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Séchoir

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Description

[0001] The present invention relates to a drying machine, comprising a tub for containing laundry, a condenser spatially communicated with the tub, and a fan that enables air to flow from the tub to the condenser, wherein the condenser has a body, an air inflow passage connected adjacent to a bottom portion of the body, and an air outlet adjacent to a top portion of the body, wherein the air inflow passage approximately extends along a tangential direction of a cross section of the body, so that air that enters the body from the air inflow passage rises along a side wall of the body in a centrifugal rotation manner.

[0002] A drying machine of this generic type is disclosed in the Korean Patent Abstracts relating to KR 10 2007 0075486 A. Accordingly, a condenser of the drying machine includes a condensing duct, a condensate supply pipe, and a cyclone forming unit.

[0003] In United States Patent 3,990,870 means and method for separating and collecting particulate matter from a gas flow are disclosed. Separation of particulate matter from a gas flow is achieved by interacting the gas flow with a water curtain within a contacting chamber, the gas flow entering that chamber tangentially near the bottom thereof.

[0004] In an existing drying machine or an existing clothes drying device such as a washer-dryer having combined functions of washing and drying, a drying process is usually as follows. With a heater placed in a heating tunnel, dry air is heated into dry hot air, which subsequently enters a laundry treatment drum to exchange heat and humidity with wet clothes, and takes moisture away from the clothes, thereby forming humid warm air. The humid warm air passes through an outlet disposed at the laundry treatment drum to enter a condenser. By condensation in the condenser, moisture in the humid warm air is condensed into liquid water and discharged from the air through a drainage tunnel. After the condensation, the air becomes dry cold air which is driven into the heating tunnel again by a fan, and the dry cold air becomes dry hot air after heating, and enters another circle. The circle repeats until the drying program ends.

[0005] The condenser may use various condensation methods. A common method is to use water as a cooling medium to exchange heat with the humid warm air, thereby condensing moisture from the humid warm air. Such condenser generally has a body in a passage shape, and a cooling water pipe which is connected to the body. Humid warm air passes the condenser upwards against a direction of gravity. At the same time, cooling water flows out from the top of the condensation device down to exchange heat with the humid warm air. Generally, due to the limit of space, that is, due to the limited spatial height of the body of the condenser, the heat exchange distance between the humid hot air and the cooling water is quite short. In addition, the humid warm air ascending at a high speed may blow away the water flow after meeting the

cooling water, or even blow water droplets into the fan and the subsequent air heating device.

[0006] An objective of the invention is to provide a drying machine with an improved condenser, which has better heat exchange performance and from that cooling water is not easily blown into a fan or an air heating device.

[0007] To achieve the foregoing objective, a technical solution established by the invention is as follows: A drying machine, including a tub for containing laundry, a condenser spatially communicated with the tub, and a fan that enables air to flow from the tub to the condenser, where the condenser has a body, an air inflow passage connected adjacent to a bottom portion of the body as determined with reference to a direction of gravity, and an air outlet adjacent to a top portion of the body, and the air inflow passage approximately extends along a tangential direction of a cross section of the body, so that air that enters the body from the air inflow passage rises along a side wall of the body in a centrifugal rotation manner. Further, a cooling water inlet pipe is connected to the condenser body in a centrifugal manner. Finally, a centre position of the cooling water pipe at which the cooling water inlet pipe is connected to the condenser body is higher in a gravity direction than a centre position of the air inflow passage at which the air inflow passage is connected to the condenser body, and the cooling water inlet pipe and the condenser body are connected at a lower half portion of the condenser body.

[0008] The drying machine may be a machine having a clothes drying function, for example, a machine used only to dry clothes, or a washer-dryer.

[0009] According to the invention, the cooling water inlet pipe that is connected in a centrifugal manner enables the cooling water that flows in to flow downwards along an inner wall of the body spirally, and a water film is formed on the inner wall of the body, which is advantageous to heat exchange with the air, and makes it difficult for the air to blow the cooling water to generate water spray.

[0010] According to the invention, the cooling water is far away from the fan and the air heating device located at a downstream position in an air circulation direction of the condenser, and scattering water droplets are not easily blown into the fan and the air heating device. In addition, better heat exchange performance is achieved when the cooling water is closer to a portion at which the airflow is concentrated.

[0011] Compared with the prior art, in the present invention, the air inflow passage approximately extends along the tangential direction of the cross section of the body, so that the air that enters the body from the air inflow passage rises along the side wall of the body in a centrifugal rotation manner, and the air travels a longer distance in the condenser body to achieve more heat exchange; in addition, resistance loss caused because airflow directly impacts a wall surface is effectively reduced; and moreover, cooling water flows on the wall

surface of the condenser, which prevents water droplets from being carried into the air and entering the fan and the air heating device.

[0012] As a preferable improved solution, a central axis of the air inflow passage approximately coincides with a tangent of a cross section of the condenser body at a portion which is connected to the air inflow passage. Such a structure enables most air to be close to an inner wall surface of the body when rising in a rotatable manner, which achieves more desirable heat exchange performance.

[0013] As a possible improved solution of the invention, at least a portion of the body which is adjacent to the air inflow passage is cylindrical-shaped. The cylindrical shape is advantageous to the spiral ascending of the airflow because the air can flow closer to the wall surface with minimum resistance. However, other suitable shapes, such as an oval section structure, also satisfy the purposes of the present invention.

[0014] As a further improvement of the invention, the air inflow passage is approximately horizontally arranged, which is more advantageous to rotation and circulation of airflow.

[0015] As a further improvement of the invention, the cooling water inlet pipe approximately extends along the tangential direction of the cross section of the body. In this way, rotation of the water flow is more obvious and attachment between the water flow and the inner wall of the body is better.

[0016] As a further improvement of the invention, the cooling water inlet pipe approximately extends horizontally, which is more advantageous to the rotation of the water flow along the inner wall of the body.

[0017] As a further improvement of the invention, the cooling water inlet pipe is connected in such a way that the cooling water rotates in a centrifugal manner along the side wall of the body, and a rotation direction is the same as a centrifugal rotation direction of the air that enters the body from the air inflow passage. Therefore, the air encounters lower resistance when flowing, the cooling water is not easily blown to generate water spray, and better heat exchange performance is achieved when the air contact with the cooling water for a longer time.

[0018] Preferred embodiments of the invention are now described in details with reference to the accompanying drawing. In the drawing,

FIG. 1 is a schematic diagram of a drying machine;

FIG. 2 is a schematic diagram of a condenser; and

FIG. 3 is a top view of the condenser in FIG. 2.

[0019] As shown in FIG. 1, a washer-dryer 1 has a laundry treatment drum assembly 3 located in a box body 2, where the laundry treatment drum assembly 3 includes a drum 5 which can rotate when being driven by a motor 4, and an outer tub 6 which is sleeved outside the drum

5. The tub 6 is connected to and is spatially communicated with a condenser 9; the condenser 9 is further connected to a fan 11 and an air heating passage 10 in sequence; the other end of the air heating passage 10 is then spatially communicated with the tub 6, so that an air circulation path 7 is formed in the tub 6, the condenser 9, the fan 11, and the air heating passage 10.

[0020] In a drying process, a heater 12 in the air heating passage 10 heats drying air 8 that flows through the passage; the heated high-temperature drying air 8 enters the laundry treatment drum assembly 3 under the effect of the fan 11, heats wet clothes in the drum 5 to make moisture in the clothes evaporate; and the drying air 8 further carries the evaporated moisture and enters the condenser 9, and the moisture in the drying air 8 is condensed and becomes liquid again, and is separated from the drying air 8, and the drying air 8 then is at a low temperature and becomes dry, and is driven by the fan 11 to enter the heating passage 10 again, and a new cycle is started. The cycle repeats until the clothes in the inner drum 5 is finally dried.

[0021] As shown in FIG. 2 and FIG. 3, the condenser 9 has a body 21, an air inflow passage 22 is connected adjacent to a bottom portion of the body 21, and an air outlet 23 is disposed adjacent to a top portion of the body. The other end of the air inflow passage 22 is connected to the tub 6, and the air outlet 23 is communicated with the fan 11. Therefore, with the fan 11, the drying air 8 from the outer drum 6 is sucked into the body 21 of the condenser 9 through the air inflow passage 22 and leaves the condenser body 21 from the air outlet 23.

[0022] The air inflow passage 22 is horizontally arranged, and a central axis 220 of the air inflow passage 22 approximately coincides with a tangent of a cross section of the condenser body 21 at a portion 24, which is connected to the air inflow passage 22. The portion 24 of the condenser body 21 which is connected to the air inflow passage 22 is cylindrical-shaped. Therefore, the drying air 8 that enters the condenser body 21 from the air inflow passage 22 rises along a side wall 210 of the condenser body 21 in a centrifugal rotation manner.

[0023] In order to condense the drying air 8, a cooling water inlet pipe 25 is connected to the condenser body 21 horizontally and approximately along a tangential direction of the cross section of the condenser body 21, so that cooling water 26 rotates in a centrifugal manner along the side wall 210 of the body after entering the condenser body 21. A rotation direction of the cooling water 26 is the same as a centrifugal rotation direction of the drying air 8 that enters the body 21 from the air inflow passage 22.

[0024] A centre position of the cooling water pipe 25 at which the cooling water inlet pipe 25 is connected to the condenser body 21 is higher in a gravity direction than a centre position of the air inflow passage 22 at which the air inflow passage 22 is connected to the condenser body 21, and the cooling water inlet pipe 25 and the air inflow passage 21 are connected at a lower half

portion 27 of the condenser body 21, close to the air inflow passage 22 and in particular, to an area in which the drying air 8 is relatively concentrated. As can be seen from FIG. 2, in this embodiment, the cooling water inlet pipe 25 is connected to the portion 24 of the body 21 which is connected to the air inflow passage 22.

[0025] Various specific embodiments described above and shown in the accompanying drawing are merely used for describing the invention in detail, and are not regarded as the entirety of the invention.

Claims

1. A drying machine, comprising a tub (6) for containing laundry, a condenser (9) spatially communicated with the tub (6), and a fan (11) that enables air to flow from the tub (6) to the condenser (9), wherein the condenser (9) has a body (21), an air inflow passage (22) connected adjacent to a bottom portion of the body (21), and an air outlet (23) adjacent to a top portion of the body (21), wherein the air inflow passage (22) approximately extends along a tangential direction of a cross section of the body (21), so that air that enters the body (21) from the air inflow passage (22) rises along a side wall (210) of the body (21) in a centrifugal rotation manner, **characterized in that**

- a cooling water inlet pipe (25) is connected to the condenser body (21) in a centrifugal manner, and

- a centre position of the cooling water pipe (25) at which the cooling water inlet pipe (25) is connected to the condenser body (21) is higher relative to a gravity direction than a centre position of the air inflow passage (21) at which the air inflow passage (22) is connected to the condenser body (21), and the cooling water inlet pipe (25) and the condenser body (21) are connected at a lower half portion (27) of the condenser body.

2. The drying machine according to claim 1, **characterized in that** a central axis (220) of the air inflow passage (22) approximately coincides with a tangent of a cross section of the condenser body (21) at a portion (24) which is connected to the air inflow passage (22).
3. The drying machine according to claim 1, **characterized in that** at least a portion (24) of the body (21) which is adjacent to the air inflow passage (22) is cylindrical-shaped.
4. The drying machine according to claim 1, **characterized in that** the air inflow passage (22) is approximately horizontally arranged.

5. The drying machine according to any one of claims 1 to 4, **characterized in that** the cooling water inlet pipe (25) approximately extends along the tangential direction of the cross section of the body (21).

6. The drying machine according to any one of claims 1 to 5, **characterized in that** the cooling water inlet pipe (25) approximately extends horizontally.

7. The drying machine according to any one of claims 1 to 6, **characterized in that** the cooling water inlet pipe (25) is connected in such a way that cooling water (26) rotates in a centrifugal manner along the side wall (210) of the body, and a rotation direction is the same as a centrifugal rotation direction of the air (8) that enters the body (21) from the air inflow passage (22).

Patentansprüche

1. Trocknungsmaschine, welche einen Bottich (6) zum Aufnehmen von Wäsche, einen Kondensator (9), der in räumlicher Kommunikation mit dem Bottich (6) steht, und einen Ventilator (11), welcher das Strömen von Luft aus dem Bottich (6) zu dem Kondensator (9) ermöglicht, umfasst, wobei der Kondensator (9) einen Körper (21), einen Lufteinströmkanal (22), der einem unteren Abschnitt des Körpers (21) benachbart angeschlossen ist, und einen Luftauslass (23), der einem oberen Abschnitt des Körpers (21) benachbart ist, aufweist, wobei sich der Lufteinströmkanal (22) annähernd entlang einer tangentialen Richtung eines Querschnitts des Körpers (21) erstreckt, so dass Luft, welche aus dem Lufteinströmkanal (22) in den Körper (21) eintritt, entlang einer Seitenwand (210) des Körpers (21) auf eine durch Rotation unter Fliehkraftwirkung bestimmte Weise aufsteigt, **dadurch gekennzeichnet, dass**

- ein Kühlwasser-Einlassrohr (25) mit dem Kondensatorkörper (21) auf eine der Fliehkraftwirkung entsprechende Weise verbunden ist, und

- eine Mittelpunktsposition des Kühlwasserrohres (25), an welcher das Kühlwasser-Einlassrohr (25) mit dem Kondensatorkörper (21) verbunden ist, bezüglich einer Schwerkraftichtung höher als eine Mittelpunktsposition des Lufteinströmkanals (21) ist, an welcher der Lufteinströmkanal (22) mit dem Kondensatorkörper (21) verbunden ist, und das Kühlwasser-Einlassrohr (25) und der Kondensatorkörper (21) an einem unteren Halbabschnitt (27) des Kondensatorkörpers verbunden sind.

2. Trocknungsmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** eine Mittelachse (220) des Lufteinströmkanals (22) annähernd mit einer Tan-

gente eines Querschnitts des Kondensatorkörpers (21) an einem Abschnitt (24) zusammenfällt, welcher mit dem Lufteinströmkanal (22) verbunden ist.

3. Trocknungsmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** wenigstens ein Abschnitt (24) des Körpers (21), welcher dem Lufteinströmkanal (22) benachbart ist, zylinderförmig ist. 5
4. Trocknungsmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** der Lufteinströmkanal (22) annähernd horizontal angeordnet ist. 10
5. Trocknungsmaschine nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** sich das Kühlwasser-Einlassrohr (25) annähernd entlang der tangentialen Richtung des Querschnitts des Körpers (21) erstreckt. 15
6. Trocknungsmaschine nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** sich das Kühlwasser-Einlassrohr (25) annähernd horizontal erstreckt. 20
7. Trocknungsmaschine nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** das Kühlwasser-Einlassrohr (25) auf eine solche Weise angeschlossen ist, dass Kühlwasser (26) unter Fliehkraftwirkung entlang der Seitenwand (210) des Körpers rotiert und eine Rotationsrichtung dieselbe ist wie die Richtung der Rotation unter Fliehkraftwirkung der Luft (8), welche aus dem Lufteinströmkanal (22) in den Körper (21) eintritt. 25 30

Revendications

1. Séchoir comprenant une cuve (6) servant à accueillir du linge, un condenseur (9) en communication spatiale avec la cuve (6) et un ventilateur (11) qui permet à l'air de s'écouler de la cuve (6) vers le condenseur (9), dans lequel le condenseur (9) possède un corps (21), un passage d'arrivée d'air (22) relié de manière adjacente à une partie inférieure du corps (21) et une sortie d'air (23) adjacente à une partie supérieure du corps (21), dans lequel le passage d'arrivée d'air (22) s'étend approximativement le long d'une direction tangente d'une section transversale du corps (21), de sorte que l'air entrant dans le corps (21) au départ du passage d'arrivée d'air (22) monte le long d'une paroi latérale (210) du corps (21) à la façon d'une rotation centrifuge, **caractérisé en ce que** 40 45 50
 - un tuyau d'admission d'eau de refroidissement (25) est relié au corps du condenseur (21) de manière centrifuge, et 55
 - une position centrale du tuyau d'eau de refroi-

dissement (25) en laquelle le tuyau d'admission d'eau de refroidissement (25) est relié au corps de condenseur (21) est, par rapport à un sens de gravité, plus élevée qu'une position centrale du passage d'arrivée d'air (21) en laquelle le passage d'arrivée d'air (22) est relié au corps de condenseur (21) et le tuyau d'admission d'eau de refroidissement (25) et le corps de condenseur (21) sont reliés sur une moitié inférieure (27) du corps du condenseur.

2. Séchoir selon la revendication 1, **caractérisé en ce que** l'axe central (220) du passage d'arrivée d'air (22) coïncide approximativement avec une tangente d'une section transversale du corps (21) en une partie (24) qui est reliée au passage d'arrivée d'air (22).
3. Séchoir selon la revendication 1, **caractérisé en ce qu'au moins une partie** (24) du corps (21) adjacente au passage d'arrivée d'air (22) est de forme cylindrique.
4. Séchoir selon la revendication 1, **caractérisé en ce que** le passage d'arrivée d'air (22) est approximativement disposé à l'horizontale.
5. Séchoir selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** le tuyau d'admission d'eau de refroidissement (25) s'étend approximativement le long d'un sens tangent de la section transversale du corps (21).
6. Séchoir selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** le tuyau d'admission d'eau de refroidissement (25) s'étend approximativement à l'horizontale.
7. Séchoir selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** le tuyau d'admission d'eau de refroidissement (25) est relié de telle manière que l'eau de refroidissement (26) tourne de manière centrifuge le long de la paroi latérale (210) du corps et un sens de rotation est identique à celui d'un sens de rotation centrifuge de l'air (8) entrant dans le corps (21) au départ du passage d'arrivée d'air (22).

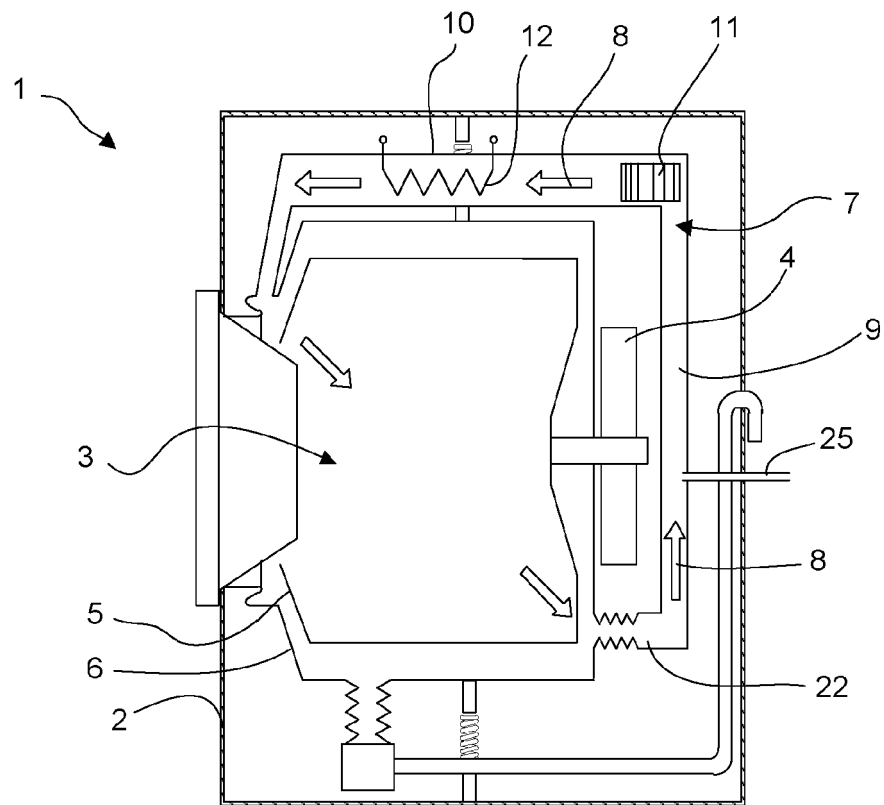


FIG. 1

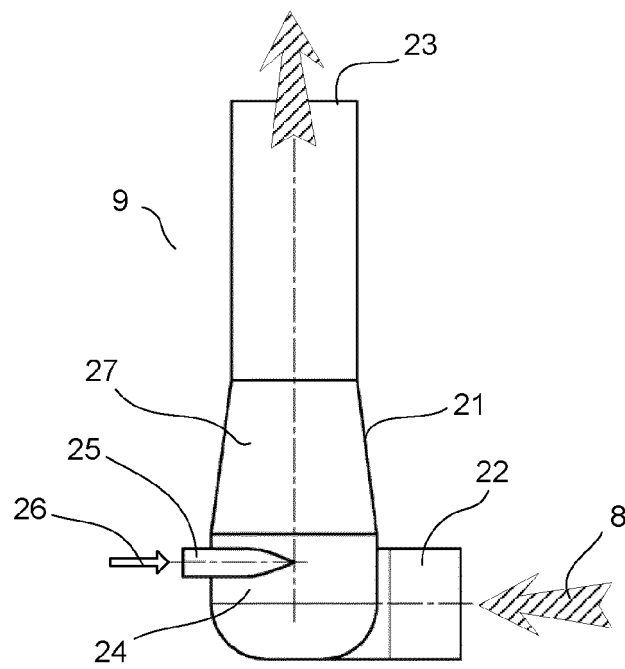


FIG. 2

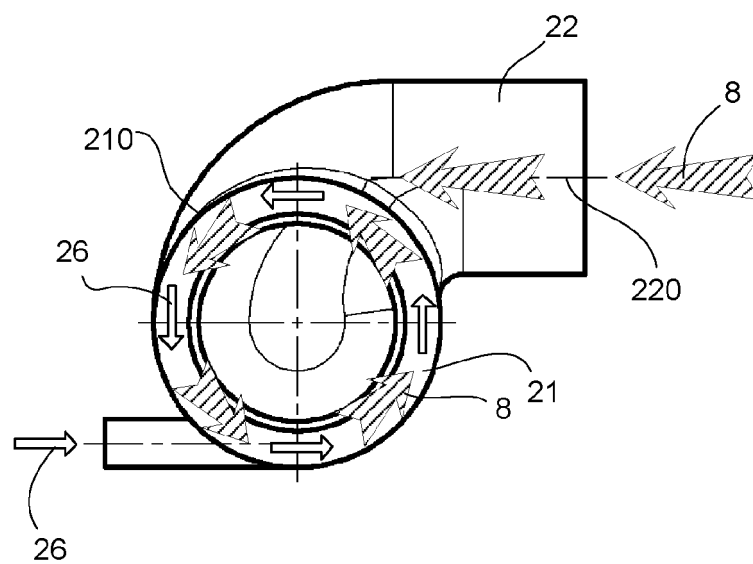


FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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