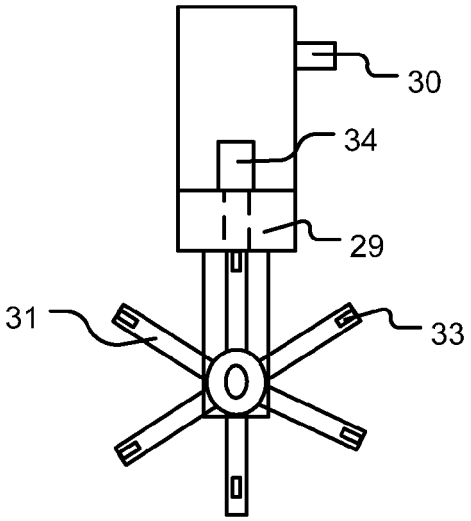

Fig.5

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EUROPEAN SEARCH REPORT

Application Number
EP 08 10 5369

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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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	7 November 2008	Diaz y Diaz-Caneja

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