A THERMOELECTRIC HEAT PUMP LAUNDRY DRYER
WÄSCHETROCKNER MIT THERMOELEKTRISCHER WÄRMEPUMPE
SÈCHE-LINGE À POMPE À CHALEUR THERMOÉLECTRIQUE

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Proprietor: Arçelik Anonim Sirketi
34950 Istanbul (TR)

Inventors:
• SAHIN, Yavuz
  34950 Istanbul (TR)
• KAYA, Mehmet
  34950 Istanbul (TR)
• HARTOKA, Onur
  34950 Istanbul (TR)
• KOCATURK, Serdar
  34950 Istanbul (TR)

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The present invention relates to a laundry dryer comprising a thermoelectric heat pump.

In laundry dryers wherein the drying air is circulated within a closed cycle, the drying air activated by a fan removes the moisture of the laundry by being passed over the laundry and the water vapor in the air is condensed at the condenser. The drying air dehumidified at the condenser is later heated by being passed over the heater thus delivering hot and dry air unto the laundry. In laundry dryers generally air cooled type condensers are used. The air sucked by means of the cooling fan from the outer environment is delivered to the condenser and thus the drying air passing through the condenser is provided to be condensed by cooling. In the state of the art, furthermore thermoelectric heat pumps are used in laundry dryers in addition to the condenser and the heater. The thermoelectric heat pumps are also named as Peltier elements. The thermoelectric heat pumps have hot and cold sides and perform both the functions of condensing by cooling and also heating the drying air. While the hot side of the thermoelectric heat pumps used in laundry dryers assists the heater, the cold side assists the condenser. In the process of drying the laundry, the drying air is cooled by some amount while being passed over the condenser, afterwards is passed over the thermoelectric heat pump and thereby the dehumidification process of the drying air is accomplished in two stages. Similarly, the heating process is also in two stages. The drying air, which is almost completely dehumidified of the moisture contained therein by passing through the condenser and the cold side of the thermoelectric heat pump, is heated some amount by passing over the hot side of the thermoelectric heat pump and afterwards the heating process is completed by the drying air being passed over the main heater. In the said laundry dryers wherein the heater, the condenser and the thermoelectric heat pump are used together, the problem of pressure loss arises due to the numerous paths and turns wherein the drying air circulates. The pressure of the drying air decreases while passing particularly from the heat sinks which provide heat transfer in the hot and cold sides of the thermoelectric heat pump and the volumetric flow and hence the speed of the drying air which is activated and delivered unto the laundry by the drying fan, decreases and the efficiency of drying is lowered. Furthermore, the low speed air passing over the thermoelectric heat pump decreases the operational efficiency thereof. When air with low volumetric flow and low speed passes from particularly the hot side of the thermoelectric heat pump, heat emission from the hot side to the outside becomes weaker. Decrease in the effectiveness of the thermoelectric heat pump hot side also results in decrease in the effectiveness of the cold side and hence the condensation efficiency is lowered.

In the German Patent Application No. DE102006016294, a laundry dryer comprising thermoelectric heat pump is explained. The drying process air is directed from the cold side of the thermoelectric heat pump to the hot side by means of an air guidance device. In the German Patent Application No. DE102006026251, a laundry dryer is explained wherein the drying air is circulated in a closed channel system. The drying air is parallelly passed through the thermoelectric heat pump having cold side and hot side.

The aim of the present invention is the realization of a laundry dryer which comprises the thermoelectric heat pump and wherein the pressure losses that occur in the drying cycle are decreased.

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 thermoelectric heat pump (Peltier) having a hot side and a cold side, some portion of the process air activated by the fan continues its path in the drying duct after leaving the drum, passing from the condenser, the hot side, the cold side and the heater respectively and is delivered again to the drum in dehumidified and heated state. The other portion of the drying air is guided directly to the hot side of the thermoelectric heat pump by means of a divider disposed in the drying duct, without circulating through the condenser and the cold side of the thermoelectric heat pump and is again delivered to the drum over the main heater.

In an embodiment of the present invention, the end of the divider extending into the drying duct is in the form of a plate that extends in the reverse direction of the process air flow and vertically upwards in the drying duct.

In another embodiment of the present invention, the end of the divider extending to the inlet opening of the hot side, is in the form of a plate that bears against the sides of the inlet opening by extending in the horizontal direction to almost the center of the inlet opening.

In another embodiment of the present invention, a filter that extends into the second drying duct is integrated with the divider so as to form a barrier in front of the process air flow.

In the laundry dryer of the present invention, pressure losses are decreased by means of the divider, the effectiveness of both the hot side and the cold side of the thermoelectric heat pump are increased.

The laundry dryer realized in order to attain the aim of the present invention is illustrated in the attached figures, where:
The elements illustrated in the figures are numbered as follows:

1. Laundry dryer
2. Drum
3. 3', 3" Drying duct
4. Fan
5. Heater
6. Condenser
7. Thermoelectric heat pump
8. Cold side
9. Hot side
10. 10', 10" Inlet opening
11. Divider
12. Filter

The laundry dryer (1) comprises a body, a drum (2) wherein the laundry is placed, a drying duct (3) wherein the process air is circulated, a fan (4) providing the circulation of process air in the drying duct (3), a heater (5) that heats the process air, a condenser (6) providing the dehumidification of the process air and a thermoelectric heat pump (7) disposed after the condenser (6) in the drying duct (3), that condenses by cooling and afterwards heats the process air passing thereover.

The thermoelectric heat pump (7) comprises a cold side (8) that condenses the process air passing thereover by cooling, a hot side (9) that heats the process air passing thereover and an inlet opening (10) placed at the hot side (9) that provides entry of the process air into the hot side (9).

The laundry dryer (1) of the present invention comprises a divider (11) that,
- is disposed in the drying duct (3),
- one end of which extends into the drying duct (3) and dividing the drying duct (3) into two, as the first drying duct (3') and the second drying duct (3''),
- the other end of which extends to the inlet opening (10) and dividing the inlet opening (10) into two divisions as the upper inlet opening (10') and the lower inlet opening (10''),
- that guides the process air flowing in the first drying duct (3') directly to the hot side (9) from the upper inlet opening (10'), without circulating the condenser (6) and the cold side (8) and
- that guides the process air flowing in the second drying duct (3'') and circulating the condenser (6) and the cold side (8) to the hot side (9) from the lower inlet opening (10'') (Figure 1, Figure 2).

The thermoelectric heat pump (7) is positioned horizontally inside the body of the laundry dryer (1), the cold side (8) is situated below, and the hot side (9) above, and the condenser (6) is situated under the cold side (8), at the lowermost place inside the body of the laundry dryer (1). The said elements are arranged one above the other from the drum (2) towards the base as the hot side (9) - the cold side (8) - the condenser (6).

In another embodiment of the present invention, the end of the divider (11) inside the drying duct (3) is in the form of a plate that extends into the drying duct (3) vertically and in the reverse direction of the process air flow (Figure 2).

In another embodiment of the present invention, the end of the divider (11) on the side of the inlet opening (10), is in the form of a plate that bears against the sides of the inlet opening (10) by extending in the horizontal direction to almost the center of the inlet opening (10) (Figure 2).

In another embodiment of the present invention, the laundry dryer (1) comprises a filter (12) integrated with the divider (11) and disposed in the second drying duct (3'') so as to form a barrier in front of the process air (Figure 1). The filter (12) only filters the process air flowing in the second drying duct (3'').
filtered. Moreover, the filter (12), since being integrated with the divider (11), can be cleaned by being taken out of the laundry dryer (1) together with the divider (11) easily.

[0024] In the laundry dryer (1) of the present invention, the effectiveness of the thermoelectric heat pump (7) is increased by increasing volumetric flow of the process air passing from the hot side (9) of the thermoelectric heat pump (7) by means of the divider (11) and the pressure losses of the process air are decreased. Furthermore, the condensation effectiveness of the cold side (8) is increased by decreasing the volumetric flow of the process air passing from the cold side (8) of the thermoelectric heat pump (7).

Claims

1. A laundry dryer (1) comprising a drum (2) wherein the laundry is placed, a drying duct (3) wherein the process air is circulated, a fan (4) providing the circulation of process air in the drying duct (3), a heater (5) that heats the process air, a condenser (6) providing the dehumidification of the process air, a divider (11) that is disposed in the drying duct (3) and a thermoelectric heat pump (7) disposed after the condenser (6) in the drying duct (3), having a cold side (8) that condenses the process air passing therewith by cooling, a hot side (9) that heats the process air passing thereover and an inlet opening (10) arranged at the hot side (9) that provides entry of the process air to the hot side (9), characterized in that,

- one end of the divider (11) extends into the drying duct (3) and dividing the drying duct (3) into two, as the first drying duct (3') and the second drying duct (3''),
- the other end of the divider (11) extends to the inlet opening (10) and dividing the inlet opening (10) into two divisions as the upper inlet opening (10') and the lower inlet opening (10''), wherein the divider (11)
  - guides the process air flowing in the first drying duct (3') directly to the hot side (9) from the upper inlet opening (10'), and,
  - guides the process air flowing in the second drying duct (3'') and circulating the condenser (6) and the cold side (8) to the hot side (9) from the lower inlet opening (10'').

2. A laundry dryer (1) as in Claim 1, characterized by the divider (11) the end inside of the drying duct (3) of which is in the form of a plate that extends into the drying duct (3) vertically and in the reverse direction of the process air flow.

3. A laundry dryer (1) as in Claim 1 or 2, characterized by the divider (11) the end on the side of the inlet opening (10) of which is in the form of a plate that bears against the sides of the inlet opening (10) by extending in the horizontal direction to almost the center of the inlet opening (10).

4. A laundry dryer (1) as in any one of the above Claims, characterized by a filter (12) integrated with the divider (11) and disposed in the second drying duct (3'').
Revendications

1. Un sèche-linge (1) comprenant un tambour (2) dans lequel le linge est placé, une conduite de séchage (3) dans laquelle l’air de processus est circulé, un ventilateur (4) permettant la circulation de l’air de processus dans la conduite de séchage (3), un dispositif de chauffage (5) qui chauffe l’air de processus, un condenseur (6) permettant la déshumidification de l’air de processus, un diviseur (11) qui est disposé dans la conduite de séchage (3) et une pompe à chaleur thermoélectrique (7) qui est disposée après le condenseur (6) dans la conduite de séchage (3) et qui présente un côté froid (8) qui condense l’air de processus passant sur celui-ci en refroidissant, un côté chaud (9) qui chauffe l’air de processus passant sur celui-ci et une ouverture d’entrée (10) ar- rangée sur le côté chaud (9), qui permet l’entrée de l’air de processus dans le côté chaud (9), caractérisé en ce que

- une extrémité du diviseur (11) s’étend dans la conduite de séchage (3) et divise la conduite de séchage (3) en deux comme la première conduite de séchage (3') et la seconde conduite de séchage (3")
- l’autre extrémité du diviseur (11) s’étend dans l’ouverture d’entrée (10) et divise l’ouverture d’entrée (10) en deux divisions comme l’ouverture d’entrée supérieure (10') et l’ouverture d’entrée inférieure (10’’), où le diviseur (11)
- guide l’air de processus écoulu dans la première conduite de séchage (3’) directement au côté chaud (9) à travers l’ouverture d’entrée supérieure (10’), et
- guide l’air de processus, qui écoule dans la seconde conduite de séchage (3”) et circule le condenseur (6) et le côté froid (8), au côté chaud (9) à travers l’ouverture d’entrée inférieure (10’’).

2. Un sèche-linge (1) selon la Revendication 1, caractérisé par le diviseur (11) dont l’extrémité dans la conduite de séchage (3) est en forme de plaque qui s’étend dans la conduite de séchage (3) verticalement et dans le sens contraire à l’écoulement de l’air de processus.

3. Un sèche-linge (1) selon la Revendication 1 ou 2, caractérisé par le diviseur (11) dont l’extrémité au côté de l’ouverture d’entrée (10) est en forme de plaque qui s’appuie sur les côtés de l’ouverture d’entrée (10) en s’étendant dans le sens horizontal par rapport à peu près au centre de l’ouverture d’entrée (10).

4. Un sèche-linge (1) selon l’une quelconque des revendications précédentes, caractérisé par un filtre (12) intégré avec le diviseur (11) et disposé dans la seconde conduite de séchage (3’).
REFERENCES CITED IN THE DESCRIPTION

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